IEEE India Info

IEEE India Council Newsletter

Vol. 14 :: No. 2 :: Apr – Jun 2019

Message from the Chairman

Dear IEEE Indian Members,

I am happy to see that second issue of 2019 of India Council (IC) newsletter is being released. The newsletter is having information of India Council, Sections, Chapters, Affinity Groups etc., interesting articles on diverse fields of interest to our members along with few regular informative columns. I congratulate and thank the efforts taken by Mr. H.R. Mohan, Newsletter Editor. I would also like to put on record and thank the Section leaders who have extended their cooperation in providing the inputs to the newsletter.

The flagship program of IEEE IC, viz. INDICON-2019, will be held in Marwadi University, Rajkot, Gujarat in collaboration with IEEE Gujarat Section during December 13-15, 2019. I hereby appeal to all IEEE members to make this INDICON another success story, as in the previous years. All India Student, Women in Engineering and Young Professional Congress (AISWYC) is to be held in Hyderabad during September 28-30, 2019.

During this Second quarter of 2019, IC ExCom held on 8th June parallel to TENSYMP-2019 which was organised during June 7-9, 2019 in Kolkata. IEEE R10 Director attended the TENSYMP and interacted with IC ExCom members. Few major decisions were taken during the meeting. The changes in the IC by-laws were also approved. One of the major changes in the by-laws is to induct the advisors and various vice-chairs. A core committee consisting of current chair, chair-elect, immediate past chair, secretary and treasurer has been suggested to help the IC chair on the emerging and burning issues for consideration to the IC ExCom for approval. A search committee has also been formed to give the IC life time achievement awards to past IC chairs and Sections chairs for their outstanding contribution towards the growth and organising IEEE events for the benefit and of value to IEEE members.

New technically co-sponsored conference fee imposed by IEEE is implemented without hampering the number of events. IEEE India Office helps the organisers. New guidelines for IC Awards and e-notice are formulated. Now any IEEE event information can be sent through e-notice to all the Indian IEEE members by paying INR 5000/ per e-notice, to IC account. Section chairs should endorse the e-notice for the same.

I am sure that with the help of active IEEE volunteers in India, we will be able to make one of the best councils of IEEE.

Prof. Sri Niwas Singh, *FIEEE, FIET, FNAE, FIETE, FIE(I)*
IEEE IC Chair 2019
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Message from Editor

H.R. Mohan, hrmohan.ieee@gmail.com

Dear readers,

We are presenting the second quarter issue of India Council Newsletter (ICNL) for the year 2019. This current issue of ICNL is a bumper issue in 207 pages and features a record number of 38 articles as against 25 in the last one. As the page level has gone up significantly, the issue is presented in three parts – Part 1, having regular items such as messages, reports on activities, usual columns such as IT Happenings, Information Resources, Books, Book Excerpts and Announcement; Part 2, a special section featuring the presentations made during the 160th celebration of Sir JC Bose as articles guest edited by Dr B. Sathyanarayana and Part 3 featuring contributed articles by professionals and academic community including one 2nd year student.

ICNL thanks the organisers/chairs of the Bangalore, Kerala, Kharagpur, Madras, Nagpur Sections for sending the reports of their activities as per guidelines, and Vice Chair, IC SAC for the report on the Industry Visit focusing on Nokia University Collaboration Experiential Learning. We are aware of the fact that not all the activities are reported and only a very insignificant proportion of numerous activities that are conducted across the Sections. We look forward to receiving matter from all the organizers of events directly at the newsletter email id ieee.icnl@gmail.com as per the guidelines published in the newsletter elesewhere and also available at https://goo.gl/DcVPmx

ICNL thanks the authors who have enthusiastically responded to our request and contributed the following informative and interesting articles included in this issue in Part 3.

1. India's Trillion Dollar Opportunity in SaaS by Mr. Suresh Sambandam
2. Digital Plantation story of RGE by Mr. Abhishek Singh & Mr. Leong Hoe Wah
3. Move over, Pessimists - Emerging Top 50 Technologies Offer a Gold Mine of Opportunities by Mr. S. Anand
4. Supply Chain Management Practice in India by Mr. V. Ramachandran & Mr. M. Sundaram
5. An Overview of ICT Tools for Supply Chain Management by Prof. Prashant R. Nair
6. AI for All by Mr. S. Arjun
7. Machine Learning via Genetic Algorithm Demystified for Today's Era by Dr Vivek Venkobarao
8. Journey from Monolith Application to Microservices by Ms. Nithya Rajagopalan & Mr. Kumaraswamy Gowda
9. Establishing Community Radio Station in India by Mr. G. K. Jakir Hussain
10. Glassless 3D Technology -- A 3D Solution without glasses - the future of 3D Technology by Mr. M. Venkatesan
11. Space FPGA Mitigation Effects, Challenges and Trends by Mr. V. P. Sampath
12. Electric Vehicles for India: Overview and Challenges by Mr. A. Rakesh Kumar & Dr. Sanjeevikumar Padmanaban
13. Internet of Things (IoT) and E-Healthcare System – A Short Review on Challenges by Dr. T.Poongodi, Dr. Balamurugan Balusamy, Dr. P. Sanjeevikumar, Dr. Jens Bo Holm-Nielsen
14. Marine Autonomous Systems – Technology, Opportunities and Use Cases by Mr. Madhan Dhanushkodi & Mr. Darshan Rajagopal
15. Architecting for Strategic Outcomes by Mr. Pradeep Henry
16. Why Design Thinking Helps Identify Great Artificial Intelligence Use Cases by Mr. Sojan George & Mr. Rajeev Mullakkara Azhuvath
17. Operating System Security – A Short Note by Mr. Kunal Abhishek & Dr. E. George Dharma Prakash Raj
18. Data Privacy – Yesterday, Today & Tomorrow – An Overview by Mr. Ramkumar Ramachandran
19. Universal Acceptance: The concept that all domain names should be treated equally
20. IEEE Xplore® Digital Library Continues to be Your Career Partner by Dr. Dhanukumar Pattanashetti
21. Why Standards Matter? IEEE Standards Development Initiative in India by Mr. Srikanth Chandrasekaran
22. e-commerce -- Past, Present and the Future by Mr. K. Vaitheeswaran
23. Starvation Deaths, Migrant Labour, Gypsies and Blockchain by Mr. Santosh K Misra IAS
24. Detecting fake news and information by Dr. Paromita Pain
25. Neuromarketing: An Overview by Prof. K. Ganapathy
26. Management Lessons from a Rural Indian Water Project by Mr. Sathish Vaidyanathan
27. Building Tech startup culture through colleges for generating National and International Opportunities by Mr. B. Parameshwar Babu
28. Startups as an investment asset class by Mr. Sanjay Mehta

29. The Progress and Value of Patents in India by Dr. Kalyan Kankanala
30. Making an Impactful Presentation by Dr. Ch. Aswani Kumar
31. 5 Key Types of Workplace Harassment and Ways to Stop it.by Ms. Viji Hari

ICNL wishes to add that the above articles published in this issue are not peer reviewed and are also not checked for plagiarism for which the authors are responsible. Further, the views expressed in these articles are that of the authors and ICNL is not responsible for any consequences of using the information provided in these articles.

We are happy to have published briefs about the following books and thank the publishers for providing copies of the books.

- Big-Data Analytics for Cloud, IoT and Cognitive Computing
- Indian Patent Law and Practice
- Management Immemorial: Learnings from Literature
- BCC: Behind Closed Cubicles
- TITAN: Inside India's Most Successful Consumer Brand
- Leading and Motivating Global Teams: Integrating Offshore Centers and the Head Office
- Spark: The Power to Become Big is Within You
- Fundamentals of High - Voltage Engineering
- Social Media & Mobile Marketing

We are also happy to have published the excerpts from the book "BCC: Behind Closed Cubicles" with the permission of the author..

Chairman Dr. S.N. Singh has provided a comprehensive message highlighting major decisions taken by the India Council and the forthcoming major events being organised by India Council. The" What's hot in IT - An Indian Perspective" a regular column by Prof. S. Sadagopan, Director, IIIT Bangalore provides a broad overview on various important happenings in the IT and Telecom sectors in India during mar-May 2019. We are sure that readers will find the information and the related links provided in the column "Information Resources" compiled by the editor Mr. H.R. Mohan will be of interest to ICNL readers. We wish to add that "Interesting Reads", a regular blog post published once a week by him may also be of interest to our readers The archives of these blog posts can be accessed at https://goo.gl/VGXizd A no. of important announcements which include events such as TENCON-2019 and INDICON-2019, IC Awards, guidelines, useful links also appear in Part 1 of the issue which will interest our readers.

We wish to thank Dr. B. Satyanarayana (Secretary, IEEE Bombay Section) Guest Editor for the Special Section (Part 2) on Sir JC. Bose for his efforts in coordinating with the speakers in getting the articles written based on the presentations made during the 160th Anniversary Celebration organised on 17th Feb 2019 at Bangalore, a task most difficult. .This special section comprises of the following seven informative articles which have interesting historical facts.

1. Sir Jagadish Chandra Bose: Scientist Par Excellence: A Tribute by Dr. B.S. Sonde
2. Jagadish Chandra Bose: The Physicist who was forgotten by Dr. D.P. Sen Gupta
3. Sir Jagdish Chandra Bose, James Clerk Maxwell and there on….. by Dr. S. Pal
4. mmWave Applications in NextGen Wireless Broadband Evolution in 5G Era: Impact of Sir JC Bose invention by Mr. C.S. Rao, Ms. Arpita Hura and Ms. Mouna Jain
5. Radio Astronomy: How J.C. Bose's invention opened a new window to the Universe by Dr. Yashwant Gupta
6. Design and Construction of Working Replica of Sir J.C Bose 60 GHz Experiment by Dr. Shaik Kareem Ahmmad, Dr. Syed Ilyas Mohiuddin and Dr. Mohammed Arifuddin Sohel
7. Sir Jagadish Chandra Bose: Biologist, Biophysicist, Botanist, Physicist, Archaeologist and Polymath by Mr. Sudhir Phakatkar

We wish to remind our readers to encourage new members to join IEEE at 50% of the annual subscription and enjoy the membership benefits till Dec 2019.

ICNL wishes to acknowledge various internet sources for the information presented in this issue of the newsletter. Our exclusive thanks to inshorts (https://www.inshorts.com) and Mr. Sunil Agarwal & Mr Ajit Ninan for the permission to use their thought provoking cartoons appeared in Times of India.

IEEE Bangalore Section Activities

Siddaganga Institute of Technology, Tumakuru

IEEE SIT SB student participate in the IIT MADRAS FEST "SHAASTRA 2019"

IEEE SIT SB members participated attended in SHAASTRA 2019, the national level technical fest organized by IIT Madras from Jan 3rd to 6th. The participants were selected based on the first round of the questions prepared by the IIT Madras team. After that there was an online test on TechGIG platform, based on which the participants were filtered. 13 students were finally selected from IEEE SIT SB. All of them attended events on Quantum computing, AI, ML and PCB Design. The participants gained much insight on the practical applications of the technology. It was a wonderful and marvelous experience for following student participants: Lalithashree V; Gowtham M P; Gopinatha B M; Pranav; Kavana; Harshita S; Harshita B K; Teju. V; Zakir; Supreeth; Srinidhi; Shradha; Nikitha; Aakash; Amruth; and Manasa.

Arduino Application Workshop for Maruthi Vidya Kendra, Belagumba.

IEEE SIT SB, organized an Arduino workshop for the students of MVK, Belagumba. As these students had an earlier exposure to Arduino, this workshop was held to improve their skills at the application level. Gowtham M P and Gopinatha B M headed the leads of the workshop session with the help of the volunteers and members. The projects explained to the students included: Automatic water pump; Radar; Smart street light; Automatic railway gate; Medi kit; Smart parking system; and Sun tracker The student volunteers Harshita s, Harshita B K, Kala, Dinesh, Farazi, Shrada, Sneha, Nikita, Manasa k j, Vennala M V helped throughout the session.

Photoshop Workshop

IEEE SIT conducted a Photoshop workshop on 6th February 2018. Event was guided by Pratik, Adithya Sahu, Supreeth and Srinidhi. At the beginning, all the 60 student participants were made to install Adobe Photoshop Applications on their laptops, and then introduced to the basics of the Photoshop and later were trained so that they could design a poster at end the workshop. As a part of this workshop, a challenge was given to the participants to come up with a poster of their own design.

Arduino Application Workshop

IEEE SIT SB, organized an Arduino workshop for IEEE SIT SB members from 11th to 13th of March. Lalithashree V, Gowtham M P, Gopinatha B M, Harshita s, Harshita B K were the leads of the workshop session with the help of the volunteers and members. Students were taught from the scratch, including installation of IDE, basic knowledge of Arduino and was extended up to interfacing of sensors with Arduino and knowing its application in real-time scenario.Though it was planned as a two-day event, it was extend to three days to provide better training. At the end of the third day, a hackathon was conducted where two problem statements were given to solve within one hour. Based on the performance and problem-solving skills, winning team was given with the Node MCU module as prize.

Latex Workshop

IEEE SIT SB conducted latex workshop on 30th March, as Latex is one of the basic required software for report making. Workshop was mentored by Mr. Mruthyunjaya, one of the alumni of our college. A total of 138 students participated in the workshop, these students were taught about the usage of the latex software right from the beginning.

Reports by: B.M. Gopinatha, gopinathhbmg@gmail.com

IEEE Kerala Section Activities

IEEE Kochi Sub Section

IEEE HAC Grant Win of $35000 for IEEE Kerala Section project

A proposal for IEEE HAC Humanitarian Projects titled "Techno Unnati: Revival of flood affected Kerala School through technology" submitted by Dr. Bijoy Antony Jose of CUSAT (Secretary, Kochi Subsection) has been approved in March 2019. The granted amount is $35000 (Rs. 24 Lakhs) for flood affected Gov HSS Kuttamassery near Aluva. This project aims to build computer lab, library, physics lab and smart classes which will benefit 600+ students. Out of 35 applications obtained worldwide, only 5 were approved. Kochi Subsection chaired by Prof. Aanandan has been helping the school post floods. Bijoy has formed an implementation team along with Kerala Section representatives Sarada Jayakrishnan, Shahim Baker, Sunitha Khan along with Mr. Satish Babu as advisor from HAC.

Figure 1: School immersed in water damaging computer lab and other electronic equipment.

"National Colloquium on Future Technologies: Green Machines, Refurbishing & Eco-friendly Electronics"

A colloquium on Future technologies was conducted by Dr. M V Rajesh at College of Engineering Poonjar sponsored by Dept of Environment and Climate change of Kerala along with IEEE Kochi Subsection of February 22 & 23, 2019. Sessions were held on refurbishing of electronic products, environmental impacts of solar panels and battery, strategies in moving towards green computing, reuse of electronics in industry, and green energy. Mr V R Narayanan, Head of Operations, Maker Village, was the inaugural speaker along with several speakers from IEEE.

"India's Indigenous Processor Program" – National Science Day

IEEE Kochi Subsection in association with IEEE computer society with organised an invited talk on **India's Indigenous Processor Program** at Department of Electronics CUSAT. It was financially supported by KSCSTE. Dr Neel Gala, the Tech lead of SHAKTI Processor Program of IIT Madras as well as the CTO of Incore Semiconductors spoke on the 350 crore project happening at CDAC, IIT Madras and IIT Bombay on developing indigenous processor in India. This was held as a part of the National Science day celebrations on 25th February 2019 to inspire the young minds of scientific society.

Report by: Dr. Bijoy A. Jose, bijoyjose@cusat.ac.in

IA/IE/PELS Jt. Chapter Kerala

PELS SB Chapter inauguration and invited talks

IA/IE/PELS Jt.Chapter Kerala organized inauguration of recently formed PELS SB chapters and conducted invited talks in three PELS SB chapters during March 2019. Prof. K. Biju, Secretary, IA/IE/PELS Jt. Chapter Kerala coordinated these programmes. The resource person was by Dr. Sanjib Kumar Panda, Professor of National University of Singapore (NUS) and PELS Asia-Pacific Regional Chair.

1. GEC Kannur

The inauguration of IAS and PELS student chapters of IEEE SB GCE Kannur took place on 11th Mar 2019. On the same day a technical talk was delivered by Prof. Panda on the topic "Can a dumb electrical load be made smart using electric spring to mitigate renewable energy source variability issue?". 63 IEEE members attended the event and talk.

2. GEC Thrissur

The IEEE PELS SBC of the Government Engineering College (GEC), Thrissur was inaugurated on 12th Mar 2019 by Dr. Sanjib Kumar Panda, Professor of National University of Singapore (NUS) and PELS Asia-Pacific Regional Chair. Dr. Jaison Mathew, Staff Advisor, PELS welcomed the gathering and introduced the speaker to the gathering which was followed by presidential address by Dr. B Jayanand, Principal-in-Charge GEC. In his inaugural address, Dr. Panda presented a brief history of the PELS and various activities carried out by the society. He stressed the importance of serving the community and the institution back through various programmes connected with PELS such as Empower a Billion Lives competition. He informed the gathering about different opportunities for IEEE PELS members. Dr. Panda also commented on the ongoing trends in transportation industry such as electric vehicles and how power electronics can play a major role in this area. Dr. Panda began his lecture by stressing the importance of increasing photovoltaic generation to reduce the Grid Emission Factor (GEF). One of the drawbacks of conventional system is that generation side has no information about the demand. Also the variations in the source side affect the critical load adversely. To protect the critical-load from these variations, Dr. Panda introduced the concept of electrical spring. The electrical spring absorbs the variations in input voltage to control the voltage across non-critical load while the voltage across the critical load is maintained within the required limits. This improves the reliability of the system to a great extent. The non-critical load together with electrical spring forms a smart load. The talk was followed by an interactive session with the students. 32 IEEE members attended the programme.

3. CE Karunagappally

The PELS SBC of College of Engineering Karunagappally was inaugurated on 13th March 2019. Prof. Muhammed Kasim S (Chair IA/IE/PELS Jt.Chapter Kerala) was present. 35 IEEE members attended the progarmme.

Workshop on PCB design and fabrication

On 1st Feb 2019, the IEEE IAS SBC of GEC Thrissur conducted a workshop on 'PCB Designing and Fabrication'. The resource person was Dr. Jaison Mathew. This workshop gave immense knowledge and information in the development of PCB's to the students. The event was conducted by the students itself which made a much better environment for the participants. Enabling them to have more interaction and clear their doubts without any shyness. The interaction with the participants on the workshop made the volunteers to have a much better idea of what the students wish to have. The workshop had a participation of over 30 students.

Workshop on circuit simulation using Proteus

The IEEE PELS SB Chapter GEC Thrissur conducted a workshop on 5th Feb 2019. The intention of the workshop was to help the students to have a deeper knowledge of the circuit with the help of circuit simulation using Proteus which could help them with their future studies and projects. Dr Jaison Mathew was the resource person. The workshop discussed the need for simulation, different tools available in Proteus etc. It was a fully hands-on workshop. Participants designed and simulated simple circuits during the session itself. Assignments were given for analysing the effectiveness of the session and the follow up was done. The workshop made the students gain a deeper knowledge on the topic. The workshop gained immense appreciation from the students. A total of more than 34 students participated.

WiE Insight

IEEE IA/IE/PELS Jt. Chapter Kerala celebrated the spirit of womanhood with" WiE Insight" as a part of international women's day 2019 to tribute all women who brought phenomenal change in the society. The program was aimed to elevate the unlimited power of women in the context of science and technology. WiE insight conducted from March 8 to 16. About 25 events happened around Kerala as a part of WiE Insight. The program mainly focused on benefits of girl student members in IAS, IES and PELS. The major activities conducted as a part of WiE insight was a photographic contest and a two level quiz competition naming Quest. The topic of the photographic competition was "Women's Day Celebration and Women Empowerment". About 15 entries were received for the competition around the SBCs in Kerala.

Industrial visit

An Industrial visit to the Load Despatch Centre, Kalamassery was jointly organized by the IEEE IAS and PELS SB Chapters of Musaliar Engineering College of Engineering, Chirayinkeezhu on 23rd Mar 2019. The visit gave an insight into understanding the current distribution to domestic consumers, factories and also how the parameters travel around the stations. 25 IEEE student members & four faculty members joined the trip.

ELEKTRA 2019

A three day technical summit 'ELEKTRA 2019' was held at College of Engineering, Munnar during 5-7 Apr 2019.The event was coordinated by Department of EEE in association with IEEE PES & IAS SB chapters of College of Engineering Munnar. The event was inaugurated on 5th Apr by Mr Jabir Mudambra , Electrical Inspector, Idukki District. In his inaugural address, Mr Jabir Mudambra talked about the advancements in electrical engineering in modern days. It was followed by a technical session by himself on the topic 'Electrical Safety'. The technical session was followed by an ice breaking session which made the delegates more comfortable and relaxed. The programmes of the first day ended up with a campfire in the evening followed by the dinner.

The proceedings of the second day started with an industrial visit to Solar Powered Micro grid, Marayoor and Hydro Electric Power Station, Mattupetty. The delegates were shown the operations of the plants and control rooms by the staff. Two parallel workshops – "Installation of Solar PV systems" and "Blockchain" were held in the afternoon. . It was followed by a session on the topic 'Battery Designing and Management in Industrial Area' By Er. Ani Thomas, Area Manager, Exide Industries Limited. Cultural events were presented by both external and internal delegates in the evening. The second day ended with a dinner thereafter.

The third day programmes started with a sunrise trekking. It was one of the major attractions of the event and made the joy of the delegates in its peak. The trekking was followed by a session on 'Entrepreneurship' by Er. Sonia Mohandas, CEO, Waferchips techno solutions. There was an technical interacting session on the topic Artificial Iintelligence in IOT taken by Er. Archu S Vijay, CTO, Waferchips techno solutions. The last session was a technical talk on 'Basics of Control and Protection of Power System' by Dr Krishna Kumar, Assistant Engineer, KSEB. The delegates were given basic awareness on power system protection during the session. It was followed by valedictory function and a feedback session. The three day programme ended up with a lunch and a photo session.

102 delegates (58 IEEE members and 44 non-members) from various engineering colleges across Kerala attended the programme. This three day technology summit received appreciations from all delegates in terms of the quality of the various sessions, industrial visit, trekking, internship drive and the overall conduct of the event. The IEEE members and volunteers of SB Chapter were immensely satisfied in the way the event was organized, and it is decided to conduct the programme in the future also.

Report by: K. Biju, bijuk@ieee.org

Gautam Buddh Nagar to launch e-portal to report workplace harassment: UP's Gautam Buddh Nagar district has tied up with an IT firm to build a software and website that will allow women to report workplace sexual harassment online. The software, expected to be launched on August 15, will be available for private and government organisations. Authorities said they will provide a list of private organisations operating in the district.

Govt recognised over 1 startup every hour in May 2019: DPIIT Secretary Ramesh Abhishek tweeted that since the beginning of the Startup India initiative, 18,861 startups have been recognised by DPIIT. "In May 2019 alone, 814 startups have received recognition. This is more than 1 startup every hour!" he added.

IEEE Kerala Section Student Activities

The student Activities of Kerala Section is vibrant in organizing activities and promoting the vision of IEEE across the section. With 97 student branches the student team led by the student activities chair support and volunteer to any activity that needs technological solutions.

For effective management of such a vibrant, geographically spread student membership, the section has been following the hub and spoke administrative model; the Local Integrated Network of IEEE in Kerala (LINK). The primary aim of LINK is networking student branches in an effective way, thereby increasing the value in IEEE Student membership. LINK has achieved tremendous results, causing an exponential increase in student branches and student activities in IEEE Kerala Section. The LINK and its subsidiary HUB teams (three in numbers divided as Travancore Hub, Kochi Hub and Malabar Hub for the geographic distribution of Kerala Section) are being trained with effective leadership skills which is being passed on to the student community, thus improving key skills like professionalism and ethics in students.

Under the guidance of the Student Activities Committee, more than 650 events were conducted at student branch level during the span of January to May 2019. Moreover the student team hosted 19 events across the section that aimed in technical upliftment of its members. Apart from that, training for newly inducted student office bearers was also held so as to familiarise them with their duties and responsibilities. The International Women's Day was celebrated as a week long celebration named WiE Wave and 140+ events were reported as part of WiE Wave 3.0. 80+ events were also reported as part of Science Week celebration in accordance with the National Science Day on February 28th.

SCIENCE WEEK 2.0

February 28th is Internationally celebrated as Science Day. To convey the importance of this day, the student community of IEEE Kerala Section decided to conduct a series of events related to science, creating awareness about the day and how the day was declared as Science Day. Various technical events , conferences and competitions were conducted in SB's across Kerala. The event focused to develop the technical skills of the student in a comprehensive and effective way through various hands on session. **80+ events were held under Science Week celebration.**

ORE Tech Community Launch

ORE the technical community of IEEE Kerala Section Students was an initiative by IEEE Kochi Hub. ORE stands for Outreach for Resources in Engineering. The community is built upon the IEEE Student Technical enthusiasts with skill sets and interest to learn with knowledgeable people from different disciplines and streams, students and professionals as our mentors. The community was launched through Social Media on 5th March 2019 with a poster launch.

WIE WAVE 3.0

March 8th is worldwide celebrated as International Women's Day. In regard to this IEEE KERALA SECTION and WOMEN IN ENGINEERING team of IEEE LINK decided to celebrate the social, economical, technical and cultural achievements of Women. The achievement of this event was that from the beginning till the end, from discussions till execution, each and every single step was coordinated solely by girls.

WiE Wave 3.0 had taken the theme "Balance for Better; Technology for Future" stressing on the importance of gender equality and technical empowerment. The event was celebrated from March 5th to 15th of March 2019. Stressing on the importance of gender equality and technical empowerment. This year, the main theme will be split into four sub-themes for the Student Branches to focus on the different perspectives of the importance of uplifting technology and sciences among the women community. The sub -themes aims at highlighting the main theme itself more effectively, so that the events can be conducted by the members and volunteers with better quality and relevance. **140+ events were held under WiE Wave 3.0**

VIRAGO 2.0

IEEE Travancore Hub conducted VIRAGO 2.0, the edition of the hub's women's day event on 9th March 2019 at UKF College of Engineering, Paripally, Kollam. The hub's women's day event which attracted 40 participants consisted of a talk series including inspiring and informativetalks by Ms. Arundathy Kurup, Ms Lakshmi Shaji and Mr. Sreenath Sasikumar on the topics 'A scholar's guide to opportunities in tech', 'Demystifying analytics and role of machine learning' and 'Cyber Security' respectively. The event also included an ice breaker session and a technical session called 'Inside Out',which included dismantling and reassembling of a CPU. This was done by participants with the assistance of Mr Manoj.

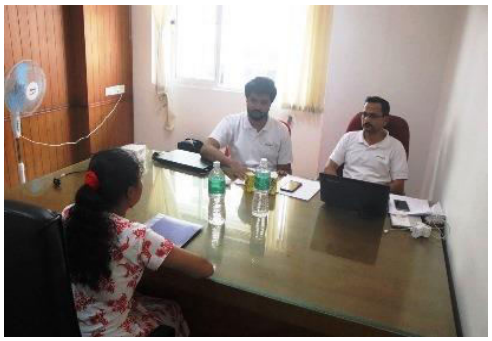
Minerva 4.0

IEEE Kochi Hub conducted its most prestigious and very own WIE Event of all times, Minerva 4.0 on March 15th, 2019 at Viswajyothi College of Engineering and Technology, Vazhakulam, marking the end of the WIE WEEK 2019.

The fourth version of Minerva, held this year, in contrast with the previous versions of the yesteryears witnessed a total change in its structure. The event was held as a single one for all zones, with 52 female delegates from colleges all over the Kochi hub and various disciplines and year of study. The prime focus of the one-day event was to not simple empower our girls but empower them technically. This change was a new introduction to the typical series of events being conducted and worked successfully with all delegates completely satisfied with the sessions and great feedback was given from their side.

The guest speaker for the day was Ms. Anjana Krishnan, Ruby on Rails developer who handled a session on programming using Ruby for the girls. A small idea pitching competition was held alongside the two mini-workshop sessions on Bash-Linux handled by Mr. Balu M N, former Chairman at IEEE SB VJCET and another one on Git and Git Hub by the team from ORE Community of IEEE Kerala Students.

IEEE Job Fair 2019



The IEEE Job Fair 2019 is a Career Service dedicated to educating, advising, and connecting IEEE members to global opportunities in order to foster their intellectual, social, and personal transformation. The IEEE Job Fair 2019 ensue 2018 Job Fair, which was initiated by the IEEE Kochi subsection and its Student activity group, IEEE Kochi Hub. It is a recruitment drive which provides a rostrum for all the IEEE members across the country to clearly express their potential contributions, their technical, managerial and 'soft skills' such as communication and professionalism. IEEE Job Fair is also an opportunity for the attendees to evaluate different organisations and whether the opportunity they've applied for aligns with their professional interests, skills, values, and goals. The event had participation from 42 student branches across the IEEE Kerala Section and was held on **30th and 31st March 2019** at **Muthoot Institute of Technology and Science**. A total of 12 companies from various sectors sought to utilise the opportunity to get the best talent for their organisation. Around 300+ students attended the event bringing about a change of great magnitude in their approach to professional life. **Prominent companies like Support Sages, IROV, CIED Technologies, Infusory Future Tech Labs, Inker Robotics, Tachlog, Metric Tree Labs, Green worms Eco Solutions, DiDroid Technologies, Onesoft, ZappyHire and Pumex Infotech were our recruiters this year.** At the end of the two day job fair, around 38 students were placed in 7 of the recruiting companies (some results are yet to be announced) and it ended on a positive note. The initiative was well appreciated by the section, the companies and the students. The companies were glad to see such an enthusiastic crowd at a job fair and congratulated the organizers on the successful conduct of the event.

WIE-Learn: Mentorship program for Girls

The technical community of IEEE Kerala Students and IEEE Kochi Hub along with WIE (Women in Engineering) affinity group, on 7th Apr 2019, organized an online mentorship program, called WIE - Learn, with the aim of promoting the recruitment of women in technical disciplines. The training program started from WIE week and continues till the WIE summit 2019.

The course was open for students from SBs all over the Kochi section. Teams of five were eligible to apply for the course, and a total of 17 teams were shortlisted, from about 45+ teams. Each team was assigned a mentor. (mentor to student ratio was 1:5).

The training sessions were given online, with meetups being held once in a while, to check on progress, and conduct discussions. These sessions were designed for every week, with weekly projects being given to the teams. The track chosen for training was 'Web Development', and the course plan was formulated, with instructions being given to both mentors and students.

WIE - Learn, is a new initiative taken up by the WIE, with plans being made to extend it in the coming years.

ROADMAP TO SUCCESS IN ENGINEERING STUDIES - Kannur

Roadmap to success was an initiative by IEEE Malabar Hub to bring awareness on engineering to the engineering enthusiastic students and their parents, in different regions of Kerala. A career guidance program for 12 th pass-out students was hosted by IEEE SB VJEC in association with the IEEE Malabar Subsection on 11th May 2019 at Vimal Jyothi Engineering College,Chemperi Kannur.Fifty two students along with their parents participated in the event and the session was very interactive and the parents and students gave a positive review on the event.

ROADMAP TO SUCCESS IN ENGINEERING STUDIES - Palakkad

IEEE SB of GEC Sreekrishnapuram conducted Road Map to Success in professional education on 11th May, in the college. The program aimed to give the audience an introduction to the various fields in engineering and their scope, mainly through interactive talk sessions with experts in the field.

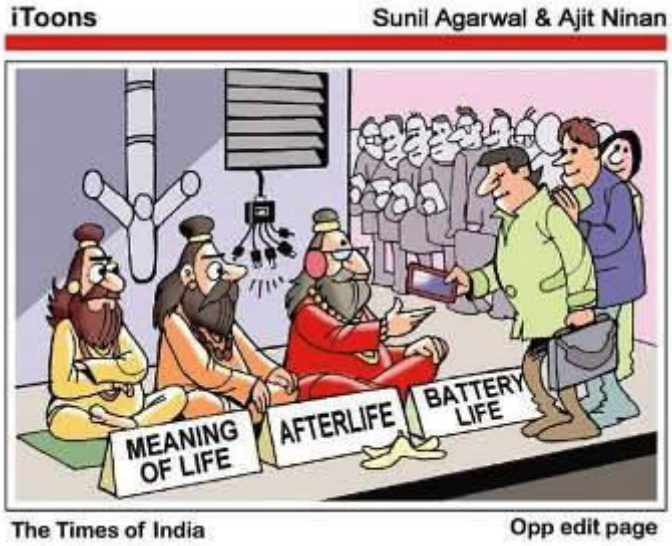
The event began at 10 am in the morning, with the inauguration ceremony. Dina, WIE Secretary of the SB gave the welcome speech. She was followed by Mrs. Vinita Chellappan, the SB Counsellor, who addressed the audience which consisted of 29 students and their parents and briefed them on IEEE, the event at hand and its relevance. The main speakers followed.

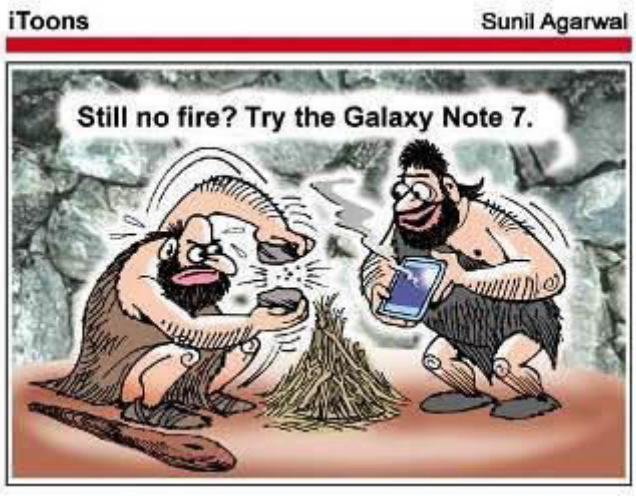
Hack-Kochi: Hackathon Python & ML

ORE, the Technical Community of IEEE Kerala Section in association with IEEE Kochi Hub conducted Hack-Kochi, the first hackathon of the season on May 18th, 2019 at the Kerala Startup Mission on Machine Learning and Python. The hackathon began at 10: 30 am with a brief introduction about the company by Mr. Jyothis K.S. The participants were given two problem statements well explained by Mr. Deepu Xavier to complete by the end of the day. The 10 contestants were allotted time until 4:30 pm. This was followed by individual presentations of ideas and program codes. The panel allotted 24 hours for 3 people who made significant progress and by 6:00 pm, the event was officially concluded. Prizes and certificates were distributed later.

The Section sponsors an officer training program to newly inducted SB officers. Officer Trainings of 2019 was held at Cochin University of Science and Technology to train student officers on effective student branch administration and planning. Over 110 students from 57 student branches attended the event. Altogether the IEEE Link F2F 2019 was a platform for planning the activities for next year and training section for the new torchbearers. It also played an important role in helping the members have a better concept on technology and have clarity on their purpose as engineers, varying from research to entrepreneurship.

Report by: Mr. S. Nandan, Chair-Student Activities Committee, IEEE Kerala Section, nandans@ieee.org





MIT 'roboats' can now self-assemble to make bridges, markets: MIT researchers have added new features to its autonomous robotic boats 'roboats', which it had co-created alongside Amsterdam's AMS Institute, that lets them target and attach to each other. The aim of the project is not limited to just on-demand transportation, but to also form "pop-up" structures, such as footbridges, performance stages or even food markets, researchers revealed.

IEEE Kharagpur Section Activities

IEEE AP-MTTS Student Branch Chapter of IIT Kharagpur

Workshop on "Connecting World through Electromagnetics"

IEEE AP-MTTS Student Branch Chapter (under IEEE Kharagpur Section) of IIT Kharagpur organized a workshop on "Connecting World through Electromagnetics" during 26th to 28th April, 2019. The workshop attracted 22 participants belonging to various engineering institutions from all over India.

This workshop introduced the participants to the cutting edge technologies like Microwave Passive Components, Microwave Systems, RADAR Communication, Antenna Miniaturization and On-chip Antennas, Optical Metamaterials, Microwave Tomography, Electronics Packaging etc. Some important modules of a transceiver system were also presented in detail, i.e., from concept to simulation, fabrication, and packaging. Simulating various electromagnetic scenarios using HFSS, ADS, MATLAB, Python etc. were also covered.

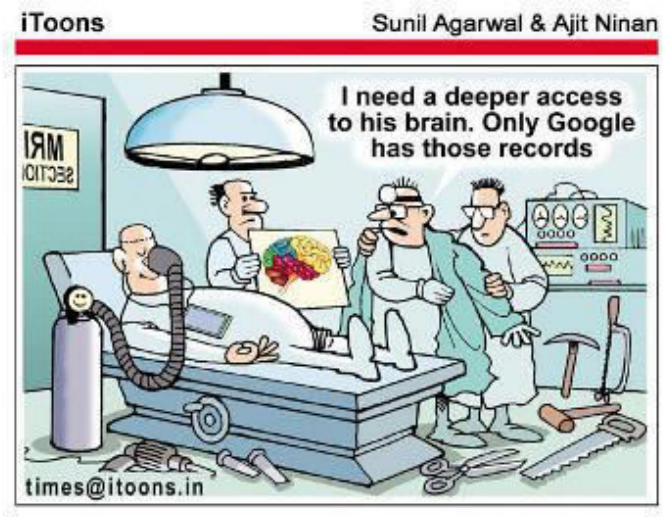
Apart from these, there were talks from IIT Kharagpur faculties and interactive sessions with technical experts from DRDO and other defense organizations of India.

Besides the academic activities the participants were also taken to the Nehru Museum of Science and Technology by the organizers for some recreation.

In the valedictory session the participants were presented with customized coffee mugs along with the certificates for promotion of IEEE and the chapter.

To see workshop pictures on the Facebook page of IEEE AP MTTS Student Branch Chapter Kharagpur Section IIT Kharagpur, pl. visit http://bit.ly/2YOLH4b

Report by: Shuvodip Majumdar, ieee.apmtts.sbciitkgp@gmail.com, shuvodipmajumdar@gmail.com



IEEE Madras Section Activities

IEEE IAS & IEE TEMS Madras Chapter

National Technology Day Conference on "Inclusive Smart Governance"

Madras Chapters of IEEE Industry Applications Society, & IEEE Technology and Engineering Management Society in association with L&T Smart World and Communication conducted the **"National Technology Day Conference"** on **"Inclusive Smart Governance"** on 10th May 2019 at Chennai L&T HQ Campus. The Conference commenced with Inaugural Session & Lighting of Digital Lamp by the dignitaries. Mr. R Srinivasan, EVP & Head, Smart World & Communication (SW&C) and Vice Chairman, IEEE IAS Madras Chapter welcomed the delegates and set the context for the conference on the significance of smart Governance and its impact on social sectors namely Education, Health and Agriculture. He mentioned that the Annual IEEE conference is organized by SW&C to coincide to celebrate May 11 as National Technology Day to mark India's technological advancements.

Keynote Address was delivered virtually by Mr. S. Rajavel, Sr. VP & Head, Water, Smart World & Communication, Chairman, IEEE-IAS Madras Chapter. Mr. Rajavel appraised the gathering, of various smart city project implemented by SW&C and how it is now poised to extend the same to the rest of country.

Mr. H.R. Mohan, Editor, IEEE India Council Newsletter & Coordinator, R10 IEEE CS & Chair R10 Sub-Committee delivered a presentation on the Smart Governance emphasizing its significance to bring in transparency and accountability. He conducted a game of Bingo with a quiz on the various Government initiatives which kept the audience actively engaged.

In an informative session, Ms. Priya K Murthy, Head Enterprise Business , Acer India presented the different learning styles of a traditionalist Vs Gen Y & Z. She emphasized on the disruptive power of e-education in terms of quality, affordability, accessibility, personalized content management. With the ever changing landscape in education sector to match the emerging demand for new skillsets, ways of overcoming challenges faced by India through e-education with a blended learning approach was presented. Audience were familiarized to different e-learning models and the impact that it could have on imparting quality education to the remotest of rural areas.

In a very interactive session, Mr Harsha Muroor Founder and CEO, Teslon Technologies Pvt. Ltd. and his team commenced their presentation with the various healthcare problems prevailing in the country, including accessibility, lack of training to medical practitioners, reducing doctor-patient ratio. Benefits of Electronic Health Records, with way of ensuring data privacy in handling the e-Records & usage of blockchain was explained. Telemedicine portal which connects patients & doctors virtually is gaining momentum. Smart pharmacy ensures access of medicine for all by connecting Pharma producer to consumer through block chain intervention. The application of AI & machine learning in patient care & health sector was presented. The total Teslon package of complete hospital management and the impact of the usage was elaborated with the real time demo of a Smart health checkup Kiosk.

Mr. Kunal Prasad, COO & Founder, CropIn Technologies, presented the session on e agriculture. Cropin specializes in providing SaaS solution to agri businesses globally. Various farm management solutions, business intelligent solutions, input channel management, plot level analysis that aids in crop prediction, yield calculation methods were demonstrated to the participants. Integrated value chain platform was showcased to explain how the holistic digitalization of all the stakeholder platforms can result in tremendous revenue & reachability. Enormous database from agritech can be used towards turning around agri sector by leveraging Analytics & Predictive techniques.

Mr Madhukar Srivatsava, CTO, SWC emphasized the importance of rural Communication and the various challenges mitigated during implementation of Bharatnet project. He explained that the 3 key focus areas on Digital Infrastructure consists of Utility to Every Citizen, Governance & Services on Demand, Digital Empowerment of Citizens. His list of benefits of having a digital village and how it is achieved by communication network was well received by the audience.

Mr. C Krishnan, Project Director of Idisha Early Warning Dissemination System (EWDS) detailed the technology architecture and functioning of EWDS, a project of national importance and first of its kind in the country, funded by World Bank. He demonstrated how effectively the project had helped the state government in disaster readiness and its management preventing loss of precious lives during the recent Cyclone Fani.

The event was organized offering free guest Wi-Fi facility, e-gate pass, e-registration desk, online feedback forms etc. and was widely appreciated by the IEEE members and the dignitaries. The project staff could virtually take part in the event as it was live streamed in L&T@work.

The conference ended with the vote of thanks delivered by Mr. Kiran Kumar. The conference was well attended by over 100 external delegates comprising of engineering students, academicians, research scholars, scientists, industry professionals and IoT enthusiasts and was highly appreciated.

IEEE Computer Society Madras Chapter

Mini Tutorial on Demystifying Machine Learning & Artificial Intelligence

What ever may be the new technology, the initial wave brings in too many different and confusing ideas mixed with new acronyms and terminologies. IEEE CS Madras in association with ACM, CSI and initiated 'Demystfying' series of programs for the benefits of IT community. The first in the series titled 'Demystifying Machine Learning & Artificial Intelligence' was organized in two batches on 18th and 25th of May 2019 with the support of Amitysoft, , a two-decade old pioneer in career transformation service provider The program was delivered by Ms. Rohini, Head, Advanced Technology Labs of Amitysoft Technologies supported by Ms. Valli.

The program brought out how Machine Learning & AI is different from conventional programming. It brought clarity on what is Data Analytics, what is Machine Learning and What is Artificial Intelligence. The program presented an innovative classification of algorithms based on their nature which helped the participants to understand the entire algorithms space in a matter of couple of hours. While several Amitysoft developed case studies on implementation of the algorithms were demonstrated, interesting videos of popular AI algorithms added value to the program.

Srikanth Aravamudhan, Chief Technology & Innovation Officer and K R Jayakumar, Director of Amitysoft added value to the program by sharing their insights. Lively interaction with participants made the program interesting and absorbing from the beginning to the end. The feedback from 45 participants attended the program was excellent. Almost everyone said that they would be able to confidently talk about Machine Learning & AI post attending this program. Participants mentioned that they look forward to many such sessions in the future. There was a test conducted at the end of the program. Mr. H R Mohan, Imm Past Chair & Chair, Spl. Events of IEEE CS, Madras who coordinated the programme awarded certificates to the participants. Mr. Johnson, Head of Human Energy Augmentation Team & General Manager (Business & Strategy) at Amitysoft was instrumental in organizing this program and ensuring its success with the help of his able team.

IEEE ADSF SIGHT

A two day exposure programme on "Deep Sea Fisheries"

IEEE ADSF SIGHT organised a two day exposure programme on "Deep Sea Fisheries" for engineering students and engineering college professors in association with IEEE Madras Section, IEEE Student Branch of Annai Vailankanni College of Engineering, IEEE Student Branch of DMI Engineering College and IEEE Student Branch of Hindustan Institute of Technology and Science during 20-21 May 2019.

On 20-05-2019, the team arrived at SIFFS (South Indian Federation of Fishermen Societies) Boatyard, Veli Trivandrum where the first day programme was organized. Navigational instruments, safety equipments, satellite phone, VHF, and other fishing items are arranged for the visitors in the boatyard. They could see the building of various sizes of boats made by Fibreglass and plywood. They interacted with experienced deep sea fishermen from Thoothoor area, Kanyakumari district and experts Shri. Satish Babu, IEEE Former Chief Executive, SIFFS & Humanitarian Activity Committee, Dr. Manoharan Arumugam, Chair: IEEE Madras Section and Shri. Joseph, Chief Executive, SIFFS. The second day (21.05.2019) programme was organized in KDFSF (Kanyakumari District Fishermen Sangams Federation), Nagercoil. Shri. Mariyadhass, Chief Executive-KDFSF has played a lead role in the programme along with his colleagues.

Discussions

Gillnets and long lines are the major fishing gears used for deep sea fishing by the fishermen of Thoothoor area. The duration per fishing voyage is 30 days and they do fishing in all along the east coast and west coast of India. Government of Tamil Nadu supplied satellite phone very recently to a group of 8 boat owners. The operational cost per call is Rs.35 and fishermen considered this as expensive. The Distress Alert Transmitter (DAT) supplied to the fishermen on subsidised price by the Department of Fisheries, Government of Tamil Nadu is not an effective devise. So, fishermen are not shown interest in buying the devise. The continues disasters of Tsunami-2004, Yemyin-2007, Nargis, Nisha-2008, Phyan-2009, Laila-2010, Thane-2011, Nilam-2012, Helen, Lehar-2013, Hudhud-2014, Vardah-2016, Okhi- 2017, Gaja- 2018 and Fani-2019 inflicted serious damage to the fishermen and their property. Engineers could develop a system of knowing such kind of disaster in advance in their fishing boat so that they could find the means of saving their lives. The most important concern in the fishing sector is the safety of life at sea. Collision between ship and fishing boats are becoming very common now a days and it is one of the urgent needs to be addressed. Most of the time fishermen are not getting the better price for their catch due to unhealthy practices of middlemen, local merchants, lack of good preservative, post harvest loss etc. Fish marketing societies (FMS) are formed in early eighties by KDFSF to save the fishers from the clutches of middlemen.

Demonstrations

A solar powered mobile phone charging station designed by Mr. Vincent Jain for the Veli boatyard is inaugurated by Dr. Manoharan. Mr. Jain also made a demonstration of fire alert system for using in the fishing boats and in boatyard which is also developed by him. His another demonstration in the programme is various kinds of LED lights covered by plastic bottles, bamboo, coconut shell, sea shell, cloth, pot, arak nut leaf, palm leaf etc. He is the creative designer of all these products. He requested the support of engineers to improve the designs of the products. This can be further expanded to a business which could be adopted for women Self Help Groups.

Prof. Gaswin Kastro was selected as "Best Faculty Volunteer of IEEE ADSF SIGHT" for the year 2018. He was honoured by a momento and a tree plant. Shri. Satish Babu, planted a tree in the Veli boatyard. He requested to everybody to avoid using plastics which is not only harmful to the human population to the world.

At the end the day team visited Jeppiar Fishing harbour, Muttom to see the live activities of fishing.

The following areas are included in the exposure programme.

1. Fish landing centre
2. Fish market
3. Fish marketing societies
4. Boat building centre
5. Sea safety items
6. Navigational equipments
7. Fishing craft and gears
8. Interaction with fishing experts and fishermen leaders
9. Meeting with IEEE experts in fishing

Colleges participated

1. Annai Vailankanni College of Engineering-Azhakapapuram
2. DMI Engineering College-Aralvaimozhi
3. Hindustan Institute of Technology and Science-Chennai
4. Loyola Institute of Technology and Science-Thovalai
5. Sri Sairam Engineering College-Chennai
6. Stella Mary's College of Engineering-Nagercoil
7. Holy Cross College –Arts and Science-Trichy
8. St. John's College-Arts and Science-Muttom

Seminar on Ocean Pollution and Ocean Safety

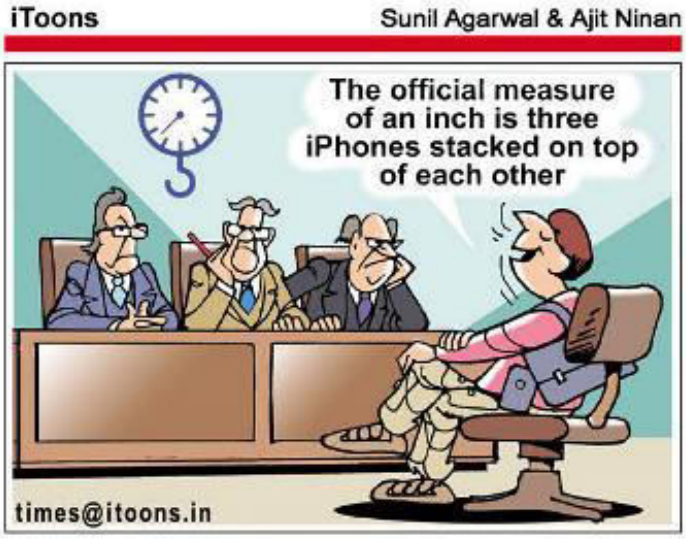
Oceans help feed the world, provide a living for millions of people, and are home to most of the life on the planet. But development, over fishing, pollution and introduction of exotic species in marine habitats has jeopardized marine eco-systems as well as biodiversity. Construction activities, sewage and pollution from industries in the field large cities threaten coastal eco-systems. So the amount of pollution in our ocean waters is alarming. In Indian Ocean around 5-6 million tones of petroleum and oil have been discharged into it—which is around 40% of the total petroleum spill in the world's waters.

Discussing ocean pollution brings up a diffuse, complex series of issues. Nevertheless, some pollution problems can have been successfully addressed. Since the network of oceans on this planet is interconnected, the pollution issue will only truly be solved by consistent improvement in areas across the globe. Knowing that the growing human population has intensified

the problem of ocean pollution, it is clear that we each need to get involved in contributing to the solution. It will require high degree of participation and collaboration at the individual, family, community, industry and government levels. Efforts at all of these levels become more effective with elevated public awareness about pollution source and impacts. Continued public support is vital for research, monitoring and further development of pollution reduction strategies and technologies.

To address this serious issue, South Indian Federation of Fishermen Societies (SIFFS) organized an awareness seminar by inviting fisherwomen, fishermen, youth from the community and students. The awareness seminar "Ocean Pollution and Ocean Safety" organized jointly with Kanyakumari District Sangams Federation (KDFSF), Friends of marine Life(FML) and Institute of Electrical and Electronics Engineers Artisanal Deep Sea Fishers Special Interested Group on Humanitarian Technology (IEEE ADSF SIGHT). It was supported by MAERSK, the largest container ship and supply vessel operator in the world since 1996. It was held on 28.05.2019 at Chinnathurai, Kanyakumari district. Mr. Robert of FML was the resource person for the seminar. He was assisted by Ms. Gouthami of FML. Mr. Vincent Jain of SIFFS-IEEE ADSF SIGHT organized the seminar along with his colleagues Mr. Christudas Mendez and Mr. Ubald Xavier. Fishers' representatives from women Self Help group, Fishermen cooperative society, youth with a total 37 participants attended this seminar.

Reports by: Vincent Jain, jain1.siffs@gmail.com



Google Maps to let India users see live train, bus travel status: Google Maps has added new features to let India users check live bus travel times in 10 cities and also see live status of trains. It will also offer mixed-mode commute suggestions that now combine auto-rickshaw and public transport.

Zomato announces 26 weeks paid parental leave for men, women: This also will apply to non-birthing parents and in cases of surrogacy, adoption and same-sex partners. Further, new parents will also be given an endowment of $1,000 per child.

IEEE Nagpur Section Activities

Workshop on Agile way of working and Design Thinking

A six-day IEEE workshop on "Agile way of working and Design Thinking" was organized during 20-25 May 2019 under the aegis of IEEE Nagpur Subsection, along with the support of TATA Consultancy Services as knowledge partner. It was conducted by renowned Ninja Agile Coach Mr. Prasanna Deshpande.

Heads of Department and Senior Professors from reputed colleges of Nagpur like RCOEM, GHRCE, YCCE, SVPCET and CCOEW attended the workshop.

The workshop provided extensive hands on sessions on the Agile and Kanban frameworks. The participants gained immense benefit as they worked on real life problem statements and learnt to design Products/Solutions which could add value to all stakeholders. Each group of participants was led by a Product Owner who mentored them throughout the workshop. The product life cycle design process was ably supported by Product Owners drawn from Academia and Industry like Dr. Preeti Bajaj, Mr. Kuldeep Singh Rana and Mr.Pranav Chauhan. Mr. Ranjit Singh, Vice Chair-Industry Relations IEEE Nagpur Subsection was also present throughout the workshop and gave critical inputs to the participants.

The groups created wonderful presentations to showcase their respective product design approaches. On the last day of the workshop, all the presentations were judged by Mr. Arvind Kumar, Chair-IEEE Nagpur Subsection. He gave the participants valuable feedback and discussed future course of action on sustainability and continuity of the project.

The participants' feedback gave a big thumbs-up to the fabulous organization of workshop, in-depth course content and its impactful delivery. The workshop was a runaway success in terms of bridging the gap between the Industry and Academia.

On the concluding day, certificates were distributed to the participants in recognition of their sincere efforts

Report by: Dr. (Mrs.) R. R. Khandelwal, richar.khandelwal@yahoo.com

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"We must design for the way people behave, not for how we would wish them to behave."
— Donald A. Norman

"Entrepreneur, design thinking is the ability to create, portray and deliver tomorrow's distinction, today. ~"
— Onyi Anyado,

"If a picture is worth a thousand words, a prototype is worth a thousand meetings"
— IDEO.org

"Design before development leads to dead ends." *— Liz Brown*

SAC IEEE India Council and Nokia University Collaboration
Experiential Learning – Industry Visit

The Student Activities Committee (SAC), in association with Nokia University Collaboration Team, Bangalore, successfully conducted a day-long workshop on upcoming mobile technologies, followed by network demos for students from IEEE sections across the country on 13th April 2019 (Saturday) at the Nokia R&D facilities in Bangalore.

The first session, after the morning coffee/tea, was conducted on 'Introduction to 4G wireless networks and its evolution' by Nagendren K. The talk focussed on the basic architecture of 2G/3G and how LTE has evolved from it. The speaker began the talk with three amusing objectives – to wake the students up, to keep them awake by the end of the talk and to tell them a bit about 4G. By the end of it, he was considerably successful in engaging the audience. Everyone had something to take away from the talk, for those in the audience who possessed a background of mobile telecom networks, the fine distinctions between LTE and 2G/3G were covered in great detail. For those new to the area, the session covered almost everything from the basics, from the OSI layer model to the 3GPP standards.

In logical succession to this session was the one on 5G, conducted by Rohith K A. Rohith focussed on the key areas for 5G, namely, Massive machine Type Communications (MMTC, also called the Internet of Things, IoT), Ultra Reliable and Low Latency Communications (URLLC), and higher data speeds. According to the International Telecommunications Union's (ITU's) IMT-2020 standards, the session showed us what the key use cases of 5G are, ranging from smart cities to self-driving cars, from work and play in cloud, to industry automation, from augmented and virtual reality to 3D UHD video streaming. He explained how modifications such as massive MIMO, network slicing, fast traffic forwarding, mm-wave communication multi-connectivity are enablers for the next generation 5G networks. When placed in context of the first session, this session enhanced the understanding of an up-and-coming technology that is poised to become a reality soon.

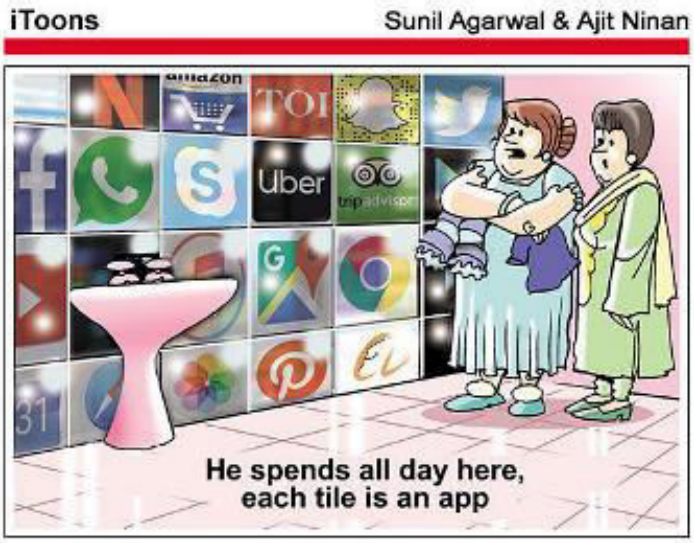
The last lecture session of the day was on one of the most trending areas of research and development today, the Internet of Things (IoT). The session, conducted by Zafrul Umar, provided rich detail, from why IoT is needed, to sensing as a service for smart cities supported by IoT, and even smart dust which employs sensors the size of dust particles. Zafrul also presented Nokia's Wide Area Global Network that Nokia provides for dedicated IoT application and characterised with low power and light-weight messages.

After the sessions, we had a break for lunch and also a group photograph post lunch. Three visits were organized post lunch and lasted till evening:

1. Technology demonstration of 4G and VoLTE
2. Technology Demonstration of 5G
3. Lab Tour of Nokia Product R&D labs

Overall, the one-day workshop was an enriching experience for the students who attended it. They got a taste of currently trending fields of research such as 5G and IoT. The workshop saw enthusiastic participation from around 97 students representing 10 out of 11 IEEE sections of India. Students from IEEE Bengaluru, Delhi, Gujarat, Hyderabad, Kerala, Kolkatta, Madras, Mumbai, Pune and Uttar Pradesh Section under the umbrella of IEEE India Council took benefit of the opportunity, though the representation from local Bengaluru section was higher. The initiative has received a very good feedback, 5 on 5 on all three aspects, Experiential learning outcome, Hospitality and registration Process. Gautama Bhardwaj from Bengaluru and one of the participant quotes : 'Thank you for the email and the participation letter. It was extremely well organized and exceeded all my expectations. I truly enjoyed the visit and learnt a lot. I'm really looking forward to further such events and collaborations which can help bridge the gap between industry and academia".

Report by Dr. Rajashree Jain, rajashreejain@gmail.com



World's 1st AI humanoid robot artist can draw from 'sight': British inventor and art gallery owner Aidan Meller has co-created a robot Ai-Da, describing it as the "world's first ultra-realistic AI humanoid robot artist". Ai-Da is capable of drawing from 'sight' using cameras in the eyeballs and AI algorithms created by Oxford University scientists.

Amazon unveils drone to carry out 30-minute deliveries 'soon': Amazon unveiled a new autonomous, electric 'Prime Air' drone aimed to start delivering packages to customers in 30 minutes or less, "within months". The drone can fly for up to about 24 kms and carry up to about 2.3 kgs, representing a majority of its packages.

Apple's iOS 13 features option to 'silence unknown callers': When the 'Silence Unknown Callers' setting is turned on, iOS uses Siri intelligence to let calls from numbers in Contacts, Mail and Messages ring a user's phone. However, all other calls are automatically sent to voicemail.

What's hot in IT - An Indian Perspective

Prof. S. Sadagopan
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May 2019

Universities, Science & Technology, Policy, Special events and Milestones

- **IISc** researchers claim **super-conductivity at room temperature** on May 27, 2019
- Engineering college seats approved by **AICTE drop** from 28.71 Lakhs in 2017-18 to 27.12 Lakhs in 2018-19; for 2019-20 it will drop further to 24.92 Lakhs!
- **SpaceX launched** its first set of **60 satellites** (of the 12,000 planned over 6 years) on May 23, 2019 to provide Internet connectivity
- **ISRO** successfully launches **RISAT-2B** Radar Imaging satellite on May 22, 2019
- After its first successful test flight on May 4, 2019 in Munich, **Lilium** starts 5-seater Air taxi with 300 KM range electric plane on May 16, 2019, a revolution in passenger flight
- **US President** imposes **$ 200 Billion duty** on **Chinese** imports on May 9, 2019; China retaliates and hikes duty on most US goods from June 1, 2019; **technology war** hots up on May 20, 2019 ith **Google** restricting Android access o **Huawei**; **Intel**, **QUALCOMM**getting forced to restrict supply / sourcing of components to / from China
- **Indian Parliamentary Elections** saw Narendra Modi led NDA coming to power on May 23, 2019 with a thumping majority
- **Shoot-out in USA** kills dozen people on May 31, 2019; fire in Surat Coaching Center kills dozen people on May 30, 2019; Super **cyclone Fani** causes extensive damage to life and property in **Odisha** on **May 3** and **West Bengal** & **Bangaldesh** on **May 4, 2019**; thankfully, there was minimum loss of lives thanks to extensive planning and coordination by the State governments and Central government

Products

- **Greaves Cotton** launches electric scooter **Ampere Zeal** for Indian markets on May 28, 2019; it is priced at Rs 66,950 (after Rs 18,000 subsidy from Government under FAME II Policy)
- **Apple** launches **iPod** (priced at $ 199) after four years on May 28, 2019
- **OnePlus** launches **7 Pro** in Bangalore on May 20, 2019
- **NOKIA** launches **Nokia 4.2** in India priced @ Rs 10,000 on May 10, 2019
- **Google** announces **Pixel 3** phone on May 10, 2010 (part of multiple announcements during **Google I/O**)

Markets

- India's stock market index **Sensex** touches 39,593 on Exit Polls predicting NDA victory on May 20, 2019 and went past 40,000 on NDA victory on May 23, 2019; Rupee gained nearly a Rupee on May 20, 2019
- **HPE** acquires **Cray** (the only company focused exclusively on super computers, founded by super computer pioneer Seymour Cray) on May 18, 2019
- **Uber IPO** is finally through in May 6, 2019; priced at $ 45 Uber raises $ 8.1 Billion, but loses value on the very first day of trading! In fact, created history by way of losing the maximum on Day 1 among all IPO's post 1975!

Indian IT Companies

- **Mindtree** starts delivery center in Atlanta in USA in May 2019
- **TCS** is **No 1** most-valued Indian company bypassing Reliance on May 5, 2019
- With 2018-19 turnover of $ 8.6 Billion **HCL** is **No. 3** Indian IT Services company (next to TCS and Infosys) bypassing Wipro with 2018-19 turnover of $ 8.1 Billion

MNC IT Companies in India

- **Goldman Sachs** starts a new delivery center in Bangalore with 1.25 Million square feet space to host 7,300 people at a cost of $ 250 Million on May 30, 2019 (it will be the third center globally for GS)
- Swiss Bank **UBS** hired 1,900 people in India in 2018-19 as per its May 2019 Report
- **Texas Instruments** (TI) gets approval from Government for an additional R & D facility in Bangalore in May 2019; the near Rs 1,000 Crore facility near International Airport will house 2,000 engineers. TI was the first MNC to bet on India with a facility in Bangalore set up way back in 1985!
- **MasterCard** to invest $ 1 Billion over the next years in India as per May 6, 2019 announcement
- AI driven Analytics firm based of Silicon Valley **ThoughtSpot** to invest $ 25 Million in Bangalore R & D center as per May announcement
- Fintech start-up **Samco** commissions its Rs 20 Crore R&D Center in Chennai in May 2019

People

- **Narendra Modi** takes oath as **India's Prime Minister** for a second time on May 30, 2019
- **UK Prime Minister** Theresa May announces her decision to **step down** in June on May 24, 2019
- **US Billionaire pays off students loan for 400 students** on May 20, 2019
- **Wal-Mart International CEO** Judith McKenna visits FlipKart Bangalore supply chain centre during May 2-3, 2019
- **Japanese new Emperor Naruhito** is sworn in on May 1, 2019 (Emperor Akihito abdicated his power on April 30, 2019)
- **Yogi Deveshwar** who transformed **ITC** from a cigarette company into an FMCG biggie over 25 years, passed away on May 11, 2019

Start-up Scene

- **FlipKart** set to acquire **Namdharis** in May 2019

Interesting applications

- RBI (Reserve Bank of India) extends the window of operations for **RTGS** by another 90 minutes (430 PM to 6 pm) from June 1, 2019 by facilitating online payments over longer period

Interesting numbers

- **Reliance Industries** with annual 2018-19 turnover of Rs 6.23 Lakhs Crores is bigger than **Indian Oil** with Rs 6.17 Crores, the first time ever!
- **GST** collection for May is stagnant at Rs 1 Lakh Crores

General

- Narendra Modi led NDA coming to power with 300+ seats on May 23, 2019 creates history; the first Prime Minister after Nehru & Indira Gandhi to get a second term as Prime Minister. Congress Party (Grand Old Party of India) continues to suffer with miniscule size of 52 seats!

April 2019

Universities, Science & Technology, Policy, Special events and Milestones

- **JEE Main results** out on April 29, 2019 (ahead of time)
- Professor **Gagandeep Kang** of Translational Health Science & Technology Institute, Faridabad, Delhi is the **first Indian woman** to become a **Fellow of the Royal Society** on April 20, 2019
- **NIRF** 2019 rankings out on April 8, 2019; IITM and IISc top the list; IITM, IITD, IITB, IITKGP & IITK are the **Top 5 Engineering Institutes**; IISc, JNU, BHU, UoH and Calcutta University are **Top 5 Universities**; IITM, IISc, IITD, IITB & IITKGP are the **overall Top 5**
- UC Berkeley Professor and IITK Alum Professor **Jitendra Malik** named **2019 IEEE Computer Society's Computer Pioneer award winner** on April 2, 2019
- IIT-KGP Alumnus and IITB faculty Dr **Subhasis Chaudhury** takes charge as **IIT - Bombay** Director on April 15, 2019
- MIT visualization scientist could share the first-ever picture of a black hole on April 10, 2019
- **Korea** becomes the first country to start offering **5G services** commercially on three networks in Korea starting April 2019; Samsung S10 5G is the first device to offer the service

- **Air India server breakdown** for six hours (330 AM to 930 AM on April 27, 2019) leads to several hours of wait for thousands of passengers across the globe
- **Japanese Emperor** abdicates power *on April 30, 2019***;** the **new Emperor** is anointed on May 1, 2019
- **Sensex** touches **39,000** on April 28, 2019
- **Microsoft** market capitalization touches **$ 1 Trillion** on April 25, 2019
- Crude **oil price** shoots **past $ 75** per barrel on April 25, 2019
- **Bajaj quadri-cycle** finally reaches Indian roads on April 18, 2019
- **Terrorist attack in Sri Lanka** on Easter Sunday kills hundreds on April 21, 2019
- **Jet Airways operations** come to a **grinding halt** on April 17, 2019
- Fire damages the 850-year old historic Notre Dame cathedral in France on April 16, 2019; global efforts to restore the monument takes off in a big way
- **Indian Parliamentary Elections** off to a good start on April 12, 2019; to end on May 19, 2019 with results on May 23, 2019
- **Gmail** turned 15 on April 1, 2019
- RBI cuts Repo rate by 0.25% on April 4, 2019; Maruti will stop selling Diesel cars from April 1, 2010

Markets

- Markets ended high by the end of the financial year 2018-19 with BSE touching 39,000 and **NSE** touching 11,500 by March 31, 2019 (the last day of trading) representing 9% increase over the year
- **Mindtree** joins the **"billion dollar club"** on April 17, 2019
- **L & T Infotech** hostile take-over of Mindtree continues to draw attention in April too

Indian IT Companies

- **Mindtree** joins the **"billion dollar club"** on April 17, 2019
- **TCS & Infosys** post good results for Q4 and the financial year 2019-20 on April 12, 2019; TCS revenue crosses $ 20 Billion; Infosys revenue crosses $ 11 Billion
- **Wipro** posts **38% growth** in Q4 profits; announce buyback of Rs 10,400 Cr

MNC IT Companies in India

- **ThoughtSpot** (US-based AI & analytics company) announces its decision to invest $ 25 Million in Bangalore center

People

- **Wal-Mart CEO** visits India during April 15-16, 2019
- IIT-KGP Alumnus and IITB faculty Dr **Subasis Chaudhury** takes charge as **IIT - Bombay** Director on April 15, 2019
- Government of India's experiment of **lateral induction of talent in government** fructifies with five joint secretaries appointed on April 12, 2019
- **Kanishak Kataria**, IITB Alum, is No 1 in Indian Civil Services Exam (results were out on April 8, 2019)!
- **David Malpass** was named the **13th World Bank President** on April 5, 2019
- **Keshav Murugesh** and **Praveen Rao** are **Chair** and **Vice Chair** of **NASSCOM** for FY 2019-20 (starting April 1, 2019)

Start-up Scene

- Leading **RPA** (Robotic Process Automation) vendor **UiPath** gets **$ 568 Million fund infusion** on April 28, 2019
- **BookMyShow** invests in Pune-based payments start-up AtomX in April 2019
- **Dream11** (Mumbai-based fantasy sports company) is the latest Unicorn (with investment from Steadview Capital on April 9, 2019) that too with just 220 employees!
- **Airbnb** to invest up to $ 200 Billion in **Oyo** starting April 2019

Interesting numbers

- **GST** collection for March Rs 1.06 Lakh Crores, the largest ever
- **Sensex** crosses 39,000 for the first time ever on April 1, 2019

General

- **Gaana** reaches **100 million** monthly users in April 2019

- **BoB (Bank of Baroda)** becomes the third largest Indian Bank (after SBI and HDFC) with the merger of Dena Bank and Vijaya Bank on April 1, 2019; the transition was fairly smooth for millions of customers
- Google abandons AI Ethics board on April 3, 2019

March 2019

Universities, Science & Technology, Policy, Special events and Milestones

- **AI** pioneers **Yoshua Benigo** (Univ. of Montreal), **Geoffrey Hinton** (Univ. of Toronto) and **Yann LeCun** (New York Univ.) win **Turing Award** (the Nobel Prize in Computing) on March 28, 2019
- **Abel Prize 2019** goes to Norwegian woman (the first time ever for a woman) Prof. Karen Uhlenbeck of UT Austin
- **India** successfully demonstrates capability to shoot down Low Earth Orbit satellite, joining an elite club - the 4th Nation with such capability
- Google and Facebook suffer outage lasting several hours in March 2019
- **Election Commission** announces date of **General Elections to the 17th Parliament** on March 10, 2019; April 11 to May 19 are the election days and with May 23, 2019 is the day of counting!
- **UIDAI** decision to charge Rs 20 per eKYC transaction on March 9, 2019 to upset the apple-cart of Fintech companies
- **Supreme Court** appoints **mediation council** to find a solution within 8 weeks for the vexed **Ayodhya problem** on March 7, 2019
- **US Senate** votes **to end local emergency** in US Southern border on March 14, 2019
- **WWW** turns 30 in March 2019
- **Wikipedia** turns 18 on March 12, 2019
- Kirloskar Industries turns 100 in March 2019
- British Parliament votes to delay Brexit on March 13, 2019; Prime Minister Theresa May suffers another loss of vote on March 29, 2019; BRExit is in deep trouble
- Mozambique storm, Plane crash, New Zealand bombing, Mumbai bridge collapse and Dharwad building collapse cause lots of human misery in March 2019

Products

- **Apple** launches **TV App, News and Credit Card** on Mar 25, 2019 in an exclusive event in SFO
- **Google** launches Google Music App in India on March 12, 2019
- **Google Bolo App** launched in India on March 6, 2019, targeting rural children
- **Galaxy S-10** and **S10+** launched by **Samsung** in India on March 6, 2019

Markets

- Markets ended high by the end of the financial year 2018-19 with BSE touching 39,000 and NSE touching 11,500 by March 31, 2019 (the last day of trading) representing 9% increase over the year
- **L & T Infotech** hostile take-over of Mindtree kept March alive
- Japanese **Murta** picks up stakes in Coimbatore-based **Versa** on March 10, 2019
- **Arcelor-Mittal** wins bid for **Essar Steel** on March 9, 2019
- **NVIDIA** acquires chip maker **Mellanox** for $ 4.9 Billion on March 8, 2019

Indian IT Companies

- **Infosys** buys 75% stake in **Stater** – an **ABN AMRO subsidiary** – for $ 130 million on March 29, 2019
- **HCL** signs contract worth $ 1.3 Billion with **Xerox** on March 1, 2019
- **Infosys** gets **Rolls Royce** contract on March 7, 2019
- **Kirloskar turns 100** in March 2019

MNC IT Companies in India

- **Google Pay** expands to 200,000 merchants in India in March 2019, thanks to **PineLabs** and **Innoviti**

People

- IIT-KGP Alumnus and IITB faculty Dr **Subasis Chaudhury** named **IITB Director**
- **Premji's** philanthropy touches Rs 100,000 Crores in March 2019
- **Mukesh Ambani** enters the global Top 10 Richest list in March 2019

- **Jet Airways founder Naresh Goyal** steps down from the Board on March 25, 2019 after 27 years as Chairman; Bank Consortium led by SBI take 51% control
- **Ghose** is the new Lokpal!
- **Goa Chief Minister Manohar Parrikar** passed away on March 17, 2019; an IIT Bombay Alum and a humane person he was Goa Chief Minister four times and Union Defence Minister
- **Subhash Garg** is the new **Finance Secretary** from March 9, 2019
- **Adhiya** is the Chairman for **BoB** (Bank of Baroda); assumes special significance as **Vijaya Bank** and **Dena Bank** are said to merge into **BoB** on April 1, 2018

Start-up Scene

- **Mirace** of South Korea invests $ 150 Million in **BigBasket**; with their valuation BigBasket turns Unicorn!
- Blockchain start-up "**New Street Tech**" gets Rs 14 Cr funding on March 25, 2019
- **Ola Cabs** gets its license revoked on March 21, 2019; gets back its license after paying Rs 15 L fine on Mar 25, 2019
- **90 Start-ups** get **Angel tax exemption** on March 20, 2019
- **PineLabs** acquires **Quikcilver** for $ 110 Million on March 19, 2019
- **Hyundai & Kia Motors** invest $ 300 Million in **Ola Cabs** on March 12, 2019
- **Zoho** acquires **ePoise** on March 8, 2019
- **Cognizant** acquires **MeritSoft** on March 5, 2019

Interesting applications

- **Multi-modal transport card Swagat** launched on March 4, 2019

General

- Several governments around the world, including Indian Government, decide to ground Boeing 737 Max planes in March 2019; Boeing sees $ 42 Billion loss of market capitalization on a single day on March 13, 2019
- Ethiopian Airlines crash leaves 171 dead (including 4 Indians) on March 8, 2019
- For the third year in a row, **Indore is the cleanest city** in India

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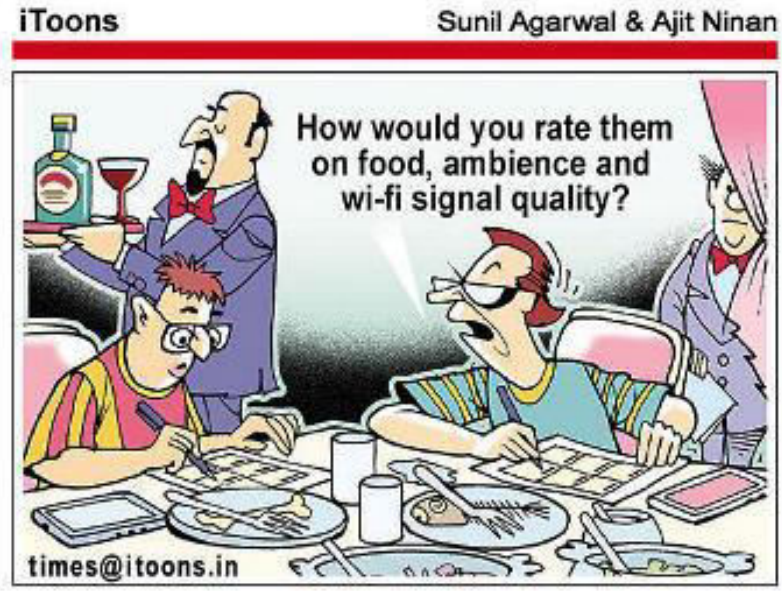
About the author: Professor Sowmyanarayanan Sadagopan (ss@iiitb.ac.in) is the Director of IIIT-Bangalore. These are his personal views. He has been writing on "What's Hot in IT" from an Indian perspective continuously from 1997; Times of India, Financial Express, IT Magazine carried the monthly (and yearly columns) till 2016; IEEE India has been carrying the quarterly columns since 2017



Information Resources

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The history of machine learning: Today, machine learning powers tools such as self-driving cars, voice-activated assistants and social media feeds. However the ideas behind machine learning have a long history, and rely on maths from hundreds of years ago and the enormous developments in computing in the last 70 years. Full story at https://www.bbc.com/timelines/zypd97h

Getting started with Git and GitHub: the complete beginner's guide: Git and GitHub basics for the curious and completely confused (plus the easiest way to contribute to your first open source project ever!) http://bit.ly/2F3fb76

12 Industries Experts Say Millennials Are Killing — And Why They're Wrong: The perception of the millennial generation as exceptionally narcissistic, immature, and disengaged from society has fueled a thousand hot takes on the industries they're "killing." Here's what's really going on. Every few weeks, another story about the dreaded generation surfaces: millennials are killing casual dining; millennials are killing breakfast cereal; millennials are killing home ownership. Pundits aren't shy about diagnosing what's causing these deaths, either. Also known as Gen Y, millennials are often painted as screen addicts who can't eat a meal without sharing it on Instagram — which is why they won't sit down for a meal at Applebee's. They're commitment-phobes who balk at the idea of being tied down, and that's why home ownership rates are down. http://bit.ly/2RefuRd

What is computational storage?: Computational storage is an information technology (IT) architecture in which data is processed at the storage device level to reduce the amount of data that has to move between the storage plane and the compute plane. The lack of movement facilitates real-time data analysis and improves performance by reducing input/output bottlenecks. http://bit.ly/2F3fE9m

Ten big global challenges technology could solve: According to The MIT Review, the following are ten big global challenges technology could solve while none is easy, but all are incredibly important. Carbon sequestration, Grid-scale energy storage, Universal flu vaccine, Dementia treatment, Ocean clean-up, Energy-efficient desalination, Safe driverless car, Embodied AI, Earthquake prediction, Brain decoding. http://bit.ly/2XKl3JM

Governments are rushing to regulate the internet. Users could end up paying the price: For years, this libertarian thinking was the guiding philosophy of Silicon Valley as tech firms aggressively pushed back at any attempt to regulate them or control how people behaved online. Conveniently, this lack of regulation allowed them to build massive monopolies and make huge profits. Today, Silicon Valley is facing the backlash. Amid widespread concerns over fake news, influence campaigns, cybersecurity and the sharing of violent and extremist content, more and more countries are pushing to rein in big tech. https://cnn.it/2Wzo663

How to Be a Better Web Searcher: Secrets from Google Scientists: A 2016 report by Stanford University education researchers showed that most students are woefully unprepared to assess content they find on the web. For instance, the scientists found that 80 percent of students at U.S. universities are not able to determine if a given web site contains credible information. And it is not just students; many adults share these difficulties. http://bit.ly/2X98af4

Top 11 RPA tools: If you're ready to start welcoming robots into your workflow, here are 11 of the top RPA tools for streamlining your workflows and saving your users from the tedium of old software, as well as some open source projects to check out. http://bit.ly/2WwTa6x

AI Knowledge Map: How To Classify AI Technologies: This landscape is useful for people new to the space to grasp at-a-glance the complexity and depth of this topic, as well as for those more experienced to have a reference point and to create new conversations around specific technologies. http://bit.ly/2X1PMVu

What is Blockchain Technology?: Blockchain technology offers a way for untrusted parties to reach consensus on a common digital history. A common digital history is important because digital assets and transactions are in theory easily faked and/or duplicated. Blockchain technology solves this problem without using a trusted intermediary. This explainer will offer simple definitions and analogies for blockchain technology. It will also define Bitcoin, Bitcoin Cash, Ethereum, Litecoin, blockchain, and initial coin offerings. Along the way, we'll highlight promising use cases for blockchain technology. http://bit.ly/2KlqLyL

The Automation Playbook: The Automation Playbook is a useful source of information for all industries as you look for guidance in how to approach the Industrial Internet of Things (IIoT), new communication protocols, control implementation, safety, asset management, predictive maintenance, a mobile workforce, and so much more. It covers them in three chapters – Factory & Machine Automation, Batch Processing and Continuous Processing. http://bit.ly/2Zp4SlA (Simple registration is required to download this playbook)

No sleep, no sex, no life: tech workers in China's Silicon Valley face burnout before they reach 30: He is so focused on keeping his start-up alive that he can't sleep at night. She was asked in an interview if she would be willing to break up with her boyfriend for the job. A young couple want their own family but have no energy for sex after work. These are some of the struggles faced by the hundreds of thousands of young workers in China's tech industry like Yu Haoran, a 26-year-old computer science major, who in 2014 founded Jisuanke, a start-up in Beijing's hi-tech Zhongguancun district to teach kids coding. Yu has worked nights and weekends to grow his business from a 10-coder team to one with a 200 million yuan (US$29.8 million) valuation thanks to venture capital backing. But the personal price he pays is chronic insomnia, sometimes getting just two hours of sleep every night. http://bit.ly/2MJj878

Why your smartphone is causing you 'text neck' syndrome: Most of us hunch over our smartphone for at least two hours a day. This can effectively increase the weight of your head by up to 27kg, damage your posture, and if you text while walking, expose you to all kinds of accidents. Typically people crane their neck forward 45 degrees when sending text messages. This places a weight of almost 22kg on the spine, cervical ligaments and other muscles – five times the pressure considered normal, according to a Surgical Technology International study. Over the course of a year, this amounts to an additional 1,000 to 1,400 hours of pressure on the average smartphone user's spine. http://bit.ly/2ML7W9Z

32 Statistical Concepts Explained in Simple English (a series in 11parts); This resource is part of a series on specific topics related to data science: regression, clustering, neural networks, deep learning, decision trees, ensembles, correlation, Python, R, Tensorflow, SVM, data reduction, feature selection, experimental design, cross-validation, model fitting, and many more. Part 11 at http://bit.ly/2X4uvul (Links to the rest 10 parts are at the end of the post)

Facial Recognition: 16 Industries The Tech Could Transform; From screening patients for clinical trials to assessing the emotional state of drivers, we dive in to how facial recognition technology is shaping the future. The biometric software behind facial recognition applications can identify facial structures, contours, and expressions, making it a no-brainer for security and identification purposes. But it can also lead to creative applications that serve a different purpose. Listerine, for example, created an app that uses facial recognition to notify people who are blind that they were being smiled at. While the technology is still developing, many companies (including Amazon) are banking on it as a disruptive force in a myriad of markets. At the same time, the tech is highly controversial — with privacy as a point of concern. From creating checkout-free retail stores to eliminating concert tickets, here are 16 industries that are starting to transform with facial recognition technology. http://bit.ly/2wPCjRP

Web 3.0: the decentralised web promises to make the internet free again: Have you recently considered deleting your Facebook account, boycotting Amazon or trying to find an alternative to Google? You wouldn't be alone. The tech giants are invading our privacy, misusing our data, strangling economic growth and helping governments spy on us. Yet because these few companies own so many of the internet's key services, it seems there is little people can do to avoid having to interact with them if they want to stay online. However, 30 years after the world wide web was created, a third generation of web technology might offer a way to change things. The DWeb, a new decentralised version of cyberspace, promises to enable better user control, more competition between internet firms and less dominance by the large corporations. But there are still serious questions over whether it's possible – or even desirable. http://bit.ly/2XHZ3yT

100 common Windows 10 problems and how to solve them: Now that Windows 10 has overtaken Windows 7 as the most popular operating system, it's bigger than ever. The sequel to Windows 8.1 has been out for more than three years now, and has given users plenty of time to figure it out. Luckily, most Windows 10 problems have been patched out by Microsoft over the last few years. There are still some security exploits and other bugbears that have either lingered or have been caused by recent Windows updates. This is in part because Windows 10 updates are still kind of a mess, the most recent of which, the October 2018 Update, caused all kinds of issues, including Blue Screen errors on Microsoft's own Surface devices. That could be why the adoption of that update is only now starting to take off, just in time for the next one. If all of these problems are any indication, Microsoft has a lot of work to do. Plus, there are still a lot of Windows 10 problems that are still around, like printer connectivity issues. But, who knows, maybe Microsoft will actually fix some of these problems in the Windows 10 May 2019 Update, which should be out soon. Still, if you're having a hard time with

the operating system, we've compiled a guide to 100 of the most common Windows 10 problems, and how to fix them – whether it's a Windows 10 problem with a printer or connectivity issues. So, if you're trying to troubleshoot your device, keep reading. http://bit.ly/2KeO4Ki

5G & The Future Of Connectivity: 20 Industries The Tech Could Transform: The next generation of wireless technology could affect a wide range of industries, from healthcare to financial services to retail. 5G is set to enhance connectivity across networks. This is especially important as the number of Internet of Things (IoT) devices rises, along with the amount of data they generate. The technology will enable faster data transfer speeds (from 4G's 1Gbps to 10Gbps). As a result, 5G creates tremendous opportunity for numerous industries, but also sets the stage for large-scale disruption. Major 5G network deployments are expected by 2020, and a projected 4.1B IoT cellular connections will use 5G worldwide by 2024, according to Ericsson. From enabling remote robotic surgery and widespread adoption of autonomous cars to improving crop and livestock management, 5G is poised to disrupt a plethora of the world's biggest industries. We dig in below. http://bit.ly/2WFQecG

The Rivers in Our Skies: In December 2016, meteorologist F. Martin Ralph was sitting in a restaurant in San Francisco. On the TV screen, the weather report was talking about a particular kind of weather formation called an atmospheric river, which was headed right for California. Atmospheric rivers are exactly what they sound like—rivers of water vapor, flowing through the atmosphere. They move from the tropics toward the continents and poles, stretching to as much as 375 miles wide and carrying more water than multiple Mississippi Rivers. When an atmospheric river meets mountainous terrain like the Sierra Nevada, the water vapor condenses and becomes rain or snow. Strong atmospheric rivers can bring about floods and landslides, but the water and snowpack they leave behind provide California with 25 to 50 percent of its yearly precipitation in just a few days. http://bit.ly/2X2D4G5

How much is your data worth?: If data are the new oil, then Google, Facebook, Amazon and other tech groups are, naturally, the biggest extractors. But nearly every kind of company is getting into the business, which is worth $76bn, and will be more than double that by 2022 — nearly $200bn. Think about that for a minute. Data are, for Big Tech companies and others that harvest it, the main business input — in fact, the only real input, aside from labour. Imagine if GM or Ford didn't have to pay for steel or rubber or widgets — think what their margins would be. That's the business model of surveillance capitalism. You aren't just the product, to be sold to advertisers. You are also the raw material to make the product used to sell you to advertisers. Yep, we are in the Matrix. Full report at http://bit.ly/2IBwEV4

How the Boeing 737 Max Disaster Looks to a Software Developer: Apparently the 737 Max pitched up a bit too much for comfort on power application as well as at already-high angles of attack. It violated that most ancient of aviation canons and probably violated the certification criteria of the U.S. Federal Aviation Administration. But instead of going back to the drawing board and getting the airframe hardware right (more on that below), Boeing relied on something called the "Maneuvering Characteristics Augmentation System," or MCAS. Boeing's solution to its hardware problem was software. http://bit.ly/2WDoQff

What Is Edge Computing?: The cloud is no longer sufficient to instantaneously process and analyze the troves of data generated — or soon to be generated — by IoT devices, connected cars, and other digital platforms. Enter edge computing. http://bit.ly/2Wz7POj

Shorter Walks, Better Shopping: How Airport Design Is Changing: A surge of air travelers is pushing airports to renovate and expand like never before — and many are going with modern designs that can accommodate revolutionary changes in technology. http://bit.ly/2XHtOEi

Industry 4.0 as an evolution, not a revolution: Industry 4.0 is the way forward for manufacturing enterprises looking to future-proof their businesses. Enterprises will accelerate adoption at scale and fully realize the benefits by understanding fundamental business needs and implementation stages as an evolution with increasing value add. This report explains the logical phases leaders should consider before embarking on their Industry 4.0 journey and help improve the current low rate of successful full scale adoption. https://infy.com/2X76VwN

How One Man's Legacy Could Help Rebuild Notre-Dame Cathedral: Following the devastating fire at Notre-Dame Cathedral in Paris, hundreds of millions of Euros have already been pledged to help facilitate its reconstruction. But while funding is crucial, technology may well hold the key to making an accurate restoration possible. This is where the late Doctor Andrew Tallon comes in. A pioneering art historian and father of four, Tallon sadly died on November 16, 2018, from cancer at the age of just 49. Though he is no longer with us, his work now appears more vital than ever. http://bit.ly/31q6u0d

Freedom on the Net 2018: The Rise of Digital Authoritarianism: Freedom on the Net is a comprehensive study of internet freedom in 65 countries around the globe, covering 87 percent of the world's internet users. It tracks improvements and declines in internet freedom conditions each year. The countries included in the study are selected to represent diverse

geographical regions and regime types. In-depth reports on each country can be found at www.freedomonthenet.org. http://bit.ly/2ReZf6v

OSINT (Open Source Intelligence) Tools and Resources Handbook; The handbook contains over 130 pages of recommended tools, technologies, apps, extensions, websites and other resources of value to research and intelligence professionals. Download the handbook from http://bit.ly/2X77mXX

Best cloud storage of 2019 online: free, paid and business options: Businesses and consumers are increasingly reliant on cloud based storage solutions instead of in-house, on-premise local storage hardware. Your files are stored in the cloud, which is a simplified view of what is essentially someone else's infrastructure (data center, server, hard drive, connectivity etc). Ever since Amazon popularised storage online with S3 (Simple Storage Service), 13 years ago, Google data shows that interest for "Cloud Storage" alone has increased by 40x over the past decade. So much so that people less frequently refer to it as "online storage". Given the multitude of cloud storage providers out there, one has to wisely choose a provider who will offer the maximum amount of low-cost storage and bandwidth, while still keeping your data safe. This list represents our top picks for cloud storage: most offer a free tier allowing you to see if they're right for you before handing over any hard-earned cash. Business users will need to consider carefully what their needs are as terms and conditions as well as quality of service is likely to differ significantly from their consumer alter ego. http://bit.ly/2ZlT03A

87 Revealing Job Interview Questions From Hiring Managers In Business And Tech: Maybe you're a hiring manager seeking better questions to plumb the depths of candidates' souls, or you're an interviewee wanting mock questions to be ready for anything in the job market. This list should help you sharpen your blade ahead of an interview. http://bit.ly/2ZlmTAZ

Leonardo da Vinci: 500 years after his death his genius shines as bright as ever: This year marks the 500th anniversary of Leonardo da Vinci's death. Widely considered one of the greatest polymaths in human history, Leonardo was an inventor, artist, musician, architect, engineer, anatomist, botanist, geologist, historian and cartographer. Full Post at http://bit.ly/2Rcnq5l Additional reading: Bibliography of articles on Leonardo da Vinci (currently 29 articles); Leonardo joined art with engineering; 8 things you may not know about Leonardo da Vinci, on the 500th anniversary of his death; Why Leonardo da Vinci was a genius; Leonardo da Vinci designed an ideal city that was centuries ahead of its time; Leonardo da Vinci revisited: was he an environmentalist ahead of his time?; How Leonardo da Vinci, 'Master of Water', explored the power and beauty of its flow; Leonardo da Vinci's helicopter: 15th-century flight of fancy led to modern aeronautics; Four ways in which Leonardo da Vinci was ahead of his time; How Leonardo da Vinci made a living from killing machines. http://bit.ly/2ICNnY5

Open Source Software: The Complete Wired Guide: When someone buys a new smartphone, often they're preoccupied with the camera specs or the size of the screen or its storage capabilities. It's easy to overlook one of the most foundational aspects of these sleek consumer gadgets: their operating systems. The world's most popular mobile operating system is Google's Android. It powers more than 86 percent of smartphones in the world. What's even more remarkable is that Android is based on the open source Linux operating system. That means anyone can view the code at the heart of the vast majority of smartphones, modify it, and, more important, share it with anyone else. This openness enables collaboration. Unlike, say, Microsoft Windows, which was developed and is maintained by a single company, Linux is developed and maintained by more than 15,000 programmers around the world. These programmers might work for companies that compete with each other, or they might volunteer to create something new that's then given away. For free. Gratis. Full guide at http://bit.ly/2F4afyv

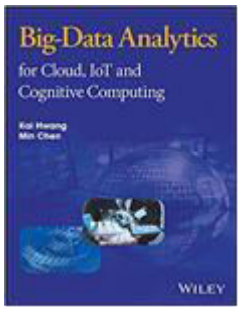
Informatics as a Fundamental Discipline for the 21st Century: Informatics for all is a coalition whose aim is to establish informatics as a fundamental discipline to be taken by all students in school. Informatics should be seen as important as mathematics, the sciences, and the various languages. It should be recognized by all as a truly foundational discipline that plays a significant role in education for the 21st century. http://bit.ly/2ReZf6v

PC components explained: how to pick the best components for your PC: Even if you already know how to build a PC, finding the best PC components is always a test of endurance. Whether you're looking for the best graphics card, processor, motherboard or even RAM, it's always a lot of work. The market can get confusing, especially if you're new to the computing world, but we're here to help you get your planning and research started. So, we crafted a tutorial, to help you find the best PC components at the right price, so you can build the best PC without too much added stress. We'll help set you on the right path to finding the best PC components, as having a good idea of what you want can make building a PC so much easier. http://bit.ly/2WCaN4W

Talks to help you find the right job (11 videos): You want work that makes you feel happy, challenged — and appreciated. These talks might help you find that elusive combination, as you define your working life on your own terms. http://bit.ly/2RaoGpR

For more resources, pl. visit Interesting Reads archives at http://bit.ly/2XGyIkZ

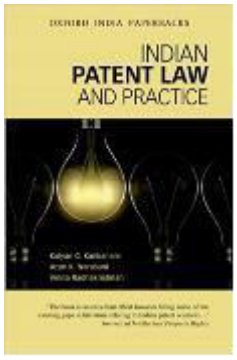
Books



Big-Data Analytics for Cloud, IoT and Cognitive Computing

Kai Hwang and Min Chen
2017 / 432 Pages / Paperback / Rs. 839 (On Amazon India Rs. 674)
ISBN: 978-8126570430 / Wiley

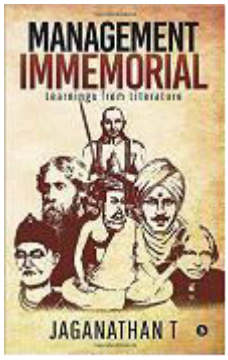
This book blends together big-data theories with emerging technologies on smart clouds over the Internet of Things (IoT). Data analysts and computer scientists must learn how to use clouds and IoT effectively to discover new knowledge, or to make critical decisions intelligently. This book aims to close the gaps between these learning groups, and encourages mutual learning and collaborative work between data scientists and cloud programmers. The world-renowned authors take a technological fusion approach to integrating big-data theories, cloud design principles, IoT sensing, machine learning, data analytics, and Hadoop and Spark programming in a single volume in 3 parts and 8 chapters. Part 1 focuses on data science, the roles of clouds and IoT devices and frameworks for big-data computing. Big data analytics and cognitive machine learning, as well as cloud architecture, IoT and cognitive systems are explored, and mobile cloud-IoT-interaction frameworks are illustrated with concrete system design examples. Part 2 is devoted to the principles of and algorithms for machine learning, data analytics and deep learning in big data applications. Part 3 concentrates on cloud programming software libraries from MapReduce to Hadoop, Spark and TensorFlow and describes business, educational, healthcare and social media applications for those tools. The companion website at https://www.wiley.com//legacy/wileychi/hwang2/ gives you access to the rich tools and resources available for this text which include: PowerPoint slides and Solutions Manual.



Indian Patent Law and Practice

Kalyan C. Kankanala et al
2012 / 376 Pages / Paperback / Rs. 465 (On Amazon India Rs. 427)
ISBN: 978-0198089605 / Oxford India

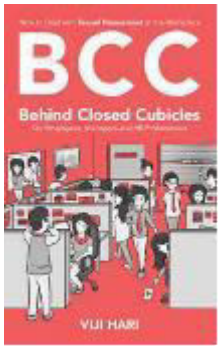
This book is a practical and comprehensive reference work on Indian patent law. It covers various facets of Indian patent law ranging from acquiring a patent to enforcing and managing patent portfolios. Each chapter provides insights into theory before elaborating on practical issues. The volume blends technology, management, and law to give an insight into patent concepts. Supplemented by analyses of relevant cases and illustrations, the work delves into patent aspects relating to chemistry, pharmaceuticals, biotechnology, software, electronics, and manufacturing. Discussions on skill-based aspects of patent law such as specification and claim drafting, licence drafting, patent searching, and infringement analysis have also been included in the book. Providing a lucid presentation of complex issues, the volume also analyses comparative jurisdictions from across the world. Patent professionals can use the book to refer to specific issues with ease as it provides an understanding of various aspects of law based on provisions in acts, rules, and decided cases. Business managers may refer to strategic elements and business parameters to enable decision-making at various points in the patent life cycle. It will be a valuable text to students and teachers of law, science, technology, business and management



Management Immemorial: Learnings from Literature

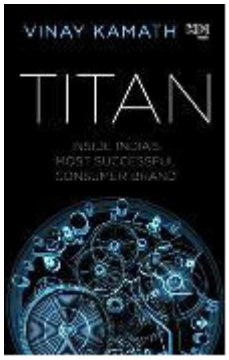
T. Jaganathan
2019 / 174 Pages / Paperback / Rs. 250
ISBN: 978-1684660353 / Notion Press

'Management Immemorial' is more than a 'self-help' book in that it is not just a coaching guide for 'growth skills'. Using Indian Literature as reference, the author triggers further introspection. The reader of this book will feel inspired to delve deeper and find new learnings for his or her own development. The ideas have been categorized under 3 sections viz. Aspirational Attitudes, Scintillating Skills and Leadership Traits. 'Management Immemorial' uses amazing references from classical and contemporary literature, anecdotes from epics like Ramayanam, Mahabharatham and elucidations from the holy 'Bhagawad Gita'. References are drawn from classical Indian languages Tamil, Sanskrit and Hindi. The author uses a unique style of expounding contemporary management concepts using impactful references from Literature not normally seen in any other `self-help' book. The highlights of this book are its simple style, coherent flow, powerful quotes, fascinating stories, enriching experiences, Stimulating references, all related to Best Practice ideas and Valuable Take-aways. Essentially, `Management Immemorial' is a powerful read for those who want to develop their career and life. Forewords from Prof. L.S.Ganesh (IIT Madras) and H.R. Mohan (ACM, IEEE & CSI), eminent thought leaders add luster to the contents of the book.



BCC: Behind Closed Cubicles
Viji Hari
2016 / 158 Pages / Paperback / Rs. 200
ISBN: 978-1946204608 / Notion Press

This book BCC is a collection of 18 short, real life stories of Sexual harassment at across the Indian Workplace. BCC, demonstrates, through a collection of short stories, how apparently harmless statements and actions have impacted people at the workplace. The short stories are based on real life sexual harassment incidents from across the Indian corporate world. Stories that include both genders, and range from freshers to CXOs, and across different industries. BCC attempts to give tips and share best practices to Employees, Managers, HR, Committee members, Employers, etc., so the reader is better equipped to deal with different forms of incidents. This book will also help students to understand the context of Sexual Harassment before they start their career.

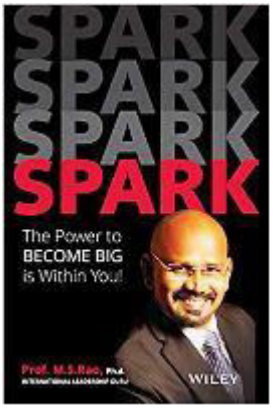


TITAN: Inside India's Most Successful Consumer Brand
Vinay Kamath
2018 / 224 Pages / Hardcover / Rs. 599 (On Amazon India Rs. 335)
ISBN: 978-9350099780/ Hachette India

When Titan Company Limited launched its quartz watches some 30 years ago, the founders' a merry bunch of Tata employees who started out simply wanting to do something different could not have foreseen just how completely they would capture the imagination of Indian consumers in the post-liberalization era of the 1990s. The brand they created at first against tremendous odds and restrictive norms injected freshness into the market and in retail spaces through its cutting-edge marketing strategy and empathetic advertising. Not only did the new watchmakers on the block transform watches from being utilitarian objects to fashion statements, but it also systematically ventured into areas untapped by corporate entities with its brands Titan, Tanishq, Titan Eyeplus, Skinn and Taneira, and established itself as a winner across multiple verticals. Titan: Inside India?s Most Successful Consumer Brand takes readers from boardrooms to back rooms to reveal how a quintessential Indian brand from the house of the Tatas, not known till then for its success in the consumer goods market, reached such remarkable heights. It is a tale of innovation and fortitude, of thinking outside the box and staying the course, of obsession with detail and the courage to acknowledge failure. A story that will inspire every reader, here is the inside account of what continues to make Titan tick. The book authored by Vinay, a seasoned business reporter, correspondent and editor captures what lies at the heart of the company and the brand Titan – a best known home-grown brand, it's people and its tremendous success in consumer business makes it rewarding for readers.

Leading and Motivating Global Teams: Integrating Offshore Centers and the Head Office
Vimal Kumar Khanna
2017 /186 Pages / Hardcover / Rs. 995 (UK Original Price UKP 63.99)
ISBN: 978-1498784740/ Auerbach Publications, CRC Press

This book provides techniques for offshore center managers and head office managers to motivate and manage globally distributed teams, which are spread across the offshore center and the head office, and thereby achieve higher productivity. Readers learn how to integrate the offshore center with the head office to make the offshore team an extension of the head office. While integrating teams with the head office, offshore center managers can still retain independence and authority to meet team aspirations. The book provides insight into devising new organizational structures to balance the authority and responsibilities of offshore center and head office managers. Head office managers responsible for managing globally distributed projects learn how to achieve a higher success rate on their projects and be better rewarded for their efforts in offshoring. Head office managers also learn techniques to make more significant contributions in their expatriate assignments to the offshore center. This book with numerous case studies guides both the offshore center managers and the head office managers to fully realize the potential of the offshore center, which can result in higher revenues and profitability. It will serve as a valuable reference to managers of all levels ranging from first level project managers to senior and executive managers. The TOC of the book include: Introduction; Be "Truly Global" in Outlook and Character; Authority and Freedom to Offshore Center Management; Integrate Offshore Center with Head Office but Retain Local Work Culture; Career Growth for Offshore Center Employees to Global Top Positions; Fair Representation of Offshore Center Management in Global Committees; Look Beyond Offshoring Only Peripheral Projects; Avoid Over-Insistence on the Cost-Reduction Purpose of the Offshore Center; Unified Awards across the Offshore Center and the Head Office; Roles and Responsibilities of the Offshore; Being an Expatriate Manager from the Head Office to the Offshore Center; and Using the Offshore Center to Make Strategic Contributions to the Company. The author, Vimal Kumar Khanna has over 31 years of industry experience and has won multiple international honors for his contributions to the management and technology domains and is a Honorary Editor of IEEE Communications.



Spark: The Power to Become Big is Within You
M.S. Rao
2019 /168 Pages / Paperback / Rs.299 (On Amazon India Rs. 280)
ISBN: 978-8126578153/ Wiley

This book contains inspiring examples of extraordinary achievers. It develops success-mindset. It unlocks your hidden potential. It cultivates mindfulness and ensures a work-life balance. It offers tools and techniques to ignite your spark. It unleashes the leader in you. It draws a blueprint to provide meaning to your life. The author distils leadership insights that help good leaders become better. The 21 principles, practices and habits that prepares one for "Success with a mind-set" and ignites your spark and unleash the leader in you include: Acquire self-awareness; Discover your biological clock; Be an early riser; Exercise every day; Acquire internal locus of control; Visualize effectively; Equip with affirmations; Use your internal dialogue effectively; Strengthen your subconscious mind; Journal regularly; Read avidly; Improve your memory; Improve your concentration; Practice yoga daily; Practice meditation; Cultivate mindfulness; Acquire emotional intelligence; Practice for 21 days; Take feedback; Be persistent; and Learn, unlearn and relearn. The author wants everyone to treat these 21 tools as 21 bricks of your brand; Cement these bricks to build an everlasting leadership brand by practicing regularly to fast-track your career and provide meaning to your life. This book is a recommended read for everyone wanting to excel as extraordinary achievers.
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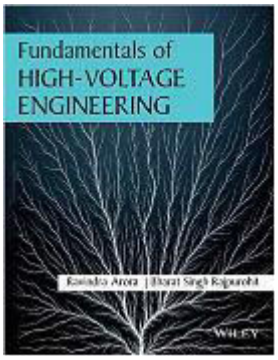


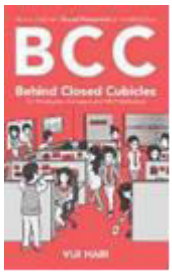
Fundamentals of High - Voltage Engineering
Ravindra Arora & Bharat Singh Rajpurohit
2019 /408 Pages / Paperback / Rs.499 (On Amazon India Rs. 484)
ISBN: 978-8126579747 / Wiley

This book has a novel approach in describing the fundamental concept of field-dependent behavior of dielectrics when subjected to different types of high voltages. The contents begin with a systematic classification of electric fields and the techniques of field estimation. In-depth coverage of performance/behaviour of gaseous, solid and liquid dielectrics has been made in the book. The basics of high voltage laboratory techniques, non-destructive testing, measurement of high test voltages and dielectric properties are also covered in detail in this book. The chapters of the book include: Introduction to High-Voltage Engineering; Electric Field Intensity, Stress Control, and Types of Breakdown in Dielectrics; Transient Overvoltages and Insulation Coordination in High-Voltage Networks; Field-Dependent Electric Strength and Breakdown in Gaseous Dielectrics and Vacuum; Lightning, a Breakdown Phenomenon in Atmospheric Air, Its Effects and Protection; Solid- and Liquid-Insulating Materials, Their Classification, Properties, and Breakdown; Generation of High Test Voltages; Measurement of High Test Voltages; Non-Destructive Testing and Quality Control of Electrical Equipment; and High-Voltage Test Laboratory Design and Curriculum Experiments. The text of the book is written in simple explanatory manner for both the UG & PG students with number of solved numerical examples, multiple choice questions as a part of learning exercise. The laboratory experiments included in the book is an added feature for the exposure ti industrial practice.

Social Media & Mobile Marketing
Puneet Singh Bhatia
2019 / 296 Pages / Paperback / Rs.499
ISBN: 9788126578078 / Wiley

Social media and Mobile marketing exemplify two extreme pivots of any human behaviour. While the first marketing form (social media) establishes the desire of an individual to connect to the largest (like-minded) human audience possible, the second form (mobile marketing) reflects that person and rsquo;s inner-most need to view the world through a most personalized and private lens. Social Media and Mobile Marketing (SMMM)and is a 2-in-1 volume that aims to establish key concepts and underlying frameworks for the two most important and emerging digital marketing application areas: social media and mobile marketing. The first part of the textbook develops the basics of social media marketing outlining key social media actors and actions. SMMM establishes an easy to follow SOCIAL Media Marketing Framework to showcase the six key stages of social media platform implementations. The second part of the book outlines the evolution of mobile marketing and how marketers can establish and extend influence from web to mobile platform through a structured MOBILE Media Marketing Framework. The text is presented in four parts namely: Part I Understanding Social Media Marketing; Part II Executing Social Media Marketing; Part III Social Media Marketing: The Road Ahead; Part IV Understanding Mobile Marketing; Part V Executing Mobile Marketing; Part VI Mobile Marketing: The Road Ahead; and Part VII Social Media and Mobile Marketing Careers.

Excerpts from the book BCC: Behind Closed Cubicles



BCC : Behind Closed Cubicles: For Employees, Managers and HR Professionals
by Viji Hari
2016 / 158 pages / Paperback / Rs. 200 (at Amazon India) / Notion Press

This book BCC is a collection of 18 short, real life stories of Sexual harassment at across the Indian Workplace.

BCC, demonstrates, through a collection of short stories, how apparently harmless statements and actions have impacted people at the workplace. The short stories are based on real life sexual harassment incidents from across the Indian corporate world. Stories that include both genders, and range from freshers to CXOs, and across different industries.

BCC attempts to give tips and share best practices to Employees, Managers, HR, Committee members, Employers, etc., so the reader is better equipped to deal with different forms of incidents. Below are some snippets from the book from the Afterword section.

Over the last couple of decades, the media has elaborately reported some of the scandalous and high-profile cases in India:

- Ashok Kumar Ganguly: The former Supreme Court judge stepped down as head of the West Bengal human rights commission in 2014 after a law intern accused him of sexually harassing her in a hotel room.
- The case of KPS Gill, former Punjab director general of police. Gill was found guilty of outraging the modesty of Rupan Deol Bajaj, an IAS officer, by a trial court in 1996. She had complained in 1988 that Gill had made sexual advances at a party where he was allegedly drunk.
- In Haryana, SPS Rathore, former inspector general of police. Rathore was convicted in 2009 for molesting 14-year-old Ruchika Girhotra in 1990. After years of harassment by officials, Ruchika committed suicide in 1993.
- RK Pachauri — The Energy and Resource Institute (TERI) Director General, Nobel Laureate and former environment minister's involvement in a case of sexual harassment is one of the most shocking cases. On May 2015, an internal probe by TERI found that RK Pachauri was guilty in the sexual harassment case filed against him by a woman colleague. TERI committee also recommended disciplinary action against Pachauri. The committee found that Pachauri's repeated attempts to build a personal relationship with the woman had amounted to 'sexual harassment.'
- Possibly the most notorious case of them all. The former Tehelka chief was accused of sexual assault during a Goa event by a former colleague. The case grabbed international headlines after allegations that staffers at Tehelka had tried to bury the complaint.
- Phaneesh Murthy's initial case as one of India's best known software executives and a rising star. Phaneesh Murthy had to resign from Infosys in 2002 after his secretary Reka Maximovitch accused him of sexual harassment.

Vishaka case and guidelines

Vishaka is the women's rights group that filed a PIL in the Supreme Court of India — the case of Bhanwari Devi vs. the State of Rajasthan in 1997. Bhanwari Devi was a woman from a potter community who tried to prevent a child marriage that was being conducted as part of her duties as a worker of the Women Development Programme. She was raped by the landlords of the community in order to teach her a lesson. The rape survivor did not get justice from the Rajasthan High Court and the rapists were allowed to go free.

This resulted in the Vishaka guidelines, which deals with sexual harassment of women at the workplace. The verdict defined sexual harassment, laid down duties of employers in dealing with complaints and stipulated formation of committees to address complaints from victims of harassment.

Prior to this verdict, the person facing sexual harassment at workplace had to lodge a complaint under Section 354 or 509 of the Indian Penal Code (IPC).

On 9th December 2013, the **Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013** came into force**.** This statute superseded the Vishaka Guidelines for prevention of sexual harassment introduced by the Supreme Court of India.

4 key steps to be compliant with the Act:

- Sexual Harassment Policy creation in compliance to the Act – detailing the Employee and Employer's roles and responsibilities; Complaint and Redressal mechanisms.

- The setting up of an Internal Committee as per guidelines that is equipped to ensure prevention and redressal. This should handle complaints after a thorough investigation and recommend actions to be taken.
- Ensuring awareness among the Internal Committee and Employees by way of training on the Act and on the Complaints and Redressal mechanisms as detailed in the policy.
- Statutory reporting of the cases filed, action taken should be reported and filed in the Company's annual report.

Some Observations on what the Act states:

- Employment rules/service rules should also be amended to include:
- Termination or action taken due to sexual harassment at workplace based on and in compliance with the Internal Committee (IC) report or findings.
- Victim has the right to ask for a transfer or leave during pendency of enquiry
- Per law, there should be an IC formed at every branch of the company in the country, where there are more than 10 employees. The District Officer is required to constitute a Local Committee at each district, and if required at the block level.
- IC is also applicable for an all-men branch. As even a lady vendor or a lady visitor to the workplace needs to have the option of raising the complaint.
- IC – can also be headed by a Senior male employee in case a Senior woman is not available in a particular branch. But in all, there should be 2 women as part of the IC including the 3rd party NGO representative.
- The IC is required to complete the inquiry within a time period of 90 days.
- Annual Statutory reporting – as part of the Annual report that every company files, the number of cases reported and action taken should be published.
- A victim has to raise a complaint within 3 months of the incident.
- Sexual harassment at the workplace is a criminal offence as per the changes made in IPC. So a victim can raise a criminal complaint case as well as a case with the ICC and both can run in parallel.

Role of Employer:

- Provide a safe working environment for persons coming in contact with the workplace.
- Create and empower the Internal Committee as defined in the Act.
- Ensure your organization's anti-sexual harassment policy is aligned with the provisions of the new law.
- Display conspicuously at the workplace, the penal consequences of sexual harassment and the composition of the Internal Committee.
- Organize workshops and awareness programmes periodically for sensitizing employees on the Act and organizing orientation programmes for members of the Internal Committee.
- Changes to the employment contracts/Service rules to make the employees are legally bound for the acts of sexual harassment at the workplace.
- Submit necessary information pertaining to sexual harassment to specified authorities.
- Help your employee to initiate legal action against the perpetrator (if the perpetrator is not an employee) under criminal law.

Role of Internal Committee at the workplace:

- Shall provide assistance to the victim to make the complaint in writing.
- Complaints need to be filed within 3 months from the last incident occurrence date. IC may extend the time limit by another 3 months.
- Before initiating an inquiry, at the request of the aggrieved woman, IC must take steps to settle the matter through conciliation.
- Shall recommend action during pendency of inquiry like granting leave or transferring either the victim or respondent.
- If IC arrives at the conclusion that the allegation against the respondent has not been proved, it shall recommend to the employer that no action is required.
- If IC arrives at the conclusion that the allegation against the respondent has been proved, it shall recommend to the employer:
    - To take action for sexual harassment as a misconduct in accordance with the provisions of the service rules applicable to the respondent or where no such service rules have been made, in such manner as may be prescribed.
    - To deduct, notwithstanding anything in the service rules applicable to the respondent, from the salary or wages of the respondent such sum as it may consider appropriate to be paid to the aggrieved woman or to her legal heirs.
- If Internal Committee arrives at a conclusion that the allegation against the respondent is malicious or the aggrieved woman or witness or any other person making the complaint has made the complaint knowing it to be false or has

produced any forged or misleading document, IC may recommend to the employer or the District Officer, as the case may be, to take action in accordance with the provisions of the service rules or as may be prescribed.

- Shall record the settlement of an inquiry and forward to the employer to take action as per the recommendations.
- Shall share copies of settlement to the victim and respondent.
- Committee to submit annual report in each calendar year and prepare the cases received, disposed, pending and preventions measures during the year and submit the same to the employer and the District Officer.
- The role of the Committee will not be restricted to complaint resolution but will encompass prevention measures as well.

Confidentiality:

Every aspect of an investigation should be kept confidential. Maintaining confidentiality is critical to the integrity of an investigation. There can be serious consequences for failing to ensure that confidentiality is maintained. These consequences include:

- Damage to someone's reputation if others learn that the allegations were made.
- The success of the investigation can be undermined if others know of the investigation.
- The subject of the investigation could try to cover-up any misconduct if they learn they are being investigated.
- The company may face liability or negative publicity.
- The company's ability to defend any legal action associated with the matter could be compromised.
- The disclosure of the information could cause retaliatory action.

If you are victim, how to deal with Sexual Harassment:

- Make it clear to the harasser that you consider the behaviour as harassment.
- Say a firm 'NO' and tell the person to stop contacting you.
- Stop answering the person's calls, emails, and other messages.
- Delete or mark the number as spam in your phone and social media accounts.
- Inform your friends and family what's going on.
- Don't publicize your location and daily habits.
- Keep records and evidences.
- Talk to the HR, Internal Complaints Committee or Harassment cell at your institution or workplace.
- If you work in an unorganized sector or organisation with less than 10 employees, then reach out to the Local Complaints Committee.

If it is a rape or an assault or any form of criminal act, then a Police complaint needs to be lodged under the Indian Penal Code.

Announcements

'IEEE Region 10 Conference Leadership Program at Goa during 17-18 Aug 2019

This program aims to train volunteers from the sections of Region 10 to organize and guide IEEE conferences efficiently and effectively ensuring the quality as per IEEE standard in their respective sections. The topics to be covered will include: IEEE Conference History and Context Setting, Why Run a Conference? Benefits and Value of Conference Organizing, Measurement and Success Criteria for Events, Getting Started: Creating a Plan of Action, Sponsorship: Definitions, Roles and Accountability (Including MoUs and MGA Sponsorship Approval Process), Organizing Committee: Roles and Formation, Technical Program, Peer Review and Conference Quality, Conference Publications Start to Finish (IEEE Conference Publications Program, IEEEXplore, Plagiarism Checking, eCopyright, etc.), Financial Management of Your Conference: What You Need to Know, Event Planning / Running the Event, Closing Your Conference, Best Practice Discussions / Case Studies, IEEE Meetings, Conferences & Events Overview. All Sections requested to encourage participation and nominate one delegate (maximum two) from your section by 6th April 2019. For additional info, pl. contact Mr. Deepak Mathur, Director - Elect 2019-2020 - IEEE Region 10 (Asia Pacific), deepakmathur@ieee.org

ILS-19 WIE International Leadership Summit at Bangalore during 30-31 Aug 2019

IEEE Bangalore Section and WiE AG Bangalore Section will conduct the WIE International Leadership Summit (ILS19) during 30-31 Aug 2019 at Hotel Sterlings Mac Bangalore. WIE ILS19 will provide regional opportunities to foster networking, mentorship, and possible collaboration. This program is part of the portfolio of global initiatives that focus on Empowerment, Entrepreneurship, Leadership, and Future Technology. The theme of the Summit will be "Redefining the Defined" More at wie-ils2019.org

IEEE TENCON-2019 at Kochi during 17-19 Oct 2019

TENCON is the flagship premier international technical conference of IEEE Region 10. The Theme for TENCON-2019 is "Technology, Knowledge, and Society". It will be held during 17 – 20 Oct 2019 at Hotel Grand Hyatt, Bolgatty, Kochi, Kerala. Conf. website http://www.tencon2019.org

IEEE INDICON-2019 at Marwadi University, Rajkot, Gujarat during 13-15 Dec 2019

IEEE INDICON-2019, the flagship conference of the IEEE India Council will be held at Marwadi University, Rajkot, Gujarat from December 13 to 15, 2019. Conf. website http://indicon2019.in/

IC Awards

To recognize the contribution of volunteers at various levels and student branches and industry associates towards progress of IEEE, India Council constituted following awards:

1. Outstanding Volunteer Award
    a. IEEE Volunteer (Age greater than 35)
    b. IEEE Volunteer (Age equal to and below than 35)
2. Outstanding Student Branch Award
    a. Outstanding Student Branch
    b. Outstanding Upcoming Branch
3. Outstanding Volunteer Award
    a. Outstanding Student
    b. Outstanding WIE Student
    c. Outstanding YP
4. India Council Outstanding Industry Award
    a. IEEE IC Technologist of the Year 2019
    b. IEEE IC Women technologist of the Year 2019
    c. IEEE IC Technology Start Up of the Year 2019

5. India Council Leadership Awards

    a. India Council Lifetime Achievement Awards for IC Chairs
    b. India Council Leadership Awards for Section/Subsection Chairs

Timelines

- Call For Nominations April 2019
- Nomination Deadline Sept 2019
- Evaluation Period Oct/Nov 2019
- Recipient Notified: End Nov

For applying please follow the link https://ieee.checkboxonline.com/ICAWARDS2019.aspx

For more details pl. visit the India Council website or contact Dr. Preeti Bajaj, Vice Chair Awards –IEEE India Council 2019, Email: preetib123@yahoo.com / preetibajaj@ieee.org Mobile: +91 9822220369

Amazon Web Services Providing IEEE Entrepreneurship Member Benefit

Amazon Web Services (AWS) is excited to support the engineering-driven businesses of IEEE members! Through its AWS Activate program, AWS will now provide IEEE members with credits for access to cloud computing resources.

AWS Activate is a program that allows companies to access over 150 web-based services and tools to support their growing businesses; whether it's simple website hosting, storage, data analytics tools, IoT services, or building and training machine learning models (and much more). Join some of the fastest-growing startups in the world and build your business using AWS!

IEEE Entrepreneurship Community Members will be eligible for:

- $10,000 in AWS Promotional Credit valid for 2 years;
- 1 year of AWS Business Support (up to $5,000);
- 80 credits for Self-Paced Labs ($80 value).

Complete this IEEE form in order to have your IEEE membership confirmed and receive your ID for AWS Activate Services as an IEEE Entrepreneurship Member Deal.

AWS Worldwide Public Sector helps startup, government, education, and nonprofit customers deploy cloud services to reduce costs, drive efficiencies, and increase innovation across the globe. With AWS, you only pay for what you use, with no up-front physical infrastructure expenses or long-term commitments. Public Sector organizations of all sizes use AWS to build applications, host websites, harness big data, store information, conduct research, improve online access for citizens, and more. AWS has dedicated teams focused on helping our customers pave the way for innovation and, ultimately, make the world a better place through technology.

Proposals to host R10 SYWL Congress 2020

Proposals are now invited from IEEE Sections in Region 10 to host the IEEE Region 10 Student, Young Professionals, Women-in-Engineering & Life Members (R10 SYWL) Congress 2020.

The congress is held every second year and provides ample opportunities to Students, Young Professionals, WIE for personal development and to learn about the IEEE goals and policies. Participation by LM members also gives a chance to share knowledge, and experience with younger IEEE members.

R10 SYWL Congress also provides an excellent opportunity for the volunteers of the host Section to enhance their organizational skills and participate in an international event. It is therefore strongly suggested to the leadership of interested Sections to involve their Committee members, especially YP, WIE and student volunteers to submit a thoroughly prepared proposal. To assist in preparing the proposal a detailed guideline is enclosed. Please adhere to the instructions outlined in the document for a better chance of due consideration of your proposal by Region 10.

Last date to submit the proposal, completed in all respect, is Sunday, 28 July 2019.

Please submit the proposal in PDF format by email to Ms. Ewell Tan at mailto:ewell.tan@ieee.org and Dr. Zia Ahmed, Region 10 Vice Chair (Membership Activities) at zia.ahmed@ieee.org

Guidelines for submitting reports to get published in the IEEE INDIA INFO, the India Council Newsletter (ICNL)

- Please submit the event reports within TWO months of its happening. Older events reported may be ignored.
- The matter may be in doc / rtf / txt format. Please avoid other formats such as pdf, jpg as they will not be considered.
- Please use SINGLE column format (while the report is prepared).
- Please avoid embedding the photos in the document relating to event reports. However, images referred in articles alone may be embedded at appropriate places in the article document in addition to sending them separately.
- Please send the event photos (typically one/two best) separately (even in they are included in the report).
- Preferred format for photos is "jpg". Please avoid sending the photos in "bmp", "png" formats.
- Photographs in digital form should not to exceed 1024 pixels in width. You may use any photo editing software (MS Office Picture Manager is quite useful) to re-size the image. This will reduce the file size of the images considerably. Pl. avoid sending large size photos (Sometimes we get files even up to 6 MB size). We generally recommend file sizes less than 500K.
- Provide your name, full affiliation, membership no. and email id at the end of the document.
- Send the matter by email with the subject: From <Section / College Name in short form> -- Report on <Event Name (short name is OK) & Date> eg: "From Madras Section / SSNCE -- Report on Conf on Wireless Networking dt. 10-11, Feb 2017"
- Please send the matter by email to ieee.icnl@gmail.com
- Please note that the matter sent to other email ids may get ignored and may not be considered.
- Please submit the matter for publication latest by 8th of the publication month (currently Mar, Jun, Sep, Dec as ICNL is a quarterly) to facilitate inclusion in that quarter's issue of IC Newsletter.
- Pleae note that while all efforts will be made for publishing, due to certain practical constraints, the actual publishing may be delayed.
- We will be constrained to ignore the submitted materials, if they do not follow the above guidelines.
- Please co-operate with us by adhering to the guidelines specified.

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Some useful IEEE web links

- Global Benefits Finder: http://www.ieee.org/membership_services/membership/benefits/index.html
- 2019 IEEE Membership and Society Membership Dues: http://www.ieee.org/membership_services/membership/join/join_dues.html
- IEEE Society Memberships: http://www.ieee.org/membership_services/membership/societies/index.html
- Payment Options: http://www.ieee.org/membership_services/membership/join/referral_payment.html
- IEEE Student Activities: http://www.ieee.org/membership_services/membership/students/index.html
- IEEE Xplore Digital Library: http://ieeexplore.ieee.org/Xplore/home.jsp
- IEEE Websites / Sitemap: http://www.ieee.org/sitemap.html

IEEE India Council Website

The website of the IEEE India Council (IC) has been redesigned using the Wordpress content management system and is hosted on the IEEE webserver at http://sites.ieee.org/indiacouncil/ with the efforts of the web master Dr. Suryanarayana Doolla of IIT Bombay. The readers may find the following links of the IC website useful.

- Home: http://sites.ieee.org/indiacouncil/
- Executive Committee: http://sites.ieee.org/indiacouncil/about-ieee/executive-committee/
- Sections: http://sites.ieee.org/indiacouncil/about-ieee/sections/
- Announcements: http://sites.ieee.org/indiacouncil/category/announcements/
- Events: http://sites.ieee.org/indiacouncil/events/
- Newsletter Archives: http://sites.ieee.org/indiacouncil/newsletter/newsletter-archives/
- Conference Norms: http://sites.ieee.org/indiacouncil/conference-norms/
- INDICON: http://sites.ieee.org/indiacouncil/indicon/
- Student Activities – Awards: http://sites.ieee.org/indiacouncil/student-activities/awards/

Special Section on
Sir J.C. Bose 160th Anniversary Celebration Presentations

1858-1937

Sir J.C. Bose 160th Anniversary Celebration on 17th Feb 2019 at Bangalore

Guest Editor Message

Sir Jagadish Chandra Bose is a physicist, biologist, biophysicist, botanist and archaeologist. He pioneered plant science, and laid the foundations of experimental science in the Indian subcontinent. He proved by experimentation that both animals and plants share much in common. He demonstrated that plants are also sensitive to heat, cold, light, noise and various other external stimuli. It is widely considered that J.C. Bose was at least 60 years ahead of his time.

In 1895, Sir Jagadish Chandra Bose first demonstrated in Presidency College, Calcutta, India, transmission and reception of electromagnetic waves at 60 GHz, over 23 meters distance, through two intervening walls by remotely ringing a bell and detonating gunpowder. For his communication system, Bose pioneered in development of entire millimeter-wave components like a spark-gap transmitter, coherer, dielectric lens, polarizer, horn antenna, and cylindrical diffraction grating. This is the first millimeter-wave communication system in the world, developed about 125 years ago. This is the oldest Milestone achievement from the Asian continent. Bose's experimental work on millimeter-band microwave radio was commemorated as an IEEE Milestone on 14th September 2012 and a plaque in this regard may be viewed in the main corridor of the Acharya Jagadish Chandra Bose Auditorium in the Main Building of Presidency College, Kolkata, India.

IEEE celebrated the 160th anniversary of Sir Jagadish Chandra Bose by reflecting on his life and works through eminent speakers compassionately projecting his work to 150 plus IEEE members and engineers on Sunday, 17th February 2019 at the landmark World Trade Center Auditorium in Bengaluru, India. This workshop showcased the innovations of Sir J C Bose and its relevance and contribution to the modern technology.

While Dr. B.S. Sonde (ASM Technologies), Dr. D.P. Sengupta (NIAS) and Dr. Surendra Pal (DRDO) reflected on the life of Sir Jagadish Chandra Bose, Mr. C.S. Rao (Quadgen Wireless Solutions) and Dr. Yashwant Gupta (NCRA) presented the applications of Sir J C Bose's work in unlicensed 5G band for communication networks and Radio Astronomy. The highlight of the workshop was the demonstration of the working replica model of JC Bose's millimetre wave experiment by Dr. Shaik Kareem Ahmmad and Dr. Syed Ilyas Mohiuddin (MJCET) and demonstration of microwave apparatus by Mr. Sudhir Phakatkar (NCRA).

IEEE Foundation as part of the "Furthering Indian Perception of IEEE" project sponsored the J.C. Bose workshop organized by IEEE Bombay Section, IEEE India Council and IEEE Bangalore Section, and supported by IEEE SPS Bombay Chapter and IEEE APS-MTTS Bangalore Joint Chapter. A detailed report on this event was published in the Jan-Mar 2019 issue of the IEEE ICNL. Please refer http://ieeecs-madras.managedbiz.com/icnl/19q1/p20-p21.pdf.

Inspired by the quality of talks by the eminent speakers and unanimous demand by the participants, it was decided that we bring out manuscripts of these talks delivered as a Special Section in the IEEE India Council Newsletter. This Section includes the following articles:

1. Sir Jagadish Chandra Bose: Scientist Par Excellence: A Tribute by Dr. B.S. Sonde
2. Jagadish Chandra Bose: The Physicist who was forgotten by Dr. D.P. Sen Gupta
3. Sir Jagdish Chandra Bose, James Clerk Maxwell and there on….. by Dr. S. Pal
4. mmWave Applications in NextGen Wireless Broadband Evolution in 5G Era: Impact of Sir JC Bose invention by Mr. C.S. Rao, Ms. Arpita Hura and Ms. Mouna Jain
5. Radio Astronomy: How J.C. Bose's invention opened a new window to the Universe by Dr. Yashwant Gupta
6. Design and Construction of Working Replica of Sir J.C Bose 60 GHz Experiment by Dr. Shaik Kareem Ahmmad, Dr. Syed Ilyas Mohiuddin and Dr. Mohammed Arifuddin Sohel
7. Sir Jagadish Chandra Bose: Biologist, Biophysicist, Botanist, Physicist, Archaeologist and Polymath by Mr. Sudhir Phakatkar

We are highly grateful to all the speakers for providing us with their articles in spite of their very busy schedules. I can't thank enough Shri HR Mohan, Editor, IEEE India Council Newsletter for his patience and persuasion as well as his painstaking efforts in producing this Section so beautifully. We sincerely hope that the readers will find this compilation very informative and its contents, highly inspiring.

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SIR JAGADISH CHANDRA BOSE
Scientist Par Excellence: A Tribute

Dr. B. S. Sonde
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Article based on the *Key-Note Address* delivered at 'Celebrating Sir Jagadish Chandra Bose', a special event organized by IEEE, India Council at Bengaluru on 17th February 2019.

Introduction:

India has been commemorating the 160th birth anniversary year of Sir Jagadish Chandra Bose (1858-1937), a scientist of great eminence well known for his contributions in many fields, particularly physical sciences and physiology and for the revival of scientific research in the country on modern lines in the pre-1900 era. IEEE deserves to be complimented for bringing out a Special Section of the *Proceedings of the IEEE* in 1998 [1] to commemorate the *Centennial of Solid-State Diode Detector* by giving due credit to J. C. Bose for its invention and use in his 60 GHz Microwave Spectrometer during 1896-98. The Special Section has also brought out the importance of this device in his microwave communication experiments in Calcutta in the pre-1900 period and its use in G. Marconi's highly successful, long-distance, trans-Atlantic radio communication experiment of 1901, which paved the way in the following years to establish radio as a major means of global communication. Besides, IEEE has also ensured in 2012 that J. C. Bose is included in the same *Hall of Fame on Radio* jointly with G. Marconi *(Italy)* and A. Popov *(Russia)*, the only two other inventors recognized earlier. It is in this backdrop that the event organized by IEEE-India Council in Bangalore on 'Celebrating Sir Jagadish Chandra Bose' assumes much significance as it provides the present generation an excellent opportunity to pay respects and tributes to this great scientist. Besides being a *devoted researcher* in *cutting-edge* areas in multiple disciplines in those days, J. C. Bose was an inspiring teacher, a skillful experimenter who designed his own research equipment, a committed institution builder and a great humanist who believed that the benefits of science should reach out to the society at large. Thus, even today, J. C. Bose stands out as a *Role Model* for the younger generation intending to take up careers in academics and research work. These aspects are briefly covered in the Article along with the *lessons to be learnt* from the life and work of J. C. Bose.

J. C. Bose and his Career:

Looking at his intelligence and scholastic abilities in his childhood, parents of J. C. Bose sent him to Calcutta for high school education where better and more opportunities were available for this. This enabled him to proceed to England after his graduation from the Calcutta University for further studies at the famous Cambridge University in England. Here he became a student of Lord Raleigh, eminent Physicist and Cavendish Professor of Physics at the University. Lord Raleigh was much impressed by his intelligence, knowledge of Physics, devotion to studies and independence of thinking. This developed into a life-long friendship between the two greatly benefitting young J. C. Bose from the *mentoring, guidance and patronage* in his research work received from Lord Rayleigh throughout his career. After obtaining his *Natural Science Tripos* from Cambridge, J. C. Bose returned to Calcutta, where he was appointed as a faculty member in the Physics Department of Presidency College, Calcutta a prestigious college of long-standing. In this capacity he was engaged in both teaching and research and built many useful instructional facilities in the Physics laboratory at the College. Being an inspiring teacher, he was able to educate and train many young students to get interested in Physics studies and carve out productive careers in this subject area. Being interested and familiar with issues of contemporary relevance in electromagnetism, J. C. Bose pursued this area for his research work at the Presidency College. Box A presents a brief outline of major milestones in the life and career of J. C. Bose.

Box A: J. C. Bose-Life and Career: Major Milestones

1858, Nov. 30: Born in Mymensingh, East Bengal (in present-day Bangladesh), Enlightened and encouraging parents, Well-known family background.

1870-76: Student at St. Xavier's School, Calcutta.

1876-80: Student at St. Xavier's College, Calcutta, obtained his B. A. Degree from Calcutta University.

1880-84: Student at Christ Church College, Cambridge University, England, under Lord Rayleigh, Cavendish Professor of Physics, obtained his *Natural Science Tripos* from the University in 1884.

1885: Joined Presidency College, Calcutta as Officiating Professor of Physics; Promoted as Permanent Professor a few years later, became Senior Professor and continued until superannuation (1915) from Indian Educational Service; Emeritus Professor at Presidency College: 1915-20.

1896: Received D.Sc. Degree from the University of London, England on the Recommendation of Lord Rayleigh.

1896-98: Conducted pioneering mm-wave propagation experiments with certain polarizing crystals leading to development of 'solid-state detector for electrical disturbances' included in a seminal paper in the Proc. of the Royal Society, London in January 1897, named by him as 'Electric Eye', but by others in his time as 'Coherer', as 'Diode' years later.

1901: G. Marconi used the solid-state detector based on the work of J. C. Bose in Trans-Atlantic Radio Communication experiment.

1904: US Patent on 'Detector for Electrical Disturbances' granted to J. C. Bose.

1917: Knighthood conferred by the British Government.
Bose Research Institute the first such Institute in the country established in Calcutta, with J. C. Bose as its first Director.

1920: Elected Fellow of the Royal Society, London.

1927: Elected General President of the Indian Science Congress.

1937, Nov. 23: Breathed his last in Calcutta at the age of 79.

J. C. Bose and his Research:

In the physics of electromagnetism of the pre-1900 era, three path-breaking discoveries as follows stand out [1, 2]:

a) *Electromagnetic Induction* by which relative motion between a magnet and a nearby conductor produces an electromotive force in the conductor and vice versa, i.e., magnetism producing electricity and electricity producing magnetism, discovered almost simultaneously in 1831 by Michael Faraday in England and Joseph Henry in U. S. A.
b) *Electromagnetic Theory of Light* and the famous Field and Wave Equations of the electro-magnetic field postulated and explained in 1873 by James Clark Maxwell in England, based on Faraday's discoveries in electricity and his concept of electric and magnetic lines of force.
c) *Experimental Researches* verifying Maxwell's Theory during 1887-89 by Heinrich Rudolf Hertz in Germany demonstrating the generation of electromagnetic waves and their transmission in free space over a few meters in the laboratory.

These discoveries attracted the attention of many scientists/investigators in the succeeding years to conduct further experiments on the Hertzian doublet and the radiation emerging from it as well as on antennas and wave propagation. J. C. Bose was also fascinated by this research direction and he took up his work on quasi-optical researches with electromagnetic waves at a wavelength of 5 mm (Frequency ~60 GHz). Through this he demonstrated in 1898 a microwave spectrometer containing transmitter, receiver, horn antennas and waveguides, which many years later turned out to be the essential parts of a millimeter wave / microwave communication link. The invention of the solid-state detector device came from his millimeter-wave propagation measurements through certain polarizing crystals by following the optics route. In particular, his seminal paper in 1897 'On the selective conductivity exhibited by certain polarizing substances' published in the Proceedings of the Royal Society, London [1] led directly to this invention. He had named this device as the 'electric eye' or 'artificial eye' as it was transforming the electromagnetic radiation of any wavelength impinging on it into an electrical signal. J. C. Bose also invented many other useful solid-state detector devices for 'wireless' waves in this period, known as 'self-restoring coherers'. He conducted much of his research in the area of millimeter wave and microwave physics wherein he is considered to be a pioneer. As an extension of these studies, J. C. Bose went on to the discovery of some similarity in the response of the living and the non-living and conducted path-breaking research work in the response phenomenon in plants and made many significant contributions in Physiological Science, particularly plant physiology.

J. C. Bose was a prolific writer and he travelled frequently to Europe and U. S. A. on various scientific missions and for technical lectures. He was a firm believer that scientific knowledge needs to be shared, as only through this means that the knowledge can grow and expand. It was with this conviction that J. C. Bose got immersed in disseminating his research contributions through lectures and publication of papers in learned journals for their wider utilization. It is interesting to

note that J. C. Bose had great reluctance in getting his research contribution patented to safeguard its intellectual property. This is because he was against any commercialization of science, which was gathering momentum in those days. However, it was only through the sage advice and insistence of his long-term friend, Swami Vivekananda that J. C. Bose was prevailed upon to patent his unique invention of 'Detector for Electrical Disturbances' in U. S. A. in1904 as a one-time gesture. However, J. C. Bose ensured that a specific clause was included in the Bose Research Institute's founding registration document (1917) that no member of the Institute may be allowed to apply for patent for any idea and/or device developed at the Institute!

J. C. Bose and his Friends/Admirers:

J. C. Bose had several friends and admirers, both in India and abroad, whom he considered to be instrumental in enhancing his scientific research and capabilities. They included eminent scientists, such as Lord Rayleigh, Lord Kelvin and Sir J. J. Thomson in England and great luminaries such as Swami Vivekananda and Nobel Laureate Poet Rabindranath Tagore in India to name a few. Each one of these had lasting impact on the career of J. C. Bose as can be seen below:

a) *Lord Rayleigh, Cavendish Professor of Physics (1879-85) at Cambridge University* taught Physics to J. C. Bose and became his life-long friend, philosopher and guide. He was also responsible for patronizing the research contributions of J. C. Bose in the area of millimeter waves at the Royal Society, London, in the Victorian British Empire and in the western world.
b) *Lord Kelvin, after whom the absolute scale of temperature (K) is named,* was a great admirer of the pioneering research work of J. C. Bose and also his patron in England and European countries. On his advice, J. C. Bose used a highly sensitive Kelvin Galvanometer in his revolutionary experiments as the end detector.
c) *Sir J. J. Thomson, discoverer of the particle 'electron' in 1897* was an admirer of J. C. Bose and his pioneering contributions to millimeter wave communication. In his Foreword to a Book by J. C. Bose containing a collection of his papers (1926), Sir J. J. Thomson writes: *"Another aspect of these papers is that they mark the dawn of the revival in India of interest in researches in Physical Science; this which has been so marked a feature of the last thirty years is very largely due to the work and influence of Sir Jagadish Chandra Bose".*
d) *Swami Vivekananda, an erudite scholar and Indian religious leader,* a friend and admirer of J. C. Bose for many years had visited U.S.A (1893) and seen the benefits of science to mankind and the usefulness of patenting of scientific inventions. On his advice, J. C. Bose agreed to patent his pioneering development of the solid-state detector in spite of his committed reluctance to do patenting. Swami Vivekananda also made arrangements with his disciple, S. C. Bull in U.S.A. to endorse /file the patent application of J. C. Bose in1901) and the U.S. patent was granted in 1904.
e) *Rabindranath Tagore, Nobel Laureate (1913)* was also a friend and admirer of J. C. Bose for many years and they used to enjoy each other's company whenever they met. Rabindranath Tagore utilized every possible opportunity to encourage J. C. Bose in his research work and to scale new heights in his 'science'. On being informed of his path breaking invention of the solid-state diode detector in 1897 by J. C. Bose, Rabindranath Tagore sent him a congratulatory poem written in Bengali, especially suited for the occasion. An English translation of this poem is reproduced below as extracted from [1] which sums the warm feelings of the great poet towards J. C. Bose!

Box B: Congratulatory Poem composed by Poet, Rabindranath Tagore, NL

To: Professor Jagadish Chandra Bose

Across the oceans, on the western shore,
Reigns the temple of the Goddess
Of wealth of science.
There you have journeyed, my friend,
And returned richly crowned.
You anointed the motherland,
Modest at heart, poor and shy.

The great and the gloried
Of these far-off lands
Assembled and acclaimed
Your work in unison,
The words resounding their message,
Far and wide, the seas beyond.

Her eyes welled up in tears,
Mother sends you the Message
Of her humbled heart,
Through a poet of whom
The world of science has never heard.
Only in the inner self of yours,
Will these words echo
As gentle murmurs of
Mother's whispered tone.

19th July, 1897 Rabindranath Tagore

(English translation from Bengali by Sugata Basu Sengupta, July 1997; Reproduced from Proc. IEEE, Vol. 86, No.1, pp. 221-222, Jan. 1998)

Concluding Remarks:

As can be seen from this Article, J. C. Bose was indeed a great teacher, researcher and humanist of international fame and he brought glory to India through his scientific contributions in multiple fields and his concern for the society at large. He is truly a *role model* for any academic of 21st century India, as he demonstrated that both inspiring teaching and cutting-edge research can be handled by an individual at the same time with each one contributing to the quality and standard of the other. Besides, his thoughts on dissemination of knowledge with a view to permit it to grow freely at a rapid rate and his commitment not to commercialize knowledge are worthy of careful consideration by the present generation in the context of the on-going trends in globalization. These and other lessons learnt from the life, work and contributions of J. C. Bose during his time in the 19th-20th centuries are worth emulating in present-day India as well.

References:

1) P. K. Bandyopadhyay, *et al (Guest Editors),* Special Section on the "Centennial of the Semiconductor Diode Detector", Proc. IEEE, Vol. 86, No. 1, pp.218-285, January 1998.
2) B. S. Sonde, "100 Years of Radio:1895-1995, Some Reflections", Current Science, Vol.70, No. 4, pp.322-325, February 1996.

About the author

Prof. B. S. Sonde received his B.E. (Telecom) and M.Sc. (Engg.) degrees from the University of Pune (1958, 1959) and Ph.D. in Engineering from the IISc (1963). He was a member of the academic staff of IISc (1964-97) until his appointment as Vice Chancellor, Goa University (1997-2002). During this period, he was also appointed as Member of the Council of IISc (1998-2001). His fields of interest cover Microelectronics, Instrumentation, Digital Technology & Applications in Electronics and Communications, wherein he has trained scores of students for B.E., M.E., M.Sc.(Engg.) and Ph.D. Degrees of IISc, published over 90 papers in prestigious scientific/technical journals, a series of 10 text/reference books widely used in engineering education in India and also many technical reports.

He has been Chairman/Member of Advisory/Governing Bodies of many Institutions in India, including CSIR laboratories, ISRO centres, UGC, AICTE, NAAC, NBA, KSHEC and IITs/Universities. Prof. Sonde has been an invited speaker at many national/international Conferences. He has been a recipient of many awards, notably Ramlal Wadhwa Gold Medal of IETE (1978), Jaya Jayant Award for Teaching Excellence of IISc (1992), Distinguished Alumnus Award of College of Engineering, Pune (1994), Chapter Development Award of ISHM-The Microelectronics Society, USA (1996), Life-Time Achievement Awards of Instruments Society of India (2002), Systems Society of India (2010) and IETE (2013) and IEEE-Bangalore Medal of Honour (2018). Prof. Sonde is a Distinguished Fellow of IETE and SEE, Honorary Fellow of ISTE and a Senior Member (LS) of IEEE (USA). Prof. Sonde has been an active participant at Conferences/Symposia held by IETE, IEEE and other technical professional societies, edited/published many proceedings of such events and he has been closely connected with the development of quality higher education in general and electronics & communication engineering education, research and industry in the country.

Jagadish Chandra Bose
The Physicist who was forgotten

Dr. D. P. Sen Gupta
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This paper touches upon the life of the great Polymath, Acharya Jagadish Chandra Bose, his upbringing, his academic achievements, his researches with emphasis on his wireless transmission of millimeter waves that were far ahead of his time and hence went unrecognized for decades, his invention of diode which would not have been recognized had it not been for a patent that he was forced to apply for and was granted. With radical changes in communication technology, he is recognized as the forerunner of smart phones widely used today.

Jagadish Chandra Bose, grew up on the shoulders of a dacoit. His father Bhagavan Chandra Basu was a Deputy Magistrate and he appointed a dacoit who on being released from the jail came to Bhagawan Chandra for a job. Bhagawan Chandra appointed him as a servant to take care of his four-year-old son Jagadish. Bhagavan Chandra set up a primary school for children of washer men, sweepers and other low earning people of the town and sent Jagadish to the same school. After completing high school education away from home, he went to St. Xavier's College in Calcutta where he came under the influence of Father Lafont. After studies at St. Xavier's College under Father Lafont., He set off for England in 1880 to study medicine. Afflicted by *Kala azar* before he left India, he had difficulties to continue the study of medicine and joined Christ's College, Cambridge, in 1881 under the tutorship of Lord Rayleigh, who was a polymath. Rayleigh got the Nobel Prize for discovering Argon. He took Jagadish under his wings. Jagadish also studied under Francis Darwin, son of Charles Darwin, Sir James Dewar and Sydney Vines the great physiologist. Europe was surging ahead in scientific studies and research. Cambridge was in the front line.

Jagadish completed his *Tripos* in *Natural Sciences,* Physics, Chemistry and Botany. He also obtained a degree from London University. Equipped with excellent recommendations he returned home after four years (1881-1885) to seek an interview with the Viceroy Lord Ripon who was very pleased to meet Jagadish. But despite the instructions from the Viceroy, the Director of Public Instructions ned to offer a Professor's position to Jagadish Chandra but was compelled to offer him one after much hassle, described in reference (1)

Jagadish teamed up with his mentor Father Lafont and helped him in science popularization. Jagadish Chandra also gave lectures at the Indian Association for Cultivation of Science (IACS) set up by Dr Mahendralal Sircar in 1876. This was the time when Bengal renaissance had brought extraordinary people from all walks of life together, in self-assertion as Indians. Several years passed and Jagadish Chandra realized that rather than spend his life as a Science teacher he would like to become a Scientist and a teacher.

It was in the year of 1894 that Jagadish Chandra made the resolve of getting involved in research. Abala Bose, his wife, fully supported his resolve. Jagadish Chandra used to visit the Asiatic Society where he came across a paper written by Professor Oliver Lodge, entitled…" Heinrich Hertz and his successors". He was fascinated by the article.

Choosing an area of research is always difficult. As a matter of fact, Jagadish Chandra changed his area of research at different stages of his life. But at every stage his research was based on accurate experiments since Jagadish Chandra knew that experimental research was his forte.

According to D.M. Bose (1), his nephew and a well-known physicist the research activities of J.C. Bose, extended from 1894 to 1937, the year he died, can be divided into three periods.

1) *During the first period extending from 1894 to 1899, he produced the shortest of then possible electromagnetic waves (the microwaves) and extensively studied their quasi-optical properties. His researches with coherers not only led to the anticipation of semi-conductors but the effect of microwaves on the coherers led to the next important phase of research.*
2) *During the second period, extending from 1899 to 1904, began with his study of the fatigue effect in metallic coherers, used for detection of electric waves, from which he went over to the study of various other inorganic systems which exhibit stress under different kinds of physical stimulation. The similarities in responses of inorganic and organic systems led to his famous and controversial generalization about the responses in the living and the non-living.*
3) *The third period that logically followed from the second phase led to his studies of Plant Electrophysiology and led to monumental investigations, which like most of his researches, were ahead of his time. These researches lasted till the end of his life.*

Jagadish Chandra after reading the book of Prof. Lodge decided to take up experimental study of Maxwell's electromagnetic waves and their validity for different frequencies and wave lengths. He chose frequencies just beyond infrared and was the first person to produce and wirelessly transmit millimeter waves. today.

Maxwell unified various theories pertaining to electricity and magnetism and came to the stupendous discovery that visible light is nothing but a small section of electromagnetic waves that travel at the speed of about 310740 km per second which was remarkably close to the measured value of speed of light.

Maxwell stated .....

"The agreement of the results seems to show that light and magnetism are affections of the same substance and that light is an electromagnetic disturbance propagated through the field according to electromagnetic laws."

This proposition threw up many questions. Can light be produced by electromagnetic interaction? Do electric waves have the same characteristics as light waves? Can they be reflected, refracted, diffracted and polarized? How does one produce electric waves and detect them and subject them to various tests?

Heinrich Hertz, the Maxwellians, namely Oliver Lodge, G.F. Fitzgerald, Oliver Heaviside and independently Jagadish Chandra Bose were some of those pioneers to answer these questions.

Maxwell died at the age of 48 before these questions were answered by experiments. . Professor G.F. Fitzgerald of Dublin University had no doubts about the correctness of Maxwell's waves. He suggested the following:

"Get hold of a Leyden jar. Charge it. Discharge it into a loop of wire. The arrangement will generate very high frequency."

That may have been the lead, way back in 1882.

Heinrich Hertz (1857-1894) was believed to have been advised by his teacher Herman von Helmholtz (1821-1894) to undertake the research suggested by Fitzgerald to carry out experiments to produce electric waves and showing that they have optical properties.

Bose came across an interesting paper. The author had discussed how the ships out into the open sea were helpless without any signals from the lighthouses. Light signals shone from the light houses in the coasts would be scattered as they passed through fog and be invisible and even red light, the longest visible light would not be visible (2) (*The Electrician,1891).* If signals with electric waves having wavelength larger than infrared could be used that would possibly not be impeded by fog and reach the ships out into the ocean.

Bose made up his mind to undertake research on Maxwell's waves. In his own words, he wanted to show

"That the waves had all the properties that light was known to have, and the theory of electromagnetism said that they ought to have "

Bose was fully aware that he was an experimental scientist and not a mathematical physicist (as one of his celebrated pupils S.N. Bose later turned out to be) (3). His strength lay in planning and designing instruments to carry out experiments that would offer legitimacy to theoretical physics.

He built his laboratory, 20 sft in area, adjacent to a bathroom in his office in Presidency College. The first thing that he noted were the limitations of the experiments that had been reported by the researchers in England and Europe.
The electric waves that were produced got reflected on the walls and stray waves interfered with the main electric waves whose properties were to be studied. The appliances required to study the usual optical properties of electrical waves were unwieldy because the waves were long.

It fell on Bose to realize that the wavelengths should be larger than infrared yet small enough with enough energy to penetrate walls rather than get reflected and he devised ingenious gadgets to guide the waves and recapture them. The lecture delivered at Royal Institution on 29th January 1897, Bose summarized his objective of going for electrical waves of millimeter wavelength:

"For experimental investigation, it is also necessary to have a narrow pencil of radiation, and this is very difficult to obtain, unless waves of a very short wavelength are used. With large waves diverging in all directions and cutting around corners, all attempts at accurate work is futile…All these drawbacks were ultimately removed by making suitable radiators emitting very short waves."

A complete millimeter wave bench that he prepared with the clear objective of radiating millimeter waves, guiding them, receiving them and detecting them. Several parts of this bench could be patented, but Jagadish Chandra's revulsion for patenting, discussed later in the paper, prevented him from doing so. The entire apparatus could be fitted into a box measuring 60cmx30cmx30cm.

The deflection of a Galvanometer helped in carrying out the experiments to verify the quasi optical properties of the electromagnetic waves. Jagadish Chandra used ingenious methods to detect polarization and other properties of light.

He used devices, like ringing a bell, a telephone or firing a cannon ball for spectacular demonstrations of remote signalling by invisible rays.

Coherer

Detection of electrical waves is as important as producing and transmitting it (5). Professor Lodge modified the detection device produced by Professor Branly which Lodge called the Coherer and the name stuck. Bose used various types of metal contacts and came to find that point contact on a metal or cat whiskers provided the best type of detectors (4). He used many materials in this device. He measured and plotted the current/voltage or the I/V characteristics. Instead of the usual straight lines (Ohm's Law), he found two groups, one in which the current increased as the radiation was absorbed i.e. the resistance decreased e.g. in iron (as in Branly's coherer) and the other where the current decreased i.e. the resistance increased as in Potassium. The first ones, he designated as positive and the second as negative.

Quoting from Engineer (ref4) "His masterpiece, made from galena, could detect the entire EM wave spectrum lying between millimeter electric waves and violet light. He called it an "Electric eye" and patented it." and in this, one could see how close he had come to anticipating p-type and n-type semiconductors.

Instant recognition

Bose published his first paper in the Asiatic Society in 1895.He was invited to deliver a demonstration lecture at the Town hall of Calcutta where the Governor Sir William Mackenzie was present. Jagadish Chandra sent a signal longer than the infrared and the invisible ray penetrated blocks of wood, human body, two walls and rang a bell and fired a cannon ball 23m away. This was an amazing demonstration of remote control which held the audience spellbound. That was in the year 1895. So, in less than a year, Jagadish Chandra, working alone, helped by a tinsmith, produced an instrument that generated microwaves which could travel through space and activate relays and also make a novel self- adjusting Coherer respond. The Statesman and The Electrician were full of praise for Jagadish Bose's inventions. Emphasizing particularly on the usefulness of Bose's Coherer, and taking lead from the publication by *The Electrician*, the Englishman wrote: (3)

"Should Professor Bose succeed in perfecting and patenting his "Coherer", we may in time see the system of Coast lighting throughout the navigable world revolutionized by a Bengali Scientist single-handedly in our Presidency College."

Bose's second paper, "On the index of Refraction of sulphur for the electric ray" communicated to the Royal Society for Publication by Lord Rayleigh and a second paper on a unique method of measuring wavelength of electromagnetic waves, communicated by Lord Rayleigh, led to the conferment of D. Sc degree by the University of London, (1896) ,with the rare distinction of his being exempted from further examinations.

Jagadish Chandra was invited to make a presentation of his research at the Royal Society and based on strong recommendations of Sir Alfred Croft and Sir William Mackenzie, sanction for Bose's visit to England was officially announced, (on 1st July 1896)

"It has been settled that Professor Bose should proceed at once on deputation to England to be present at a meeting of the British Association."

Jagadish Chandra went to England and delivered his lecture on the quasi-optical behavior of millimeter waves to an august gathering of scientists at the British Association at Liverpool on 21st September, 1896. Among the eminent scientists present were, Lord Kelvin, Sir Gabriel Stokes, Professors J.J. Thomson, Fitzgerald, Everett, Oliver Lodge and a few continental scientists. Bose, 38years old, was *"a little nervous at the beginning. It has not often fallen on me to address such a critical audience. But I soon got interested in my subject and was encouraged by the kind manner with which the paper was received."*

Lord Kelvin, (1824-1907), the famous Physicist broke into a warm applause. He climbed up the gallery to meet Abala Bose and congratulated her on the brilliant performance of her husband. He did not stop there. He wrote to Lord George Hamilton, then the Secretary of State for India:

"*It would be conducive to India and the scientific education of Calcutta, if a well-equipped physical Laboratory is added to the resources of University of Calcutta in connection with the Professorship of Dr. Bose.'*

The Baker Laboratory, it is believed, is the outcome of the mail from Lord Kelvin.

Nikola Tesla and Guglielmo Marconi (3)

Unknown to most in Europe, an extraordinary inventor, a Serbian American, was "playing with" remote control using electromagnetic waves around 1893. He built a boat and a handheld device which could control the speed and direction of the boat. He was Nikola Tesla (1856-1943), famous for his inventing Induction motor and introducing Alternating Current power supply. Tesla coil invented by him was widely used by scientists all over the world. His work was going on in parallel to that of Bose, unknown to each other. Unlike Bose, Tesla lost no time in patenting his inventions. He had eight American patents on electrical wave transmission all of which preceded those of Marconi.

Guglielmo Marconi (1874-1937) a rich Italian with Aristocratic connections had a single point agenda. It was to use electrical waves for message transmission. He had no compunction about infringing into available technology without acknowledgement.

He used Tesla coil, Tesla earthing and with the help of a friend L. Solari in the Italian Navy had a receiver made which, it is believed, used the receiver technology of Bose which was not patented.

Marconi was a good engineer and an extraordinary marketing manager. Sending the letter 'S' (based on Morse code) across the Atlantic, brought him International fame. In response to Edison's dismissal of the claim of transmitting and receiving an electrical signal round the curved earth as "A figment of Marconi's imagination", Marconi travelled in a ship SS Philadelphia to US on February 1902 and arranged to keep receiving radio signals, noting them and getting them countersigned by the Captain. He did not waste time in throwing a huge party where he invited Graham Bell, the inventor of telephones. Marconi came to be known as the inventor of Wireless Telegraphy. Marconi's connections with Italian Aristocracy and British Royalty enabled him to arrange sending a message from the American President Theodore Roosevelt to King Edward VII in 1901 and make big news.

It is alleged that Marconi in his speech at the grand party with Graham Bell, did not mention Tesla or Bose or even his childhood friend L. Solari in the Italian navy. Bose never claimed that he invented the radio. His preceding Marconi by two years in wireless telegraphy is attributed to a letter that Sister Nivedita had written to Rabindranath Tagore. (6). That may have given rise to the widely held idea in India that "Marconi had cheated out on Bose in the invention of Radio"

It has to be admitted that it was Marconi who made "wireless telegraphy" into a viable technology which caught on.

Marconi received the Nobel Prize in the year 1909. Neither Bose nor Tesla had any share of it. Years later, in 1943, the American Supreme Court dismissed the claim of Marconi's company in US, and annulled the patent with Marconi as the inventor of Wireless Telegraphy. The long judgment was interpreted by the followers of Tesla as favouring Tesla to be the inventor of Wireless Telegraphy. There were others who disputed such an interpretation.

When Bose was asked by his nephew as to who Jagadish Chandra believed was the true inventor of Radio, Jagadish Chandra replied that "*It is not the inventor but the invention that matters"* (3)

That Jagadish Chandra's role in Wireless Technology has not been duly acknowledged in the West has much to do with Bose's aversion to patenting. The following section from Dasgupta (6) is a transcription of Bose's letter to Tagore:

"A week after his lecture in the Royal Institution in May 1901, Bose wrote to Tagore that just prior to the lecture, the proprietor of a famous telegraphy company (most likely Dr. Alexander Muirhead, a D. Sc in Electricity) had sent him a cable indicating that he wanted to see Bose urgently. When they met, he pleaded with Bose not to reveal the details of his work in the lecture but rather allow him to take out a patent on Bose's behalf, so that they may share the profit." (possibly from making crystal radio)

Bose's repugnance at the overture made by the billionaire," who to make further profit came to me like a beggar," was undisguised. "If only Tagore would witness the country's (England's) greed for money", he wrote to Tagore in disgust. "What a dreadful all-consuming disease it was." (3)

It is possible that Bose believed that we Indians are superior to the Westerners at the very least in our apathy to worldly possessions.

Patric Geddes (7) described Jagadish Chandra as a *Rishi* (hermit)

Aversion to Patenting

It may also be possible that Bose genuinely believed that knowledge should be available to all and should not be constrained by patenting (8). Patenting, it is believed, was forbidden in the Bose Institute that Jagadish Chandra had founded. It is interesting to note in this context that Bose's recognition as a pioneer in semiconductor technology was due to his American Patent (1904), the first Indian to have an American Patent. Bose was almost forced by two Western ladies,

one was Sister Nivedita and the other Mrs Ole Bull to make the Patent application, for his "electric eye". Mrs Bull lent Bose the $80 necessary for submitting the patent application. That was in the year 1901.

By now Jagadish Chandra had moved away from his research in Microwave generation, transmission and reception. This is evident from the articles in the "History of wireless" (5) which is an exhaustive study. Out of nineteen authors only two had mentioned Bose. Out of a total of 705 references made by seventeen authors there are only two references to Jagadish Chandra except for one chapter dedicated to him written by two Bengali authors, one of them being the main compiler of this collection. Had Jagadish Chandra got patents or commercialized crystal radio using galena, the situation possibly would have been different.

That Bose was forgotten in the West had other reasons as well.

Long distance Wireless telegraphy became the most sought-after engineering achievement and it could be carried out only with long waves and not short or microwaves. The short waves penetrate the ionosphere and are not reflected as long waves are. That explained how Marconi's signals with long waves could negotiate the earth's curvature.

The use of and interest in millimeter waves, first invented by Jagadish Chandra, almost ended with his establishing the validity of Maxwell's equations at millimeter wave range. The use of Wireless telegraphy using long waves assumed great importance during the first world war by which time John Ambrose Fleming's Valves (diodes) had been invented and their complex versions were being widely used. Transistors were yet to come. The use of microwaves was far off.

It was around the year 1900 that Jagadish Chandra changed track. He could not continue with researches on millimeter waves or his point contact detectors that anticipated semiconductors. Quantum mechanics was unknown and possibly beyond the mathematical training of Jagadish Chandra. Fleming's discovery of electronic Valves, diodes, was a different kind of Technology that could hardly be practiced and developed in an ill-equipped laboratory of Bose. The physicists of the first few decades of the twentieth century, namely Max Planck, Albert Einstein, Niels Bohr, Paul Dirac, S.N. Bose to name a few of the pioneers, were totally engaged in a different type of Physics. Technologies that grew afterwards were very different.

Changing Track

Jagadish Chandra got engaged with a different problem altogether. The question was "Where is the boundary between the living and the non-living?" An extract from Bose's Royal Institute discourse (10th May 1901) below reflects his observations:

"I have shown you this evening an autographic record of the history of stress and strain in the living and the non-living. How similar are the writings? So similar indeed that you cannot tell one apart from the other. We have seen the responsive pulse wax and wane in one as in the other. We have seen response sinking under fatigue, becoming exalted under stimulants and being killed under poison.

Amongst such phenomenon, how can we draw a line of demarcation, and say here the physics ends, and there the physiological begins? Such absolute barriers do not exist.

……

It was when I came upon the mute witness of these self-made records, and perceived in them one phase of a pervading unity that bears within it all things—the mote that quivers in ripples of light, the teeming life upon our earth, and the radiant Sun that shines above us –it was then that I understood for the first time a little of the message proclaimed by my ancestors on the bank of the Ganges thirty centuries ago ---"They also see but one, in all the changing manifolds of the universe, unto them belongs the Eternal Truth—unto none else, unto none else!"

It was his faith in Universalism that may have made Bose mentally bridge the gap between the living and non-living. Bose and many illustrious thinkers of his time who were somewhat carried away when Bose's experimental results appeared to hold answer to the unresolved philosophical question and their faith. Bose possibly made the mistake of basing his conclusions on the fulfilment of necessary conditions of electric response only but not sufficient conditions. (3)

To quote D.M. Bose, (1)

"Bose *was not familiar with the contemporary physicochemical investigations carried out by men like Ostwald, Bredig and their school and was therefore unable to undertake a correct interpretation of these borderline investigations of his. While his Western contemporaries designated them as inorganic models of some properties of living systems, Bose with his pantheistic background saw in the similarity an evidence that the responsive process seen in life has been foreshadowed in the living."*

Bose's presentation in the Royal Society evoked mixed response. Some were ecstatic and some skeptical and Dasgupta (6) believes, that this was when Bose began to be marginalized as a scientist in the Western world."

His researches on Plant electrophysiology using instruments, such as the Resonant Recorder, that he got made with unbelievable accuracy and amplification revealed facts about plants that were sensational and controversial. These are, belatedly, receiving attention. (10)

There is a "resurrection" of Jagadish Chandra Bose not only in the area of Plant physiology but also in Physics where he was, as just stated, virtually forgotten.

Millimeter waves that had no use about one hundred years from now, have come back in a big way. Having a short wave length (1 to 10 mm) these have high frequency and can pack a lot of information. These may be designed to have a narrow beam width. (remember Bose's lecture at the Royal Institution. 29th January 1897, trying to get a narrow pencil of radiation). Millimeter waves interact with the atmosphere and lose energy to oxygen. These are suitable for short distance transmission (hand held mobile phones, televisions) or inter-satellite communication where oxygen is absent.

In recognition of his contributions "IEEE IN MILESTONE RECOGNITION" have commemorated a milestone based on the early radio experimental work by Dr. Jagadish Chandra Bose. His experiments in the early 1900's was conducted on equipment operating at 60GHz approximately at 5mm wavelength. The plaque was installed in the main building of Presidency College, Calcutta on 15th September, 2012.

Pearson and Brattain (Brattain received the Nobel prize for inventing Transistor along with Shockley and Bardeen) in their seminal paper (ref 11) acknowledged:

"*The demonstration of the existence of radio waves by Hertz in 1888 created potential demand for a suitable detector, but it was not realized until 1904 (Bose's American patent) that semiconductor rectifiers were well-suited for this purpose. J.C. Bose found that point contacts (cat whiskers) on galena, silicon carbide, tellurium, silicon etc. were good detectors of radio waves"*

It is also on record that Sir Neville Mott, Nobel Laureate in 1977, for his contributions to solid state electronics, remarked, *"J.C. Bose was at least 60 years ahead of his time and he had anticipated the p-type and n-type semiconductors."*

Bose's ability to look much ahead of his time may be explained in the words of his good friend Rabindranath Tagore….

"I found in him (Bose), a dreamer and it seemed to me, what surely was a half-truth, that it was more his magical instinct than the probing of his reason which startled out secrets of nature before sudden flashes of his imagination……"

References

1) D.M. Bose, *Introduction to the J.C. Bose Memorial Volume of the Transactions of the Bose Research Institute (1951)*
2) Bhattacharya and Engineer: *"A collection (*Bose Institute 1995)
3) D.P. Sen Gupta, "*Jagadish Chandra Bose: The man and His Time:" in "Remembering Sir J.C. Bose,* IISc Press- World Scientific, 2009
4) M.H. Engineer, *The Millimeter Wave Researches of J.C. Bose, in Remembering Sir J.C. Bose,* IISC Press –World Scientific in *Remembering Sir J.C. Bose*
5) Tapan K. Sarkar et.al (Eds) History *of Wireless.* A. John Wiley and Sons Inc. Publication, 2006
6) S. Dasgupta, Jagadish *Chandra Bose and the Indian Response to Western Science*. (Oxford University Press 1999). IISc Press-World Scientific Publication 2009.
7) P. Geddes, *The Life and Work of Sir Jagdish Chandra Bose*. Orient Longman, Green and Co. 1920
8) K. Rajesh, "*J.C. Bose: The Inventor who would not patent.* Science Reporter. NISCOM 2000
9)J.C. Bose, *Patraboli (Letters of J.C. Bose) ed.* D. Sen (Basu Vigyan Mandir, 1994.
10) Virginia A Shepherd: *Reflections on the Many-in-One: J.C. Bose and the Roots. Of Plant Neurobiology: in Remembering Sir J.C. Bose,* IISc Press-World Scientific Publication 2009
11) G.L. Pearson and W. Brattain, *Proc. IRE 43 (1955) 1794-1806*
12) D.T. Emerson, *"The Work of Jagadish Chandra Bose:100 years of Millimetre wave Research,* http://www.tuc.nrao.edu
13) Daniel T. Emerson: "*Jagadish Chandra Bose's Millimeter wave Research in the Nineteenth Century"* National Radio Astronomy Observatory.demerson@nrao.edu

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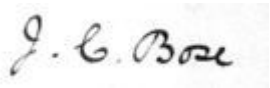
About the author

Dr. D P Sengupta An honours graduate in Physics from Calcutta Presidency College and in Electrical Engineering from IIT Kharagpur, Dr. Sen Gupta took his Ph.D from Liverpool University. He carried out teaching and research for about three decades at the Indian Institute of Science (IISc), Bangalore. He received awards for teaching excellence at both Liverpool University and IISc where he was awarded a special chair for Energy Studies. He was an AICTE Emeritus Fellow at the IISc as well as a Visiting Professor at the National Institute of Advanced Studies, Bangalore. He has co-authored several books including "Remembering Sir J C Bose", which was published by IISc Press and World Scientific Publishing Company. Among many others, he won Prof. S.N.Bose award from Government of West Bengal.

Born	30 November 1858 Mymensingh, Bengal Presidency, British India (now in Bangladesh)
Died	23 November 1937 (aged 78) Giridih, Bengal Presidency, British India (now Giridih, Jharkhand, India)
Residence	Kolkata, Bengal Presidency, British India
Citizenship	British Indian
Alma mater	Hare school St. Xavier's College, Calcutta Christ's College, Cambridge University College, London[1]
Known for	Millimetre waves Radio Crescograph Contributions to plant biology
Spouse(s)	Abala Bose
Awards	Companion of the Order of the Indian Empire (CIE) (1903) Companion of the Order of the Star of India (CSI) (1911) Knight Bachelor (1917)
	Scientific career
Fields	Physics, biophysics, biology, botany, archaeology, Bengali literature, Bengali science fiction
Institutions	University of Calcutta University of Cambridge University of London
Academic advisors	John Strutt (Rayleigh)
Notable students	Satyendra Nath Bose Meghnad Saha Prasanta Chandra Mahalanobis Sisir Kumar Mitra Debendra Mohan Bose

Signature



Source and Courtesy: ***https://en.wikipedia.org/wiki/Jagadish_Chandra_Bose***

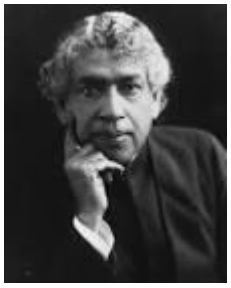
Sir Jagdish Chandra Bose, James Clerk Maxwell and there on…..

Dr. S. Pal
Dr. DS Kothari DRDO Chair
Former: Vice Chancellor, DIAT, Pune
Distinguished Scientist and Senior Advisor SATNAV-ISRO

Abstract

IEEE India Council, Bangalore & Bombay sections arranged lectures on Sunday 17th Feb 2019, on the topic "Celebrating Sir Jagdish Chandra Bose"; I had an opportunity to deliver a talk on: Sir. Jagdish Chandra Bose, Maxwell and there on.

There is quite a bit commonality between Acharya Jagdish Chandra Bose and Maxwell. Both of were "Polymath", who influenced the science of that era, in their own way, while their work & theories are quite relevant even today. Due to the efforts of some dedicated Indian Scientists in US, IEEE in 2012 recognized Sir Jagdish Chandra Bose as one of the founding fathers of RF/EM. The talk mostly concentrated on Acharya Jagdish Chandra Bose, his work and impression of his contemporary, workers and friends like Swami Vivekananda, Gurudeo Tagore and his students on his life and work. Similarly, a brief is given on James Clerk Maxwell and his work on various topics with more emphasis on EM equations.



Acharya (Sir) Jagdish Chandra Bose
CSI, CIE, FRS, IPA
(Nov 1858 – Nov 1937)
CSI-Companion of Star of India
CIE-Companion of the Indian Empire
KB-Knight Bachelor

Acharya Jagdish Chandra Bose born on 30 Nov 1858, at Mymen Singh (now in Bangladesh), was an Indian Plant Physiologist & Physicist of great repute. He was a Polymath (Physicist, Biophysicist, Botanist and Archaeologist). He was also a science & science fiction writer in Bengali, in early British India. He is more known for his pioneering investigation of RF & Microwaves (millimeter waves), optics, plant science and first one to lay the foundation of experimental science in the Indian subcontinent. He invented Cresograph, a device for measuring the growth of plant. It is worth mentioning that due to the efforts of some of the Indian scientists, working in US, in 2012 after 127 years of his invention of millimeter waves, IEEE recognized him as one of the founding fathers of RF/EM Engineering. A crater on moon is also named after him. A 1.3mm multibeam receiver, now as the National Radio Astronomy Observatory (US) 12-meter telescope, Arizona, incorporates his original papers of 1897.The Bank of England has decided to redesign the 50 Pounds note with an eminent scientist, Sir J.C Bose has been featured in the nomination.

Perhaps Acharya Jagdish Chandra Bose was never interested in developing communication receiver. He wanted to study the optics like properties of RF waves (at millimeter wavelength). Apparently he was not interested in patenting and publicity otherwise he would have been the inventor of wireless RF communication. In 1896 Marconi met him and gave a proposal for business, which Sir. J.C Bose declined. In the year 1899 Bose announced the development of "Iron-Mercury-Iron coherer with telephone detector". It is believed that his this work influenced the work done by Marconi, Popov and other researchers working on radio communication. Sir. J.C Bose was first to use semiconductor junction to detect radio waves, can be called as father of semiconductor junction diodes. In the year 1897 he presented his work on MMW at Royal Institution in London. He used waveguides, horn antennas, dielectric lenses, various polarizers and even semiconductors at ~60 GHz. We can call him even the father of waveguides and horn antennas.

As per Sir Nevill Mott (Noble Laureate – 1977). Sir J.C Bose was at least 60 years ahead of his time. In fact, Bose anticipated the existence and use of P&N type semiconductors.

As far as education is concerned, he had his graduation from St. Xavier's College Calcutta, Christ's College Cambridge, University College London. He was fortunate to have teachers at Cambridge like Lord Rayleigh, Michael Foster, James Dewar, Francis Darvin, Francis Balfour & Sidney Vines.

Acharya J.C Bose had two famous friends. : Acharya P.C Roy and Gurudeo Rabindranath Tagore. Sister Nivedita, who arranged financial support for his patent, on his coherer invention, in US, also supported him.
Before and besides Sir. Jagdish Chandra Bose and Maxwell, there were many pioneers, who put the formation of electricity, magnetism and electromagnetics: Following is the list of those pioneers.

William Gilbert	1544-1603	Electroscope
Stephen Gray	1627-1691	Electricity
Benjamin Franklin	1706-1727	Static electricity/electricity
Ewald George Von Kleist	1744-	Leyden jar
Charles Augustine de Coulomb	-	Electric charge
Alexander Voltas	1745-1782	Electric cell
Andre Ampere	1775-1786	Electric current
Michael Faraday	1791-1867	Electromotive force Generation of electricity and magnetism Studied the time variation effects on electric and magnetic field
Tesla	1856-1937	Modern A/C system
G.Macaroni	1874-1937	Radio Communication

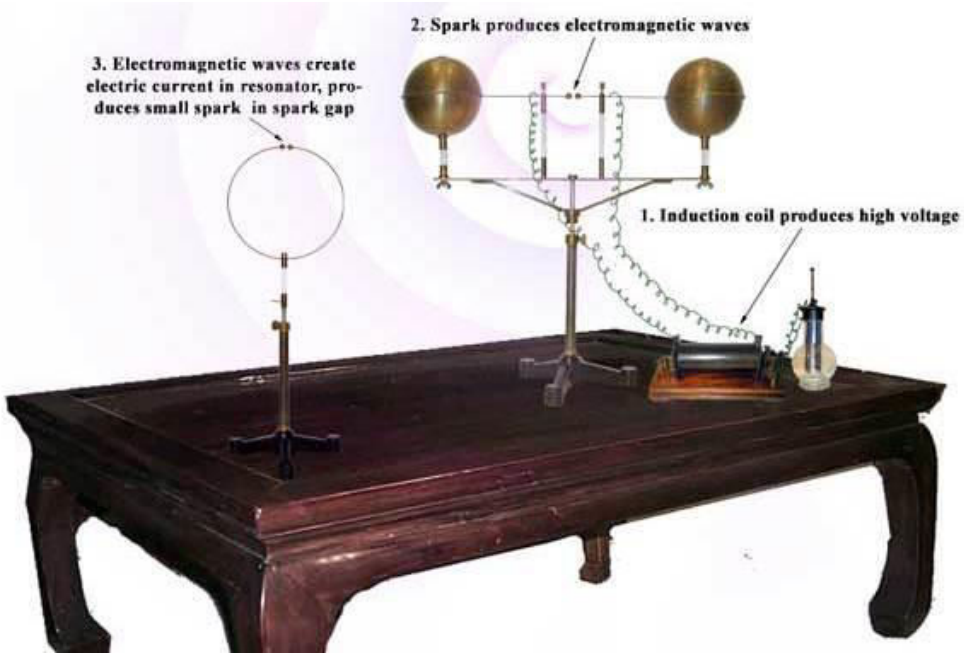
The list is representative and does not include the names of Sir. J.C Bose (1858-1867) & Maxwell (1831-1879), since the talk is about these two great scientists.

RF Wave Experimented demonstration of transmission.

After Theoretical Physicist James Clerk Maxwell who predicted the existence of electromagnetic radiation and work by Heinrich Hertz, Oliver lodge, Acharya Jagdish Chandra Bose in the field of microwave research where he reduced the wavelength to millimeter level (~ 5mm) did most remarkable experimental research. He wanted to study the light like properties of electromagnetic waves like polarization, diffraction, reflection etc which were not possible at long waves. Apparently, he did not use RF for communication purposes.

In 1895 Acharya Jagadish Chandra Bose gave his first demonstration of electromagnetic waves, by ringing a bell remotely across a wall and exploded some gunpowder in the presence of then Lieutenant Governor of Bengal Sir William Mackenzie at Calcutta town hall. He visualized that these invisible rays can pass through a wall and message can be transmitted by using these without using wires. Truly, he was the inventor of wireless communication, though he did not pursue it further.

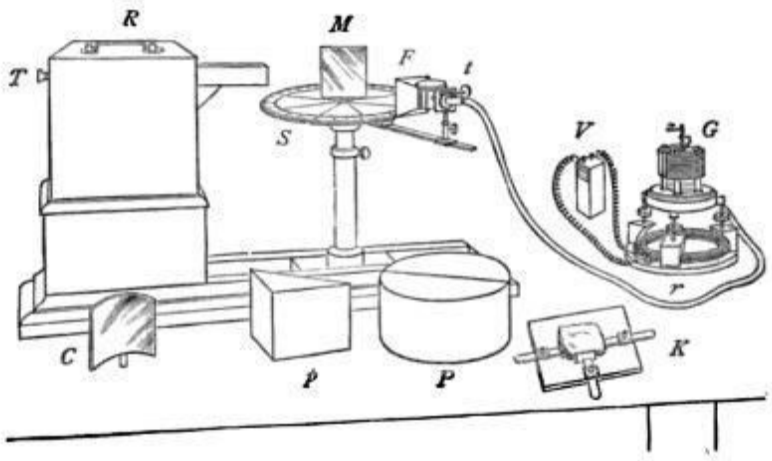
Rudolph Hertz a German Scientist (1857-1894)



Hertz Experiment (1879)

MM Wave Apparatus at JC BOSE Museum Kolkata

Acharya J C Bose with his RF equipment



Line Diagram Of The RF Equipment

In the year 1895 he published a scientific paper "On polarization of electric rays (EM) by double refracting crystals"(Asiatic Society of Bengal). Lord Rayleigh in Oct 1895 communicated Sir Jagdish Chandra Bose's second paper to Royal Society of London. In Dec 1895, London Journal Electrician (Vol 36), published Bose's paper, "On a new electro-polariscope". During the same period, he invented coherer, which he later on patented in US, and was used by G. Marconi to receive signals across Atlantic in Dec 1901. Marconi was celebrated worldwide for his achievement, but the fact that Bose invented the receiver was totally concealed.

Acharya Jagdish Chandra Bose besides working on radio waves (MMW) carried out studies on plants, cell response, metal fatigues.

Sir Jagdish Chandra Bose was a brilliant scientist of his period and his work was appreciated and acknowledged by great scientists of that era like Lord Rayleigh, Lord Kelvin and others. Although in the initial stages he did face some racial discrimination in the British era,in India but his talent was recognized by then Viceroy who supported him to get academic position in Presidency College with full pay enpar with Britishers. I feel Acharya J.C Bose was well recognized by great scientists and even literary figures like Gurudev Rabindranath Tagore.

Acharya J.C. Bose was a great teacher and researcher. Some of his famous students who influenced science in pre and post independence era were:

Prof S.N. Bose, Prof. Meghnath Saha, Prof. Prasad Chandra, Prof. S K Mitra, Prof. Mahalnobis & Prof. D.M. Basu

Acharya Jagdish Chandra Bose and Gurudeo Rabindranath Tagore

Sir Jagdish Chandra Bose had a great admirer and friend in Gurudeo Rabindranath Tagore.*

In 1931, on the occasion of Tagore's Seventieth birthday, Bose confessed, how the Poet had influenced his ideas and his work, opening before him a wider view of life: His friendship has been unfailing through years of my ceaseless efforts during which I gained step by step- a wider and more sympathetic view of continuity of life and its diverse manifestations.

(*Acknowledgement:Biswanth Banerjee Vishva Bharty India)

Tagore found Jagadish Chandra to be endowed with a rare faculty of poetic sensibility and imagination, who appeared to him someone more than a scientist: …" to my mind he appeared to be the poet of the world of facts that waited to be proved by the scientist for their final triumph.. in the prime of my youth I was strongly attracted by the personality of this remarkable man and found his mind sensitively alert in the poetical atmosphere of enjoyment which belonged to me" Hence, to both Tagore and Bose, there never existed any rigid distinction

BOSE and Literature

In his presidential address at the Bengal Literary – Conference in 1911, Bose suggested

"You are aware that, in the West, the prevailing tendency at the moment is, after a period of synthesis, to return upon the excessive sub-division of learning, Such caste-system in scholarship, undoubtedly helps at first, in the gathering and classification of new material. But if followed too exclusively, it ends by limiting the comprehensiveness of truth. The search is endless. Realization evades us. The Eastern aim has been rather the opposite, namely that, in the multiplicity of phenomena, we should never miss their underlying unity. After generations of this quest, the idea of unity comes to us almost spontaneously, and we apprehend no insuperable obstacle in grasping it".

BOSE IN HIS LAST PHASE OF RESEARCH

He pursued in a research to draw a link between the animate and the inanimate in their responses to electric stimulus, and wrote his seminal book, Responses in the Living and Non-living (1902). This project of Bose served to fulfill two crucial purposes: firstly, to contest the Western stereotypical image of India as 'a nation of dreamers', by leaving a distinctly Indian imprint in the corpus of modern science, and secondly, to widen the world view of modern science and to bring a refreshing spirit to the excesses of Western scientific methodology by infusing the Eastern spiritual resources and Vedantic beliefs which proclaim the ideal of the Unity of Life.

Rabindranath Tagore, who had always been an avid supporter of Bose's researches and discoveries, found in his works an essence of Indian scientific spirit, a reflection of Indian national culture, its national pride and heritage. In his poem for Bose, published in Kalpana, Tagore, addressing the scientist, was effusive in praise:

Tagore as a poet on Bose

From the Temple of Science in the West,
Far across the Indus,
Oh, my friend, you have brought
the garland of victory,
decorated the humbled head of the poor Mother ….
Today, the mother has sent blessings
In words of tears,
of this unknown poet.
Amidst the great Scholars of the West
Brother, these words will reach only yours years

BOSE AS A TRUE NATIONALIST

In his letter to Tagore, dated 29th November, 1901, Bose acknowledged his responsibilities as a scientist to revive the national pride of his county: I am alive with the life force of the mother Earth, I have prospered with the help of the love of my countrymen. For ages the sacrificial fire of India's enlightenment has been kept burning, millions of Indians are protecting it with their lives, a small spark of which has reached this country (through me)

Bose's discoveries on electric responses, which were premised alleging the distinctions between the living and the non-living, actually reiterate the ideals of Hindu Vedic Monism that asserts a sense of unity and strength, a grand cosmic unity within the diversity. In this respect, Bose was considerably influenced by Rammohan Roy, who is often designated as the pioneer to rediscover and identify this essential monism within Classical Indian thought, and who according to Bose, was the first to see the "Unity of All Intellectual Life", and the "importance of absolute freedom in all fields of inquiry.

BOSE'S FINAL PHASE OF DISCOVERY

In the final phase of Bose's research could be characterized as the continuation of his endeavor to search for the Unity of Life, in which he attempted to bridge the gulf between the inanimate and the animate worlds by posting the plant world as the progressive connecting link. This phase of Bose's research thus promised to collapse the further existing barriers between different fields of scientific research, thereby strengthening his commitment to his Vedantic belief in cosmic unity.

Acharya JC Bose and Gurudev Rabindranth Tagore

In a tribute to his friend Sir Jagadish Chandra Bose (1858-1937) who died on 23 Nov 1937, Rabindranth Tagore (1861-1941) wrote: Years ago, when Jagadish Chandra, in his militant exuberance of youthfulness, was contemptuously defying all obstacles to the progress of his endeavor, I came into intimate contact with him, and became infected with his vigorous hopefulness. There was every chance of his frightening me away into a respectful distance, making me aware of the airy nothingness of my own imaginings. But to my relief, I found in him a dreamer, and it seemed to me, what surely was a half-truth, that it was more his magical instinct than the probing of his reason which startled out secrets of nature before sudden flashes of his imagination.

James Clerk Maxwell (1831–1879)

James Clerk Maxwell was another Polymath. He is more famous for the theoretical formulation of electromagnetic theory, although he contributed in many areas of Physics.

Maxwell is considered by many physicists to be the nineteenth century scientist with the greatest influence on twentieth century physics. His contributions to the science are considered by many to be of the same magnitude as those of Isaac Newton and Albert Einstein, although he was not as fortunate as the other two in getting laurels and recognition during his life. In 1931, on the centennial of Maxwell's birthday, Einstein himself described Maxwell's work as the: *"most profound and the most fruitful that physics has experienced since the time of Newton"*. Einstein kept a photograph of Maxwell on his study wall, alongside pictures of Michael Faraday and Isaac Newton.

History of Maxwell's equations

Electromagnetism, one of the fundamental fields of physics, the introduction of Maxwell's equations (mainly in *"A Dynamical Theory of the Electromagnetic Field"*) was one of the most important aggregations of empirical facts in the theory of physics. It took place in the nineteenth century, starting from basic experimental observations, and leading the formulations of numerous mathematical equations, notably by Charles-Augustin de Coulomb, Hans Christian Orsted, Carl Friedrich Gauss, Jean Baptiste Biot, Felix Savart, Andre-Marie Ampere and Michael Faraday. The apparently disparate laws and phenomena of electricity and magnetism was integrated by James Clerk Maxwell, who published an early form of the equations, which modify Ampere's circuital law by introducing a ***displacement current term***. He showed that these equations imply that light propagates as electromagnetic waves. ***His laws were formulated by Oliver Heaviside in the more modern and compact vector calculus formalism,*** he independently developed. Increasingly powerful mathematical descriptions of the electromagnetic field were developed, continuing into the twentieth century, enabling the equations to take on simpler forms by advancing mathematics that is more sophisticated.

The concept of electromagnetic radiation originated with Maxwell, and his field equations, based on Michael Faraday's observations of the electric and magnetic lines of force, paved the way ***for Einstein's special theory of relativity, which established the equivalence of mass and energy. Maxwell's ideas also ushered in the other major innovations of 20th century physics, the quantum theory***.

His description of electromagnetic radiations led to the development (according to cassical theory) of the ultimately unsatisfactory law of heat radiation, which prompted Max Planck's formulation of the quantum hypothesis – i.e, the theory that radiant-heat energy is emitted only in finite amounts or quanta. ***The interaction between electromagnetic radiation and matter, integral to Planck's hypothesis, in turn has played a central role in the development of the theory of the structure of atoms and molecules.***

James Clerk Maxwell the Polymath, as a child ad maintained an unquenchable curiosity, for which all came on his way. He developed interest in optics by observing various colours on soap bubbles.

He considered electric & magnetic fields as fluids, wanted to use: **Newton's formula f = ma**

Besides EM theory, he worked on thermodynamics, statistics, atomic movements, RGB (Red, Green & Blue) Colur combination & viscoelastic materials.

Maxwell's equations are a set of partial differential equations that, together with the Lorentz force law, form the foundation of classical electromagnetism, classical optics, and electric circuits. The equations provide a mathematical model for electric, optical, and radio technologies, such as power generation, electric motors, wireless communication, lenses, radar etc. Maxwell's equations describe how electric and magnetic fields are generated by charges, currents, and changes of the fields. One important consequence of the equations is that they demonstrate how fluctuating electric and magnetic fields propagate at the speed of light. Known as electromagnetic radiation, these waves may occur at various wavelengths to produce a spectrum from radio waves to γ-rays. The equations are named after him. He also first used the equations to propose that light is an electromagnetic phenomenon.

$e + \frac{df}{dx} + \frac{dg}{dy} + \frac{dh}{dz} \quad 0$	(1)	Gauss' Law
$\mu\alpha - \frac{d\text{[illegible]}}{dy} \quad \frac{d\text{[illegible]}}{dz}$ $\mu\beta - \frac{d\text{[illegible]}}{dz} \quad \frac{d\text{[illegible]}}{dx}$ $\mu\gamma - \frac{dG}{dx} - \frac{dF}{dy}$	(2)	Equivalent to Gauss' Law for magnetism
$P - \mu\left(\gamma\frac{dy}{dt} - \beta\frac{dz}{dt}\right) - \frac{dF}{dt} - \frac{d\Psi}{dx}$ $Q - \mu\left(\alpha\frac{dz}{dt} - \gamma\frac{dx}{dt}\right) - \frac{dG}{dt} - \frac{d\Psi}{dy}$ $R - \mu\left(\beta\frac{dx}{dt} - \alpha\frac{dy}{dt}\right) - \frac{d\text{[illegible]}}{dt} - \frac{d\Psi}{dz}$	(3)	Faraday's Law (with the Lorentz Force and Poisson's Law)
$\frac{d\gamma}{dy} \quad \frac{d\beta}{dz} = 4\pi p' \qquad p' - p + \frac{df}{dt}$ $\frac{d\alpha}{dz} \quad \frac{d\gamma}{dx} = 4\pi q' \qquad q' - q + \frac{dg}{dt}$ $\frac{d\beta}{dx} \quad \frac{d\alpha}{dy} = 4\pi r' \qquad r' - r + \frac{dh}{dt}$	(4)	Ampère-Maxwell Law
$P - \xi p \quad Q - \xi q \quad R - \xi r$		Ohm's Law
$P - kf \quad Q - kg \quad R - kh$		The electric elasticity equation (**E** = **D**/ε)
$\frac{de}{dt} + \frac{dp}{dx} + \frac{dq}{dy} + \frac{dr}{dz} - 0$		Continuity of charge

Maxwell's Original EM equations

Oliver Heaviside (1850-1925

$$\nabla \cdot \mathbf{D} = \rho \qquad (1) \qquad \text{Gauss' Law}$$

$$\nabla \cdot \mathbf{B} = 0 \qquad (2) \qquad \text{Gauss' Law for magnetism}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \qquad (3) \qquad \text{Faraday's Law}$$

$$\nabla \times \mathbf{H} = \frac{\partial \mathbf{D}}{\partial t} + \mathbf{J} \qquad (4) \qquad \text{Ampère-Maxwell Law}$$

Modern Maxwell's Equations (As modified by Oliver Heaviside

The four most common Maxwell relations are the equalities of the second derivatives of each of the four thermodynamic potentials, with respect to their thermal natural variable (temperature T; or entropyS) and their mechanical natural variable (pressure P; or volume V):

$$+\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V = \frac{\partial^2 U}{\partial S \partial V}$$

$$+\left(\frac{\partial T}{\partial P}\right)_S = +\left(\frac{\partial V}{\partial S}\right)_P = \frac{\partial^2 H}{\partial S \partial P}$$

$$+\left(\frac{\partial S}{\partial V}\right)_T = +\left(\frac{\partial P}{\partial T}\right)_V = -\frac{\partial^2 F}{\partial T \partial V}$$

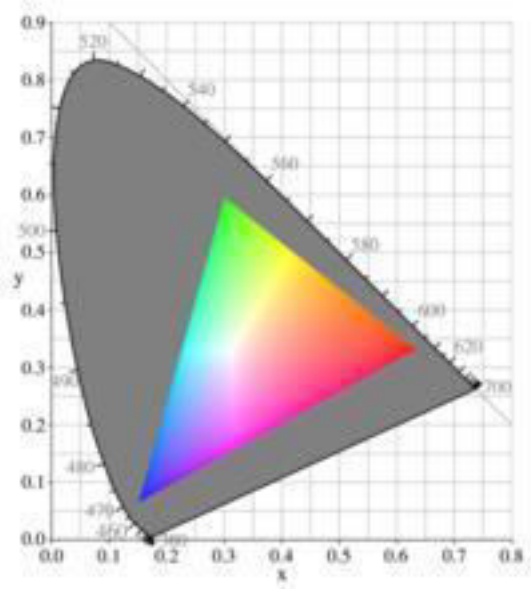
$$-\left(\frac{\partial S}{\partial P}\right)_T = +\left(\frac{\partial V}{\partial T}\right)_P = \frac{\partial^2 G}{\partial T \partial P}$$

where the potentials as functions of their natural thermal and mechanical variables are the internal energy U(S, V), enthalpy H(S, P), Helmholtz free energy F(T, V) and Gibbs free energy G(T, P). The thermodynamic square can be used as a mnemonic to recall and derive these relations. The usefulness of these relations lies in their quantifying entropy changes, which are not directly measurable, in terms of measurable quantities like temperature, volume, and pressure.

Maxwell Boltzmann Distribution

In physics (in particular in statistical mechanics), the Maxwell–Boltzmann distribution is a particular probability distribution named after James Clerk Maxwell and Ludwig Boltzmann

Maxwell's Colour Triangle



The RGB color triangle, shown as a subset of x,y space, a chromaticity space based on CIE 1931 colorimetry

Maxwell Boltzmann distribution in gasses

Maxwell Boltzmann Distribution:In physics (in particular in statistical mechanics), the Maxwell–Boltzmann distribution is a particular probability distribution named after James Clerk Maxwell and Ludwig Boltzmann.

MAXWELL'S THEOREM

In probability theory, Maxwell's theorem, named in honor of James Clerk Maxwell, states that if the probability distribution of a vector-valued random variable X = (X1, ..., Xn)T is the same as the distribution of GX for every n×n orthogonal matrix G and the components are independent, then the components X1, ..., Xn are normally distributedwith expected value 0, all have the same variance, and all are independent. This theorem is one of many characterizations of the normal distribution.Since a multiplication by an orthogonal matrix is a rotation, the theorem says that if the probability distribution of a random vector is unchanged by rotations and if the components are independent, then the components are identically distributed and normally distributed. In other words, the only rotationally invariant probability distributions on Rn that have independent components are multivariate normal distributions with expected value 0 and variance σ2In, (where In = the n×n identity matrix), for some positive number σ2.

Maxwell's Materiala

Maxwell material is a viscoelastic material having the properties both of elasticity and viscosity. It is named for James Clerk Maxwell who proposed the model in 1867. It is also known as a Maxwell fluid.

Generalized Maxwell Model:The **Generalized Maxwell model** also known as the **Maxwell–Wiechert model** (after James Clerk Maxwell and E Wiechert[1][2]) is the most general form of the linear model for viscoelasticity. In this model several Maxwell elementsare assembled in parallel. It takes into account that the relaxation does not occur at a single time, but in a set of times. Due to the presence of molecular segments of different lengths, with shorter ones contributing less than longer ones, there is a varying time distribution. The Wiechert model shows this by having as many spring–dashpot Maxwell elements as are necessary to accurately represent the distribution. The figure on the right shows the generalised Wiechert mode

Displacement Current

In electromagnetism, **displacement current density** is the quantity $\partial \boldsymbol{D}/\partial t$ appearing in Maxwell's equations that is defined in terms of the rate of change of $\boldsymbol{D}$, the electric displacement field. Displacement current density has the same units as electric current density, and it is a source of the magnetic field just as actual current is. However it is not an electric current

of moving charges, but a time-varying electric field. In physical materials (as opposed to vacuum), there is also a contribution from the slight motion of charges bound in atoms, called dielectric polarization.

The idea was conceived by James Clerk Maxwell in his 1861 paper *On Physical Lines of Force, Part III* in connection with the displacement of electric particles in a dielectric medium. Maxwell added displacement current to the electric current term in Ampère's Circuital Law. In his 1865 paper A Dynamical Theory of the Electromagnetic Field Maxwell used this amended version of Ampère's Circuital Law to derive the electromagnetic wave equation. This derivation is now generally accepted as a historical landmark in physics by virtue of uniting electricity, magnetism and optics into one single unified theory. The displacement current term is now seen as a crucial addition that completed Maxwell's equations and is necessary to explain many phenomena, most particularly the existence of electromagnetic waves.

Maxwell's coil

A **Maxwell coil** is a device for producing a large volume of almost constant (or constant-gradient) magnetic field. It is named in honour of the Scottish physicist James Clerk Maxwell.A Maxwell coil is an improvement of a Helmholtz coil: in operation it provides an even more uniform magnetic field (than a Helmholtz coil), but at the expense of more material and complexity.

Maxwell and light

- Maxwell theoretically showed that EM waves are light waves and vice versa.
- He also calculated the velocity which almost matched with the measured one much after his death.

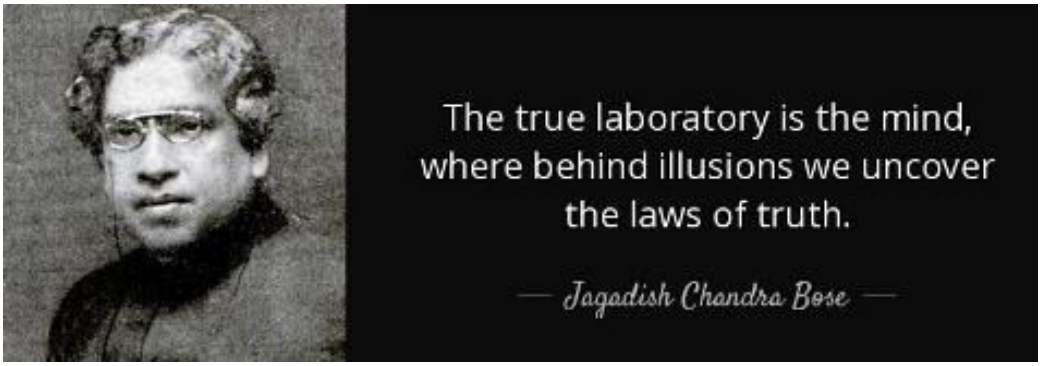
Maxwell's all calculations were based on observations and empirical formulations which were letter on proved. Hertz was the first to show the generation and propagation of EM waves through spark gap experiment.

The lecture was based on the following open/published literature:

- An appreciation of J.C Bose's pioneering work:. Sarkar T.K & Sengupta D.L (1997) IEEE
- Yogananda Paramhansa (1946) "India's Great Scientist, J.C Bose". Autobiography of a Yogi (1st Edition) New York:
- Bose Institute Website
- Wikipedia (on J.C Bose & Maxwell)
- The Scientist and the Poet: Acharya Jagdish Chandra Bose and Rabindranath Tagore by Biswanath Banerjee-Vishwa Bharati India
- Maxwell's Legacy by James C. Rautio IEEE-Microwave Magazine-June 2005
- Encyclopedia Biography of World Great Scientists
- History of Wireless Communication-Microwave Journal 2015.

About the author

Dr.Surendra Pal is a space communication, RF, EM and GNSS expert. He is currently Dr. D.S.Kothari DRDO Chair. He was the Vice Chancellor of Defence Institute of Advanced Technology (DIAT), Pune, Prof. Satish Dhawan Professor, Senior Adviser and Programme Director of Satellite Navigation, ISRO, Bengaluru. He was also the Distinguished Scientist, Associate Director and Chairperson of GAGAN-PMB. He is a Fellow of IEEE, Fellow of Indian National Academy of Engineers (FNAE), Fellow of National Academy of Science (FNASc), Distinguished Fellow of IETE and Fellow of the IET. He had served as the national President of IETE during 2012-12.



mmWave Applications in NextGen Wireless Broadband Evolution in 5G Era Impact of Sir JC Bose invention

Mr. C.S. Rao, Co-Founder
Ms. Arpita Hura, Sr. RF engineer
Ms. Mouna Jain, Sr. RF engineer
QuadGen Wireless Solutions

Abstract

Sir JC Bose, the Original Inventor, Pioneer, and Scientist was first in the past era to discover the mmWave based Radio communications and his famous invention has become now a reality in mass adoption in this world of 5G Wireless communications. 5G and mmWave Communications have now become the defacto choice for Mobile Gigabit Broadband Speeds based Internet Access. mm Wave technology, coupled with MIMO Antenna technology invention by Prof Arogya Swamy Paul Raj of Stanford University, USA, another living legend in this 2019 era paved the way for Mobile Internet Access in Megabits era from Minutes era of Wireless Phone communications on Smart Phones/Laptops and many other form factor-based end user devices. Prof Paulraj, an Indian is a globally acclaimed Scientist, Engineer, Technologist, and Academician who is also in the National Inventors Hall of Fame, USA. Now with 2 global societal life impacting inventions of mm Wave communications and massive MIMO from 2 great Indians, we are set to experience Gigabit speed of Internet access in 5G NR (New Radio) era starting from 2020.

1. Introduction.

mmWave technology historical invention by Sir JC Bose 100 years ago has been used with practical products only since a decade through what is known as E and V Spectrum bands. Telecom NW Operators have deployed them as Point to Point and Point to Multipoint Radio links as Back haul links as "Wireless Fiber" high speed links. Now mmWave has come to be seen as Wireless Access technology for cellular applications .This is a huge transformation for mmWave adoption at massive global scale and is ready to serve Billions of people for Mobile Gigabit speed experiences .Telecom operators have done trials since past 2 years and now ready to launch live mmWave radio based 5G NR networks in USA/Europe/APAC/China /Middle East and India.

2. Digital Transformation of Our World

Digital Transformation of our World is taking place around the Mobile going from 4G to 5G driving Gbps speed Internet connectivity. If we can recall the LAN speed what we experience in our day to day office has gone from 10Mbps to 100Mbps to 1Gbps and now 10Gbps.LAN based access to Internet is the reality on the copper wire .Same kind of LAN speed we are now set to experience from the Wireless LAN (WLAN) from 1G to 10G through 5th Gen WiFi in offices and the new 5G Wide Area Radio Access technologies like 4G.

To make this Digital transformation a true reality, we need to adopt the 100 years old mmWave invention from Sir JC Bose.

JC Bose invention of mmWave is all about facilitating GHz spectrum band hitherto not used for adoption in 26/28/29 GHz bands with wide RF channel widths of n* 20 MHz to n*100Mhz bands for Gigabit Broadband delivery. Thus, a massive Digital Transformation of our world from 3 to 4 Billion People having access to high speed Internet to approximately 50 Billion Devices getting connected on Internet on massive Machine Type Communications (mMTC).

3. IT/Telecom/Internet/Media, Silicon Technologies driving the scaling potential in the society

In that, the following 5 technologies are defining the 3C's i.e. Computer, Communication, and Civilization

5G / MEC / Cloud Tech Base
Blending technologies of Communications and Computing in new ways is unleashing next generation Communication and Computational networks like **M**obile **E**dge **C**omputing

Machine Intelligence (MI)
Moving from cognitive MI toward augmented human intelligence in Radio NW planning and Performance monitoring and Optimisation has reached a level where past algorithms used have reached a limit and MI and ML based Dynamic algorithms and tools have become an imperative need due to massive scale of Network elements, devices and users in any geographic coverage.

NB-IoT
Internet of Things (IoT) getting connected is a revolutionary adoption in every walk of life, be it environmental sensors, Traffic sensors, Video Surveillance, Defence sector, Manufacturing, Automobiles, Railways, Electricity distribution Airline industry and Agriculture.

AI
AI for Analysis, computation, and decision making has become a compelling need in Telecom networks

AR/VR (Augmented Reality /Virtual Reality)
Immersive user experience to the physical world is rapidly becoming a huge adoption level.

4. Drivers & Prerequisites for 5G NR in India

Drivers
Aim for End user Enhanced Mobile Broad Band (eMBB) Target Speeds from average of evolution from 4 Mbps to 10Mbps **…**100Mbps **….**to 1Gbps and potential 100 M Subs to 500 M subs to 1B subscribers by 2025

Aspire for massive Machine Type Communications (IoT)
300M devices to 3 B devices**…**to 5B devices In India to be connected during 2019 to 2025 period

Evolve large scale Sensor centric Connected Smart Cities
50 **…**to 100**….** to **…..**1500 Smart cities

Prerequisites for 5G NR NW Infrastructure Launch
Ubiquitous availability of OFC Tx NW with Tbps Bandwidth.
Scalable Cloud Architectures in place for Core NW with strong Cyber Security framework
Always available &reliable Energy Infrastructure and Attractive Right of Way (RoW) policies

5. Diverse User demands for services

Users
Anywhere 1Gbps service
Ultra-high definition mobile video experiences

Battery Consumption
Battery consumption capability where it survives 5-6 hours a day. Making GPU's, CPU's and audio processor in the devices need to go to sleep mode whenever it is not in use so that the battery power stays longer for phone use.

Latency
<1ms NW latency

NW Element level Capacity at the Point of Presence (PoP)
<10 Gb/s peak data rates and **100 Mb/s** whenever needed

Ultra-low cost for massive machine type communications

6. mmWave 5G Network level - 5 Attributes

Cell Site Perspective
Today 300 Mbps is the capacity on the 4G /cell and in the order of migration it has go from 300Mbps to 50Gbps per cell at the expectations of anytime, anywhere, anyone (human beings or IoT devices to anything connectivity needs for 5G at higher scale.

Performance Perspective
Ultra-High Capacity(x1000) more than current level at **1,000,000** user devices per km² with Massive Connectivity (IoT) (Peak Data Rate > 50Gbps/cell) 4A Connectivity (Anytime, Anywhere, Anyone, Anything)

Management Perspective
Energy-efficient infrastructure
TCO Reduction
Flexible Configuration /Mgmt.
Load /Resource Balancing)

Architecture Perspective
Flat Structure/High Scalability
S/W- based Flexibility & Agility (Ease of innovation)
Analytics- based NI/BI
Network as-a-Service (NaaS)-Operation Perspective
High Reliability & Security
Automatic Optimization & Recovery
E2E QoE Control

7. mmWave based 5G NR – KPI s

Area	Requirements
Cell Spectral Efficiency	DL:10 bit/Hz/Cell(@10/30 Km/h)
	UL: 5 bit/Hz/cell(@10/30 Km/h)
Peak Data Rate	DL: 50 Gbps
	UL : 25 Gbps
Cell Edge Data Rate	DL : 1 Gbps(@ 10/30 Km/h)
	UL : 0.5 Gbps (@ 10/30 Km/h)
Latency	Control Plane: 50 ms
	User Data Plane : 1ms
Handover Interruption Time	10 ms

Above Peak data rates or the KPIs will not be possible if we don't have mmWave Spectrum band and the wide RF channels

8. India -Telecom NW Infra - mm Wave Scaling

Today we have around 1.8 Million Route KM route of fiber connecting all the cell towers whether Intra city or Inter City

To make 5G as a reality in India this order of the magnitude has to increase 3X times of the existing fiber i.e. from 1.8 M to 3M to cover all the cell towers and Point of presence

We need this huge magnitude increase because we are now going into mmWave which has the lesser range and hence we need that many more cell sites as the points of presence

Need to move from 500K cell sites to 1.5Million cell sites when we move to 5G

Today we have 0.5M cell towers but we need at least 0.5M cell towers additional or the poles, since we cannot have many towers, we may plan to use the existing street poles or the electrical poles to put a 5G mmWave Radio to bring the 5G technology for ubiquitous coverage reality. In summary we will approximately need the following additional NW infrastructure for 5G NR.

2 M RKM urban Intracity Fiber NW
3 M RKM Intercity Fiber for 6000 Cities
Addl 1.5 Million BTS with 4G/5G capacity
Addl 0.5 Million Poles &Towers

9. Next generation 5G mobile experience varieties are indicated below

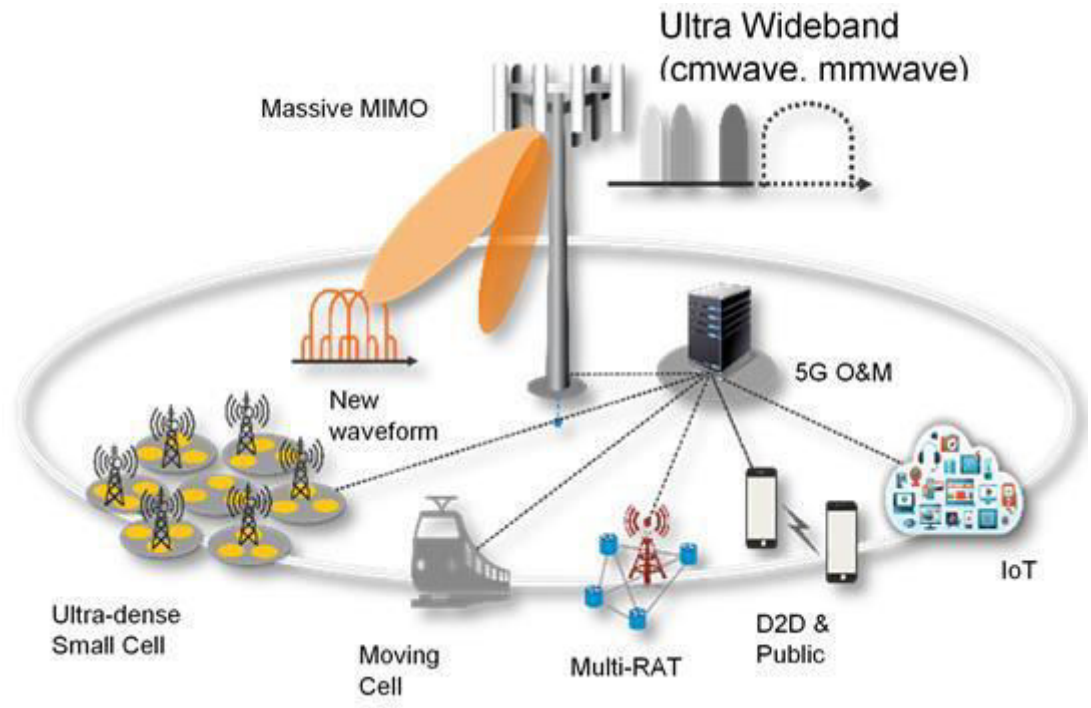
10. mmWave based 5G Applications.

Below listed Applications are driving 5G mmWave adoption need.

High speed mobility
Augmented Reality
Virtual Reality
Real-time remote-control cars
Sensors
Telepresence
Hologram Gaming

Till a few years ago the Content were getting generated by the Media and the Broadcasting houses. But in today's real life the content is getting generated by users and so the uplinking is also significantly higher compared to downlink data consumption because people want to update any events in the real time. All this content has to be backhauled and hence again this will be the big application for mmWave backhaul.

11. 5G mmWave NR Deployment Considerations



Higher Spectral Efficiency needs

Ultra-Wideband: While moving to mmWave, the RF channel bandwidth will move from 5MHz to 100MHz and upto n*100MHz and n*1 GHz facilitating high throughputs.

New Waveform will be adopted (NOMA, FBMC).

Massive MIMO, Full Duplex: From a Cell site to Handset, a MIMO of 8x8/64x64/256x256 Antenna array. facilitates Beamforming and Beam-tracking to guarantee required speeds with Radio resources. MIMO of higher degree will need higher spectrum which is provided through mmWave. 5G spectrum allocation with sub 6GHz (3.5-6GHz) will provide required coverage whereas in mmWave bands 28/39GHz will achieve capacity requirements.

Cell Densification

Ultra- dense Small Cell: mmWave Spectrum transmissions will not penetrate enough through concrete walls, and this requires small cell deployments for Ultra-Dense areas.

More Spectrum Bands and need for the following will arise like cm/mm Wave Transmission

Unlicensed Spectrum, D2D as Relay, Moving Cells will also be used.

Operational Efficiency based tools for NW Performance Monitoring (NPM)will be needed.

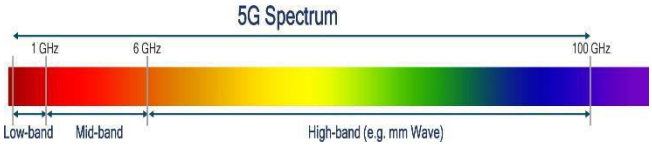
Advanced SON-Self Optimised Networks

Analytics based Control of Networks

IOT and Public Safety Networks

12. Key spectrum initiatives across the world for 5G:

Across low-band, mid-band, and high-band including mmWave FCC of USA considered the following



Low-band

- Successfully auctioned a portion of the 600 MHz band
- Spectrum availability timing aligns with 5G

Mid-band

- Opening up 150 MHz in 3.5 GHz band.
- CBRS Alliance launched to drive 5G like eco system
- 3.7-4.2 GHz and 5.9-7.1 GHz

High-band

- Opened with 11 GHz Bands leading in to mmWave bands
- 70% of newly opened spectrum is shared or unlicensed.
- Considering adding 24.25-24.45, 24.75-25.25 GHz, and 42-42.5 GHz

13. High-band: Spectrum for 5G mmWave with Ultra-Wide RF Channel widths can be seen below

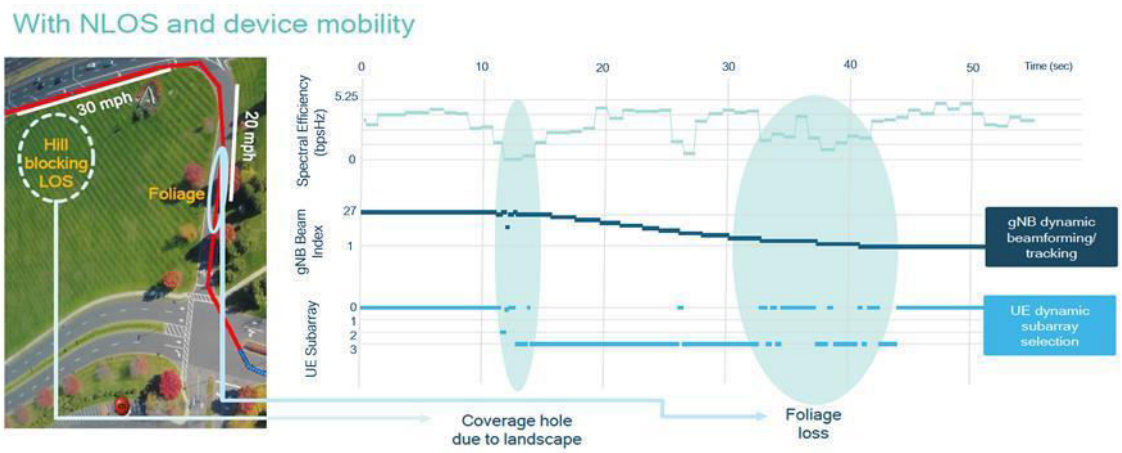
- 27.5to 28.35Ghz-850MHz@2x425 MHz of RF Channels)
- 37.6 to 38.6 GHz: 1 GHz @5x200 MHz)
- 38.6 to 40 GHz: 1.4 GHz @7x200 MHz)
- 37 – 37.6 GHz: 600 MHz @3x200 MHz)
- 64 - 71 GHz: 7 GHz @1Ghz

14. Global snapshot of 5G spectrum allocations Around the world, these bands have been allocated or targeted.

15. European Commission driving a Gigabit Society

Pioneer spectrum bands for 5G adoption in Europe are

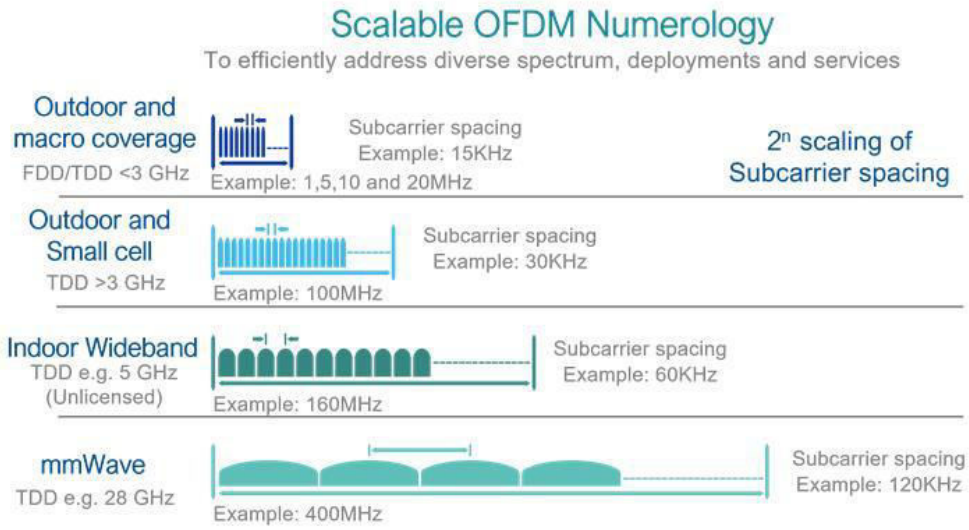
- CEPT - 26 GHz mm Wave band
- 5G commercial services to use both 3.4–3.8 GHz and 26 GHz mmWave in Europe by 2020
- Bands as per WRC-19 (e.g., 31.8 – 33.4 GHz, 40.5 – 43.5 GHz in addition to 24.25 – 27.5 GHz)



16. mmWave –NLOS-Device Mobility

Cellular Access network is always on a Non-Line of Sight (NLOS) where devices can transmit/receive data despite of foliage, constructions appearing between the transmissions. As 5G device is in mobility at 20-30 mph speed in mmWave mode of use due to landscape and foliage, spectral efficiency varies and throughput goes down, with inspite of dynamic Beamforming/Beam-tracking on UE.

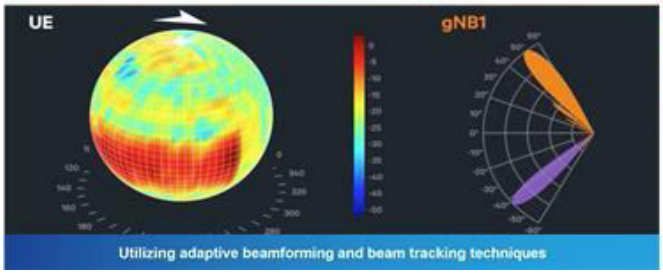
17. 5G – mmWave – Numerology



- RF Channel Width in OFDM Technology changes from 5MHz to 20MHz in 4G era
- RF Channel Width in OFDM Technology in 5G era varies from n*20 to n*100 to n*400MHz upto n*1 GHz
- Sub carrier spacing increases from 15KHz to 120KHz and Mbps era to Gbps Internet access era on mobiles.

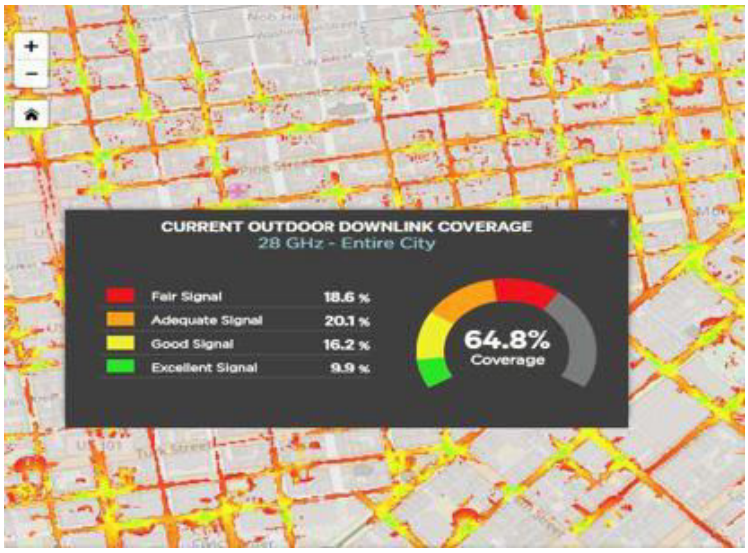
18. Mobilising 5G mmWave in Real world environments

Car based 5G Devices, Small cell BTSs, Embedded Medical Devices, Robots, and Smart Phones deployed in mmWave trials for testing outdoor coverage as well as Indoor coverage applications are given below indicating seamless handover at speeds of 30 mph.



mmWave mode of RF propagation in 5G is fully dependent on adaptive Beamforming/Beam-tracking with upto 128 antenna elements on gNodeB and UE supporting 4 sub arrays.

19. 5G NR mmWave Network Coverage Simulation



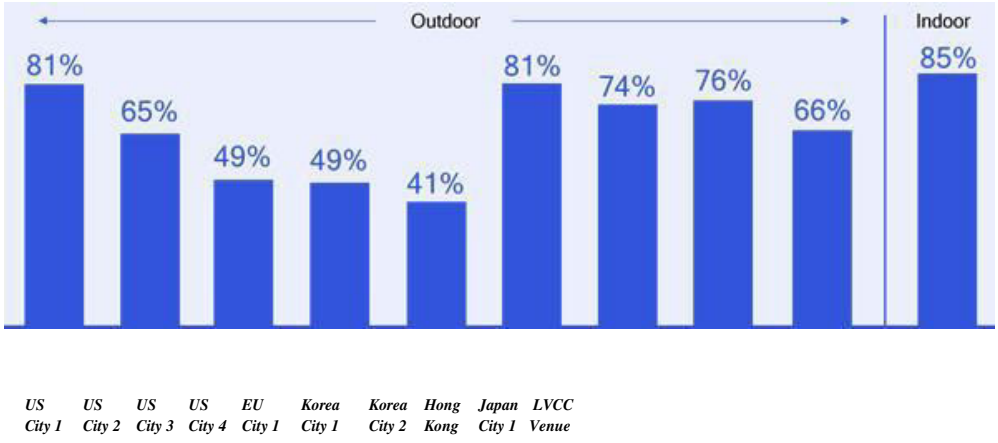
- Outdoor coverage simulated using existing LTE sites.
- Outdoor coverage complements indoor deployments.
- Below Table captures simulation results of DL coverage in mmWave coverage mode indicated.

Frequency	mm Wave 28GHz
Site Locations	Entire City
Total Area	9.77km2
Macro sites	77
Small cells	275
Site Density	36/km2
Excellent to Fair Signal	65 % Coverage

- Cell Site density per Sq.km is far higher in mmWave bands.

20. Significant 5G NR mmWave coverage via co-siting Simulations

Extensive over-the-air testing and channel measurements shown below for % of coverage with different cell density deployments in different cities is shown below.



28 GHz downlink coverage % Co-siting with LTE

Site density (per km2)	Total	48	36	32	31	28	41	31	39	37	134
	Macro	0	8	15	14	7	33	31	39	37	
	Small	48	28	17	17	21	8	0	0	0	

21. Mm Wave – Pico Radio Deployments
3 distinct form factors of BTS sites shown for mmwave based 28 -39GHz for 5G NR

Pole Top Mounted Cylinder: 12" tall x 14" OD cylindrical shape 5G BTS on pole tops Provide 360-degree coverage

Pole Wrap-Around Mounting: 12" H x 8" W x 4" D
Provide 120-degree coverage per 5G radio unit

Flat Panel *:*8" H x 8" W x 4" D Traditional Flat panel design. Provide 120-degree coverage per radio unit

mmWAVE Band
28-39GHZ FWA form factor Small cell BTSs

22. Conclusion
Inventions made by Sir JC Bose 100 years ago is becoming a reality now. This will transform next generation Wireless Access technologies for global citizen around the world. Upcoming interoperability testing at sub-6 GHz & mmWave will ensure future 5G deployments to be great success. OEMs like Nokia, Ericsson, Huawei, Samsung and ZTE etc. and Telcos like AT&T, China Mobile, Sprint, SK Telecom, Vodafone conducting trails in their Networks & laboratories promises 5G to be great success ***for pioneering invention based mmWave centric Gigabit era***

References

a) *Qualcomm 5G Technical literature.*
b) *Telco trial data simulations*
c) *QuadGen 5G Network element database*

About the authors

Former President and CEO of Lucent, India, Mr. Rao have had a distinguished career in telecommunications. In addition to holding executive positions with BT India, Intel India, Tellabs India, CDOT India and Reliance Communications India, Mr. Rao is the President of AUSPI India, Chairman of the WiMAX Forum India and former Chairman of ASSOCHAM - a premier national Chamber of Commerce India.

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Radio Astronomy: How J.C. Bose's invention opened a new window to the Universe

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Prologue: Sir J.C. Bose's work in radio microwave optics was specifically directed towards studying the nature of the phenomenon and was not an attempt to develop radio into a communication medium. His experiments took place during the same period (from late 1894 on) when Guglielmo Marconi was making breakthroughs on a radio system specifically designed for wireless telegraphy. In 1895, he demonstrated the generation & reception of radio waves in Kolkata, a good 2 years before the experiment by Marconi. It is thanks to this stellar breakthrough that we are able to probe the Universe in a unique manner using radio wavelengths.

1. Introduction to Radio Astronomy

Astronomy is one of the oldest sciences. It started from the time mankind turned its gaze upwards to try and understand the heavens. It began with use of naked eyes which are natural detectors for light waves, but evolved dramatically with the advent of the telescope. Galileo turned the recently invented optical telescope to the heavens and revolutionised astronomy forever (figure 1). Over the times since then, optical telescopes have evolved from the simple ones that Galileo used to the large, sophisticated facilities that modern day astronomers employ.

Figure 1: Galileo and the telescope, c.1609

There are two main factors that drive the need for larger telescopes. A bigger telescope is able to collect more light, hence can see fainter sources i.e., they are more sensitive and can see more objects in the Universe. Bigger telescopes also provide higher resolution – the ability to distinguish between nearby objects or sources in the sky. The sensitivity depends on the size of the aperture of the telescope (D) and is proportional to D^2. The resolution depends on the ratio of the wavelength of the radiation λ to the size of the aperture of the telescope, and is proportional to λ/D. Thus, a bigger telescope gives both higher sensitivity and better resolution.

Going beyond light waves : Light is a form of electromagnetic radiation and is part of a much wider spectrum of waves, ranging from the lowest frequency (largest wavelength) radio waves to the highest frequency (smallest wavelength) gamma rays, as shown in figure 2. The same object can emit, or be studied, at different wavelengths of the electromagnetic spectrum. Studying the same object in the Universe at different wavelengths can give different and complementary information about the object, and hence a more complete picture can be assembled. Figure 3 illustrates this with an example from studies of the Andromeda galaxy at different parts of the electromagnetic spectrum. However, there are some objects and phenomena can be studied ONLY at some specific wavelengths. Thus, multi-wavelength astronomical observations could greatly improve our understanding of the Universe.

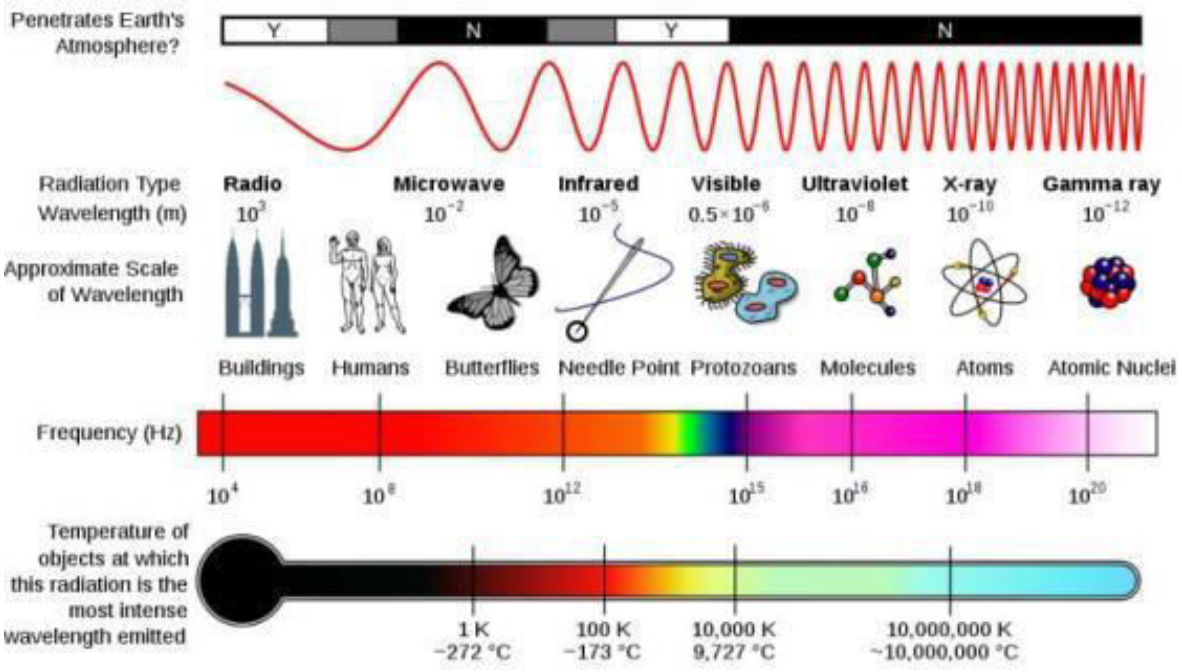

Figure 2: The Electromagnetic Spectrum

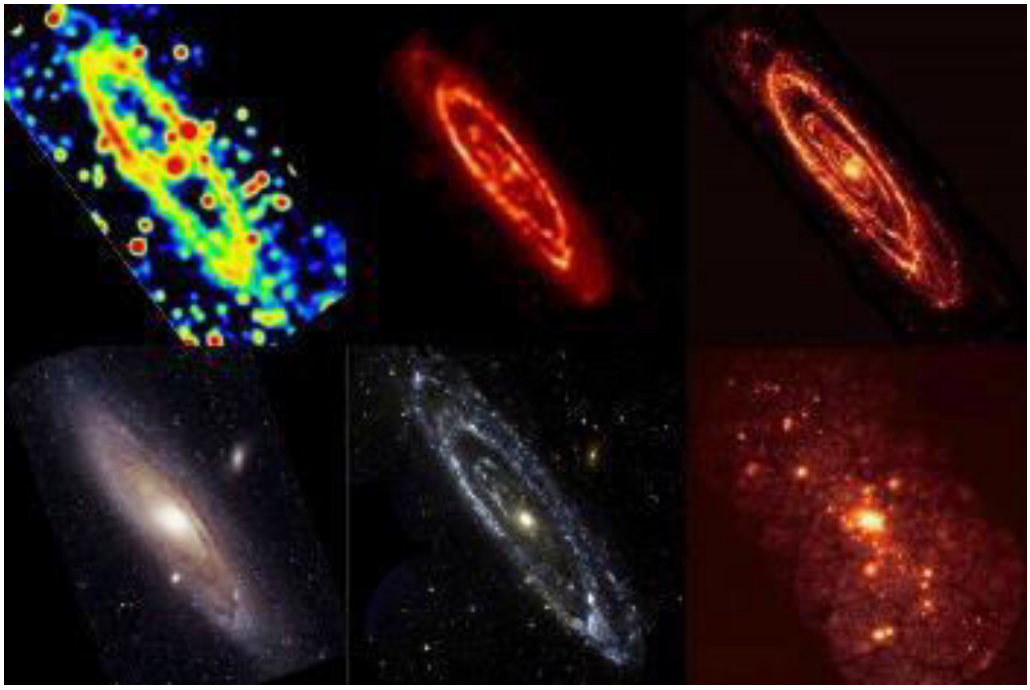

Figure 3: The Andromeda galaxy at different wavelengths – from Radio to Gamma-rays – showing different aspects of the galaxy becoming prominent at different wavelengths

However, there are some hurdles to overcome. First, we need to have the detectors for all the wavelengths. This has become possible over time with the development of technology e.g. photographic plates, charge-coupled devices, radio communication equipment. Second, not all the wavelengths from outer space reach us because of various effects in the Earth's atmosphere and ionosphere. As can be seen in figure 4, the two main Earth-based windows for astronomy turn out to be the optical window and a very wide portion of the radio window; for all the other wavelengths, we have to have space-based observing facilities. Hence it was natural that radio astronomy was the next branch to develop after optical astronomy.

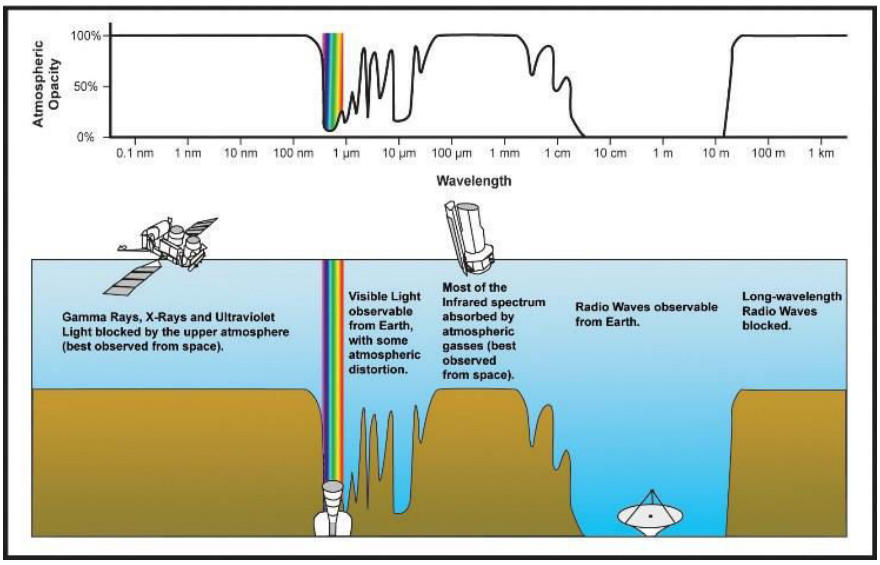

Figure 4: Multi-wavelength astronomy – Earth-based and space-based windows

2. Radio Astronomy basics

Genesis and early days : Detectors for radio astronomy came about during the1930s as an off-shoot of the developments in radio communications technology. As often happens in scientific discoveries (especially in astronomy), serendipity played a major role. Radio Astronomy has its origin in the Bell Labs, USA where, while debugging trans-atlantic communication systems to understand the cause of unwanted noise that was being picked up by the equipment, in 1931 Karl Jansky built an antenna designed to detect radio waves at a frequency of 20.5 MHz. It was mounted on a turntable that allowed it to be rotated in any direction (see figure 5). It had a diameter of 100 ft. and height of 20 ft. He was able to show that the source of noise in the communication system was not coming from any terrestrial source, but from a given direction in the sky -- from the Milky Way. With this breakthrough discovery, radio astronomy was born, and Karl Jansky is known as the father of radio astronomy.

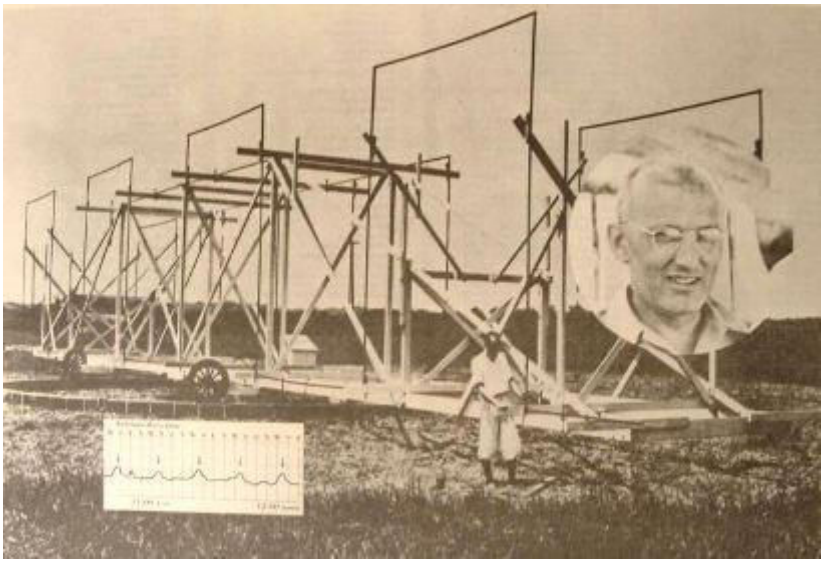

Figure 5: Karl Jansky and the first detection of radio waves from the Universe, in 1931

Basics of radio telescopes : A radio telescope antenna (figure 6) is basically like any satellite dish that we use for receiving television signals; but there is one major difference : celestial radio signals are *very* weak, so much so that we have a separate unit of flux to describe them : 1 Jy = 10^{-26} W/m^2/Hz. On this scale, the strongest celestial radio sources are about 1000 Jy, and today radio astronomy probes sources as weak as few micro Jy. Put another way, the typical input power to a radio telescope from celestial sources is ~ -100 dBm, meaning that it would take a few 100 years of continuous operation of the telescope to collect 1 milli Joule of energy. These signal levels are so weak that the typical instrumental noise levels from the receiver electronics can easily overwhelm them, making the detection of celestial sources a difficult task.

In order to overcome the above issues, radio astronomers do the following : use large antennas so as to collect as much signal as possible, use large bandwidth to increase the amount of signal (most celestial sources emit over a fairly large range of frequencies); build high quality low noise receivers to minimise the harmful effects of noise; and integrate the final signal over as long a duration of observation as possible, so as to further improve the signal to noise.

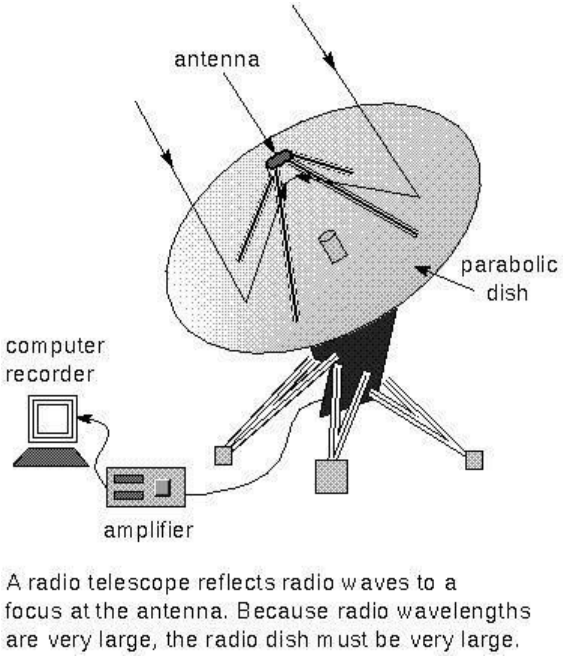

Figure 6: The basic radio telescope

Single Dish vs Multi-dish Radio Telescopes : From the arguments above, and our understanding that both resolution and sensitivity depend on the physical aperture size of the telescope, the goal has been to build larger and larger antennas for improved performance of the radio telescope. However, due to practical limits, fully steerable single dishes of more than about 100 m diameter are very difficult and expensive to build (see figure 7 for some examples). Now, for 100 m size radio telescope operating at a typical wavelength of 1 m (frequency of 300 MHz), the resolution (λ/D) is approximately 0.5 degree, which is very poor compared to the resolution achieved with the simplest optical telescopes !

To overcome this challenge, radio astronomers discovered the technique of aperture synthesis where, to synthesize a telescope of larger size, many individual dishes spread out over a large area on the Earth are used. Signals from such array telescopes are combined and processed in a particular fashion to generate a map of the source structure, with a resolution that is now give by λ / D_s , where D_s is the largest separation between the antennas in the array. This his allows radio telescopes to be competitive in resolution to telescopes at shorter wavelengths (like optical). Figure 8 shows some examples of some well known multi-dish aperture synthesis array radio telescopes, and figure 9 illustrates the improved resolution achieved by the use of such telescopes.

Figure 7 : the picture on the left is of the largest fully steerable single dish radio telescope in existence today – the 100-m Greenbank Telescope in USA; the other two are largest non-steerable (fixed) single dish radio telescopes : the 300-m Arecibo Radio Telescope (middle) in Puerto Rico, and the 500-m FAST observatory (right) in China

Figure 8 : the picture on the left is of the Very Large Array (VLA) radio telescope in the USA and that of the right is the Atacama Large Millimetre Array (ALMA) located in Chile.

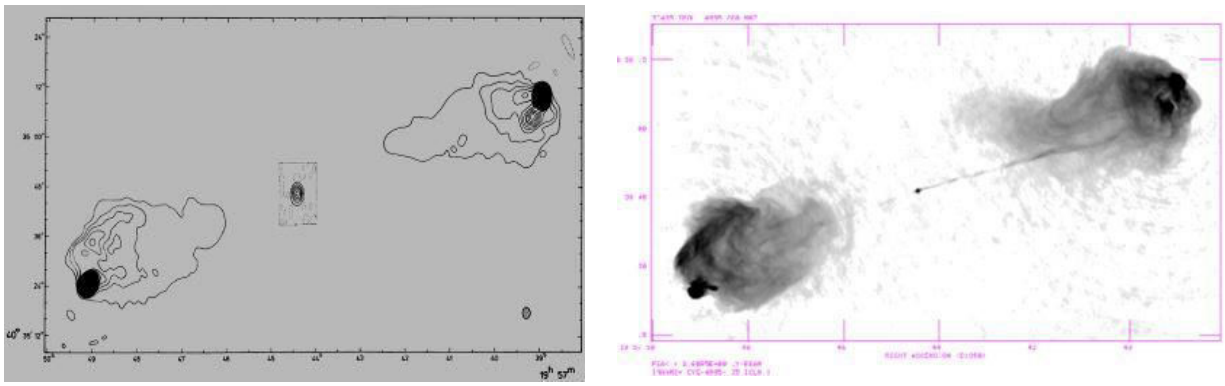

Figure 9 : Illustrating the improvement in resolution with the advent of aperture synthesis array telescopes. The image on the left is of the radio galaxy Cygnus-A made with a single dish antenna; the one on the right is an image of the same galaxy made with the Very Large Array (VLA) radio telescope in the USA.

3. Case study of a modern radio observatory : the GMRT

Introduction and basic paramters : The Giant Metre-wave Radio Telescope (GMRT) is a world class facility for studying astrophysical phenomena at low radio frequencies (50 - 1450 MHz). Completed in 1992 by the National Centre for Radio Astrophysics (NCRA), of the Tata Institute of Fundamental Research, it is an array telescope consisting of 30 antennas of 45 m diameter (see picture in figure 10), operating at metre wavelengths -- the largest in the world at these frequencies !

It is situated at a Latitude of 19 deg N and Longitude of 74 deg E, about 70 km N of Pune, 160 km E of Mumbai. Of the 30 antennas, 12 are located in a central compact array and the remaining 18 are spread out along 3 arms of Y-shaped array, going out to distances of 14 km from the centre (see figure 11). By appropriate combination of signals from all the 30 antennas, the resolution of a 28 km size antenna is achieved.

Figure 10 : A panoramic view of part of the GMRT array

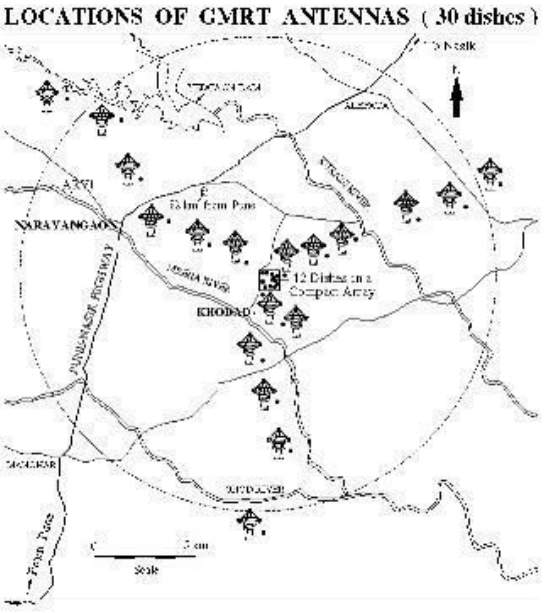

Figure 11 : Showing the layout of the GMRT array, centred near the village of Khodad and extending out to radial distances of a bit more than 14 km, along 3 arms arranged in a roughly Y-shaped configuration.

Many different sub-systems and technologies go into making an instrument like the GMRT, several of them requiring cutting-edge technologies to be developed and deployed :

1. *Mechanical sub-system*
2. *Servo sub-system*
3. *Antenna feeds (including positioning & control)*
4. *Receiver chain -- analog*
5. *Optical fibre sub-system*
6. *Receiver chain -- digital*
7. *Telemetry sub-system*
8. *"On-line" Control and Monitor sub-sytem*
9. *Off-line data processing chain(s)*

GMRT : Operations, Usage & Science : The GMRT observatory is open to international participation via a formal proposal system. Proposals are invited twice a year and reviewed by the GMRT Time Allocation Committee, and allocated time on the telescope. Observations are scheduled for 2 cycles of about 5 months each. The GMRT is typically oversubscribed by a factor of 2.5 i.e. the demand for observing time is more than the available time, and hence only the best proposals are allocated time. As shown in figure 12, The GMRT sees users from all over the world, with the distribution of Indian vs Foreign users being close to 50:50.

The GMRT is a powerful instrument to probe several astrophysical objects and phenomena, and the range of science possible with the facility is quite wide spread, covering topics such as:

1. The Sun, extrasolar planets
2. Pulsars : rapidly rotating neutron stars
3. Other Galactic objects like supernova remnants, microquasars etc
4. Other explosive events like Gamma Ray Bursts
5. Ionized and neutral Hydrogen gas clouds (in our Galaxy and in other galaxies)
6. Radio properties of different kinds of galaxies; galaxy clusters
7. Radio galaxies at large distances in the Universe
8. Cosmology and the Epoch of Reionization
9. All sky surveys such as the 150 MHz TIFR GMRT Sky Survey (TGSS)

Many interesting new results have been produced in the last 17 years or so that the GMRT has been functional. Today, more than 40 papers per year are published in international journals that use data and results from the GMRT.

Current Status & Future Prospects : The GMRT has just completed major upgrade that improves its sensitivity by a factor of up to 3 times, and also make it a much more versatile instrument. The upgraded GMRT provides near seamless frequency coverage from 120 to 1450 MHz at present (likely to be extended down to 50 MHz), with a maximum instantaneous bandwidth of 400 MHz (replacing 32 MHz of the legacy system), with improved sensitivity receivers. There are also accompanying improvements in the servo system, the monitor and control system and infrastructure facilities. These upgrades will keep the GMRT at the forefront on the global stage, as one of the most sensitive radio facility at metre wavelengths, for the next decade or so.

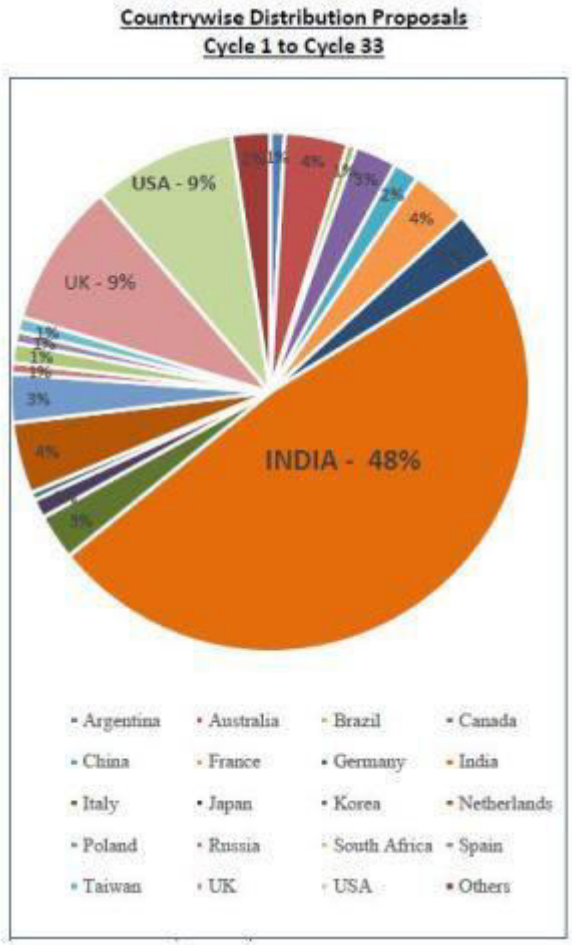

Figure 12: Proposal allocation pie-chart for the GMRT from cycles 1 to 33 (2003 to 2018), showing usage by scientists from several countries across the world, with a roughly 50% participation from Indian astronomers.

About the author

Prof. Yashwant Gupta presently heads the National Centre for Radio Astrophysics as the Centre Director. He obtained his M.S. and Ph.D. in Radio Astronomy from the University of California, San Diego in 1990, after completing his Bachelor's degree in Electrical Engineering from IIT Kanpur in 1985. In addition to research in the astrophysics of pulsars, Prof Gupta also has significant interest and involvement in instrumentation and signal processing applications in radio astronomy. He has led the recent major upgrade of the GMRT, and is also involved in the technical developments at the SKA, in addition to being the Science Director from India on the SKA Board.

To commemorate JCBose's birth centenary in 1958, the JBNSTS scholarship programme was started in West Bengal. In the same year, India issued a postage stamp bearing his portrait.

On 14 September 2012, Bose's experimental work in millimetre-band radio was recognised as an IEEE Milestone in Electrical and Computer Engineering, the first such recognition of a discovery in India

The Bank Of England has decided to redesign the 50 UK Pound currency note with an eminent scientist. Indian scientist Sir Jagadish Chandra Bose has been featured in that nomination list for his pioneering work on Wifi technology

Design and Construction of Working Replica of Sir J.C Bose 60 GHz Experiment

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1. INTRODUCTION

Sir Jagadish Chandra Bose one of the pioneered of Radio Physics, demonstrated in Calcutta, India, the generation, transmission and reception of electromagnetic waves in 1895. So Jagadish Chandra Bose first demonstrated in Presidency College, Calcutta, India, transmission and reception of electromagnetic waves at 60 GHz, over 23 meters distance, through two intervening walls by remotely ringing a bell and detonating some gunpowder. For his communication system, Sir J.C Bose pioneered in development of entire millimeter-wave components like a spark transmitter, coherer, dielectric lens, polarizer, horn antenna, and cylindrical diffraction grating. This is the first millimeter-wave communication system in the world, developed more than 100 years ago. This is the oldest Milestone achievement from the Asian continent.

Bose chose quasi-optical, millimeter-wave frequency range. The wavelengths he used ranged from 2.5 cm to 5 mm. The reason for the choice of millimeter wave by Sir J.C. Bose was primarily due to the advantage of studies of quasi-optical properties of the radio waves within his laboratory of limited size that was available to him at the Presidency College [1]. However, the components and systems developed by Sir J.C. Bose, initially at millimeter wave and subsequently at microwave, were outstanding discoveries made more than 100 years ago, in Calcutta, India, most of which are now being used, in a modernized form for Earth/space links and remote sensing and 5G communication

Sir J. C. Bose invented the Mercury Coherer (together with the telephone receiver) used by Marconi to receive the radio signal in his first transatlantic radio communication over a distance of 2000 miles from Poldhu, UK to New found land, St. Johns in December 1901. In 1895, Sir J. C. Bose gave his first public demonstration of electromagnetic waves, using them to ring a bell remotely and to explode some gunpowder. He sent an electromagnetic wave across 75 feet passing through walls and body of the Chairman, Lieutenant Governor of Bengal. Sir J. C. Bose holds the first patent worldwide to invent a solid-state diode detector to detect EM waves. The detector was built using a galena crystal. Sir J. C. Bose was a pioneer in the field of microwave devices. His contribution remains distinguished in the field and was acknowledged by the likes of Lord Kelvin, Lord Rayleigh [2-3].

The institute of Electrical and electronics Engineering (IEEE) a professional body with members from 160 countries, wants to pay the homage to Sir J.C. Bose. In 1986 IEEE forum has recognized Sir J.C Bose mm wave experiment as a millstone experiment. In November 2012 IEEE approached Muffakham Jah College of engineering and technology (MJCET) for making the first working model of Sir J.C Bose mm wave experiment to be installed at B.M Birla science museum at Hyderabad. In this paper we present the detail construction, design and working of Sir J.C Bose mm wave experiment working Replica designed by Muffakham Jah College of engineering and technology.

2. DESIGN AND CONSTRUCTION OF WORKING REPLICA

Bose's experiments were carried out at Presidency College, although for demonstrations he developed a compact portable version of the equipment, including transmitter, receiver, and various microwave components. Some of his original equipment still exists, currently at the Bose Institute. Figure 1. Shows the sir J.C Bose original mm wave setup and MJCET designed working replica. The working replica was planned, designed and executed in the physic lab, MJCET. The detail construction and working of replica as follows.

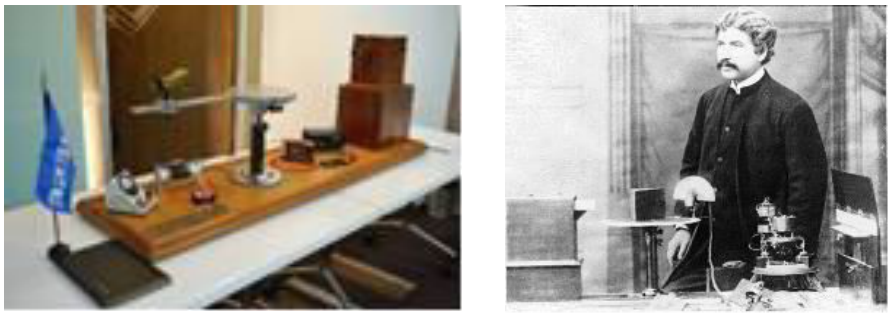

Figure 1. MJCET designed working Replica and Original J.C Bose apparatus

2.1 The Radiator

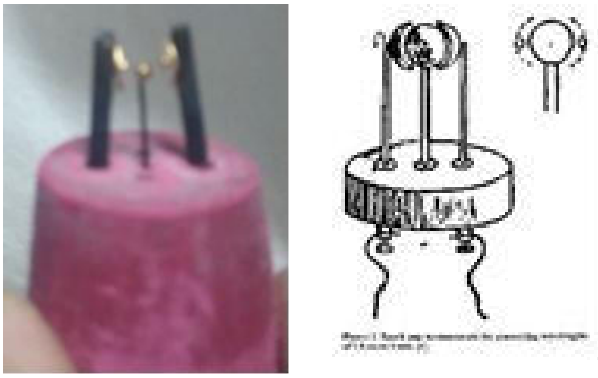

Figure 2. Sparking element of the Replica and Original Sparking element

In the working Replica the radiator consists of sparking element consist of DC power supply of 12V, 6Amps is connected across the primary of the coil, magnetic disturbances are created by applying the key which results in emission of flash of radiations form the secondary coil. The sparking elements consist of two gold spherical beads of 0.5mm diameter and one interposed sphere situated at the center of the tow beads of 1.5mm diameter. Figure 2 shows the sir. J. C Bose sparking element and MJCET designed sparking element. The working of the sparking element as follows.

- The wires of the primary coil are in connection with a small storage cell through a tapping key. The coil, a small storage cell and the key are enclosed in a tinned iron box which screens the space external from magnetic disturbances.
- Each time the key is pressed, the primary circuit of induction coil is made or broken and magnetic disturbance is produced. Therefore, pressing and releasing of key ensures flash of radiations. In front of the box the radiator tube (square). The radiating apparatus has a square tube of 1 sq. inch. cross section.

2.2 Spiral Spring receiver

Single layer of steel springs of 2 mm diameter and 1 cm length are placed in square piece of Ebonite with a shallow rectangular depression (Sensitive surface = 1cm x2 cm). Glass slide is used to prevent springs falling out. Springs are compressed by brass piece which slides in and out using screw therefore the resistance can be varied. When radiation is generated by sensitive contacts, there is sudden decrease in resistance and galvanometer was deflected. It responds (sensitive) to different types of radiations by varying the electromotive force which give rise to current that reaches receiver and galvanometer shows deflection. Figure 3 shows the design of spiral spring receiver of Sir J.C Bose and working replica.

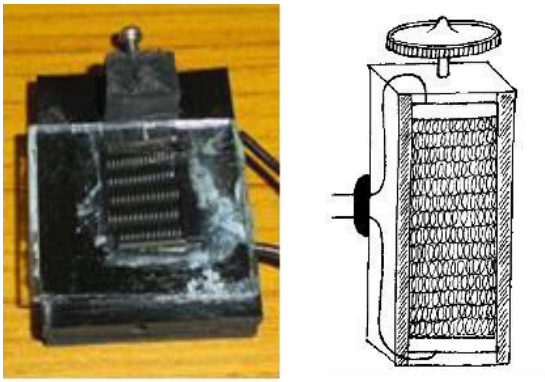

Figure 3 Spiral spring receiver of working replica and Original Sir J.C Bose receiver

2.3 Determination of Wavelength of and Cylindrical Grating

The grating made of equidistant metallic strips, which are vertical and parallel. The diameter of the cylindrical grating is 100 cm. A piece of thin sheet ebonite is bent in the shape of a portion of a cylinder and kept in that shape by screwing against upper and lower circular guide pieces of wood. Against the concave side of the ebonite are stuck strips of rather thick tinfoil at equal intervals. Figure 4 shows the design of cylindrical grating of working Replica.

The diffracted waves follow the equation. $(a+b) \sin \theta = n \lambda$
Where, (a+b) is sum of breadths of strip and space in the grating. (6mm)
θ is angle of diffraction
n is order of diffraction
λ is wavelength

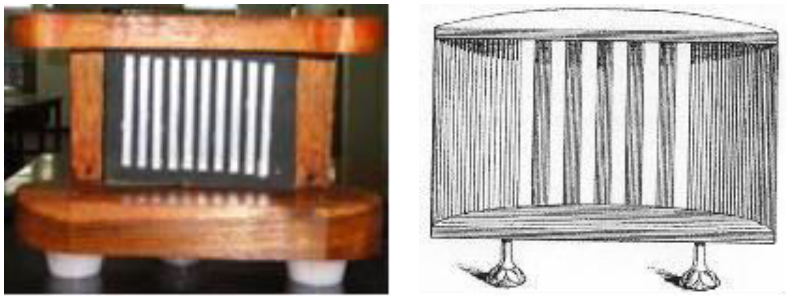

Figure 4 Design of Original cylindrical grating and working Replica

The measurement of the frequency of mm waves produced by our experimental setup has been recorded with spectrum analyzer at Research Center Imarat DRDO. Hyderabad and frequency of the replica was around 60 GHz. This frequency is similar to the frequency generated by Sir J.C Bose in his experiment. This is an achievement for the developers of the replica to attain same frequency as the original. Figure 5 shows the recording frequency spectra of working replica produced by RCI.

Figure 5 Photograph of 60GHz frequency generated by working replica

3. QUALITY TEST

The quality test of receiver was conducted at physics laboratory MJCET. The experiment repeated by pressing radiator key 50 times. For each time key press, the galvanometer reading was recorded. The report of quality test is given in figure 6 and it was found that Replica receiver absorbs radiation. It also gives the variation of signal changes recorded galvanometer which is in the range of 10 units to 30 units.

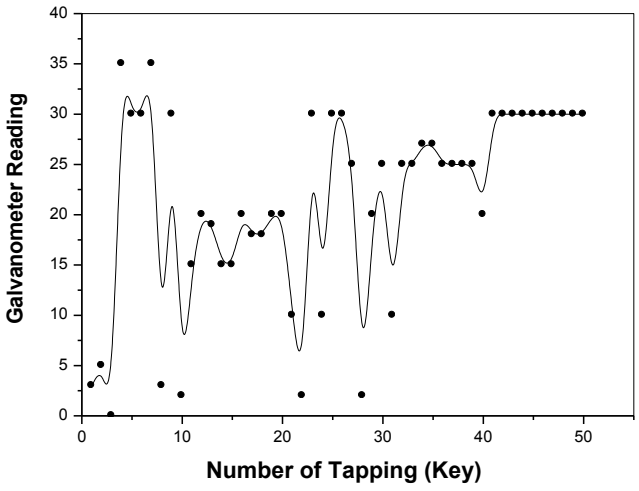

Figure 6 Variation of Galvanometer deflections with number of tapping

4. CONCLUSION

The following conclusion were drawn from the present experiment

- MJCET successfully designed and demonstrated working replica of Sir J.C Bose 60 GHz mm wave experiment
- The sparking elements consists of two spherical beads of 0.5mm diameter and one interposed sphere situated at the center of the tow beads pf 1.5mm diameter
- The spiral spring receiver designed with Single layer of steel springs 2 mm diameter and 1 cm length placed in square piece of Ebonite with a shallow rectangular depression (Sensitive surface = 1cm x2 cm). The quality test confirms the accurate signal detection of spiral spring receiver.
- The frequency of the Replica was measured and it is around 60 GHz. This frequency is similar to what Sir J.C Bose had generated in his experiment. This is an achievement for the developers of the replica to attain same frequency as the original.

5. ACKNOWLEDGEMENT

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6. REFERENCES

[1] A.K. Sen, TENCON '98. 1998 IEEE Region 10 International Conference on Global Connectivity in Energy, Computer, Communication and Control Page(s):288 - 290 vol.2
[2] Darrel T. Emerson, IEEE Transactions on Microwave Theory and Techniques, Vol. 45, No. 12, pp. 2267-2273, Dec. 1997
[3] T. K. Sarkar, D. L. Sengupta, IEEE Antenna and Propagation Magazine, Vol. 39, No. 5, Oct. 1997

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Sir Jagadish Chandra Bose
Biologist, Biophysicist, Botanist, Physicist, Archaeologist and Polymath

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Sir Jagadish Chandra Bose was a Biologist, Biophysicist, Botanist, Physicist, Archaeologist and polymath. He has pioneered the investigation of radio and microwave optics, made significant contributions to plant science, and laid the foundations of experimental science in the Indian subcontinent. IEEE named him one of the fathers of radio science.

Jagadish was born in Munshiganj (Bikrampur), present day in Bangladesh on 30th November 1858. His father, Bhagawan Chandra worked as a deputy magistrate and assistant commissioner in Faridpur, Bardhaman and other places. He was a leading member of the Brahmo Samaj. He was a firm believer in learning and knowing one's mother tongue prior to any foreign language and therefore Bose's early education started in a vernacular school. Jagdish's education started in same school.

Bose joined the Hare School in 1869 and then St. Xavier's School at Kolkata. In 1875, he passed the Entrance Examination (equivalent to school graduation) of the University of Calcutta and was admitted to St. Xavier's College, Calcutta. At St. Xavier's, Bose came in contact with Jesuit Father Eugene Lafont, who played a significant role in developing his interest in natural sciences. He received a BA from the University of Calcutta in 1879.

Bose wanted to go to England to compete for the Indian Civil Service. However, his father, a civil servant himself, canceled the plan. He wished his son to be a scholar, who would "rule nobody but himself." Bose went to England to study Medicine at the University of London. However, he had to quit because of ill health. The odour in the dissection rooms is also said to have exacerbated his illness.

Then Jagdish secured admission in Christ's College, Cambridge to study natural sciences. He received a BA (Natural Sciences Tripos) from the University of Cambridge and a BSc from the University of London in 1884, and a DSc from the University of London in 1896. Among Bose's teachers at Cambridge were Lord Rayleigh, Michael Foster, James Dewar, Francis Darwin, Francis Balfour, and Sidney Vines.

Bose returned to India in 1885, carrying a letter from Fawcett, the economist, to Lord Ripon, Viceroy of India. On Lord Ripon's request, Sir Alfred Croft, the Director of Public Instruction, appointed Bose officiating professor of physics in Presidency College. The principal, C.H. Tawney, protested against the appointment but had to accept it. The British still believed that Indians were gifted in sciences but lacked the capability to deal with exact sciences.

Bose was not provided with any facilities for research. On the other hand, he was a "victim of racialism" with regard to his salary. In those days, an Indian professor was paid Rs. 200 per month, while a European drew Rs. 300 per month. Since Bose was officiating, he was offered a salary of only Rs. 100 per month. With a remarkable sense of self-respect and national pride, he decided on a new form of protest. He refused to accept the salary check. In fact, he continued his teaching assignment for three years without any salary. Finally, both the Director of Public Instruction and the Principal of the Presidency College fully realized the value of Bose's skill in teaching and also his lofty character. As a result, his appointment was made permanent with retrospective effect. He was given the full salary for the previous three years in lump sum. Very soon Bose became popular professor among students and Simultaneously he started research on electromagnetic waves.

During the decade1960s; Scottish scientist James Clerk Maxwell had published his landmark paper, `A Dynamical Theory of the Electromagnetic Field', in which Maxwell's equations demonstrated that electric and magnetic forces are two complementary aspects of electromagnetism. He shows that the associated complementary electric and magnetic fields of electromagnetism travel through space, in the form of waves, at a constant velocity of light. He also proposes that light is a form of electromagnetic radiation and that waves of oscillating electric and magnetic fields travel through empty space at a speed that could be predicted from simple electrical experiments.

After Maxwell, German physicist Heinrich Hertz published the results of his experiments on electromagnetism and shown the existence of electromagnetic waves in free space in 1890s. Subsequently, British physicist Oliver Lodge, who had demonstrated their similarity to light and vision including reflection and transmission. Hertz and post-Hertzian experiments used wavelength in cm. and short cm. wave region. in August 1894 (after Hertz's death) Lodge's work was published in book, `The work of Hertz and his successors', caught the attention of scientists in different countries, including Bose in India.

To conduct research on electromagnetism, Bose had converted a small enclosure of 24 square foot space, adjoining a bathroom in the Presidency College into a laboratory. He invented generator, transmitter and receiver for microwave region

of electromagnetic spectrum there. He devised equipment's for the research with the help of one untrained roadside tinsmith.

Bose made public demonstration of his invention at Town Hall of Kolkata, in November 1895. Bose ignited gunpowder and rang a bell at a distance using radio waves. Lieutenant Governor Sir William Mackenzie witnessed Bose's demonstration.

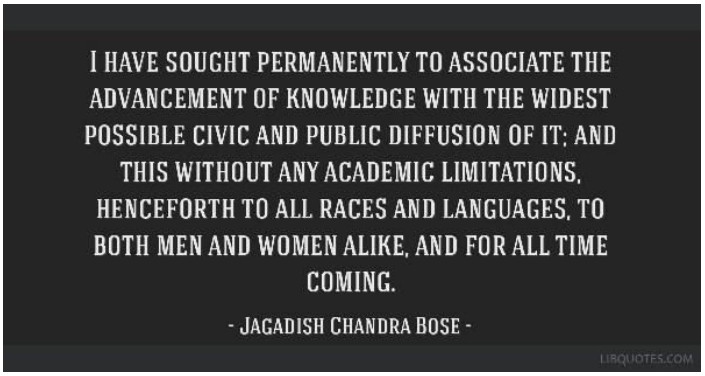
The spark gap transmitter used a spark gap radiator made of three tiny 3 mm metal balls excited by high voltage from an induction coil to generate microwaves at 60 GHz. The transmitter was enclosed inside the metal box to prevent sparks from the coil's interrupter from disturbing the action of the receiver, and the microwaves emanated from the waveguide i.e. metal tube. The receiver point contact detector was placed inside a waveguide receiving antenna, very much like the transmitting antenna with a matching polarizing grid.

Bose had also carried out experiments to study refraction, diffraction and polarization for same electromagnetic waves. Bose also developed spiral-spring detector and coherer. He publishes scientific papers on his research in 1995 and communicated to the Royal Society of London. Bose was invited by Royal Institution to give the prestigious Friday evening discourse on 29th January 1897. There he openly displayed the construction and workings of his microwave apparatus.

Sir J C Bose's work is commemorated by IEEE, as the oldest milestone achievement from Asia.

About the author

Mr. Sudhir Phakatkar is working in GMRT, TIFR as an Electronics Technician for 29 years. He is also serving on the committee of Khodad Rural Science Center. He is very active in science popularization among in students and laymen. As a part of it, he wrote two books in Marathi, namely - Radio Durbin and Vidnyanyatri Dr. Govind Swarup. Mr. Phakatkar wrote a column in the Sunday supplement of a Marathi newspaper on research organizations of India as well as several articles on scientific subjects for Marathi Science Magazines. Three more books by him are in the production.



The Bose Research Institute in Calcutta

India's Trillion Dollar Opportunity in SaaS

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The current size of India's IT Industry is $167 billion and it is growing at 8% year-on-year. (Source: NASSCOM). At this rate of growth it will take us another 25 years and up until 2042 to get to $1 trillion. That's because not all revenues are created equal.

Revenue vs Enterprise Value

The quality of revenue is always measured by a revenue-to-value arbitrage. Most of the IT industry revenue for India comes from IT Services. The revenue-to-value multiple for IT Services revenue is between 1.5x-2.0x. The best companies are valued at 2x-3x revenue, such as Cognizant's enterprise value multiplier of 2.52.

Let's fast forward and look at a different kind of company, Freshworks. While the company's revenue is about $100 million, it's enterprise value is $1.5 billion. That is a revenue-to-value multiplier of 15, or ten times more than a typical IT services revenue multiple.

This is an order of magnitude of difference. If you use this 15X multiple and do the math, to make $1 trillion in enterprise value, we need is **66 companies with $1 billion each in revenue.** While a trillion dollars might have looked impossible initially, it doesn't seem as such when you only need to create 66 $1 billion dollar companies. This equation shift can happen because of the high quality of SaaS product revenue.

The Road to a Trillion

Still, building 66 $1 billion revenue SaaS companies isn't easy. You can't just build them directly. To do that would be like trying to directly jump to the 15th question in a game of "Who Wants to Be a Millionaire". To get to this target, we need to build a pyramid of large SaaS companies.

During a conversation with Shekhar Kirani (Partner, Accel India) and 5-6 other SaaS founders at SaaSx4, Shekhar said, "I am not sure that if Girish (Founder of Freshworks) had to start his journey all over again, he would be able to repeat the same kind of success." This wasn't meant to take anything away from Girish, as we all have incredible regard for him and what he has achieved. What Shekhar was really trying to say is that there is no formula to make a billion dollar company, and I totally agree with him. All we can do is increase the odds of success by creating a larger pool of probability to make this happen. To do that, we need to start at the bottom of this pyramid.

We should build a large base of small companies that start out doing a million dollars in revenue. By probability, some of them would scale up to about $10 million, and eventually a small percentage of these would go on to become billion dollar companies.

Where do we start?

To achieve this kind of goal, you need to create a completely new ecosystem. According to the Startup Genome Project Report - 2018, "An ecosystem should focus on a startup sector most closely related to its strongest traditional strengths relative to global competition."

The key questions we must ask are, "What is the traditional strength of our country?" and "How does it relate to the global competition?"

There are four major global technology ecosystems in the world: the United States (primarily Silicon Valley), China, Israel and India. Let's look at how each one positions itself. The US showcases itself as the place for cutting-edge technologies and goes after everything new. China seems to be constantly looking at how they can replicate Silicon Valley inventions faster and cheaper. (In fact China is getting so good at this, that the number of unicorns and patents in AI/ML that China has produced is exceeding if not equally that of Silicon Valley.) And Israel has positioned itself as a leader in deeptech, encryption, security, and military technology.

However, when it comes to India, there is no clear positioning or messaging. There is a lot of confusion around what our strengths are. We talk about Artificial Intelligence and Machine Learning, but those are the same things that China and the US are going after!

This reminds me of a scene in the movie "A Beautiful Mind", where a beautiful, tall, blonde girl and her friends walk into the bar where John Nash and his friends are. Every guy in the group wants the blonde. But Nash comes up with this theory that the only way for all of his friends to get a date is to ignore the blonde and go after her friends instead, doing what is best both for the individual and the group.

AI and ML are deeply rooted in data, and companies like Google and Facebook are the current lords of data. So going after the AI and ML tag without having this data can be suicidal unless you are in an extremely niche field. So if AI/ML are the tall blonde, who are the friends India should be focusing on?

India's Best Bet

In my view, the next best thing for India is SaaS and we should heavily bet on it. It also plays to the strength of India. Over last 30-40 years, due to the IT services boom, our country has built deep domain expertise in basically every industry vertical. It is that expertise that needs to be productized to make India a global SaaS hub.

Although India hasn't positioned itself well in the global SaaS space, it can take inspiration from what Chennai has done. Chennai has already established itself as the SaaS capital of the country. How did Chennai do this?

Chennai does more than a billion dollars in SaaS revenue. This is high quality revenue unlike ecommerce companies whose top line numbers are essentially gross merchandise value. SaaS revenues are in the range of 80-90% gross margin. The CoGS for SaaS is close to zero or negligible.

The Chennai ecosystem has about 10,000 people working in SaaS. The talent pool is not just purely coders, but a well-rounded pool of product management, UX designers, inbound marketers, inside sales, and of course programming talent.

How can India replicate Chennai's success in SaaS in other cities like Pune, Indore, Cochin, Hyderabad, Vizag, and position itself in the global marketplace?

Busting Some Myths

The first myth is that we think success in SaaS is always about funding. But for SaaS to take off, investor funding is inconsequential. In the below quadrant, there are more than four companies going after the global SMB market. There are unicorns such as Freshworks who have $260 million in funding, while Zoho is four times bigger in revenue and got there with ZERO external funding. KiSSFLOW, with just $1 million in funding has been able to build a comparable business with Chargebee which received $25 million. So it's been proven that both models actually work, whether you are building a unicorn like Freshworks or a multi-million dollar success story like KiSSFLOW and funding isn't a deal breaker or game changer in the SaaS marketplace.

The next myth is location. People generally think you need to be in the most happening place to make it. So we have large numbers of professionals and entrepreneurs leaving smaller towns like Indore and Vizag to go to Bangalore or Mumbai to make it big.

It may seem counterintuitive, but SaaS actually requires a quiet place away from a lot of noise and distraction of a city like Bangalore where your team members are churning every 12-15 months. The first 18-36 months of a SaaS company are critical and you need a quiet place and an undistracted team. There is enough proof that SaaS companies can be built from '*dokku*' places (a Tamil word meaning 'middle of nowhere') like Tenkasi, Renigunda, and Jallandhar.

The next common myth is we won't get talent out in the middle of nowhere. A SaaS business in the early stages requires only a team of 10-15 to make it big. So a founder needs to simply worry about putting a solid founding team together, and not so much about the next 100 hires all at once. Most of the initial success for KiSSFLOW was done with a small team of 15 people. So the location and the team size are inconsequential too.

In the image above, I want to focus on what it takes to be successful in the Global SMB market. While these principles can apply in many situations, the steps to success can be seen in this flywheel image.

It all starts from building a really fantastic product that is offered at an affordable price point. To sustain low prices, you need high volumes. High volumes can only be achieved if the software is sold to pretty much everyone in your target segment irrespective of whether they are small, medium or big. The only way to sell to everyone is to go online. To sell online, you need transparent pricing and the ability to experience the product, which also means you need good support collecting feedback. This makes the product better and you are back to the beginning.

This is the recurring loop that moves a SaaS company forward and makes it unstoppable.

Small Steps to a Trillion

A trillion dollars in value for a single sector of an economy may seem very lofty, but that doesn't mean that it is impossible. By creating a thriving ecosystem across the country and leveraging the skills we have learned over the last few decades, we can build thousands of very profitable companies. Using the multiplying power of SaaS and excellent products, we can even grow to the point where $1 trillion is a legitimate possibility. Let's take this vision as a reality and move forward!

About the author

Suresh Sambandam is the Founder & CEO of OrangeScape, makers of KiSSFLOW, a disruptive, SaaS-based enterprise-level work automation and collaboration platform with more than 10,000 customers across 160 countries. He is an expert and renowned entrepreneur on a mission to democratize automation and create immersive work experience for enterprises of all sizes. Suresh is passionate about entrepreneurship and technology startups, and spends a significant amount of time in the startup ecosystem mentoring young founders. He received the prestigious "Entrepreneur of the Year Award" for 2018 from the Confederation of Indian Industries (CII).

Building SaaS products from India for the world: Chennai conclave SaaSBOOMi shows the way

SaaSBOOMi is an initiative created by successful Chennai-based SaaS founders to help SaaS-focused entrepreneurs learn the ropes about creating technology for customers in the country, and beyond. With Chennai strengthening its position in the SaaS domain, with around 30 SaaS companies offering employment to 10,000 techies, these founders have crafted SaaSBOOMi to be a platform to educate and inspire the next set of SaaS founders so that they can ride the SaaS wave.
https://yourstory.com/2019/01/saas-chennai-conclave-saasboomi

Digital Plantation story of RGE

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Abstract – This article highlights the digital plantation story of Asian Agri palm plantation business. The focus of this article shall be on the key challenge faced by the Asian Agri in the management of ganoderma fungi infestation in its palm plantation, and the current utilization of digital technologies and further possible enhancements to enable earlier detection of the ganoderma infestation so that better treatment and overall containment of the infestation can be performed to significantly minimize the impact to harvest yield.

Index Terms—digital plantation, digital agriculture, plantation management system, plantation, palm tree, hyperspectral imaging, ganoderma.

1 INTRODUCTION

Established in 1979, Asian Agri spearheads Royal Golden Eagle (RGE)'s palm oil operations and is currently one of Asia's largest palm oil producers with an annual production capacity in excess of 1 million tons, and manages more than 160,000 hectares of palm oil plantations. The findings and recommendations of this article are done via interviews with relevant mill personnel and palm management system owners, as well as other relevant research on the topic of early detection of ganoderma fungi infestation and its management. [1]

2 KEY CHALLENGE OF GANODERMA INFESTATION AND ITS IMPACT

Managing more than 160,000 hectares of palm oil plantations, Asian Agri faced a number of key challenges, the most critical of which is the management and containment of the Ganoderma fungi infestation.

There are several different species of Ganoderma fungi, such as Ganoderma Heterobasidion, Pleurotus, Lentinus, but it is Ganoderma boninense which has been identified as the major cause of the fungi disease of oil-palm trees. The fungi causes the deadly Basal Stem Rot (BSR) disease, wood-decay and butt rot in oil-palm trees. It is known as the most destructive disease of oil palm plantations in Southeast Asia. It is responsible for a significant portion of oil palm losses, estimated at US$500 million a year in Southeast Asia. [2]

And as pointed out by (Camille et al, 2010), the detection of ganoderma fungi in crops such as palm trees, represents a major issue in palm estate management. Current detection & diagnostics method via direct visual symptom observation is difficult and time-consuming, while other methods such as those based on root or stem tissue chemical analysis are very expensive and damaging. [3]

3 CURRENT GANODERMA INFECTION DETECTION & MANAGEMENT

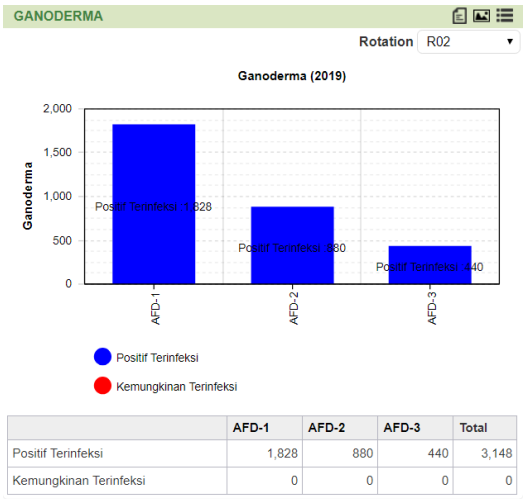
As part of its effort to track the results visual observation census, verification, final inspection and subsequent treatment & containment of Ganoderma infestation, Asian Agri has developed the Asian Agri Connected Plantation (AACP) digital platform [4]. The AACP include the field-force mobile data capture application using tablets plus dashboarding and alerts capabilities at the Plantation Operations Control Center.

Currently, the method to detect Ganoderma infestation is via direct visual symptom observation by plantation workers. Assigned plantation workers will inspect every tree within their assigned area / plots called afdeling. They will then record their visual symptoms observations into the AACP field force application using tablets. The visual observation that are recorded include the symptoms of a potential or confirmed ganoderma infection [5], such as:-

Tree Part	Visual Symptoms
Fruit	Reduced fruit size.
Leaves/Fronds	Abnormal colors, forms, necrotic areas on leaves, Wilting, yellowish fronds.
Roots	Fungal growth on root surface, wood rot, soft rot of cortex.
Stems	Bark discoloration, mold growth on lesion.

Table 1.0 – Types of symptoms due to Ganoderma infection.

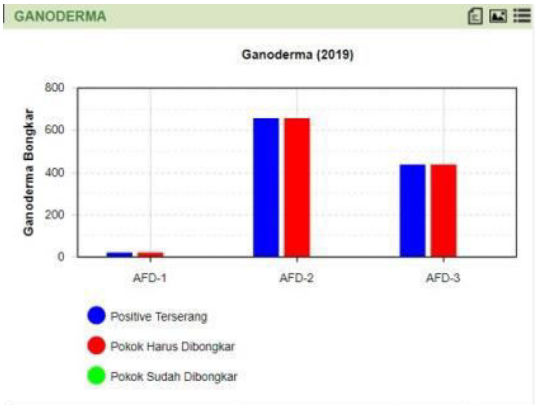
Visual observation data that is recorded shall then be updated back to the server via wireless connection at the Plantation Operations Control Center. Updated data will then be visible via the AACP's Pest & Diseases (P & D) Control Dashboards. Fig 2.0 shows the P & D Control Dashboards dashboard with the blue bar indicating the total number of trees confirmed to be positively infected, while the red bar indicating the total number of trees that shows signs & symptoms of potential infection taking place.



	AFD-1	AFD-2	AFD-3	Total
Positif Terinfeksi	1,828	880	440	3,148
Kemungkinan Terinfeksi	0	0	0	0

Fig 2.0 – Dashboard displaying the total number of trees exhibiting visual symptoms of ganoderma infection in each afdeling.

A tree is recorded as possibly infected if it shows 3 or more visual symptoms highlighted in Table 1.0, possible infection requires further verification to confirm there is a positive infection on those trees, the result of the verification and whether the symptoms show that the tree has to be removed to contain the infection is also recorded via tablet and also displayed in the AACP P & D Dashboard, refer Fig 3.0.



	AFD-1	AFD-2	AFD-3	Total
Positive Terserang	20	658	440	1,118
Pokok Harus Dibongkar	20	658	440	1,118
Pokok Sudah Dibongkar	0	0	0	0

Fig 3.0 – Dashboard displaying the total number of trees confirmed to be infected by Ganoderma (blue bar) and number of trees to be removed to contain the infection (red bar) in each afdeling.

Although, the AACP digital platform enabled Asian Agri to track the trees infected by Ganoderma based on visual symptoms, those visual symptoms such as the appearance of the fruiting body, refer Fig 4.0, is difficult to spot and only appears at a late stage of the infection. Once the fruiting body is visible, the infection has reached a late stage where the entire palm tree has to be removed in order to contain the disease from spreading to surrounding areas as a result of the spores released by the fruiting body. Furthermore, even the stump and root system needs to be removed together with the tree, to further contain the infection.

Fig 4.0 –Fruiting body observed on the trunk of the tree from Ganoderma infection

If not detected early, death may occur to trees infected by the Ganoderma, within 6-12 months, with the fatality rate of up to 80% of affected trees. Due to Ganoderma infection, the Fresh Fruit Bunch (FFB) yield is estimated to be reduced by an estimated 0.04t/ha to 4.34t/ha, refer Fig 5.0. Also, the fungi survives in the soil even when treated, continuous monitoring is crucial because as many as 30% of the replanted areas may be affected within 1-2 years of replanting. [6] Thus it is crucial to employ alternative methods, which we shall look at in the subsequent section, to detect the infection earlier so that effective management of the infection can be performed.

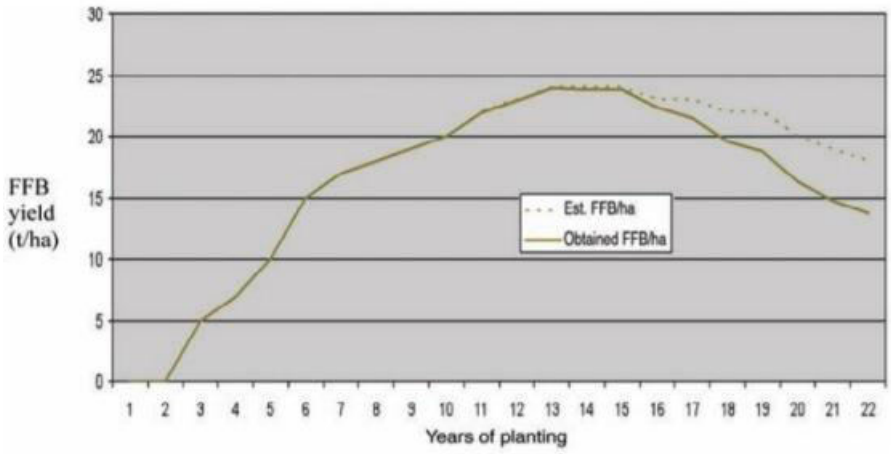


Fig 5.0 – Reduction in FFB yield due to Ganoderma infection.

4 EARLIER DETECTION OF GANODERMA INFECTION

Currently, there is no single method that is able to halt the continuing spread of this deadly disease. It is therefore crucial to identify and select the methods for early detection of the fungi infection. Currently, there are a few early detection methods [7], such as:

- Hyperspectral Imaging (via remote sensing using digital imaging and spectroscopy).
- Biochemical method.
- Chemical method (via the detection of the presence of the Ganoderma chemical compound in the trees).

4.1 Hyperspectral Imaging for ganoderma detection

Hyperspectral imaging (or remote sensing) combines digital imaging and spectroscopy (the study of the interaction between matter and radiated energy). Hyperspectral imaging involves capturing images over several spectrums, for example: visible light, Near Infrared, Infrared. Using hyperspectral imaging tools, the image and reflectance data captured exhibits a clearly distinguishable difference, refer Fig 6.0, and Fig 7.0, in between healthy trees and those infected by the Ganoderma fungi.

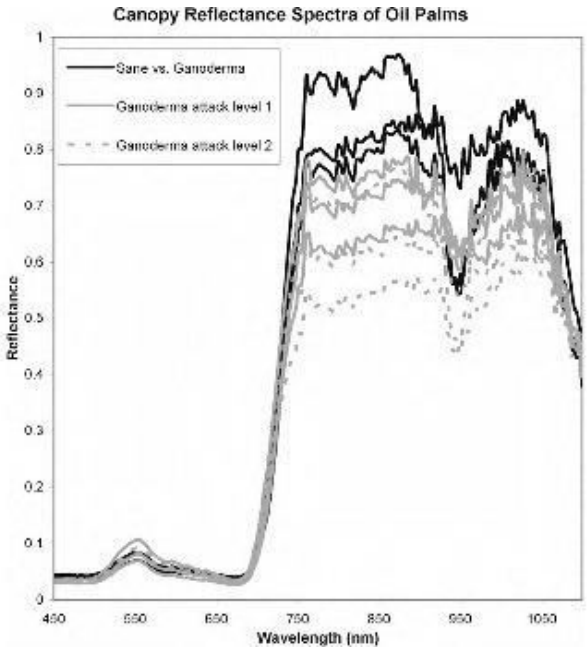


Fig 6.0 – Distinctive reflectance profiles generated from healthy and ganoderma-infected trees.

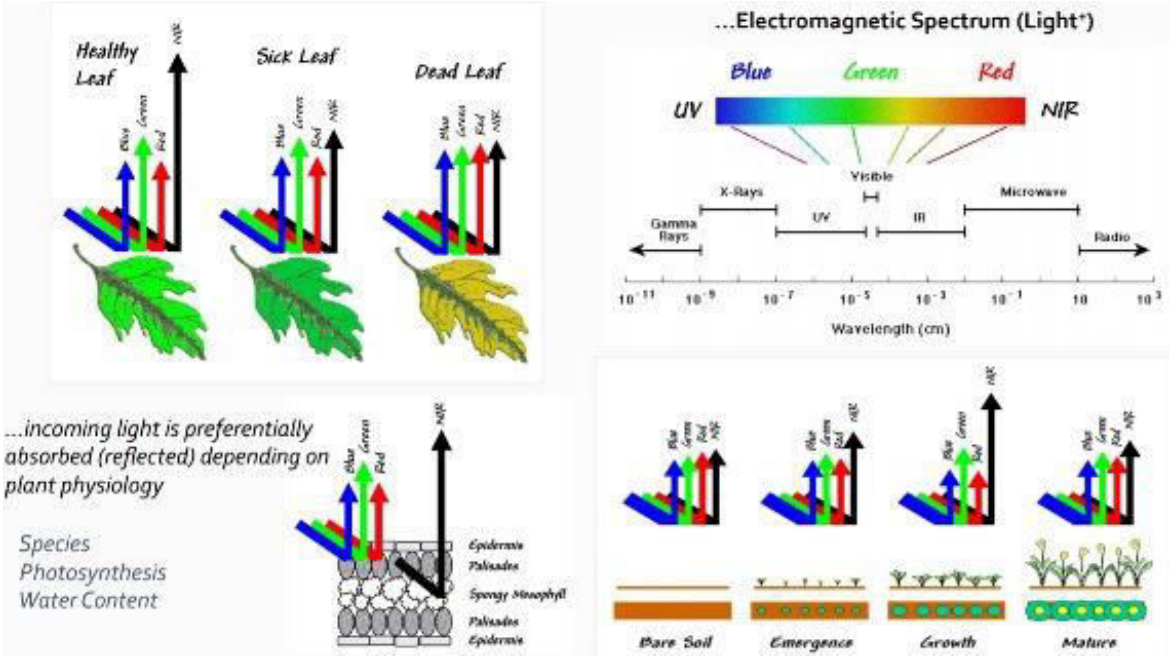


Fig 7.0 – Reflectance data captured using remote sensing enables early detection of infection symptoms such as sick or dead leaves.

As imaging and data acquisition tools, plus other technologies like Unmanned Aerial Vehicles (drones) gets more reasonably priced, the tools used to capture the data has gone from using handheld spectroradiometer (a device to measure spectral reflectance ratio of incident-to-reflected light measured from an object over specified wavelengths) in 2008, to Hyperspectral Data acquisition using UAV (drones customized to carry sensors for hyperspectral data acquisition sensors) on young and mature palm, over large plantation areas [8].

Fig 8.0, adapted from various sources [9],[10], highlights the key technologies used for Hyperspectral Imaging (remote sensing):

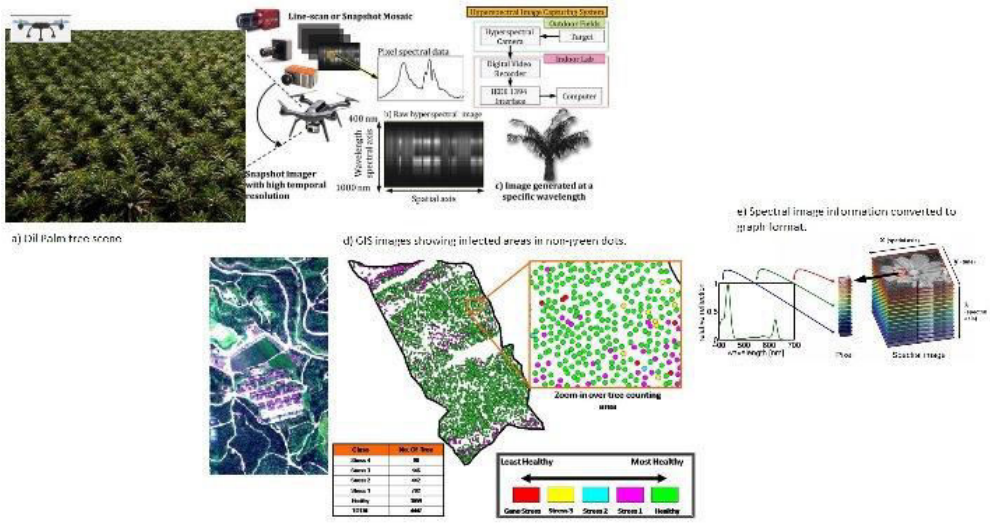


Fig 8.0, highlight the key technologies used for Hyperspectral Imaging (remote sensing)

(a) Hyperspectral data UAV (drones) fitted with Hyperspectral Cameras and Geographic Information System (GIS) technologies shall capture the required data based on the flight path planned.
(b) The resulting data in the forms of raw hyperspectral image are then made available when synched back to the Plantation Control Center servers.
(c) An image of the tree is also made available based on the different wavelengths captured (e.g. Near Infrared or NIR).
(d) Together with GIS data, the overall infected vs. healthy areas of the plantations can be plotted.
(e) Hyperspectral information in the form of hyperspectral data cube (data in 3-dimension: x and y spatial information, plus spectral wavelength information), can also be converted to graphs for deeper analysis.

The rapid progress of Hyperspectral imaging or remote sensing method & technologies for ganoderma infection, coupled with more competitively-priced UAVs fitted with advanced hyperspectral cameras, and leveraging on GIS technology allows for faster imaging and data-capturing rate of estimated 500 ha/day for 1 UAV), the data provides quick visualization and also opportunities to perform advanced data analytics on them to make prediction and to guide future actions in disease management in the plantation. Based on an earlier study, it is possible to detect ganoderma infection in trees in more than 90% of the cases with the hyperspectral imaging method [11], thus this method should be considered based on the various benefits it has over the others.

4.2 Biochemical Method for ganoderma detection

Biochemical method based on immunoassays called enzyme-linked immunosorbent assay (ELISA). Using this method, biological substances (antigens) specific to G. boninense taken from the tree sap, reacts with antibodies that are made to detect it, and a detectable signal is emitted usually in the form of color change. This method suffers from reliability issues as there are major drawbacks such as the high rate of obtaining false positives (due to reaction of antibodies happens even with antigens from unrelated fungi species) or false negatives. [12]

4.3 Chemical method for ganoderma detection

Ganoderma infection can be detected via the presence of ergosterol (a type of chemical compound that are part of the cell membrane of the ganoderma fungi) in the infected tree. To do this, a small sample can be taken from the tree stem or trunk by drilling. Next, there must be a way to extract the ergosterol (which is invisible to the eye), and then proceed to separate it from the other organic molecules using a combination of physical and chemical method. Once separated, the presence of ergosterol can then be detected. Although there is an ergosterol detection kit which employs the Thin Layer Chromatography (TLC) method to detect the presence of ergosterol via immersing the crushed samples into a special solvent, which together with the TLC plate will show the presence of ergosterol under the ultraviolet (UV) lamp. [13] The challenge of this method is that it requires quite a huge amount of physical work to extract the samples from each tree by drilling (which is also destructive), and then further work would be required to perform the separation via chemical work by trained personnel before the detection of ganoderma through the presence of ergosterol is possible.

5 CONCLUSION

The Basal Stem Rot disease caused by Ganoderma infection is deadly to oil palm trees, so it is crucial to identify and select effective early detection methods & technologies that are fast, accurate, reliable, reasonably-priced & practical on the field. Once detected, proper treatment has to be carried out and post-treatment monitoring measures, such as via Internet of

Things (IoT) sensors [14], needs to be in place to ensure that the treatment is effective. In summary, there is work to be done in the selection and implementation of effective detection & post-treatment monitoring methods and technologies. The methods & technologies chosen should integrate well with the AACP digital platform, for earlier detection, better treatment and overall management of the disease. And this will ensure the sustainability of the palm oil plantations managed by Asian Agri.

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REFERENCES

[1] The History of RGE, "*Our History*", https://www.rgei.com/about/rge-history, 2019

[2] Parisa Ahmadi, et. al. "*Early Detection of Ganoderma Basal Stem Rot of Oil Palms using Artificial Neural Network Spectral Analysis*", https://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS-12-16-1699-RE, 2017

[3] Camille C. D. Lelong, et. al, "*Evaluation of Oil-Palm Fungal Disease Infestation with Canopy Hyperspectral Reflectance Data*", https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3270866/ , 2010.

[4] Asian Agri Connected Plantation (AACP) project artifacts, "*Project Summary*", 2016.

[5] Plantwise Knowledge Bank, *"Plantwise Technical Factsheet - basal stem rot of oil palm - ganoderma boninense"*, https://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=24924

[6] Roslan Abas; et. al, "*Economic Impact of Ganoderma Incidence on Malaysian Oil Palm Plantation - A Case Study in Johor"*, http://palmoilis.mpob.gov.my/publications/OPIEJ/opiejv12n1-Roslan.pdf, 2012.

[7] Dr. Chong Khim Phin, PhD (Plant Pathology), et. al - Faculty of Science and Natural Resources Universiti Malaysia Sabah, "*Ways of detecting Ganoderma early*", http://www.dailyexpress.com.my/read/1577/ways-of-detecting-ganoderma-early/, 2015

[8] Dr. Nisfariza Mohd Noor, *High Spatial Resolution RGB and NIR UAV Based Imagery for Detection of Ganoderma Disease in Oil Palm - National Drone Exhibition and Seminar (NADES 2016)"*, https://www.jupem.gov.my/v1/wp-content/uploads/2016/06/10.%20High%20Spatial%20Resolution%20RGB%20and%20NIR%20UAV%20Based%20Imagery%20for%20Detection%20of%20Ganoderma%20Disease%20in%20Oil%20Palm%20(UM).pdf, 2016

[9] Redmond Ramin Shamshiri et. al, "*Fundamental Research on Unmanned Aerial Vehicles to Support Precision Agriculture in Oil Palm Plantations*", https://www.intechopen.com/books/agricultural-robots-fundamentals-and-applications/fundamental-research-on-unmanned-aerial-vehicles-to-support-precision-agriculture-in-oil-palm-planta, 2018

[10] Gerrit Polder, et al. *"A Spectral Imaging System for Detection of Botrytis in Greenhouses"*, https://www.researchgate.net/publication/259215766_A_Spectral_Imaging_System_for_Detection_of_Botrytis_in_Greenhouses, 2013

[11] Shohreh Liaghat , et. al, "*Early detection of basal stem rot disease (Ganoderma) in oil palms based on hyperspectral reflectance data using pattern recognition algorithms*", https://www.researchgate.net/publication/261877873_Early_detection_of_basal_stem_rot_disease_Ganoderma_in_oil_palms_based_on_hyperspectral_reflectance_data_using_pattern_recognition_algorithms, 2014

[12] J. Flood, et. al, "*Ganoderma Diseases of Perennial Crops*", https://www.researchgate.net/publication/266288594_Ganoderma_Diseases_of_Perennial_Crops_Edited_by, 2000

[13] Mohd Nasir Ismail, "*Malaysian Palm Oil Board - Economics & Industry Development Division - UMS Comes up With Kit for Ganoderma Detection*", http://bepi.mpob.gov.my/news/detail.php?id=19345, 2015.

[14] Idris A S, et. al, "*GanoSken for early detection of Ganoderma infection in Oil Palm*", http://palmoilis.mpob.gov.my/publications/TOT/TT-442.pdf, 2010

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Mr. Leong Hoe Wah is the SME - Business Research Analyst in the Digital Architecture and R&D Division of Ace Resource Advisory Services Sdn. Bhd. He has more than 18 years of experience in the IT industry. He has a diversified industry experience ranging from Manufacturing to Insurance. He started his career as a Software Engineer and progressed into Business Analysis, Pre-Sales, Technical Training, Project Management and Technology Research. He is a PMP, CPRE & ITIL-certified information technology professional.

Corporate Placements

HR Agency: "Sir, we have selected few candidates as per your requirements. Now how do you want their placements sir?"

M.D and CEO: "Put about 100 bricks in a closed room. Then send the candidates into the room & close the door, leave them alone & come back after a few hours and analyse the situation:-

1) Any candidates counting the bricks, Put them in Accounts deptt.

2) If they are re-counting the bricks, Put them in Auditing.

3) If they have messed up the whole room with the bricks, Put them in Premises.

4) If they are arranging the bricks in some strange order, Put them in Planning.

5) If they are throwing the bricks at each other, Put them in Operations.

6) If they are sleeping, Put them in Security.

7) If they have broken the bricks into pieces, Put them in Information Technology.

8) If they are sitting idle, Put them in Human Resources.

9) If they say they have tried different combinations yet not a single brick has been moved, Put them in Front office in Treasury.

10) If they have thinking of going out for the day, Put them in Marketing.

11) If they are worried about how to use bricks, Put them in Risk Management.

12) If they are staring out of the window, Put them in Strategic Planning.

And.....

13) If they are talking to each other and not a single brick has been touched, Congratulate them and put them in Senior Management

Leet Speak

Leet speak, also known as leet, leetspeak, leetspeek, or hakspeak, is a way of writing words by substituting numerals or special characters for some of the English letters. “Leet” derives from “elite,” which refers to hackers, who were among the first to use it and who elevated it to a sort of cult language.

Do you recognize these words? |-|4(k3r, 1337, 3D170R — respectively, they’re leet versions of hacker, leet, editor. If a computer program doesn’t know they’re a kind of code, it’s not likely to recognize the words in the midst of other text. However, a program designed to translate leet would have no problem.

Leet Speak Converter: http://www.brenz.net/services/l337Maker.asp

Leet password generator -- http://www.whatsmypassword.com/

Move over, *Pessimists* - Emerging Top 50 Technologies Offer a Gold Mine of Opportunities

Mr. S. Anand
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sanand@frost.com

In their book "abundance," Peter H. Diamandis and Steven Kotler give us plenty of hope that every basic need will soon be met if not done yet! The exhaustive research into it depicts how our minds get clogged with loads of information, portraying challenges that are likely to cause significant devastation in our daily world. However, many such outlandish challenges have indeed remained on paper rather than actually affecting any of us.

In fact, we live in a world of opportunities and thanks to extensive research conducted across various stakeholders, there are a lot of benefits that can be reaped, regardless of the outlook projected by pessimists.

To characterize the opportunities available, we at Frost & Sullivan, believe that we are at the cusp of a technology-driven ecosystem that is not restricted to just one branch of ICT-based innovations which find mention and examples on the Internet. We cover a wide spectrum of industries that include materials, energy, medical devices and several more that are driving transformational change. So what are they? The Top 50 Technologies, the leading research offering of the TechVision group, the global emerging technology, innovation, and convergence-focused practice of Frost & Sullivan, offers strategic guidance and actionable ideas on the hottest 50 technologies that pack maximum potential to fuel global innovation; spawn innovative products and services; and drive wholesome commercial growth. The Top 50 Technologies are key beacons that will guide the strategic moves of innovation-driven organizations in the near future.

In the 2019 edition, as many as 40 new technologies made it to the list out of the 50, giving us a perspective that newer solutions are emerging from across the different clusters that will have a positive impact on every industry. These positives will also have an influence on the different megatrends, which are macroeconomic forces that are likely to have huge ramifications on businesses, economies, and people. A trend, such as Urbanization, Smart is the New Green, and Innovating to Zero, are concepts on which numerous solutions are built. These trends give rise to novel business models that were not otherwise thought of. Slowly, we are witnessing the influence of society on different areas, creating radical change. A decade ago, no one would have thought that most businesses will be moving towards “Uberization,” which Uber has shown the world. We are transcending toward experiential living. These business models have given rise to a number of potential convergences across different industries. We are witnessing the coming together of automation, energy, and ICT industries to provide us with serendipitous innovations that disrupt traditional models. The influence of all these innovations has led to the emergence of a new breed of techno-philanthropists who are shaping the development of the “long-tail” economy. The new wave of emerging options is fuelling heavy investments from governments, venture

capitalists, evangelists and several others in the ecosystem, giving birth to the popular theme we are all excited about – Disruptive Innovations!

We now draw your attention to some of the innovations we came across that we believe will be of significant interest. These are depicted in the Top 50 chart that you see.

Within the materials realm, steady progress in R&D has propelled the development of hybrid, self-healing, nano and other materials that are likely to have an impact on sustenance, improving energy efficiency, and performance. This will result in extending the lifespan of various products and components. The broader medical devices space is leveraging developments in the domain of digital technology and creating a visible impact on technologies, such as radiomics and telerobotic surgery, which deliver a core medical value proposition through cutting-edge IT platforms and tools. In the environment space, circular and low-carbon economy principles are expected to see an upsurge in adoption in the near future as they help various industries to improve their environmental performance while simultaneously providing additional revenue streams.

Our increased focus on connected technologies brings to the fore significant developments in the field of cognitive security. The market is attractive for technologies with near-term adoptability in the area related to fog intelligence.

In the microelectronics arena, the evolution of the Internet-of-Things (IoT) and connected living could be expected to create a major stir in the smart devices market in the future due to the deployment of billions of devices. A key trend related to this development is the ever growing customer needs. Miniaturization will be a key driver as end users are constantly inclined to have electronic gadgets that are smart, handy, power efficient and, of course, economical. The spike in adoption of smart devices, smartphones in particular, has encouraged product developers and consumer electronics manufacturers to invest heavily on the research and development initiatives of technologies. High adoption of smartphones and rapid network infrastructure development are expediting the growth of smart homes (connected homes) and smart appliances. Advancements in smart home automation have assisted in navigating everyday chores efficiently. Apart from the reduction in workload, connected homes increase performance and offer optimized output. For instance, an automated solution with connected appliances would optimize the usage of appliances, thereby leading to reduction in cost and time, which will be a major boon for end users.

Key Strategies to Capitalize on Market Opportunities

In the electronics sector, the race to constantly innovate has pushed manufacturers to actively pursue partnerships, joint ventures, and collaborations to stay ahead in today's ultra-competitive marketplace.

The current stakeholders in the electronics industry are largely consumer electronics and display manufacturers, wireless communication and semiconductor developers, technology developers, research institutes, and universities. Consumer electronics companies, such as Apple and Samsung, are some of the forerunners in the electronics industry that are displaying keen interest on advancement of technologies. Automotive OEMs are also looking for potential collaborations with technology developers to incorporate the technologies in their products to offer an enhanced experience to end users.

Collaborative research initiatives and technology acquisitions are some of the key growth strategies witnessed in the electronics space. For instance, in 2014, LuxVue, a microLED company was acquired by Apple in order to use the patented microLED technology in its smartwatch.

Participants from the display, lighting, and automotive industries are expected to be the forerunners in adopting and commercializing microLED and screenless display-based solutions. Healthcare industry participants can be expected to investigate the possibilities of transient electronics and test its commercialization feasibility. Advancements in stretchable electronics would also encourage the development of flexible and transparent electronics.

2020 Scenario

By 2020, microLED is expected to be a commercially available technology in the display industry. Advanced manufacturing processes, improved efficiency, and robustness would be the key factors encouraging display manufacturers to adopt microLED as a replacement for LEDs and OLEDs. MicroLED has the potential to create an impact on the lighting industry based on developments in flexible electronics and transparent electronics.

Transient electronics would be in the final stages of research, and commercialization of the technology can be expected in the long term. Post commercialization, the technology is expected to be disruptive, particularly in the healthcare segment.

By 2020, petahertz electronics would be in the research phase and the potential for commercialization would be identified. Based on further R&D, it does have the potential to be commercialized in the long term (5-10 years).

Stretchable electronics has been in the research phase for over a decade. By 2020, some commercially available solutions may emerge due to advancements in flexible and transparent electronics. Stretchable electronics can be expected to be commercialized in the long term and have a high impact on the healthcare and consumer electronics space.

Currently, most of the screenless display initiatives are in the research phase. By 2020, holographic 3D techniques and heads-up displays are expected to be commercially available and deployed across multiple applications. Smart eyewear and brain-computer interface-enabled screenless displays would be in the research phase and their commercialization will hinge on health and safety regulations.

While each domain represents an area of intensified research & development, top-tier investments, and tremendous market potential, the possible convergence of several of these technologies opens up unprecedented opportunities for new revenue models and the next generation of innovative products and solutions.

In conclusion, we can rest assured that technologies emerging out of the innovations that we see in the Top 50 chart are poised to propel the markets forward for the next 100 years and more. They offer a gold mine of opportunities to be tapped that are both unique and abundant. Move over, pessimists.

About the author

Anand Subramanian is the Vice President with the TechVision business unit of Frost & Sullivan based in Chennai, India. Mr. Anand manages the group's overall business which includes consulting and is also responsible for providing the business unit's syndicated reports to clients. At Frost & Sullivan, Anand has focused on engagements and issues that deal with evaluation of emerging technologies and business models, their impact on market terrain and the firms that operate within it. He manages the Profit & Loss of the business unit in Asia and is the firms representative within India.

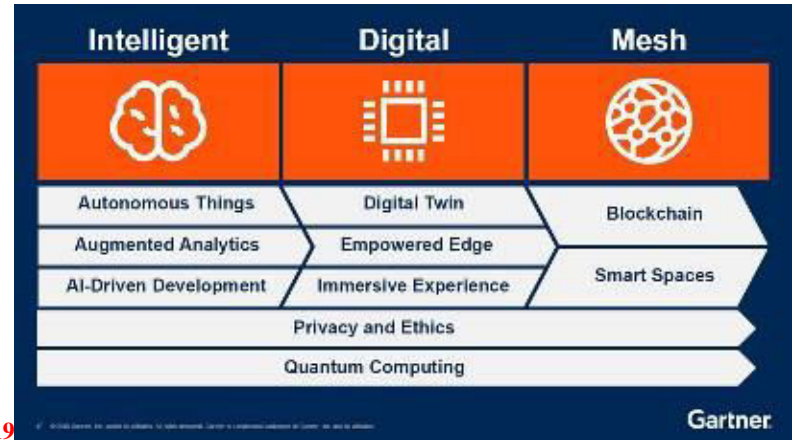
Anand has been involved with numerous proprietary engagements in North America, Europe and Asia-Pacific with Fortune 50, Fortune 500 and numerous start-ups. Anand has participated in several engagements with leading clients to help them leverage global market and technology opportunities and establish strategic partnerships. He has participated in strategic assignments for Procter & Gamble, General Motors, Lockheed Martin, Boeing, and IBM. Over the years, he has also participated in initiating and managing the production of hundreds of emerging technology studies.

Prior to his current role, Anand has worked as an analyst, project manager, and technology market consultant. He has written multiple research reports, white papers and technology articles that have been published in global research journals and prominent business magazines.

Anand has been quoted in Forbes, Washington Post and other key business dailies. He has also been invited to speak at multiple conferences as the guest of honor, thought leader and as an expert on issues related to Business Strategy, and emerging technologies in the business domain.

Anand also is the Head of Frost & Sullivan's – Global Innovation Center in India. He manages Frost & Sullivan's internal captive center which is the nerve center of all activities supporting the global offices. Anand is with Frost & Sullivan since March, 2001.

Gartner's Top 10 Strategic Technology Trends for



2019

Source & Courtesy: https://in.pcmag.com/feature/126328/gartners-top-10-strategic-technology-trends

Supply Chain Management Practice in India

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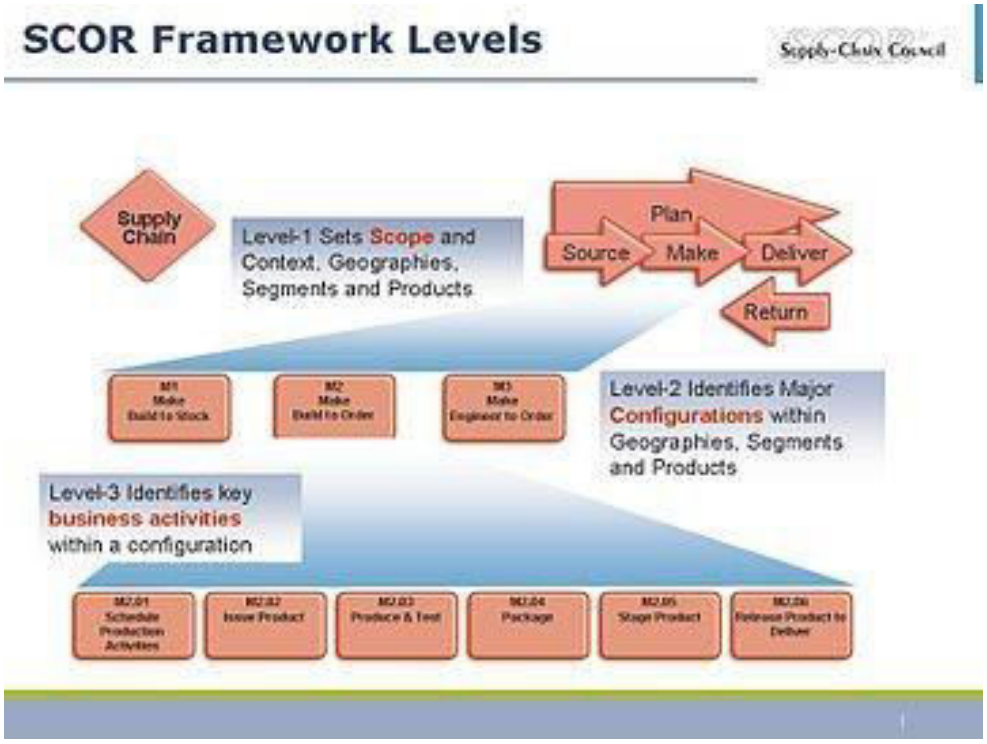
Definition of Supply chain management and its evolution

The entire field of supply chain management has emerged from the contribution of supply chain working professionals such as procurement executives, stores managers, shipping and logistics trackers, inventory controllers, production planning personnel and many more who are either directly or indirectly involved in the manufacturing planning process. There is no common definition of supply chain management across the industry and each industry body, defines it in its own way. Associations alike claim supply chain management as their expertise. And to be fair, APICS, (**American Production and Inventory Control Society**) ,in its 13th edition, defines supply chain management as "the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally."

SCOR Model



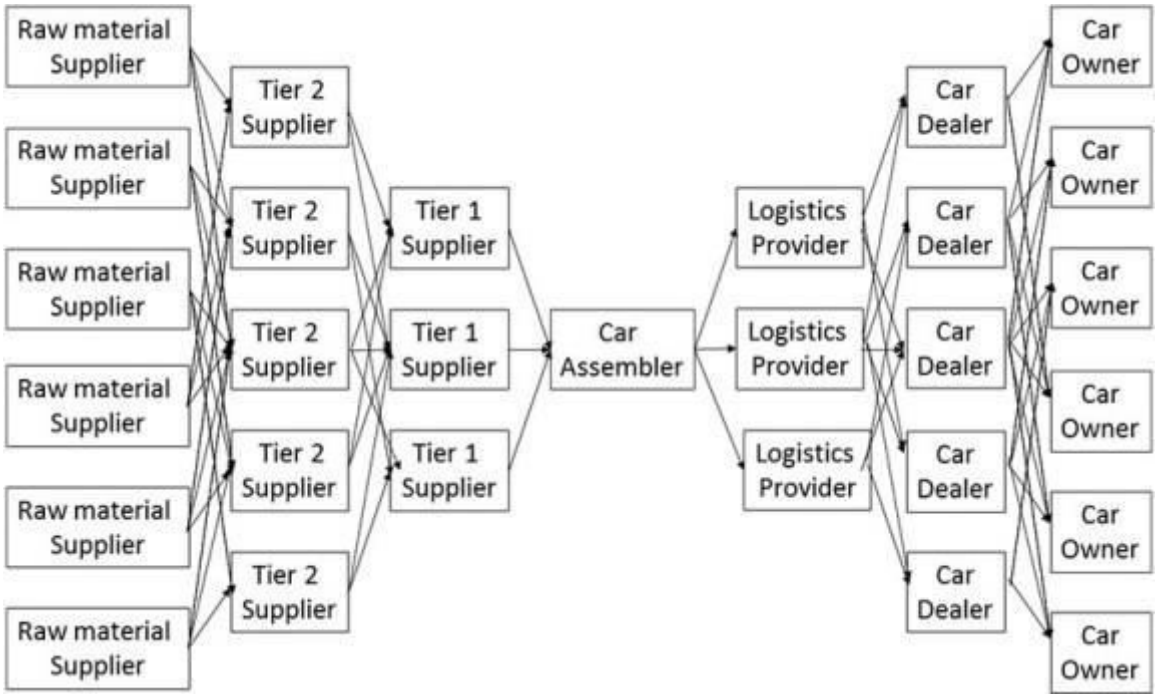
This is one of the simplest and tested theoretical framework for supply chain. Supply-chain operations reference (**SCOR**) model is a process reference model developed and endorsed by the **Supply Chain Council** as the cross-industry, standard diagnostic tool for supply chain management. The **SCOR** model describes the business activities associated with satisfying a customer's demand, which include plan, source, make, deliver, return and enable. Use of the model includes analyzing the current state of a company's processes and goals, quantifying operational performance, and comparing company performance to benchmark data. **SCOR** has developed a set of metrics for supply chain performance, and Supply Chain Council members have formed industry groups to collect best practices information that companies can use to elevate their supply chain models.

Treatment of logistics function

The *APICS Dictionary* also considers **logistics** which is a part of supply chain, as a physical activity of delivering goods, which is a part of end to end circular supply chain. Logistics in future would cover both forward and return logistics and the latter is likely emerge as a major area with increasing customer expectations and environmental norms. In essence supply chain management links, all activities to bring all stake holders together, in a circular loop. This can be seen from the following illustration

Usually it covers raw material movement from supplier and tracks till it reaches the customer, as a final usable product. This would also include information flow and money flow.

End to end supply chain



For example, in an automotive supply chain almost as a standard across the globe, the end to end supply chain begins from a car owner and the process is linked through the automobile dealerships distributed across the geography. These dealers are serviced through the logistics provider for getting the physical supply of products like cars in showroom condition by the car assembler. The assembler in turn is primarily supported through components and supplies from the sub-assembly vendors like alternator, starter motor, fuel pump suppliers who specialize in a particular component assembly. These suppliers are termed as Tier 1 suppliers. They have backward linkage with Tier 2 suppliers who in turn provide the required parts for making the sub-assemblies. Sometimes it can also extend to Tier 3 and Tier 4 suppliers in few cases before reaching the last stage, i.e raw materials supplier. An intricate web of a number of players dealing with a variety of materials, ranging from steel, aluminum, copper, rubber, plastics, chemicals and consumables together contribute to this value-adding chain. Many of the subassemblies themselves involve an intricate design and in quite few cases patented processes such as in the case of exhaust mufflers in the modern cars also exist. An illustration of this network of supply chain players is given below

Circular concept in supply chains

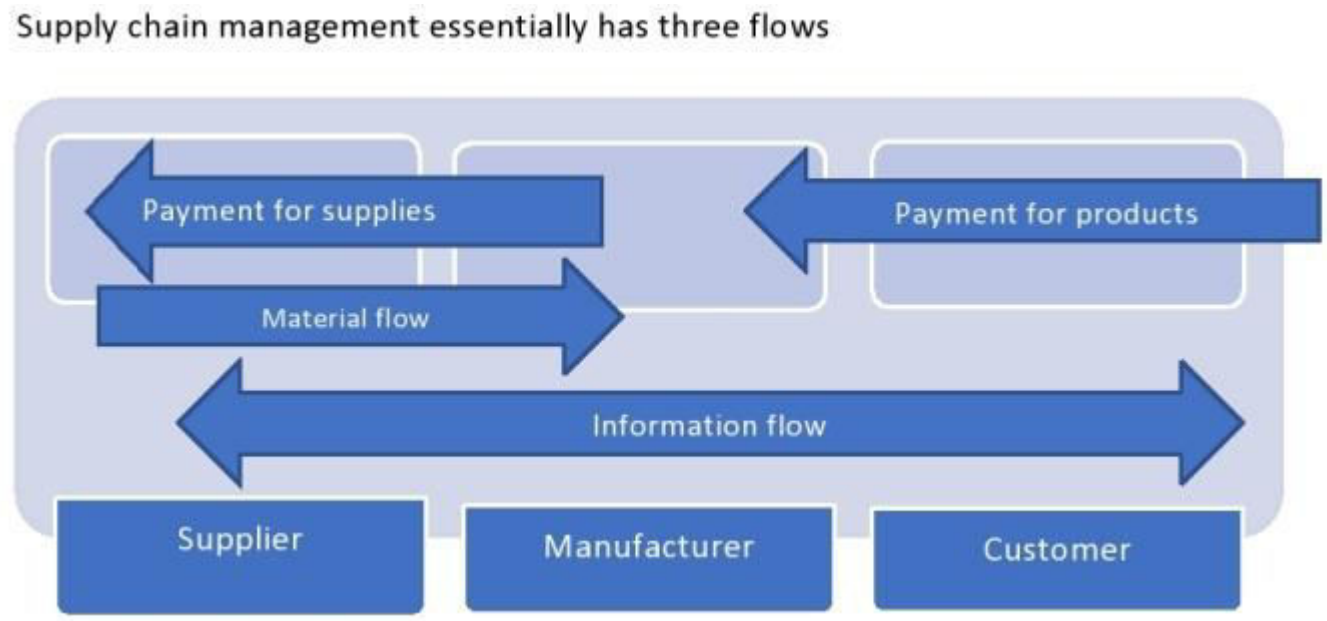
A typical buyer of a new car in a developing nation like India looks for many technical parameters in the purchase decision, such as styling, ergonomics, , ease of servicing and performance on road. They also consider commercial parameters like brand image, purchase funding options and after market value for making a purchase decision. Increasing awareness and pressure from regulatory agencies to protect the environment is pushing the manufacturers to reuse or refurbish the

components to lessen the harmful impact on environment. Therefore, it can be said that the emerging supply chains of the future will start with the customer and end with the customer, **i.e circular supply chains.**

Illustrative examples

To illustrate with an example, a Swedish OEM uses one third of recycled re-cycled materials in assembling a new truck by their designs with 90% recyclability. Another OEM uses recycled aluminium which reduces energy consumption by 95%. A French OEM leases battery for electric cars. In India aluminium, is almost recycled fully as it has a well -developed scrap collection and disposal from both domestic and industrial waste. Even plastics are recycled but their waste collection is not as rigorous as aluminium.

Supply chain management essentially has three flows namely



- the product and services flow which is normally unidirectional except in case of product returns and rejections
- the fund flow, i.e payment for the products and services received from the customer and in turn, payments effected to suppliers
- the information flow, which can be two directional i.e between the customer and manufacturer and supplier and manufacturer

Supply planning process

The first phase in supply chain management starts with supply planning process. In the supply chain operations, there exist three different environments, among the different products and services that are offered to end customers. They correspond to **Made to Stock (MTS**), **Made to Order (MTO)** and **Continuous (Process**) methods of production. There is also a small variant in the Made to Order Category in cases where high level of design and customization are involved, which is termed as **Engineer to Order (ETO)** environment. Products like soaps, shampoos, consumer durables like Television, washing machines fall under the MTS category. In these categories demand is totally dependent on the manufacturers plans to utilize the available production capacity to the hilt. Even then, there is a complex product mix planning. This is necessitated due to varying consumer demands for various product lines and individual products. These are based on their brand image and seasonal demands due to factors like weather etc.

Normally, for MTS product category, batch production schedules are prepared and the products produced in batches are kept in inventory to meet the demand during the non-production period. In most cases, the products will be highly standardized without any customization and have low value per unit. The physical size also will be small which enables quick movement of inter depot transfers in case of sudden spurt in demand in certain locations. For supply planning, in such chains, there is very little involvement of the front-end customer facing dealer except to provide logistics services and commercial billing and delivery. Economical production in batch quantities and capacity utilization are the driving forces for supply planning in MTS environment.

Unique case of automobile industry

In the case of automobiles, even though, they technically fall under MTS category, the product mix variants can create lot of mismatch between customer demand and production plan, such as in the preference for a specific color, add-ons like power steering etc. In such cases, the data on anticipated demand from customers is continuously collected from dealers based on the footfalls in the car showroom, which is aggregated across the country. In all car companies in India, the demand for product mix is calculated in real time and countrywide ERP implementation across all selling points is considered as a must. Most companies have direct EDI interface with their Tier 1 suppliers and are gradually extending the electronic data interface to Tier 2 suppliers as well. This method of production, for stock purpose is called "**push" method in manufacturing**

Scheduling with Tier 1 suppliers

It may be noted that the supply chain planning process for a Tier 1 supplier does not follow automatically from the car assemblers plan. The reason is that the supplier in Tier 1 needs to cater to the dependent demand from the car manufacturers, which are mostly in the form of firm schedules specifying products, their quantities demanded and required delivery. However, the Tier 1 suppliers also cater to the independent demand that arises from the after-market. While it would be easy to forecast requirements for say the number of steering gears required for a new car under manufacture, as it is dependent on the production schedule of a car manufacturer, the same is not possible for the requirement of after-market for steering gear. The wear and tear in usage causes independent demand and is unpredictable as such. Besides the preference for the users of cars will vary widely with regard to utilizing the car due to individual perceptions and preferences, to replace them instead of repairing etc. In certain geographies, non-availability of skilled personnel to provide service could also affect the demand for spare parts in the after-market.

Preference for Pull manufacturing

This leads to a high level of uncertainty in demand planning for the after-market and coupled with early product obsolescence by the designers, can make the independent demand highly dynamic. In all such cases, the demand is directly linked to the customer pull or customer need. Planning accordingly is based on customer need which is either directly measured like in the case of firm orders or expected demand for example in a textile showroom, during peak festival season. Such methods of production are termed as "**Pull" manufactured** wherein, the manufacturing is initiated whenever there is a **customer pull**.

One of the key complexities in planning for supplies is due to the reducing product life cycles. Earlier, many decades back, typical Indian customers preferred to maintain their cars over 10 years, whereas the emerging customers keep changing the cars, between 3 to 5 years. Even the design of cars has provided for lowering of overall life of a car, since the older products may not be able to meet statutory compliance such as new emission norms like BSVI etc, in future, as they become dated.

Make or buy decisions

The second phase in supply planning is to decide between making the component inhouse or procuring it from outside. This is termed as make-or-buy decision, which indicates the strategic choice between producing an item internally (in-house) or buying it externally (from an outside supplier). The buy side of the decision also is referred to as outsourcing. There can be number of reasons for either making a product or buying it from outside. As a general rule, most companies want to focus their efforts on core activities to sharpen their core competence. Therefore, non-core activities become obvious candidates for outsourcing. However it does not always explain why some of the core components like a crankshaft or axles in the automobile industry are still outsourced. Make-or-buy decisions usually arise when a firm that has developed a product or part wants to move away from that product and assign the supply to a reputed supplier so that they can move higher in the value chain.

Automobile industry practice in India

Make-or-buy analysis is conducted at both the strategic and operational levels. Obviously, the strategic level is the more long-range of the two. Variables considered at the strategic level include analysis of the future, as well as the current environment. Issues like government regulation, competing firms, and market trends all have a strategic impact on the make-or-buy decision. Of course, firms should make items that reinforce or are in-line with their core competencies. These are areas in which the firm is strongest and which give the firm a competitive advantage.

It can be seen that the following core factors generally cause a decision to make a component or product themselves. They are some and not fully exhaustive.

- ✓ When cost is a significant factor in business the less expensive route of making is chosen
- ✓ Use of excess capacity so that part of fixed costs such as overhead can be shared
- ✓ Direct control over production/quality is needed to sustain the quality or brand image
- ✓ Protecting the proprietary design or technology from spreading over
- ✓ Unreliable supply market and questionable level of competence of key suppliers
- ✓ Control of lead time, transportation, and warehousing costs
- ✓ Greater assurance of continual supply and leveraging of stable work force

Issues in core technology in automobile industry

Lead time issues: Development of technology in automobile components in India, is beset with getting a joint agreement from different stakeholders like public authorities and Governments as it uses the roads which are public owned. It also requires approval from the apex regulatory agencies like ARAI Pune for getting in principle approval for newer technologies as the apex approving body, acceptable to all stakeholders. The automobile OEMS who carry the last word of approval, need to create space in the crowded market place in their product mix. They also need to match various subcontracted aggregates to perform in unison to deliver the final vehicle performance. In most cases it is the time that is more critical than the cost, as can be seen in the slow shift that has taken place in India towards higher performance vehicles as compared to bare basic products like the recently phased out Maruti 800 cc car by the manufacturer, as an example, which had ruled as the single largest product over last 30 years.

Development cost implications: In every case of product development, a component supplier in India, unlike his Japanese counterparts may not have the requisite funding base for new technology. Therefore, in many cases even when the stakeholders are well aware of the limitations of the existing product, for example in the carburetor driven gasoline engines system, a full-scale shift to fuel injection pumping, a technologically superior method may not take place, quickly. The larger issue of servicing the geographically thinly spread after-markets for supply of spare parts and training of the service personnel in the unorganized sector with new technology can really become a nightmare in logistics. This is one of the reasons that currently, the battery technology in vehicle operations is taking roots slowly even with a high level of interest by major manufacturers and Federal Government, to protect environment.

Supplier organization issues: Most suppliers in India have started their business operations from a small-time business startup or with limited public participation in the initial stages of business. Except few of the second or third generation established Tier 1 suppliers in the field like TVS business group in the southern India and Anand business group in northern India, many suppliers are located near their single major customer like Gurgaon in Delhi, where the first plant of the single largest manufacturer of cars in India- Maruti Udyog Ltd began their operations in year 1983. The next level of Tier 2 suppliers has difficulties in running their organization with professionals, as their ability to attract skilled talent in India is limited. The younger generation managers also tend to shift towards career in non-auto fields like information and communication technologies which offer quicker growth and shorter lead times to acquire new skill-sets needed for that sector. In a typical automobile Tier 2 supplier organization, a freshly inducted executive becomes really productive only after a number of years as he/she requires ability to operate under scaled down conditions like managing limited supply base, geographically spread markets, stifling local regulations such as labor market hiring inflexibility etc., which are unique to Indian market.

Outsourcing decisions

The decision to outsource is strongly preferred when

- The part is not essential to the firm's strategy and lack of expertise to make it in-house
- Suppliers' research and specialized know-how exceeds that of the buyer and at lower cost
- Limited production facilities or insufficient capacity inhouse
- Difficulties in procurement and inventory considerations
- Supplier company has strong brands

Outsourcing due to unrelated technology

Many times, technology itself becomes an issue. Even in the same category of a product, take the case of tires, their application varies widely from a simple bicycle to most advanced aircraft landing gear tires. While they may have few common material ingredients, the technology is quite different and it varies across different products. For example, in the case of cars which operate under high road speeds continuously, with limited load, the cornering characteristics of tire are most critical and hence radial tires as compared to cross-ply tires in principle, may get a preference by the automobile manufacturers in procurement. Whereas in the case of bicycle tires the market for which is fully distributed across the Indian retail space, price is the single most determining factor. Therefore, in the case of cycle tires manufacturers, necessarily they have to outsource to get the entire product supplied by a least cost vendor and the other factors like quality, delivery and service in the supply chain take secondary importance. In the case of SUV vehicle tires, the quality assumes

the highest significance as the products are under keen public eye and most of SUV vehicles are used as status symbol brands in India and the best brand available is procured

In the case of car tires, the major delay in India in introducing radial tires in a big way was due to the resistance from the after-market which had significant volumes and had high preference for the older technology. The reason is that the older technology of cross-ply tires enables reconditioning of used tires with retreading to extend their economic life. Due to strong patronage for this feature by a number of users, for retreaded tires in preference to higher cost new tires, the after-market shift to radial had been slow. This preference is not applicable to both bicycle and aircraft tires in principle itself, as retreading in both cases have no takers.

In- between category in outsourcing decisions

The most difficult part in the make or buy decision by Indian automobile assemblers, is the in-between category. While the crank shaft for example, a highly technology driven and capital-intensive component is fully outsourced, the gear manufacturing an equally critical component is mostly manufactured in-house, as the criticality of performance of later is immediately visible in the market and that acts as the single-most important factor. The in-between category say camshaft which is not as critical technically as a crank shaft (as it does not take direct explosion of the combustion process in engine) it may make sense to outsource, but the commonality of process with crank shaft may result in manufacturer to make it in house as well.

Few products like auto-electricals for example require a high degree of technical specialization which is possible only by those who are competent in it. That is why companies like Bosch, Lucas TVS are used as vendors for electrical components who have the technology, global spread and volumes to supply.

Now we come to another in-between category in low value addition. In the case of automotive chains, it is a critical performance product with low technology. For two wheelers it is most critical for performance and without exception only the technically sound vendors like TI Diamond Chain and LG Rolon Chains are the known suppliers, preferred by the two-wheeler manufacturers. However, a number of processes, within the automobile chain manufacturing are labor intensive in the various stages of chain manufacturing. While it may be desirable to outsource the entire product line, to a third-party manufacturer, they would not be able to match the quality standards of large organizations like Murugappa Group or LG group in India. Therefore, they leverage their existing competence in developing external supply network by permitting contract manufacturing in select areas like chain link assembly etc, within their manufacturing facilities using limited contract labor, which are labor intensive processes.

In the case of cycle frames, which is a super critical factor for bicycle performance, TI cycles of Murugappa group in their second manufacturing green field plant at NOIDA in UP near Delhi, have positioned their single supplier for cycle frame assembly in NOIDA, adjoining their manufacturing facility. In fact, the out gate of the supplier is positioned just in front of in-gate of TI cycles assembly line in the manufacturing plant. This not only makes material movement easier, but reduces inspection needs. It offers high flexibility in manufacturing to make instant changes in product mix planning in daily manufacturing schedules. Therefore, in automobile component and assembling industry in India, contract manufacturing has turned out to be an in between category of both Making (for some processes) and buying from outside (shifting part of work outside).

Value Analysis and Value engineering application

Most automobile OEMs jointly work with suppliers to ensure a year on year cost reduction agreement in procured components. This is possible only when value analysis is carried out continuously to explore minor changes in design parameters or in the manufacturing process. Since material cost accounts for more than 60% of the cost of component, reduction in material use or alternate material selection at a lower unit price or a change in design parameter either in the design itself or by changing processes this can be enabled. Sometimes the performance of two components can be combined by redesigning and replacing them with a single component, saving significant costs.

Strategic sourcing as a supply development strategy

Increasingly strategic sourcing is utilized as the best choice for the critical supplies of automotive components. Most manufacturers, operate with " Just In Time (JIT)"strategy for supply replenishments in their assembly lines. This is necessitated by the high speed of manufacturing wherein an assembly line almost produces one car every two minutes. In such a critical speed of operation, it makes sense to make institutionalized arrangements in purchasing with commitments made and executed on a long-term basis. Many critical components, that require high capital investment may not undergo significant design changes and a continuous improvement by an existing supplier can meet the requirements over a period of time. But that requires commitment from both buyer and seller and strategic source as a strategy helps in this process. Many times, strategic sources are also single sources creating mutual dependence and consequent trust-building.

Conclusion

To sum up automobile industry in India had to evolve its own processes in supply planning due to customer practices and supplier issues. This becomes more relevant even when new technologies like electric vehicles get introduced as a number of components like battery for example may require an understanding of user preference in advance in supply planning for manufacturing of these vehicles. This coupled with the issue of likely statutory regulations for used battery disposal will need to be addressed even at the concept planning stage in supply development.

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7 Reasons Why the Supply Chain Matters to Business Success

Whether you are the CEO of an expanding corporation or the owner of a fledgling enterprise, its fortunes are subject to an undeniable truth. The success of your business links inextricably to the performance of your supply chain. If you want business success (and who doesn't?), you have to make your supply chain successful too. Of course, it is helpful to have some statistics on hand to validate the statement above. First though, since the topic is "business success", let's be clear on what that looks like.
https://www.logisticsbureau.com/7-reasons-why-the-supply-chain-matters-to-business-success/

Blockchain Technology is Set to Transform the Supply Chain

Supply chain has become complicated. Some would say cumbersome. It takes days to make a payment between a manufacturer and a supplier, or a customer and a vendor. Contractual agreements require the services of lawyers and bankers, each of which adds extra cost and delay. Products and parts are often hard to trace back to suppliers, making defects challenging to eliminate. Friction in the supply chain is a big problem. There are too many go-betweens. There is too much back and forth. The rise in uncertainty stops supply chains from working well. Suppliers, providers, and clients must interact via central third-party entities instead of directly with each other. Ostensibly simple transactions turn into lengthy multi-step procedures.

Blockchain could be the answer to many of these issues. This recent technology is what drives Bitcoin and other so-called cryptocurrencies. However, it goes much further than an unhackable way of holding and exchanging money. Blockchain can manage any form of exchange, agreement, or tracking process. In a supply chain, it can apply to anything from self-executing supply contracts to automated cold chain management.
https://www.logisticsbureau.com/how-blockchain-can-transform-the-supply-chain/

An Overview of ICT Tools for Supply Chain Management

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1. Introduction

Rapid technology advances and dynamic market forces have altered the business landscape as also fundamentally altered existing business models. Information and Communication Technology (ICT) usage and deployment has opened the doors for companies to compete in any marketplace. Even companies, which have been benefiting from protectionist policies by governments, are now exposed to the perils of increased competition due to liberalization, privatization, pricing pressures and globalization. This challenging and dynamic business environment is popularly referred to as VUCA short for Volatility, Uncertainty, Complexity and Ambiguity. Information sharing between partners in the supply chain is also crucial and these integration attempts are accompanied by ICT initiatives. Such ICT initiatives include:

- Use of bar-coding in logistics systems
- Use of EDI to communicate between branches
- Use of Material requirements planning
- Enterprise Solutions like ERP
- Internet and web services for communication between partners

Early studies on the impact of Electronic Data Interchange (EDI) on Just-in-Time (JIT) shipments in the automobile industry showed significant earnings with lowered shipment errors. Researchers have pointed out that it is necessary to develop a supply chain-wide technology strategy that supports multiple levels of decision-making and gives a clear view of the flow of products, services, and information. An interesting and inclusive attempt to outline the wide impact of ICT in SCM is the definition of functional roles of ICT outlined as follows:

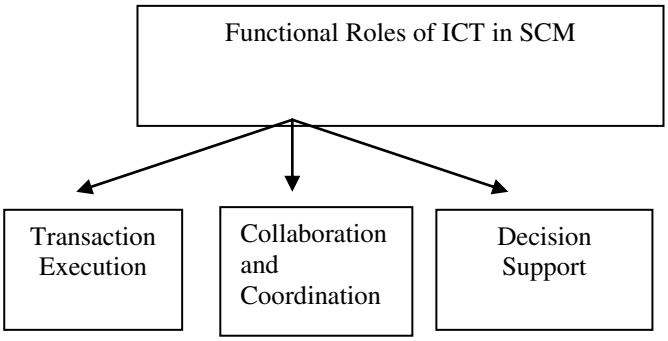

Fig. 1: Functional Roles of ICT in SCM

2. Benefits of ICT Deployment for SCM

Many of the buzz words in SCM such as Vendor Managed Inventory, Point of Sale, Collaborative Planning, Forecasting and Replenishment and ERP stem from ICT usage. ICT tools are great enablers, enhancers, levelers and facilitators of enterprise operations and thereby have become a determinant of competitive advantage for enterprises. Fundamental changes have occurred in today's global economy. These changes alter the relationship that we have with our stakeholders, our customers, our suppliers, our channel partners, and our internal operations. ICT deployment for SCM results in a shift from the linkage between physical processes such as inventory, warehouse or shipping to information-based processes across supply chain operations ICT advances generate new opportunities when suppliers, business partners and customers work together to co-create and co-produce value

ICT deployment significantly improves supply chain process integration, which leads to better enterprise performance. Improving buyer-supplier relationships and accessing actionable knowledge in a suitable manner as also managing dialogue and coordination among various stakeholders are other benefits. This greatly increases the ability of the enterprise to respond to market dynamics. Seamless access to the information as also the visibility and transparency of the information increases the efficiency of different supply chain processes.

Deployment of ICT for various processes can bring about spectacular improvements in efficiency. Auto-ID technologies such as bar coding and RFID have rendered inventory management effective and brought about inventory visibility and transparency, transportation management systems have optimized routes for shippers; Internet-enabled services have brought about better communication, collaboration and dialogue among various stakeholders. Other benefits outlined by

researchers include cost savings; improved operational efficiency, inventory visibility & control; quality, reliability & accuracy of information; improved communication, collaboration & customer-connect and innovation & differentiation of products or services.

According to a study be published in Harvard Business Review, ICT deployment in SCM helps enterprises achieve competitive advantage through improvement in adaptation, alignment and agility in their supply chains. Information technologies and information sharing are also described as key constructs to achieving to achieving supply chain integration. ICT competences are likely to improve an organization's ability to innovate and respond to customer requirements. In other words, ICT impacts all 4Rs of the supply chain namely responsiveness, reliability, resilience and relationships.

ICT can also be classified as ICT advances and ICT alignment. ICT advancement measures the extent to which a firm applies the state-of-the-art technology to augment its supply chain capabilities while ICT alignment reflects a firm's strategic emphasis in coordinating and integrating its own IT with that of its supply chain partners.

3. ICT value-add for enterprises

In 1994, an early study done on 193 automobile suppliers with respect to EDI usage for Just in Time shipments demonstrated encouraging outcomes. EDI application dramatically brought a reduction in the shipment errors thereby brining about substantial savings for the EDI-enabled enterprises. Cisco estimated savings of US $500 million leveraging web-services for its supply chain integration. Major suppliers of Wal-Mart such as Proctor & Gamble (P&G) have direct access to Point of Sale (POS) information from Wal-Mart retail outlets. By migrating placing of orders to an online application, Intel could eliminate hundreds of order clerk positions. Celestica, one of the world's largest electronic manufacturing services companies, has applied a web-based ICT tool to manage its network of suppliers across the globe. Thereby, the company could improve its customer-responsiveness, primarily helping its customer, Dell to maintain its delivery promise to end-users. Motorola used collaborative planning forecasting and replenishment tools and dramatically improved their supply chain visibility by ensuring that shelves are fully stocked and inventory levels are reduced. Seven-Eleven Japan used 70,000 interconnected Point-of-Sale (POS) terminals in stores, and computers at headquarters and supplier sites to capture real-time information and to track inventory so as to achieve greater supply chain transparency, enabling store owners to strategically stock and price items thus changing the nature of retailing in Japan

4. Overview of ICT tools for SCM

Several ICT tools are well-entrenched and widely deployed in the supply chain context. These include:

- Electronic Data Interchange (EDI)
- Bar coding and Scanner
- Enterprise Resource Planning (ERP) Systems
- Warehouse, Transportation and Inventory Management Systems

However several ICT tools for SCM are not widely deployed. We refer to them as fast emerging ICT tools. Emerging ICT tools like software agents, RFID, web services, electronic commerce, cloud computing, social media, mobile technologies, high performance computing, business analytics and decision support systems hold tremendous promise for improving supply chain performance and integration. These tools are being deployed to aid various operations for supply chain planning and execution. The rapid adoption of the Internet for communication with all stakeholders seems to reflect the potential of the new-age communication media. The impact of various emerging tools and their application domains in SCM are listed as follows:

- RFID: RFID enables managers to capture and deliver information necessary to make good decisions. This Auto-ID technology offers businesses increased supply chain and inventory visibility for greater operational efficiency, better tracking of transportation and warehouse channels with reduced inventory RFID is widely being deployed for various SCM processes like inventory management, asset tracking, VMI, demand shaping, production workflow and customer relationship management. RFID is now very popular in retail establishments all over the world.
- Decision Support Systems (DSS): Supply chain partners increasingly have to resolve conflicts among themselves in the face of extreme cut-throat competition. Decision Support Systems (DSS) is a potent tool that can be deployed for conflict-resolution in such situations and also designed to provide analysis and comprehension of complex supply chains effectively. DSS are being used to IT-enable strategic supply chain activities like inventory & transportation management, capacity & demand planning, production & distribution planning and sales forecasting.
- Software Agents: A decentralized approach to SCM using software agents has the benefit of solving the tasks by various participants in the supply chain network through their local intelligence and problem-solving paradigms. Using agent-based technologies, suppliers and manufacturers can negotiate through interaction mechanisms and

distribute various activities in a decentralized manner more efficiently. Software agents have made inroads in various activities of the supply chain like production planning, production monitoring, workflow modeling, negotiation, logistics, scheduling and transportation management.

- Cloud Computing: Cloud computing and associated technologies like virtualization, and software as a service is touted as the next 'big' thing and game changer for enterprises. With several enterprises off shoring their manufacturing and service operations to low-cost hubs in Asia with poor infrastructure and transportation networks, visibility has become a major challenge. Cloud computing can integrate all partners in this increasingly global extended supply chain into an online social network like community with real-time information on all elements in the supply chain. Several solutions are now available and many enterprises have made the shift with good results. Application areas where cloud-based solutions are available include demand forecasting, demand planning, e-procurement, distribution, inventory, warehouse and transportation systems.
- Web Services: Web services are application interfaces accessible via Internet standards that use XML and that employ at least one of the following standards: Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL) or Universal Description, Discovery and Integration (UDDI). These standards, and the next-generation standards that are being built on them, are defining the way that forward-thinking enterprises manage lightweight integration tasks. To fulfill orders, the retailer has to manage stock levels in warehouses. The stock re-ordering and replenishment are automated using web services to spectacular results.
- Business Analytics: Business analytics aims at building fresh perspectives and new insights into business performance using data, statistical methods, quantitative analysis and predictive modeling. Advanced analytics is being employed for several processes in supply chain planning and execution like demand forecasting, inventory management, production & distribution in planning.
- High Performance Computing: High Performance Computing (HPC) systems bring additional benefits of scalability, integration, portability, processing power, storage and interoperability for SCM. Mega corporations and retail giants like Wal-Mart and Pratt & Whitney have deployed HPC for SCM and thereby achieved efficient and effective data administration and analysis.
- SMAC stack: An integration of disruptive and game-changing technologies in the form of the SMAC - Social, Mobile, Analytics and Cloud stack promises to be the next wave in enterprise computing. By 2020, IDC estimates that ICT spending worldwide could touch US$5 trillion mark with fourth-fifth of this driven by the SMAC stack, which is the seamless intersection of the SMAC technologies. Technologies within SMAC complement each other and combined together deliver a force-multiplier effect to transform supply chains into value chains. The resultant value chain would boast of the advantages of robustness, agility, responsiveness, scalability, transparency and visibility. Mobile technologies and cloud computing can easily integrate diverse hardware and storage devices. Social media can facilitate instant dialogue collaboration. Business Analytics provide dashboards after mining the enterprise Big Data available through several sources. SMAC technologies can be easily accessed by all with the recent trend of enterprises encouraging their employees to Bring Your Own Device (BYOD). Various application areas of SMAC stack in SCM could include inventory management, supply chain planning & execution, optimal use of legacy applications, collaboration and customer engagement.
- Industry 4.0: This is a recent buzz word given to the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, Internet of things (IoT), robotics, Artificial Intelligence (AI), machine learning, 3D printing and cloud computing and is popularly referred to as the fourth industrial revolution. Industry 4.0 fosters what has been called a "smart factory" and also Industrial IoT (IIoT). Within modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, i.e. connectivity of physical assets, cyber-physical systems communicate and cooperate with each other and with humans in real-time and with humans in real-time both internal & cross-organizational services are offered & utilized by participants of the value chain. The value chain thereby becomes more agile, collaborative, visible and responsive. An example would be a totally connected and retooled supply chain, which can reconfigure itself on receipt of any new data point. If weather delay ties up a shipment, a connected system can proactively adjust itself and modify manufacturing priorities. With respect to SCM, there are some recent studies on challenges and risks of the Internet of Things (IoT) in SCM.

5. Assessment Framework for measuring impact of ICT in SCM

While most researchers and industry practioners are unanimous about the fact that ICT positively impacts SCM performance and improves supply chain capabilities, there an identified gap in terms of assessment and measurement of these ICT benefits and capabilities in SCM. This is despite the fact that there are several SCM performance measurement frameworks. There is also lack of clarity on the magnitude ICT has improved the competitive advantage of enterprises through improvement of supply chain.

Research is underway to develop an empirical model and assessment framework of the benefits of ICT deployment in SCM and its dovetailing into APICS Supply Chain Operations Reference (SCOR) model. This inter-disciplinary research effort by the author is under the guidance of Dr. S.P. Anbuudayasankar, Associate Professor, Department of Mechanical

Engineering, Amrita Vishwa Vidyapeetham, Coimbatore campus. The rubrics and performance indicators of various constructs for measuring of the impact of ICT in SCM are being used to provide enterprises with an ICT capability index metric for SCM. Well-defined metrics and constructs from the SCOR process reference model namely reliability, responsiveness & agility, which are considered customer-facing and cost & assets, which are internal process-facing are used for the same. Validation of this assessment framework has the potential to open new vistas on selection of appropriate ICT tool after measurement of its impact on the supply chain paradigm and understanding success factors and operational challenges for adoption of these tools. This can translate into immense potential and savings for Indian industry, both large and Micro, Small and Medium Enterprises (MSME) standing to gain considering the fact that global supply chain losses amount to over 100 billion dollars annually.

References

[1] Srinivasan, K., Kekre, S., & Mukhopadhyay, T. (1994). Impact of Electronic Data Interchange Technology on JIT Shipments. *Management Science*, *40 (10),* 1291-1304.

[2] Barros, A.P.D., Ishikiriyama, C.S., Cordeiro, R., & Peres, C.F.S.G. (2015). Processes and benefits of the application of information technology in supply chain management: an analysis of the Literature. *Information Technology and Quantitative Management (ITQM) Procedia Computer Science, 55*, 698-705.

[3] Huo, B., Zhang, C., & Zhao, X. (2015). The effect of IT and relationship commitment on supply chain coordination: A contingency and configuration approach. *Information & Management, 52*, 728–740.

[4] Auramo, J., Kauremaa, J., & Tanskanen, K. (2005). Benefits of IT in Supply Chain Management: An explorative study of progressive companies. *International Journal of Physical Distribution and Logistics Management, 35(2)*, 82-100.

[5] Simchi-levi, D., Kaminsky, P., & Simchi-levi, E. (2003). *Managing The Supply Chain: The Definitive Guide For The Business Professional*, New York: McGraw Hill.

[6] Gunasekharan, A., & Ngai, E.W.T. (2004). Virtual Supply Chain Management, *Production Planning & Control, 15 (6),* 584-595.

[7] Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: the effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics, 135,* 514–522.

[8] Schramm, T., Nogueira, S., & Jones, D. (2011). Cloud Computing and Supply Chain: A Natural Fit for the Future. *Logistics Management, 3*, 9-11.

[9] Ketchen, D. J., & Hult, G.T.M. (2007). Bridging organization theory and supply chain management: the case of best value supply chains. *Journal of Operations Management, 25 (2)*, 573–580.

[10] Ngai, E., Chau, D., & Chan, T. (2011). Information technology, operational, and management competencies for supply chain agility: findings from case studies. *Journal of Strategic Information Systems, 20 (3),* 232–249.

[11] Grover, V. & Kohli, R. (2012). Co-creating IT value: new capabilities and metrics for multiform environments. *MIS Quarterly, 36 (1),* 225–232.

[12] Fosso-Wamba, S., Akter, S., Coltman, T., & Ngai, E.W.T. (2015). Guest editorial: information technology-enabled supply chain management. *Production Planning and Control, 26 (12),* 933–944.

[13] Thongchattu, C., & Buranajarukorn, P. (2007). The Utilization of e-Tools of Information Technology Towards Thorough Supply Chain Management. *Naresuan University Research Conference archives.*

[14] Malhotra, A., Gosain, S., & El Sawy, O.A. (2007). Leveraging standard electronic business interfaces to enable adaptive supply chain partnerships. *Information Systems Research, 18 (3),* 260–279.

[15] Caton, M. (2004). RFID Reshapes Supply Chain Management. e-week, Retrieved from http://www.eweek.com/c/a/Mobile-and-Wireless/RFID-Reshapes-Supply-Chain-Management/

[16] Pechoucek, M., Vokrinet, J., Hodik, J., Becvar, P., & Pospiisil, J. (2004). ExPlanTech: Multi-Agent Framework for Production Planning, Simulation and Supply Chain Management. *Multiagent System Technologies*. Berlin: Springer.

[17] Liu, J.S., & Sycara, K.P.(1997). Coordination of multiple agents for production management. *Annals of Operations Research, 75*, 235 –289.

[18] Jha, V. (2013). Impact of Cloud Computing on Supply Chain Management. *IIM Indore Management Canvas.*

[19] Grimson, J.A., & Pyke, D.K. (2007). Sales and Operations Planning: An Exploratory Framework. *International Journal of Logistics Management, 11,* 255-274.

[20] Trkman P., McCormack, K., De Oliveira, M/P.V., & Ladeira, M.B. (2010). The impact of business analytics on supply chain performance. *Decision Support Systems, 49(3),* 318-327.

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13 Essential Types of Supply Chain Management Tools

As Amazon continues to raise the bar, the margin of error within supply chain management gets thinner and thinner. A simple mistake could easily cost your business thousands of dollars and allow your competitors to get ahead. But thanks to supply chain management software, it's never been easier for companies to avoid such pitfalls. Supply chain management tools and techniques make it possible for users to reduce errors and costs while optimizing the entire supply chain. Here are 13 different types of supply chain management tools that make these SCM software packages valuable to companies:
https://selecthub.com/supply-chain-management/13-essential-supply-chain-management-tools/

Top Supply Chain Analytics: 50 Useful Software Solutions and Data Analysis Tools to Gain Valuable Supply Chain Insights

Supply chain managers cannot afford to operate in the dark as global operating systems, pricing pressures, and increasing customer expectations become the norm, as Paul Myers, professor of practice in supply chain management at Lehigh University explains. Various economic factors such as rising fuel costs, changing supplier bases, increased competition from low-cost outsourcers, and the continuing global recession significantly impact the supply chain and create waste. Supply chain analytics is the solution to these issues because using data helps companies make more informed decisions with a greater level of insight and have access to better models and simulations.

As data analytics becomes critical in supply chain operations and management, supply chain analytics software solutions and tools have become must-have technologies. Many supply chain analytics tools feature improved forecasting and sales and operations planning to give supply chain managers the business intelligence they need to streamline operations, lower costs, and improve customer service.

We have rounded up 50 of the top supply chain analytics tools to help busy supply chain managers find those that will be of the most value to them. The tools that we chose to include are from some of the leading software and analytics companies, and they all include features to deliver value and improve operational efficiency. Many of the following tools include inventory analysis, transportation analytics, demand forecasting capabilities, and predictive analytics to serve as comprehensive solutions for supply chain analytics. Some of our tools also are supply chain management (SCM) solutions with built-in analytics to give companies a more cost-effective solution. Please note, we have listed our 50 top supply chain analytics tools here, in no particular order.
https://www.camcode.com/asset-tags/top-supply-chain-analytics/

Supply Chain Management Products & Buyers Guide

While the supply chain management software market is relatively small (compared to many other markets), the vast disparity in functionality between different SCM programs makes buying decisions much more complicated. Some programs concentrate on business intelligence, others focus on inventory control or transportation management and there are full-suite systems that do all of the above and more. This product & buyer's guide is designed to identify the features associated with supply chain management systems to help navigate the selection process.
https://www.softwareadvice.com/scm/

AI for All

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What is AI

Many problems in the world that once seemed impossible for a computer to tackle without human intervention are solved today with Artificial Intelligence. We are witnessing the second major wave of AI, disrupting a plethora of unrelated fields such as health, ethics, politics, and economy. These intelligent systems prove that machines too can learn from experience, adapt, and make meaningful decisions. While the first wave was driven by rule-based systems where experts in performing a task handcrafted a set of rules for machines to follow, thus emulating intelligence, the second wave is driven by huge amounts of data, coupled with algorithms that enable machines to recognize patterns and learn from experience.

Impact

Though at a very early stage, AI has already made a profound impact on our lives. However, the nature of the impact it has made on different establishments is as unique as itself.

On Enterprises

Enterprises are seen to make the best out of the second wave of AI, primarily owing to the abundance of data they already collect every second. Deep Learning - a subset of Machine Learning, that allows recognizing and learning from complex patterns in data - feeds on huge magnitudes of data in the order of millions of samples. Large enterprises have the benefit of being capable of collecting such data in-house for their own systems, products, and services. Today, numerous such organizations that operate at scale are starting to use AI to automate workflows, streamline their operations, and optimize production.

On Startups

Realising AI's massive potential to solve problems, entrepreneurs have been quick to adopt new strategies and launch startups with AI at its core. Usually, startups are always at the risk of being copied, and hence are in need to continuously evolve and innovate. With AI, startups enter a new paradigm of competition. The ones with better methods to acquire quality datasets come up with better AI models, and hence better products and services. Today's AI startups are helping established companies easily adopt AI. By providing AI models that power chatbots, predict and optimize resource consumption, and much more, these startups have become exemplaries to make use of state of the art AI algorithms and methods like transfer-learning and federated-learning.

On Society

The inception of the Internet gave birth to a new community of problem-solvers, who utilized technology to address many pressing problems in society. With recent advancements in AI and availability of cheap computing resources, a whole new dimension of problems is being solved with AI. From providing better insights to farmers by processing aerial footage and satellite imagery of the field to counselling people under depression through a friendly conversation, AI is helping save lives, cut down cost, reduce waste and make a positive impact on billions of people. Of course, more than any technology adoption in the past, AI will demand an enormous cultural change. Humans have always been skeptical in depending on technology and let it control their lives. We are already witnessing such moments, an example being self-driving fleet that is a reality today. Questions of ethics and decision making in AI still remain unanswered. AI is as much a weapon as it is a tool, and a strong government regularisation and policy making is going to be essential.

Future of AI

All the recent buzz around Artificial Intelligence and its advancements fall into a specific class of AI called Artificial Narrow Intelligence (ANI) or Weak Artificial Intelligence. These are AI systems designed and trained for a dedicated task which it performs with incredible accuracy. We are seeing a record-making number of research publications and breakthroughs in this field, and technology companies are embracing its power to unlock new possibilities. Yet, they fail to sound like the AI we know from the movies. That's because those fall into a different class of AI called Artificial General Intelligence or Strong Artificial Intelligence. These are systems that can perform multi-domain tasks and generalize its learnings to perform new tasks just like humans. There has been very little progress in this field, and only a handful of organizations around the world are working to push its boundaries. The future of AI lies in the advancements in this field, and we won't be seeing AI surpassing human intelligence anytime soon.

Why Democratize AI

In an ideal world, elegant AI solutions should be equally accessible by people of all backgrounds. Bias is inevitable, but what's important is that these solutions should be equally biased by all. Additionally, any organisation of any size should be able to build their own AI based solutions. True democratization of AI happens in three layers - Data, AI Skill, and Infrastructure.

Data

AI models are trained on large datasets from which the model "learns". Hence for any organisation to build its own AI models, availability of quality open datasets for a variety of tasks is crucial. These datasets should consist of samples that apply to a generic audience, and should be reusable to build models for similar but different tasks. Recognizing the need, many tech giants, large firms and government organisation have started opening up their datasets. Transfer learning allows taking a pre-trained model and re-training it with application specific data, hence being able to build a model with a very small dataset.

AI Skill

Acquiring datasets, cleaning and pre processing them, feature engineering, building models incorporating different types of neural networks, deploying them and building a pipeline to continuously optimise and retrain the model - all these demand experts highly skilled in Machine Learning and AI. Democratising AI involves granting anyone access to resources for mastering these skills. The exploding demand for internal AI skilling has lead many universities and companies to provide both free and paid courses for AI. Many machine learning open-source frameworks are now bringing AutoML functionality to help automate the entire process of applying machine learning to perform a task. These methods, though more compute hungry, take a huge step forward in democratizing AI and making it possible for smaller organisations to build AI models. Many cloud based out-of-the-box ML solutions for specific tasks like natural language processing, object detection, etc are also made available, that enable integrate the power of AI into their products and services with minimal effort.

Infrastructure

Machine Learning, and more specifically Deep Learning, is extremely compute intensive. Training Neural Networks with datasets containing millions of examples takes days or sometimes weeks even with powerful computers. Rapidly trying out things and experimenting, which are critical for perfecting a model, is almost impossible without access to necessary computing power. Deploying a trained model for users to make real-time inference demands computation resources as well. Democratizing AI also means democratizing compute resources so that any organisation can use them on demand at a low cost. Cloud Computing is cheaper than ever today, and many Cloud Service Providers provide specialised solutions for training and inference on the cloud powered by hardware accelerators that are custom designed ASICs for neural networks. With these offerings, any small startup or organisation with zero infrastructure of their own can build and deploy state of the art ML models.

Inspiring Stories of Democratizing AI

These days, we come across numerous inspiring stories of people, companies and organisations involved in doing their bit to democratize AI. Below are a select few:

AI4ALL

AI4ALL is a US-based non-profit founded with the mission to make Artificial Intelligence more diverse and inclusive. The organization has its origin in SAILORS – a summer outreach program for high school girls to learn about human-centered AI – founded in 2015 by renowned AI researcher, Dr. Fei-Fei Li, along with Dr. Olga Russakovsky and Dr. Rick Sommer of Stanford University. Through its partnerships with Boston University, Carnegie Mellon University, Princeton University, and Simon Fraser University, AI4ALL conducts summer programs to help students underrepresented in technical careers to excel in the field of AI.

National Strategy for Artificial Intelligence #AIForAll

Recognizing the need to devise a common strategy that could help build a strong AI ecosystem in the country by collaborating with the various experts and stakeholders in the field, National Strategy for Artificial Intelligence is an initiative started by the Government of India through NITI Aayog. This strategy is expected to be premised on a framework that is aligned to the country's unique needs and aspirations. The identified focus areas for AI intervention in India include healthcare, agriculture, education, smart cities & infrastructure, and smart mobility and transportation.

DeepLearning.ai

Deeplearning.ai is an initiative focused in making a world-class AI education accessible to people around the world. It is a venture by Andrew Ng, an AI pioneer, co-founder of Coursera and Director of Stanford Artificial Intelligence Lab. Deeplearning.ai offers one of the best online specialization courses in deep learning. "AI for Everyone" is another course aimed at educating non-technical business professionals on how to adopt AI in their organization by building a sustainable AI strategy. Deeplearning.ai is also collaborating with Laurence Moroney, a developer advocate at Google, in launching its new Tensorflow specialization.

OpenAI

OpenAI is an AI research organisation aiming to advance in Artificial General Intelligence with emphasis on safety and control. It democratizes AI by open sourcing its efforts and making many amazing AI tools publically available to researchers around the world. It has published more than 76 research publications, each making considerable improvements and delivering innovations in Reinforcement Learning, Robotics, Natural Language Understanding, Generative AI, One-

shot Learning, Meta-learning and much more. OpenAI envisions bringing human-level intelligence to machines, which can benefit all of humanity.

H2o.ai

H2O.ai is an open source software company that aims to democratize AI at all levels. Its H2O machine learning platform makes state-of-the-art AI algorithms accessible to all. H2O also has its own AutoML platform called H2O Driverless AI that enables data scientists easily create AI models without putting effort on data pre-processing, visualization, feature-engineering, and many other tasks in building AI models that otherwise require considerable expertise.

Google

Google has one of the strongest AI research teams in the world. With most of its products running with AI at its core, Google has set an example of how something as compute intensive as AI can effectively scale to billions of people. Google has a range of software that helps democratize AI end-to-end. Its open-source platform, Tensorflow, is the most popular machine learning framework, and enables developers and data-scientists do everything from quickly prototyping ML models to deploying them to production, all without leaving the Tensorflow ecosystem. Google Cloud, their cloud service platform, offers PaaS and IaaS that are already optimised to work best with Tensorflow models. Google Cloud also offers a whole range of ML services. Its AutoML services allow companies to make use of their pre-trained models for image recognition, speech recognition, and other common tasks without writing a single line of code. The most recent service to join the AutoML family is AutoML Tables that lets companies and enterprises simply upload their datasets and start using an ML model that has been built specifically for them.

Facebook

Facebook uses AI throughout its platform, and has made it what it is today. Accurate search results, image captioning, face detection and friend suggestion - all these features are made possible by extensive research in AI that Facebook invested in. Joining the tech culture to help fellow companies and startups grow with them, Facebook publically shares some of the state-of-the-art research publications in machine learning. From efficient vector search algorithms that scale to billions of records to data visualisation libraries, their open libraries and tools have rendered to be of great value even to developers outside Facebook. Facebook's open source machine learning framework - PyTorch - is rapidly gaining traction among machine learning researchers, as it is easier to debug and experiment.

Microsoft

Microsoft’s Azure Cloud Services has its own offerings for organisations looking to train and deploy their Machine Learning Models. With Azure Machine Learning Studio, Microsoft is making a massive move in democratising AI, letting users build ML models right from their browser with a friendly GUI interface. Azure’s Cognitive Services consist of numerous pre-trained models working together to perform common AI tasks such as sentiment analysis, image and speech recognition, search, recommendation engines, etc. Microsoft also has its own open source deep learning framework called Microsoft Cognitive Toolkit previously known as CNTK. Through Microsoft Research, the tech giant has opened up a lot of its cutting edge AI research to the public. Being a cloud service that many enterprises already use, Azure makes AI adoption as easy as possible.

Amazon

Being a technology company with most products having AI and cloud at its core, and scaling its services to billions of people, Amazon has perfected its cloud service - AWS - over the years to become one of the most popular cloud service among enterprises. Like Google cloud and Azure, AWS provides a range of scalable and flexible services for AI and Machine learning. AWS’s DeepRacer is an innovative product to help developers learn to apply reinforcement learning to train autonomous driving vehicles in simulated environment and then transfer that learning into real world. The market for autonomous vehicles is expected to see massive growth in the near future, and Amazon is pushing the world from its end to proactively make that skill set available.

About the author

S. Arjun is a young entrepreneur, Founder & President of LateraLogics Innovations LLP (www.lateralogics.com), a technology solutions company. He has several awards & recognitions to his credits that include the National Child Award for Exceptional Achievements 2014 for Computer Technology (Govt. of India), Young Innovators Award 2017 from Dr. V. A. Shiva Ayyadurai, the inventor of e-mail, Google Web Rangers Award 2018, Google Code to Learn Contest 2014, MIT App Inventor Bug Finding Contest 2014 (First Prize Winner), and MIT App Inventor App Contest 2013 (First Prize Winner). He was also felicitated jointly by CSI, IEEE CS & IEEE PCS in 2015. He has been featured in numerous regional, national and international magazines and TV programs (including National Geographic Society's Magazine). Arjun is presently pursuing 'B.Tech in CSE (Hons)' at Lovely Professional University. More at www.arjuninventor.com.

Machine Learning via Genetic Algorithm Demystified for Today's Era

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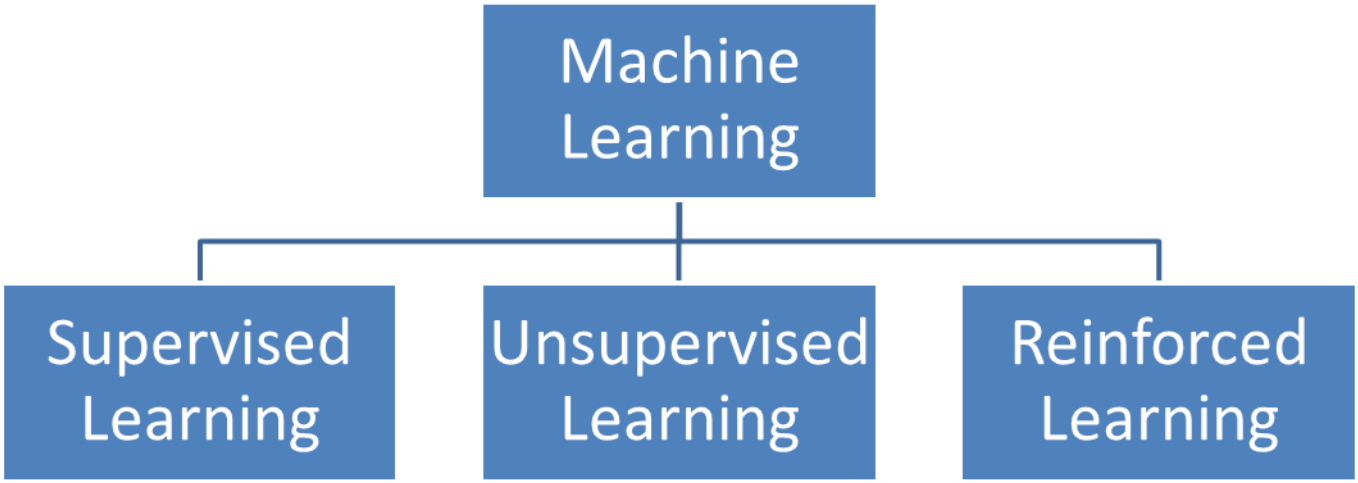
In last couple of years Machine learning and Artificial intelligence is gaining prominence and we keep hearing these terms daily. It offers a great career option today. This promises to solve problems and also benefit companies and individuals by making predictions for helping them make better decisions. The objective of machine learning is to allow the computers learn automatically without human intervention.

There are 3 major learning algorithms to make the computers learn



Supervised Learning: For learning the pattern the data scientist has ground truth ie the expected outcome is always associated with data for learning. The learned network is then compared with the known outcome to check accuracy. These sort of learning is used in handwriting recognition, translation engines etc

Unsupervised Learning: For this sort of learning the data scientist has only specific signature for learning. Usually the network is learned via clustering. User can see applications in recommendation systems like Amazon and Netflix

Reinforced Learning: For reinforcement leaning we choose the learning via actions. The action is associated with a reward. Based on action and reward the network is learned. Typically used for games.

One of the important supervised algorithms is genetic algorithms.

Introduction

A genetic algorithm is a search heuristic that is inspired by Charles Darwin's theory of natural evolution. Genetic algorithm exhibits implicit parallelism and can retain useful redundant information about what is learned from previous searches by its representation in individuals in the population, but GA may lose solutions and substructures due to the disruptive effects of genetic operators and is not easy to regulate GA's convergence.

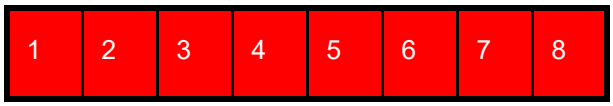
Genetic algorithms, as a member of the board class of evolutionary algorithms, are known as popular methods for global search or optimization. It is well established that it is hard and time consuming for a simple problem to find the best solution in case of complicated search spaces. To solve this problem, the members of population can grow up during their life time. For this purpose, the individuals should look for the best point in a relatively small neighbourhood using local search methods. However, using memetic algorithm has similar problem as side effects. The first one which is considered has the convergence of the population to local optimum points which decreases the efficiency of GA. The Monte Carlo method is combined with GA as a local search and it also diversifies the population when some individuals overlap on a local optimum is done in the past. But it does not perform any parameter optimization for the underlying local search which is another important challenge in memetic algorithm. As it's seen from above discussion GA with local search algorithms doesn't introduce significant difference in efficiency of prediction. However, the efficiency of prediction can be improved by dynamic adaptive techniques. However, another problem arises with cost and computational load when an advanced local search method is used to get a better efficient solution.

Glossary of terms

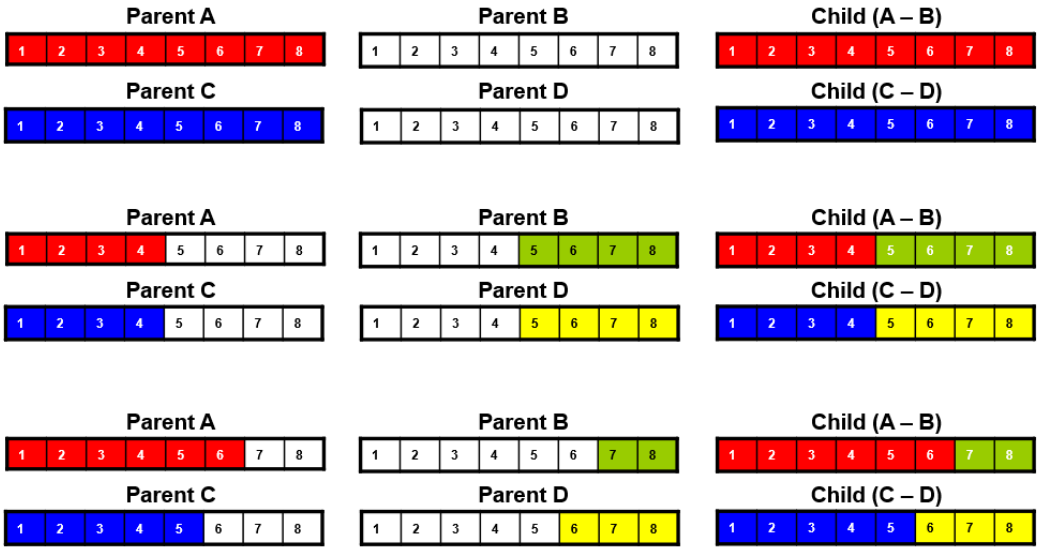
Population: Number of members in the sample space under consideration

Convergence: Tendency of members of the population to be the same.

Chromosome: Normally, in genetic algorithms the bit string which represents the individual as shown below.

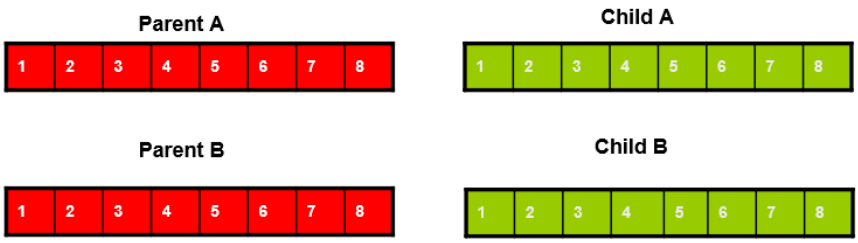


Crossover: Creating a new individual's representation from parts of its parent's representations. Illustration of crossover



Generation: When the children of one population replace their parents in that population.

Mutation: Arbitrary change to representation, often at random. Illustration of mutation



Fitness Function: A process which evaluates a member of a population and gives it a score or fitness.

Termination The algorithm terminates if the population has converged (does not produce offspring which are significantly different from the previous generation).

Most of the times the termination occurs and still we don't reach the optimum. The ML scientist would use Simulated Annealing to reduce the energy of the individuals.

Five phases are considered in a genetic algorithm.
1.Initial population
2.Fitness function
3.Selection
4.Crossover
5.Mutation

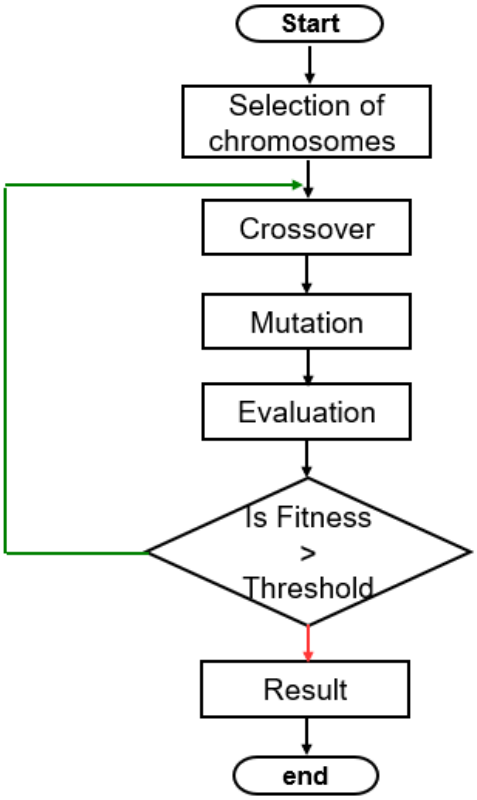


Figure 1 GA basic flow

Description of Genetic Algorithm in nutshell

An initial population is created containing a predefined number of individuals, each represented by a genetic string.

Everyone has an associated fitness measure, typically representing an objective value. The concept that fittest individuals in a population will produce fitter offspring is then implemented to reproduce the next population.

Selected individuals are chosen for reproduction at each generation, with an appropriate mutation factor to randomly modify the genes of an individual, to develop the new population.
The result is another set of individuals based on the original subjects leading to subsequent populations with better individual fitness. Those with lower fitness will get discarded from the population.

When to stop the Genetic Algorithm

This iterative process continues until one of the possible termination criteria is met:

if a known optimal or acceptable solution level is attained
if a maximum number of generations have been performed
if a given number of generations without fitness improvement occur

Basic concepts one must remember while solving Genetic Algorithm

The selection procedure randomly selects individuals of the current population for development of the next generation. The selection is based on the probability factor.

The crossover procedure takes two selected individuals and combines them about a crossover point thereby creating two new individuals.

The mutation procedure randomly modifies the genes of an individual subject to a small mutation factor, introducing further randomness into the population.

The evaluation procedure measures the fitness of each individual solution in the population and assigns it a relative value based on the defining optimization (or search) criteria

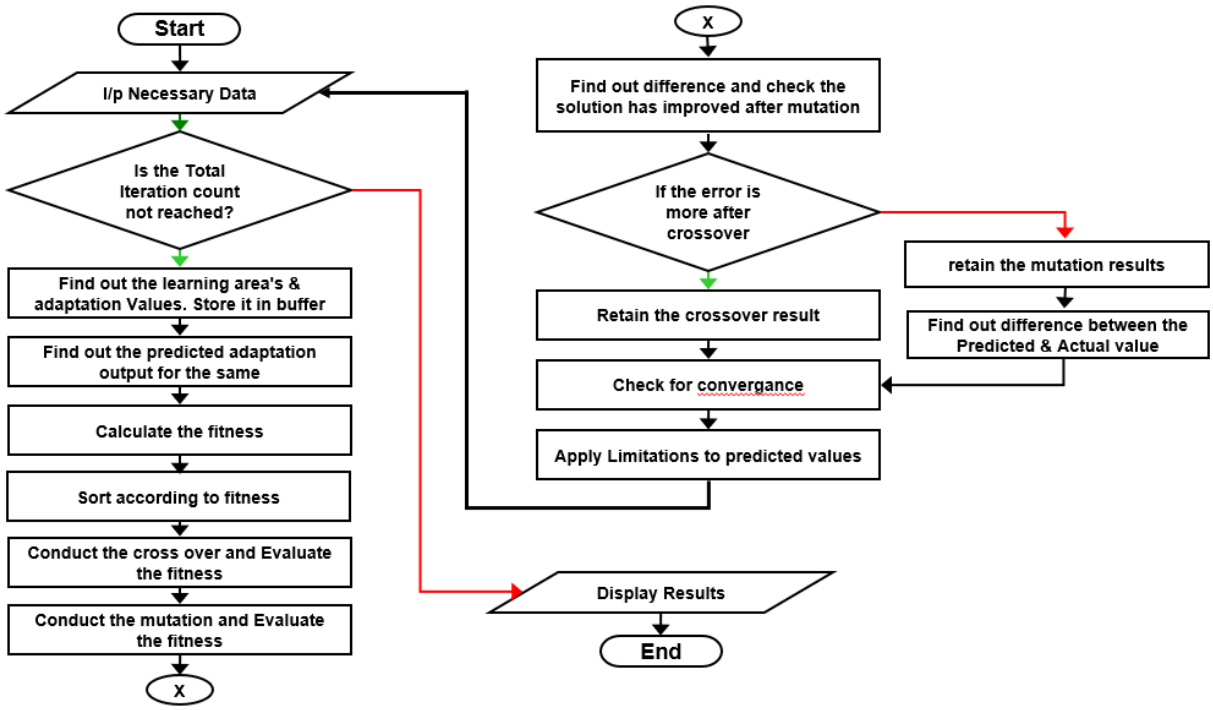


Figure 2: Detailed GA algorithm

GA Tradeoffs

Population size selection is probably the most important parameter, reflecting the size and complexity of the problem.

However, the trade-off between extra computational effort with respect to increased population size is a problem specific decision, as doubling the population size will approximately double the solution time for the same number of generations.

Other parameters include the maximum number of generations to be performed, a crossover probability, a mutation probability, a selection method and possibly an elitist strategy, where the best is retained in the next generation's population.

Advantages of Genetic Algorithm

When minimal region is identified during the search process, the GA method is not efficient, even sometimes impossible, in reaching its minimum. This is because GA is opportunistic not deterministic.

Dynamic adaptive methods are very efficient in this regard and can guarantee a local minimum, but not a global one.

Conclusion:

It requires a large computational time

There is always a tradeoff between the computational time and population.

A drawback of this algorithm is that a solution is "better" only in comparison to other, presently known solutions for solving nonlinear equations. A better solution may be obtained by using adaptive estimators like Kalman Estimators, Neural Networks etc

It can also seen that the error decreases substantially with the increase in mutation probability. But nature does not allow higher mutation probability with maximum probability can be 5%.

It is also seen that the error decreases marginally when there is a crossover. Typically, nature allows up to 90 to 95% of crossover.

References

https://data-flair.training/blogs/

https://towardsdatascience.com/introduction-to-genetic-algorithms-including-example-code-e396e98d8bf3?gi=eb9f41518b34

2008E19407 IN Vivek Venkobarao - Hybridizing Genetic Algorithms with simulated annealing and Dynamic adaptive methods for global optimization – Patent Application published

IEEE Talk Vivek Venkobarao - https://www.youtube.com/watch?v=7EMq4IqjS-k

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Vivek Venkobarao has 13 years' experience in leading Automotive tier 1 supplier in Bangalore India. He has a Ph.D in Electrical Engineering and Certificate(I&E) Stanford University California. Has 20 papers published in International journals and conferences as first author. He is also Co-Author "Handbook of Research on Emerging Technologies for Electrical Power Planning, Analysis, and Optimization" from international publisher. He is also reviewer in various SAE and IEEE conferences. He has 10 patents. His research interests include Control Systems, Mathematical model of real time systems, Neural Networks, Fuzzy logic, Bio Inspired Computing.

The 10 Algorithms Machine Learning Engineers Need to Know

It is no doubt that the sub-field of machine learning / artificial intelligence has increasingly gained more popularity in the past couple of years. As Big Data is the hottest trend in the tech industry at the moment, machine learning is incredibly powerful to make predictions or calculated suggestions based on large amounts of data. Some of the most common examples of machine learning are Netflix's algorithms to make movie suggestions based on movies you have watched in the past or Amazon's algorithms that recommend books based on books you have bought before.

So if you want to learn more about machine learning, how do you start? For me, my first introduction is when I took an Artificial Intelligence class when I was studying abroad in Copenhagen. My lecturer is a full-time Applied Math and CS professor at the Technical University of Denmark, in which his research areas are logic and artificial, focusing primarily on the use of logic to model human-like planning, reasoning and problem solving. The class was a mix of discussion of theory/core concepts and hands-on problem solving. The textbook that we used is one of the AI classics: Peter Norvig's Artificial Intelligence—A Modern Approach, in which we covered major topics including intelligent agents, problem-solving by searching, adversarial search, probability theory, multi-agent systems, social AI, philosophy/ethics/future of AI. At the end of the class, in a team of 3, we implemented simple search-based agents solving transportation tasks in a virtual environment as a programming project.

I have learned a tremendous amount of knowledge thanks to that class, and decided to keep learning about this specialized topic. In the last few weeks, I have been multiple tech talks in San Francisco on deep learning, neural networks, data architecture—and a Machine Learning conference with a lot of well-known professionals in the field. Most importantly, I enrolled in Udacity's Intro to Machine Learning online course in the beginning of June and has just finished it a few days ago. In this post, I want to share some of the most common machine learning algorithms that I learned from the course.

Machine learning algorithms can be divided into 3 broad categories—supervised learning, unsupervised learning, and reinforcement learning.Supervised learning is useful in cases where a property (label) is available for a certain dataset (training set), but is missing and needs to be predicted for other instances. Unsupervised learning is useful in cases where the challenge is to discover implicit relationships in a given unlabeled dataset (items are not pre-assigned). Reinforcement learning falls between these 2 extremes—there is some form of feedback available for each predictive step or action, but no precise label or error message. Since this is an intro class, I didn't learn about reinforcement learning, but I hope that 10 algorithms on supervised and unsupervised learning will be enough to keep you interested.
https://www.kdnuggets.com/2016/08/10-algorithms-machine-learning-engineers.html

Machine Learning Algorithms Tutorial: This Machine Learning Algorithms Tutorial video will help you learn you what is Machine Learning, various Machine Learning problems and the algorithms, key Machine Learning algorithms with simple examples and use cases implemented in Python.
https://www.youtube.com/watch?v=I7NrVwm3apg

Journey from Monolith Application to Microservices

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Traditional monolithic architecture

Any software application has three main components – an user interface, Data access layer and Datastore/database. A monolithic system is one large system that has all the three tightly coupled and deployed together. In a monolithic application, the application logic, user interface, backend tasks/jobs are all in one huge code base. While in certain circumstances monolithic applications are preferred, but there are many problems with them.

Problems with monolithic application

- Tight coupling between the different layers
- Resilience: If one part of the system fails, it could bring down entire system
- Scale: Scale everything even if a particular component needs improvement
- Deployment: Even if there is one-line of change, deploy entire system
- Complex development team structure
- Technology: Adopting newer technologies like programming languages, databases, framework

All the above problems make the software application inflexible for expansion, unscalable for complex applications and blocks continuous development.

What are microservices

At a very high level, microservices can be seen as a way to create independent applications, where applications are broken down into smaller, independent services based on domain and functionality. Each microservice is not dependent upon a specific programming language and hence allows different services to be developed with different technologies that gives best results. This makes each microservice independent and self-contained offering a single functionality in a bigger scheme of the whole application.

Monolithic vs Microservices architecture

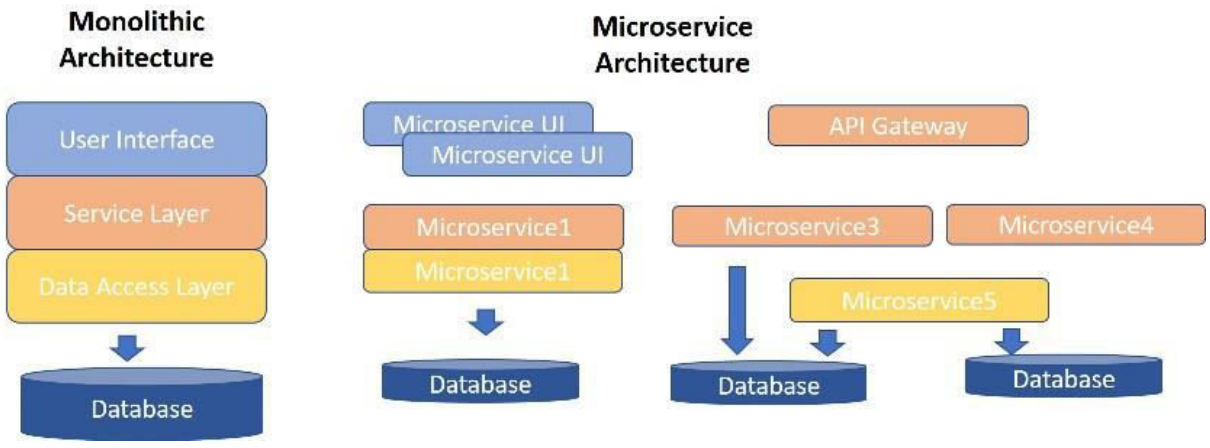

Figure 1Monolith vs Microservices architecture

Benefits with Microservices

Decoupling

Microservices enables us to make different functionalities to be loosely decoupled. Each microservice use their own execution environment but communicate to each other through REST APIs or a Message Bus. Service Discovery helps to search and find the route of communication.

Granular Scaling

Individual services can horizontally scale up or down in seconds and in an auto-scaling manner. Since each service is independent, they can be independently built, modified and scaled without having to scale the whole application. This indirectly improves performance of particular functionalities with minimum investment in resources.

Business continuity and Fault isolation

Microservice architecture is built for isolating failures and respond to outages without hampering the whole system. If there is a partial functionality or defect in one microservice, the rest of functionalities of the application can still continue, thus helping to meet SLA's for most customers.

Composability

One of the key promises of distributed systems and service-oriented architectures is to open up opportunities for reuse of functionality. With microservices, we allow our functionality to be composed and decomposed in different ways for different purposes. Each service can be aggregated using Aggregator pattern (with or without proxy) or chained using Chaining pattern(with or without branching).

Technology Heterogeneity

The composable ability of microservices also provide us flexibility with technology and team structures. It allows us to choose different technology for different services allowing to pick right tool for the job instead of having to select a more standardized one-size fit all approach. This enables faster adoption of newer technologies and autonomous development teams.

Patterns for moving from Monolith to Microservices

Domain Driven Design (DDD)

Before beginning any refactoring, figure out the domains of the application that helps to componentize in terms of business logic.

Large problem domains can be decomposed into sub-domains to manage complexity and to separate the important parts from the rest of the system.

- **Core Domains:** Core Domains must have a fundamental competitive advantage in the system and it should be the reason for the success of the system.
- **Generic Domain:** This is not the core, but the core depends on it. Examples are an e-mail sending service, notification service.

Bounded Contexts

A *bounded context* clarifies, encapsulates, and defines the specific responsibility to the model. It ensures the domain will not be distracted from the outside. Each model must have a context implicitly defined within a sub-domain, and every context defines boundaries.

The idea is that any given domain consists of multiple bounded contexts, and residing within each are things that do not need to be communicated outside as well as things that are shared externally with other bounded contexts. Each bounded context has an explicit interface, where it decides what models to share with other contexts.

Decouple components (Loose coupling)

When services are loosely coupled, a change to one service should not require a change to another. The whole point of a microservice is being able to make a change to one service and deploy it, without needing to change any other part of the system. This is really quite important.

- Create decoupled and independent components for each defined domain
- Each component serves a separate business requirement
- Rewrite new code and retire old code
- Analyze dependency between components
- HTTP REST & Service discovery for communication between microservices for minimal direct communication between services to ensure it has no direct reliability

Minimize dependency back to Monolith

A major benefit of microservices is to have a fast and independent release cycle. Having dependencies to the monolith - data, logic, APIs - couples the service to the monolith's release cycle, prohibiting this benefit.

One should establish some hard and fast rules for the kinds of dependencies that you are prepared to support. If you really cannot avoid referring back to a feature in the monolith do it through a service façade. This can provide an architectural placeholder for a future service implementation or at the very least act as an anti-corruption layer.

Strangler Pattern

The Strangler Pattern is a popular design pattern to incrementally transform your Monolith application into Microservices by replacing a particular functionality with a new service. Once the new functionality is ready – the old component is strangled, the new service is put into use & the old component is decommissioned all together.

You can develop a new component, let both the new and the old component exist for a period of time and finally terminate the old component once the new component is stable.

- Initially all application traffic is routed to the Legacy application.
- Once the new component is built, you can also test your new functionality in parallel by enable for small set of users against the existing monolithic code.
- Both the monolith and the new built component need to be functional for a period of time. Sometimes the transitional phase can last for an extended duration.
- When the new component has been stable, you can get rid of it from legacy monolithic application.

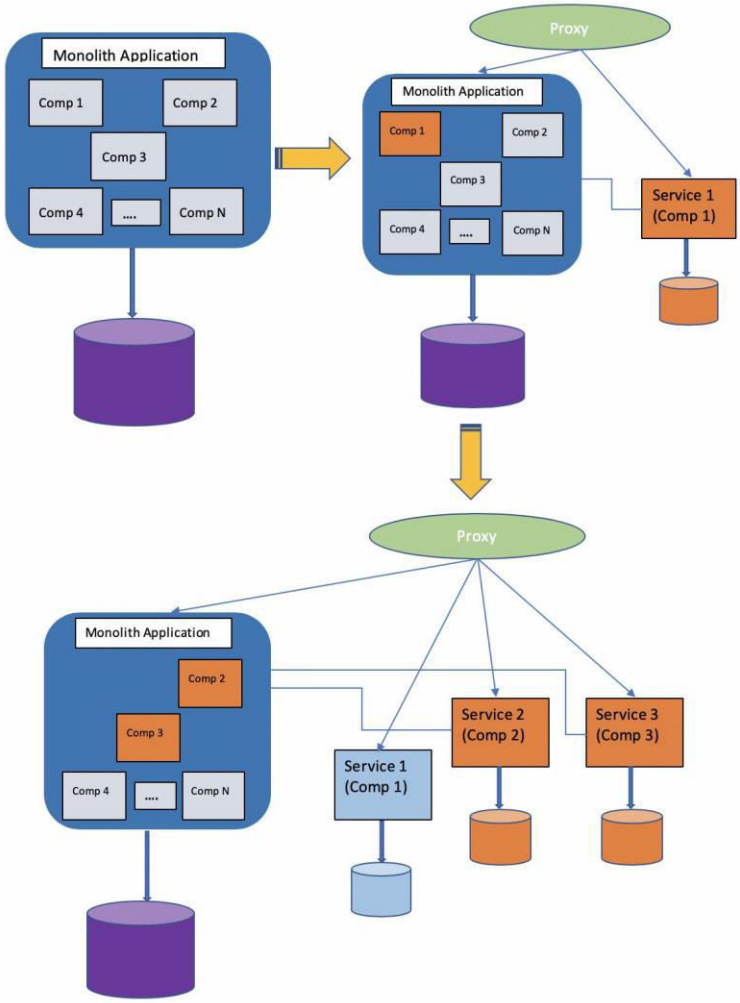

Figure 2: Strangler pattern

Feature Flag

With feature flags, engineering teams can have complete control over their various microservices. First, wrap the microservice with a feature flag, with all traffic going to the old version within the monolith application. Then, release the microservice with the feature flag ON, gradually put whatever traffic you want to the new microservice for only specific set of users, similar to a blue green deployment. Once the new microservice is stable, open up the solution for larger set of users However, feature flags can serve arbitrarily complex (or simple) variations of traffic to the new microservice.

API Gateway and Database per service

When a monolithic application is moved to microservice architecture, the database needs to be designed in such a way that it is forward looking. The best option is to keep the service self-sufficient and ensure it has its own data. This would mean that some parts of the data from the monolithic service needs to be moved. The advantage of this is that the service becomes a self-sufficient unit which can be accessed through

- API gateway - The application composes the whole by calling APIs from different services. Database transaction management can be done by Saga pattern.
- Materialized views using the CQRS pattern

Event publishing

Nearly every microservice needs to publish events when the data is updated. The Event Sourcing pattern provides a way to maintain a queue of events from the feeds that it receives. These feeds can be further aggregated in case a Domain Event model is suitable.

Challenges of Microservices

Monitoring

Breaking the system up into smaller, fine-grained microservices results in multiple benefits. It also adds complexity when it comes to monitoring the system in production. Monitoring an application based on a microservice architecture is different from monitoring a monolithic application

- Multiple servers to monitor with respect to CPU, Memory, health etc
- Multiple logs to sift through to point out where the error occurred
    - To grab our logs and make them available centrally
    - A solution could be to use Logstash or splunk along with Kibana elastic search for viewing logs. Kibana can even generate graphs from the logs you send it, allowing you to see at a glance how many errors have been generated over time
- Multiple places where network latency could cause problems
- Application metrics: These metrics relate specifically to your application. These top-level data are useful for development teams and the organization to understand the functional behavior of the system.
- Platform metrics

Monitoring requirements should be considered from the very beginning of an application's lifecycle. Systems monitoring requires contributions from both development and operations. It's a critical part of the operational support of any distributed system. Microservice architectures are even more distributed than a typical monolithic application. They require more real-time attention and proactive monitoring.

Authentication and Authorization

A common approach to authentication and authorization is to use some sort of single sign-on (SSO) solution. SAML and OpenID Connect both provide capabilities in this area.

Once Authenticated, the user principal will be provide information about all roles and access a user has. Some of the common solutions are:

Common Single Sign-On Implementations

- Identity provider could be an externally hosted system, or something inside your own organization.
- It is common to have your own identity provider, which may be linked to your company's directory service. A directory service could be something like the Lightweight Directory Access Protocol (LDAP) or Active Directory.
- SAML is a SOAP-based standard. OpenID Connect is a standard that has emerged as a specific implementation of OAuth 2.0.

Single Sign-On Gateway

- Each service could decide to handle the redirection to, and handshaking with, the identity provider.
- Gateway to act as a proxy, sitting between your services and the outside world
- The idea is that we can centralize the behavior for redirecting the user and perform the handshake in only one place.

Fine-Grained Authorization

In order to enforce resource protection of who can perform certain transactions or who can access and use specific data over an API channel, the API gateway solution should be complemented and extended with a fine-grained authorization solution. By extending the API Gateway with a dynamic policy based authorization solution, organizations will be able to enforce resource specific access control.

Service-to-Service Authentication and Authorization

Along with authenticating users, you might need to allow other services to interact with your API. While client applications can provide users with a web sign-in prompt to submit their credentials, you need another approach for secure service-to-service communication. Some of the standard methods are

- HTTP(S) Basic Authentication
- Use SAML or OpenID Connect
- Client Certificates
- HMAC Over HTTP
- API Keys

Do you really need microservices?

While microservices help with reducing the cost of application maintenance and time to production, there are cases when monolithic application is more suitable. Monoliths have fewer cross cutting concerns and less initial operational overhead. Since they are tightly coupled, they are easier to test and deploy and could also have advantage in performance. If your project is new and has lot of unknowns or if your project needs a faster time to market, then Monoliths are the way to go.

Prematurely decomposing a system into microservices can be costly, especially if you are new to the domain. In many ways, having an existing codebase you want to decompose into microservices is much easier than trying to go to microservices from the beginning.

All frameworks and patterns have their own pros and cons. We have tried to provide the necessary framework to help you apply the general principles and make a choice on what is best for your organization.

References

- Building Microservices by Sam Newman
- https://microservices.io/
- https://martinfowler.com/articles/microservices.html

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Microservice Architecture | Microservices Tutorial for Beginners

This Edureka's Microservices video at https://www.youtube.com/watch?v=L4aDJtPYI8M gives you detail of Microservices Architecture and how it is different from Monolithic Architecture. You will understand the concepts using a UBER case study. In this video, you will learn the following: 1. Monolithic Architecture; 2. Challenges Of Monolithic Architecture; 3. Microservice Architecture; 4. Microservice Features; and 5. Compare architectures using UBER case-study

Microservices

Microservices are a software development technique—a variant of the service-oriented architecture (SOA) architectural style that structures an application as a collection of loosely coupled services. In a microservices architecture, services are fine-grained and the protocols are lightweight. The benefit of decomposing an application into different smaller services is that it improves modularity. This makes the application easier to understand, develop, test, and become more resilient to architecture erosion. It parallelizes development by enabling small autonomous teams to develop, deploy and scale their respective services independently.It also allows the architecture of an individual service to emerge through continuous refactoring.Microservice-based architectures enable continuous delivery and deployment. http://bit.ly/2WCNFrB

Establishing Community Radio Station in India

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1. BACKGROUND AND OBJECTIVE

The first radio broadcasting in India was started by the Radio Club of Bombay in 1923 followed by Calcutta Radio Club in the same year and the Madras Presidency Radio Club in 1924. They all continued broadcasting service for three to four years and halted due to various difficulties. The Indian Broadcasting Company (IBC) started radio broadcasting in 1927 from Mumbai (then Bombay) and Kolkata (then Calcutta) and after three years IBC went into liquidation. In 1930, the Indian State Broadcasting Service (ISBS) under the Department of Industries and Labour started radio broadcasting and in 1936 the ISBS became All India Radio (AIR) with an objective to provide information, education and entertainment, for promoting the welfare and happiness of the masses by using AM broadcasting service (AM Radio).

The first FM broadcasting service (FM Radio) was started by AIR from Chennai (then Madras) in 1977. AIR was the only radio broadcaster in India till 1993 and AIR started to sell its time slots of FM channel to private parties, thus initiated the path to begin private FM. In 2000, FM spectrum (87 – 108 MHz) were auctioned by Government of India (GoI) to private parties with an objective to open up FM broadcasting for entertainment, education and information dissemination by commercial broadcasters; to make available quality programmes with a localized flavour in terms of content and relevance; to encourage new talent and generate employment opportunities directly and indirectly; and to supplement the services of AIR and promote rapid expansion of the broadcast network in the country for the benefit of the Indian populace. The first private FM radio broadcasting was started by Radio City at Bengaluru (then Bangalore) in 2001.

The Honourable Supreme Court of India delivered a judgement on 9th February 1995 that "The airwaves or frequencies are a public property…" and "The right of free speech and expression includes the right to receive and impart information…" which led GoI to provide permission for starting Community Radio Station (CRS). In 2002, GoI permitted well established educational institutions including IITs/IIMs to setup CRS within their campus with the objective of serving the cause of the community in the service area by involving members of the community in the broadcast of their programmes. Here community means the populace available in the serving area i.e., 10 km radius around the institution.

The first community radio broadcasting was started by Anna University, Chennai in 2004 at its Guindy campus. In 2006, GoI permitted non-governmental organizations also to establish CRS in their area of service and in 2014, GoI permitted State Agriculture Universities (SAUs), ICAR institutions and Krishi Vigyan Kendras (KVKs) to establish CRS.

The major difference in the content of private FM radio and CRS is that private FM radios transmit mostly film based entertainment programmes produced by professionals, but CRS transmit programmes mostly on development issues concerning the requirement of the community it addresses and also the programmes are made with the participation of the community. The CRS is expected to cover a range of 5-10 km radius with Effective Radiated Power (ERP) of 100 watts and the tower height between 15 to 30 meters.

2. ELIGIBILITY CRITERIA

An organisation desirous of operating a CRS must be able to satisfy and adhere to the following principles:

i. It should be explicitly constituted as a 'non-profit' organisation and should have a proven record of at least three years of service to the local community.
ii. The CRS to be operated by it should be designed to serve a specific well-defined local community.
iii. It should have an ownership and management structure that is reflective of the community that the CRS seeks to serve.
iv. Programmes for broadcast should be relevant to the educational, developmental, social and cultural needs of the community.
v. It must be a Legal Entity i.e. it should be registered (under the registration of Societies Act or any other such act relevant to the purpose).
vi. Applications of private institutions / organisations may come with the recommendation of district administration. Further, the private institutions / organisations desirous of setting up CRS in Left Wing Extremism (LWE) affected areas / border areas will also provide site security clearance for installation at the proposed geocoordinates from local administration.
vii. NGOs, registered societies and public charitable trusts shall be registered on NITI Aayog's NGO Darpan portal and the applicant shall provide its unique ID along with the application.

Eligible:

The following types of organisations shall be eligible to apply for Community Radio licences:

1. Community based organisations, which satisfy the basic principles listed above. These would include civil society and voluntary organisations, SAUs, ICAR institutions, KVKs, Registered Societies and Autonomous Bodies and Public Charitable Trusts {to be self-certified by trustee(s) that they are not blood relatives/members of family (wife or husband, son or daughter, parents, siblings)} registered under Societies Act or any other such act relevant for the purpose. Registration at the time of application should at least be three years old.
2. Educational institutions.
3. Preference may be accorded to KVKs (run by Government), to enable dissemination of information pertaining to agricultural methods, use of modern technology and practices for enhancement of output, consequently enhancing the income of farmers in line with the mandate of the Government.

Not Eligible:

The following shall not be eligible to run a CRS:

a. Individuals
b. Political Parties and their affiliate organisations [including students, women's, trade unions and such other wings affiliated to these parties.]
c. Organisations operating with a motive to earn profit
d. Organisations expressly banned by the Union and State Governments.

3. PRE-ASSESSMENT

An institution interested to apply for getting CRS license has to first gather information about whether any radio station or defence organisation or aviation is located in 10 km radius (it denotes air distance not road) exists around the institution. If no radio station exists, then the interested institution has to self-assess amongst the community about the need for setting up CRS and the requirements of the targeted community.

This self-assessment shall include the survey questionnaire recommended by the Ministry of Information and Broadcasting (MoIB) (for questionnaire visit https://mib.gov.in/sites/default/files/sur1.pdf). The survey has to be made with more than 1000 community members in order to assess the information such as the community's interest towards reading newspaper, watching TV programmes, listening to radio programmes, their interest towards participation in radio programmes and the problems faced by the community. It will ease to publicize and involve the community in CRS.

4. STEPS INVOLVED IN ESTABLISHING CRS

The eligible organisations and educational institutions desirous of establishing CRS have to obtain license to establish CRS and by purchasing equipment. The MoIB is the nodal point for dealing with the Community Radio (CR) licensing process, a five step procedure have to be followed by applicants desirous of obtaining a licence to set up a CRS.

Step 1: Application for permission for setting up CRS

For submitting the CR application to the MoIB, the applicants are encouraged to submit the application online through https://www.broadcastseva.gov.in by making processing fee of ₹2,500. Sometimes applicants may find difficult in submitting online application, in that case the applicant shall submit the application offline. The offline 'application form for permission to set up a new CRS' is also available at the above said website, the processing fee shall be paid through a demand draft in favour of "Pay and Accounts Officer, Ministry of Information and Broadcasting, New Delhi".

The following documents have to be uploaded in case of online application or to be enclosed along with seven original copies of the offline application,

For educational institutions

i. Recommendation from district administration (in case of private colleges/institutions).
ii. Site security clearance for installation at the proposed geocoordinates from district administration (in case of private colleges/institutions in LWE affected areas / border areas).
iii. Copy of Act under which university/institution has been set up.
(Attested copy of the supporting document to state whether the institution is private or government aided)
iv. Recognition and affiliation certificates of the institution, wherever applicable.

(Attested copy of the supporting document regarding recognition of the institution from central or state government i.e., AICTE/UGC approval, University Affiliation, NAAC approval, NBA approval, Autonomous approval, etc)

v. Copy of the memorandum of association/ bye laws etc of institution/organization running the institution (in case of private colleges/institutions).
vi. Complete balance sheets with auditor's report for previous 3 years.
vii. Profile of the institution.
viii. Copy of the certificate under section 12 A of Income Tax Act or any other document in support of institution being non-profit.
ix. Map of the service area (including Geo-Coordinates (Latitude and Longitude) of the Location where antenna would be placed).
x. Profile of community.
xi. Details of All Governing Body Members of organization in the prescribed format (available in application) along with the bio data of authorised signatory and all governing body members.

For NGO / trust / registered society

i. Recommendation from district administration (in case of private organisations).
ii. Site security clearance for installation at the proposed geocoordinates from district administration (in case of private organisations desirous of setting up CRS in LWE affected areas / border areas).
iii. Copy of the registration certificate.
The registration certificate is issued by the Registrar of Societies or the competent authority for the registration of Society/ Trust/ NGO or organisation.
(If the registration certificate is in languages other than Hindi/English, kindly provide translation in Hindi/English)
iv. Copy of the memorandum of association/ bye laws etc.
(If it is in any other language than Hindi/ English, translation in Hindi/English should also be provided)
v. Complete balance sheets with auditor's report for previous 3 years.
vi. Attested copy of any grant received whose funds are to be utilised for CRS.
vii. Map of service area (including Geo-Coordinates (Latitude and Longitude) of the Location where antenna would be placed).
viii. Profile of organization.
ix. Profile of community.
x. Details of All Governing Body Members of organization in the prescribed format (available in application) along with the bio data of authorised signatory and all governing body members.

For KVK / ICAR institution

i. Recognition Certificate from ICAR.
ii. Profile of the institution (KVK).
iii. Map of the service area (including Geo-Coordinates (Latitude and Longitude) of the Location where antenna would be placed).
iv. Profile of community.
v. Details of All Governing Body Members of organization in the prescribed format (available in application) along with the bio data of authorised signatory and all governing body members.

Map of the service area:

The service area of the CRS is the coverage of broadcasting service of the radio station, usually the service area of a CRS is 10 -15 kilometres (air distance), however, depending on the terrain of the region this reach might differ. The Government approved maps are available at:

i) National Atlas and Thematic Mapping Organisation (NATMO)
Department of Science & Technology (DST), Govt. of India,
Technology Bhawan (Reception Area),
New Mehrauli Road, New Delhi – 110016
Tel - 011-26590227

ii) Survey of India
First Floor, Janpath Barracks 'A',
Behind Tibetan Market,
Janpath, New Delhi – 110001
Tel – 011-23322288

Service area maps can also be obtained from the local offices of the departments mentioned above. If maps from these offices are not available for your area, you can also use a tourist map, but it must have latitude and longitude marked on it by a certified geographer, surveyor or architect.

Profile of the institution / organisation:
Besides the vision and mission that the institution subscribes to, this should, broadly, tell about the members who constitute the organisation's governing body or board, about the history and work of the organisation and the area, the community and people it serves through its work.

Complete balance sheets with auditor's report:
Chartered Accountant audited balance sheets for previous 3 years e.g.: If you are applying in 2019 (before September month), you need to provide balance sheets for financial year 2015-2016, 2016-2017 and 2017-2018. If you are applying in 2019 (after September month), you need to provide balance sheets for financial year 2016-2017, 2017-2018 and 2018-2019.

Profile of community:
The analysis made in pre-assessment about the community residing within 10 Km radius of location of CRS along with the details of members took part in the assessment from community and their problems as separate report.

The applications shall be processed in the following manner:

a. Government Universities, Deemed Universities (central and state), Government Colleges, Government Schools and KVKs (run by Government) will have a single window clearance. No separate clearance shall be necessary. A meeting of Inter-Ministrial Committee shall be convened to consider applications from such organisations. After approval by Secretary, MoIB, Letter of Intent (LOI) shall be issued subject to allocation of frequency by Wireless Planning and Coordination (WPC) Wing.
b. In case of all other applicants, including private educational institutions, LOI shall be issued subject to receiving clearance from Ministries of Home Affairs, Defence & MHRD (in case of private educational institutions) and frequency allocation by WPC wing of Ministry of Communication & IT.

The MoIB shall forward the copies of the application (complete in all respects) to all concerned Ministries (including the Ministries of Defence, Home Affairs, Communications & Information Technology, Civil Aviation, Agriculture and Human Resource Development) for clearance and get their concern. Meanwhile the applicants are called to present their case at a Screening Committee Meeting (SCM) organised by MoIB. The SCM comprises of a group of CR experts from different organisations working in the field of CR. The members of the SCM assess the objectives of the organisation wanting to set up a CRS. The interview process helps them to evaluate the applicant's commitment and capacity to run a CRS, especially to serve the community.

The LOI shall be issued by MoIB to the applicant after getting clearance from all the Ministries concerned and based on the recommendation received from SCM. This whole process may take 3-6 months of time normally.

Step 2: Application for allocation of frequency and SACFA clearance for a CRS

The applicant has to apply for frequency allocation and Standing Advisory Committee on (Radio) Frequency Allocation (SACFA) clearance within one month of the issue of LOI, to the WPC Wing of the Ministry of Communications & Information Technology through online https://www.wpc.dot.gov.in by making processing fee of ₹1,000, which shall be paid through a demand draft in favour of "The Pay & Accounts Officer, Headquarters, Department of Telecommunication" payable at New Delhi.

The WPC website works properly only in Internet Explorer and is not compatible with other browsers. Visit the home page and select 'online filing of application' under SCAFA from the left panel to create new user id and to submit the SACFA application. The organisation details along with technical parameters of the antenna and CRS location have to be provided, while providing the details select "50W (Watts)" as 'transmitter output', "180KF3E" under 'class and bandwidth of emission', "Others" under 'type of equipment to be used' and provide "VHF FM broadcast transmitter" for others, "fixed service" under 'nature of service', and "FM two-way dipole" under 'type of antenna to be used'.

After submitting the SACFA application online, fill in the application for frequency allocation available at http://wpc.dot.gov.in/WriteReadData/userfiles/file/Generallicence.doc and submit two printed copies of SACFA online application, two printed copies of SACFA online acknowledgement, three original copies of frequency allocation application, demand draft, a copy of map of CRS location and a copy of LOI received to The Secretary (SACFA), WPC Wing, Dept. of Telecommunications & IT, Sanchar Bhavan, 20 Ashoka Road, New Delhi – 110001.

After the submission of the application along with all necessary documents, the WPC wing normally take six months to issue SACFA clearance and frequency allocated for transmission.

Step 3: Signing Grant of Permission Agreement (GOPA)

Immediately after the receipt of SACFA clearance and frequency allotment letter, the applicant have to submit a bank guarantee for a sum of ₹25,000 valid for a period of five years in the format available at https://mib.gov.in/sites/default/files/BANKGUARANTEE-NS250707.pdf along with two original copies (signed in all pages) of an agreement called GOPA on ₹100 stamp paper in the format available at https://mib.gov.in/sites/default/files/Revised%20format%20for%20fresh%20GOPA%20%281%29.pdf and a copy of LOI, SACFA clearance and frequency allotment letter to The Deputy Director (CRS), Ministry of Information & Broadcasting, 'A' Wing, Shastri Bhawan, New Delhi – 110 001.

The GOPA agreement contains all the terms and conditions to be followed by the applicant and normally MoIB takes two to five weeks to countersign the GOPA agreement and to return an original copy of GOPA to the applicant.

Step 4: Application for Wireless Operating License (WOL)

Immediately after the receipt of signed GOPA, the applicant has to apply for WOL, the CRS shall be made operational only after the receipt of WOL but CRS can begin its test transmission after the receipt of signed GOPA.

The applicant has to apply for WOL to the WPC Wing of the Ministry of Communications & Information Technology through online https://www.wpc.dot.gov.in by making annual (royalty and license) fee of ₹19,700 (for having one transmitter) or ₹20,200 (for having two transmitters), which shall be paid through a demand draft in favour of "The Pay & Accounts Officer, Headquarters, Department of Telecommunication" payable at New Delhi. It is normally recommended to have two transmitters, one for transmission and another as standby.

Visit the home page and select 'online filing of application' under 'license' from the left panel to submit the license application by using the login credentials created for applying SACFA clearance. After submitting online application, submit a printed copy of online license application along with the self-attested copies of LOI, frequency allotment letter, SACFA clearance, GOPA, copy of equipment invoice of transmitter and copy of dealer possession licence to The Assistant Wireless Advisor, WPC Wing, Dept. of Telecommunications & IT, Sanchar Bhawan, 20, Ashoka Road, New Delhi – 110001.

After the submission of the application along with all necessary documents, the WPC wing normally take two to four weeks to issue WOL for transmission. It is mandatory, that a copy of valid WOL is either pasted or kept within the CRS premises which is easily visible.

Step 5: Procurement and Installation of Equipment

Once receiving SACFA clearance and frequency allotment, the applicant shall start the process of purchasing equipment. It is mandatory to start broadcasting within three months from the signing of GOPA. Apart from the setting up of infrastructure and furniture for CRS, the minimum approximate investment cost upon equipment is 5 lakhs. The applicant is also eligible to get financial assistance from MoIB for the purchase of equipment. The standard technical compliance and application form for seeking financial assistance is available at https://mib.gov.in/sites/default/files/Application_for_Financial_Assistance_under_CRSS_0.pdf, the applicant is eligible to apply only after the receiving of LOI. Normally a radio station is expected to have recording studio, production studio and transmission studio with power backup facilities.

An applicant / organization shall not be granted more than one permission for CRS operations at one or more places. However, Central / State Universities, including autonomous bodies and Agricultural Universities set up under them, having more than one campus, may be allowed to operate CRS at more than one place, provided, the distance between two CR Stations established by same organization should not be less than 25 Kms.

Universities, Deemed Universities, Agricultural Universities & KVKs, Educational Institutions, and also branch campus, if any, shall be permitted to locate the transmitter and antenna within the geographical area of the community they seek to serve. The geographical area (including the names of villages / institutions etc.) should be clearly spelt out along with the location of the transmitter and antenna in the application form.

5. CONTENT PRODUCTION AND BROADCASTING

The CRS is allowed to produce content to match its objective as mentioned earlier and its motto "Voice of/to/for the voiceless". The content should be relevant to the community (their interest and needs) it serves and the importance should

be on developmental, agricultural, health, educational, environmental, social welfare, community development and cultural programmes. One CR can broadcast programmes of other CR's and AIR with permission, but 50% of the CR's programmes broadcasted should be generated with its community's participation and in local language of the community.

The CRS shall guarantee that its programmes does not include the following,

- Offends against good taste or decency;
- Contains criticism of friendly countries;
- Contains attack on religions or communities or visuals or words contemptuous of religious groups or which either promote or result in promoting communal discontent or disharmony;
- Contains anything obscene, defamatory, deliberate, false and suggestive innuendoes and half truths;
- Is likely to encourage or incite violence or contains anything against maintenance of law and order or which promote-anti-national attitudes;
- Contains anything amounting to contempt of court or anything affecting the integrity of the Nation;
- Contains aspersions against the dignity of the President/Vice President and the Judiciary;
- Criticises, maligns or slanders any individual in person or certain groups, segments of social, public and moral life of the country;
- Encourages superstition or blind belief;
- Denigrates women;
- Denigrates children.
- May present/depict/suggest as desirable the use of drugs including alcohol, narcotics and tobacco or may stereotype, incite, vilify or perpetuate hatred against or attempt to demean any person or group on the basis of ethnicity, nationality, race, gender, sexual preference, religion, age or physical or mental disability.

The CRS shall take care its broadcasting contents with respect to religions and avoid exploitation of religious susceptibilities and committing offence to the religious views and beliefs of those belonging to a particular religion or religious denomination.

Unlike other radio's CRS is not permitted to broadcast news, current affairs and political information. However, CRS can broadcast news and current affairs contents sourced exclusively from AIR in its original form or translated into the local language/dialect. AIR shall source its news to CRS without any charges. It will be the responsibility of the CRS permission holder to ensure that the news is not distorted or edited during translation.

The broadcast pertaining to the following categories will be treated as non-news and current affairs broadcast and will therefore be permissible:

- Information pertaining to sporting events excluding live coverage. However live commentaries of sporting events of local nature may be permissible
- Information pertaining to Traffic and Weather
- Information pertaining to and coverage of local cultural events, festivals
- coverage of topics pertaining to examinations, results, admissions, career counseling
- Availability of employment opportunities
- Public announcements pertaining to civic amenities like electricity, water supply, natural calamities, health alerts etc. as provided by the local administration

In addition, CRS shall adhere to the delivery of the programme and advertising code of AIR which shall be monitored at different levels (details are available at https://mib.gov.in/sites/default/files/Monitoring%20Committees.pdf).

6. ADVANTAGES

CRS are non-commercial, so they are underwritten by local organizations, providing an outlet for those organizations to spread their message. For example, the local health department may underwrite public affairs programming and bring awareness to the public of the services they can provide. In India, most of the CRS are providing information on local engagements, power failures, water supply, local administration office announcement and recently CRS play a major role during natural calamities.

CRS can train people in radio for free and offer them vital broadcast experience and how to be a radio DJ, a radio reporter, a studio tech op and a programme controller. It can provide local musicians with valuable on air time and also promote local music.

CRS in educational institutions can change life of students as it develops verbal communication skills, teaches customer service skills, gives problem solving experience, teaches an appreciation for community issues, gives huge responsibility,

introduces to creativity in programmes and organising community events, provides better local image, improves multi-tasking and multi-talent, self-management and better access to your community.

The actual use of CRS is for the upliftment of the community by creating awareness and building self confidence among the community through its radio programmes and local events. The operational CRS are experimenting in content development, programming, community involvement and sustainability. They have succeeded in providing skill development training to community women for starting their own small enterprises, creating identity to the folk artists, train the community to develop and broadcast programmes, utilising the community to increase community participation and taking ownership in radio programmes, providing internship at CRS and more.

Apart from the above, CRS can empanel itself with the Directorate of Advertising and Visual Publicity and receive paid advertisements (details are available at http://www.davp.nic.in/writereaddata/announce/cm_g_rate_card.pdf) and also CRS is entitled to receive funding from the Department of Science & Technology, the United Nations Educational, Scientific and Cultural Organization, Agricultural Department, Local District Administration and few others for organising local events to create awareness and for broadcasting advertisements. In addition, CRS can attract local advertisements for generating revenue.

Transmission of sponsored programmes shall not be permitted except programmes sponsored by Central & State Governments and other organisations to broadcast public interest information. In addition, limited advertising and announcements relating to local events, local businesses and services and employment opportunities shall be allowed. The maximum duration of such limited advertising will be restricted to 5 (five) minutes per hour of broadcast.

7. LIST OF CRS IN INDIA

The MoIB is constantly receiving applications to setup CRS as on 30-11-2018, MoIB has rejected 1163 applications, issued LOI to 583 organisations out of which 321 organisations have signed GOPA and as on 23-08-2018, 238 organisations (list at https://mib.gov.in/sites/default/files/List%20of%20238%20Operational%20CRS%20as%20on%2023.08.18.pdf) have established CRS and as on 25-09-2018, 9 CRS have obtained financial assistances from MoIB.

It is wise to visit at least three nearby operational CRS to know more about equipment, infrastructure, facilities, source of income and their activities towards encouraging the community participation.

8. REFERENCES

[1] Policy Guidelines for setting up Community Radio Stations in India, Ministry of Information and Broadcasting, Government of India 2006.
[2] Amendment of Policy Guidelines for setting up Community Radio Stations in India, Ministry of Information and Broadcasting, Government of India 2017.
[3] Amendment of Policy Guidelines for setting up Community Radio Stations in India, Ministry of Information and Broadcasting, Government of India 2018.
[4] Community Radio Handbook, The United Nations Educational, Scientific and Cultural Organization 2001.
[5] Consultation Paper on Issues related to Community Radio Stations, Telecom Regulatory Authority of India 2014.
[6] https://www.broadcastseva.gov.in
[7] https://www.wpc.dot.gov.in
[8] https://mib.gov.in
[9] http://prasarbharati.gov.in

About the author

Mr. G. K. Jakir Hussain received his bachelor's degree in ECE from Bharathiar University, Coimbatore in 2004 and master's degree in Wireless Communication from Karpagam University, Coimbatore in 2013. Since July 2017, he his working as an Assistant Professor (Selection Grade) in the Dept. of ECE at KPR Institute of Engineering and Technology, Coimbatore. He served as an Assistant Professor in the Dept. of ECE at SSM College of Engineering, Komarapalayam from July 2005 to June 2017 and also as the station manager at SSM Community Radio Station, Komarapalayam from January 2012 to June 2017. He also served as Executive Committee Member in Community Radio Association India from 2016 to 2018 and Secretary in Tamilnadu and Puducherry State Chapter of Community Radio Station India from 2014 to 2018. He is a licensee of Amateur Wireless Station issued by the Ministry of Communications & Information Technology, Government of India. He has 13+ years of teaching experience and 5+ years of radio broadcasting experience. His research interest includes image processing, signal processing, wireless communication and internet of things.

Glassless 3D Technology
A 3D Solution without glasses - the future of 3D Technology

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Today it's hard to find a person who's never heard about 3D technology. With the popularity of 3D tablets, 3D TV sets, 3D laptops and 3D smartphones on the rise it's no wonder that more and more people are getting interested in the nature of three dimensional technology. 3D vision has started with the invention of stereoscopic 3D concept and has gradually evolved to many modern methods of 3D technology. So if you can tell the difference between anaglyph red cyan, polarized and shutter 3D glasses, you definitely have a clear perception of what 3D is and how it works . Most of us associate 3D technology with the use of special glasses or virtual reality headgear to filter what image each of our eyes sees. But what do we know about 3D without glasses? Is it just a futuristic concept or already a reality?

How 3D without glasses works?

The technology of 3D without glasses is called **auto-stereoscopy**. Because this kind of three dimensional technology doesn't utilize special spectacles or headgear it became also known as **glasses-less 3D** or **glasses free 3D**.

Auto-stereoscopy is a method of displaying stereoscopic images (adding binocular perception of 3D depth) without the use of special headgear or glasses on the part of the viewer. Because headgear is not required, it is also called "glasses-free 3D" or "glasses less 3D".

The visible world around us has three dimensions: **width (X), height (Y) and depth (Z).**

In order to experience depth, we require information from the other two perspectives. Each of our eyes picks up a slightly different image and, thanks to this information, our brain is able to draw conclusions about how far away an object is from us and this allows us to experience 3D with auto-stereoscopy technology.

Glassesless 3D is based on two different approaches of viewing:

eye-tracking and **multiple views**. The **eye-tracking system** was first implemented in autostereoscopic 3D displays by Reinhard Boerner in 1985.

Those 3D displays with eye-tracking employed provided high resolution, but were limited to a single viewer only. That's why eye-tracking approach can't be widely used for consumer products. The alternative concept is **multiple views** technique that has swiftly become the next best thing in the development of glasses-free 3D. This particular approach is based on sending imagery to multiple regions of viewing at once, thus enabling several viewing zones. Today this concept is implemented in the most flat panel displays, because it allows simultaneous viewing for multiple spectators.

The methods of 3D technology without glasses include a parallax barrier, lenticular, volumetric and holographic techniques.

Glasses-less 3D Methods

1) Parallax barrier

This method is widely used in modern **3D liquid crystal displays**. **Parallax barrier** is a special device with a series of precision slits that's placed in front of LCD, serving as a filter for output image perception. The slits allow left and right eye to see their corresponding image, which is produced by a different set of pixels. That's how the illusion of 3D vision is created by parallax barriers. To have a clearer understanding of this method see the image - it should help a lot.

The **examples of parallax barrier** employed in consumer products are Nintendo 3DS game console, HTC EVO 3D and LG Optimus 3D smartphones. Also used in Range Rover's navigation system, the parallax method allows both the driver to view GPS directions and a passenger to watch movies from the same display simultaneously.

However, the parallax method is not perfect, because it has some **disadvantages**. First one is that in order to experience stereoscopic 3D effect the viewer must be positioned at a certain angle to the display. That's actually not a big problem if we're talking about video game consoles or smartphones, but not good when it comes to 3D TV sets, laptops etc. Another constraint is that the count of horizontal pixels that work to create a different image for each eye is limited to one half.

2) Lenticular lens

The second mostly used method of **glasses free 3D** is **lenticular lens** technique. You may have heard about lenticular printing that creates the illusion of depth, haven't you? If not then you should know that an autostereoscopic 3D display with lenticular lenses utilized is actually the same technique as lenticular printing. Generally speaking the **lenticular method** is based on the use of **magnifying lenses**. Those lenses are set in arrays to produce slightly different images when viewed from different angles. They are also constructed in such way that when you see the image from one angle and then move to another angle the image changes as well and even moves (see the image).

The technique of lenticular lenses as a method of receiving a glasses-free 3D image is executed in Nintendo 3DS and **iPhone** and **iPod touch** in the form of third-party hardware overlay & screens.

Lenticular lens Work method

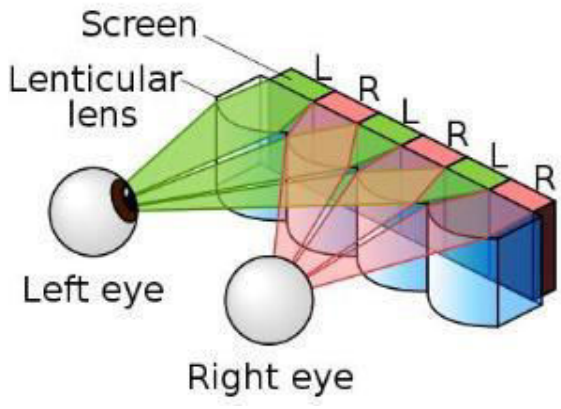

Image – 2a

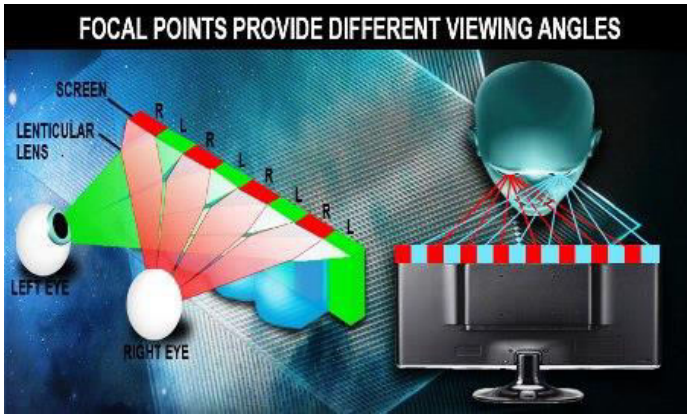

Image – 2b

3) Volumetric displays

Another type of **autostereoscopic 3D** is a **volumetric display**. This method relates to the construction of three dimensional images by means of various physical mechanisms. Volumetric displays use **light fields** to reconstruct 3D object in the volume of space. The created 3D images are thus measured in **voxels** (volumetric pixels) and can be seen with the unaided eye. A good example of volumetric imaging devices are 3D displays used for **tomography** (see the image below).

The main advantage of volumetric displays is that they allow **automultiscopic** (autostereoscopic multiple viewing) 3D experience.

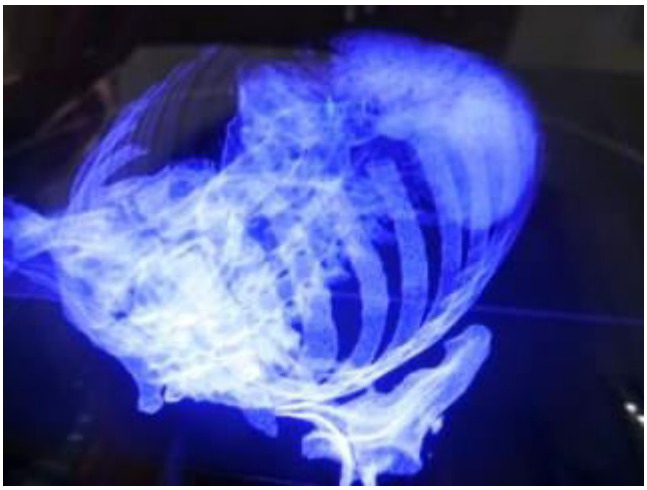

Image – Va1

Image – Va2

4) Holographic displays

The method of **holography** is based on reconstructing **3D objects** using **light recording**. A hologram is created when an interference of several electromagnetic waves with equal frequencies occurs. During a hologram recording two electromagnetic waves intersect: the main wave is emanated from the source while the second one is reflected from the object that's being recorded. A pattern of such interference leaves an imprint on some recording medium (photographic plate or other) placed in the interference area.

Holography today is used in modern holographic displays with **lasers** being the main light source. Lasers are utilized mainly because they are powerful light beams and have a fixed wavelength. The spreading of holographic 3D displays is wide in the artistic field; usually this process is combined with music and computer graphics.

The recent most notable **artistic use of holographic display** took place on April 15th earlier this year at 2012 Coachella Valley Music & Arts Festival.

The Tupac Hologram: The Act that Kick started the Hologram Trend

Image -- Th1

Image – Th2

There a hologram of deceased famous rapper Tupac Shakur was projected on the stage, giving a lifelike 3D music performance, soon many artists and groups recreated Holograms of Michel Jackson and other Artist in Musical concerts.

It's important to note that 3d technology without glasses isn't new; it has been used in a limited way with televisions. What is new with this research is its potential application to the film industry along with improvements in picture quality.

Market experts have stressed that "it remains to be seen whether the approach is financially feasible enough to scale up to a full-blown theatre", but went on to say "we are optimistic that this is an important next step in developing glasses-free 3D for large spaces like movie theatres and auditoriums."

It could take a while for the technology to get to a stage where it can be used in multiplexes, and the market may need convincing to adopt something which is expected to cost a lot of money. It could prove to be attractive to the advertising industry who may want to use it for billboards, allowing the technology to be introduced at incrementally larger stages.

The thought of seeing James Cameron's next Avatar instalment or the latest high-octane thriller played out in 3D without glasses could push the technology forward and get people to return in droves to the silver screen.

With the constant development of 3D technology and the new inventions of our technological age the 3D glasses as we know them will soon become a thing of the past. So whether you are a fan of 3D or not you simply can't deny that 3D without glasses is the future of 3D vision. When it becomes a common practice and employed in the most devices all the last doubts will fall away.

About the author

Mr. M. Venkatesan is a Media Technology Consultant & Entrepreneur. He heads the technology company, Sai Media Productions (www.saiproductionsindia.com) engaged in IT, Film Production Technology & Ad Media Industry projects in India & Canada. A professionally qualified person with D.F.M & PGD. D.F.Tech, and BSc-IT, he has represented India in various international forums and technology events and film festivals.

As an active technologist, writer & global entrepreneur and a key south Indian filmmaker in the Indo-Canadian international delegation to Canada, he has contributed and participated for the landmark Indo-Canadian Co-Production Pact "Audio-Visual Co-Production Treaty" signed between India and Canada, at Toronto in Sep 2015.

Currently he is engaged as Project Consultant & Designer and Media Producer across various international studios and agencies in India, Canada, USA and Europe. His current projects and research involves 3D Filmmaking & Auto-Stereoscopic 3D with Live Art & Media Campaigns in 3D, Auto-3D , AR/VR & Mixed Media.

His company, Sai Media Productions is involved in consulting, technology & creative services, production & propagation, implementation of new media technologies & film making in India and Canada with a strong technical team operating from Chennai, Mumbai, Bangalore and Toronto.

A guide to 3D display technology: its principles, methods, and dangers

Whether you buy into the hype or not, it's plain fact that 3D is everywhere these days. From movies and games to laptops and handhelds, pretty much every screen in the house is going to be 3D-capable in a year or so, even if you opt not to display any 3D content on it. Those of you who choose that path may stop reading now, and come back a little later when you change your mind. Because if you have kids or enjoy movies and games, there will be a point where you're convinced, perhaps by a single standout piece of media, that 3D is worth it at least some of the time. https://tcrn.ch/2X7b83H

Space FPGA Mitigation Effects, Challenges and Trends

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Space provides a challenge environment for FPGAs. Some space-grade FPGAs have been hardened-by-process. They are fabricated using a CMOS silicon-o- -insulator process, or use an epitaxial layer to protect against radiation-induced latch-up. FPGAs allows partial read back and configuration .It facilitates efficient repair of configuration memory. Bit-flipping is done in the memory elements, the configuration logic itself is vulnerable to radiation not just the data is the common fault caused by radiation.

Radiation Environment

Radiation environment comprises of beam interactions, residual gas interactions and Beam losses.Single Event Effects are produced by heavy ion striking a transistor and creating charge along its path. In the Single Event Upset (SEU), State change, due to the charges collected by the circuit sensitive node, if higher than the critical charge. For each device there is a critical LET.But in the Single Event Functional Interrupt (SEFI), Special SEU, which affects one specific part of the device and causes the malfunctioning of the whole device. In Single Event Latch-up, Parasitic PNPN structure gets triggered, and creates short between power lines and in Single Event Gate Rupture (SEGR), destruction of the gate oxide in the presence of a high electric field during radiation.

Figure 1. Environment

Single Event Effect induced upsets

Single Event Effect induced upsets in the Xilinx SRAM based FPGAs can be divided into three categories such as configuration upsets, functional upsets in user logic, and architectural upset. Configuration upsets occurs in the configuration memory and can be detected by read back of the programmed configuration memory. There are normally more than a million configuration bits stored and the cross-section per bit for heavy ions and protons is low. For SEU detection, the readback function is an efficient means. Particle penetrates the susceptible portion of a configuration memory cell .It alters its state, a readback and verification of the configuration data will detect the upset. To perform verification, the configuration data is readback from the device and compared to the configuration memory bitstream. Programmable nature of the FPGA presents a new sensitivity due to the configuration memory bitstream. As the bitstream is downloaded to the device, the functionality is determined. The changing of this data which changes the design's function. The user logic which contains elements those are not directly testable for upset through the configuration memory bit stream. The elements are block memory, logic-block flip-flops and I/O flip-flops. Observability is limited unless the user design can capture an event. Architectural upsets occur in the control elements of the FPGA SEUs in these elements are often only detectable indirectly by observing an upset signature and associating it with a control element function. This type of upset is also referenced as Single Event Functional Interrupts.Half-latch which generate many of the constant "0" and "1" values used by Xilinx designs, are susceptible to SEUs. During upset, the output values of these circuits will remain inverted until the device is fully reprogrammed. They are used across the device to drive constants. Partial configuration cannot restore the original state. Latch can recover due to the leakage of the pull-up transistor, after several seconds. Mitigation requires the removal of the half-latches. Full configuration can refresh everything. SET mitigation is achieved due to increased area and power consumption of the final circuit implementation. For the latest, deep-submicron FPGAs, although CMOS scaling has helped to overcome these disadvantages, increased logic density and lower operating voltages have reduced the critical charge necessary to generate an SET. Hardening-by-process provide SET mitigation by limiting the amount of charge that can be collected at sensitive logic nodes preventing the formation of pulses. SET filter uses a chain of inverters.It is used to

delay the signal along one path and a guard-gate to pass only those transients with widths exceeding the delay. The designer has to balance electrical performance with radiation hardness: the wider the pulse, the lower the maximum frequency of operation.

Typical Work flow

We needs to make sure that we understand the requirements and the Simulation of the environment is essential. We try to select the components/technologies and pay attention to the requirements, test the components and find some information about the selected components. We needs to try to assess the risk.SEU may not be critical, or it can be catastrophic.

- Environment simulation
- Component testing
- Mitigation
- Verification

Selection of Space grade FPGA

There are sufficient logic resources to meet the mission's processing needs, unit cost, legacy of use, the suitability of the package, its size and pin pitch, ease of assembly onto a PCB and the qualification of the mounting to withstand shock and vibration, prototyping options, the number of supply rails, the design of the power-distribution architecture, the number and type of I/O and the configuration architecture. .

Challenges for FPGA in Space

Space FPGAs need to be able to deal with the aspects of harsh environment conditions. These devices must survive the high mechanical and acoustic vibration during the rocket launch, and withstand high temperature ranges due to the vacuum in space, in which industry or military temperature grade devices, using appropriate packaging technology, are able to work safely.There are multiple parameters that determine what makes one group of techniques more or less suitable in each case.

- We need to define the radiation environment that can affect your IC.
- We needs to define the reliability targets
- We needs to identify the candidate IC technologies or existing parts and collect data on their sensitivity to TID and SEE.
- We need to identify and quantify all the effects of mitigation techniques which can be introduced at the various levels.
- We need to choose the best compromise of mitigation that allows meeting the reliability targets while also respecting the rest of the requirements. In doing this, the expected levels of final fault tolerance are estimated by analysis.
- Once implemented, validate the selected approach by fault-injection and/or radiation testing.

Three rad-hard device families are NG-MEDIUM, NG-LARGE, and NG-ULTRA, with increasing fabric size and number of logic resources. A combination of radiation hardening by process, layout, architecture (EDAC), and circuit design , together with a background scrubber to preserve the integrity of the internal configuration, are used to provide a rad-hard fabric.

Challenges of Mitigation

SEU mitigation has become more challenging as increased logic densities require less overall charge to disrupt sensitive locations. Some space-grade FPGAs have been hardened-by-process, fabricated using a CMOS silicon-o- -insulator process, or use an epitaxial layer to protect against radiation-induced latch-up. There are mitigation techniques such as SM encoding, memory protection, reconfiguration, TRM etc.Flash-based FPGAs are non-volatile devices. They can be re-programmed in-orbit..

An SET is the voltage pulse resulting from the charge deposited by an ionizing particle passing through a sensitive area of a circuit. Each SET has an unique shape, polarity, amplitude and duration which is dependent on the location and energy of the impact, device biasing and output loading conditions. SETs can propagate in the asynchronous, combinatorial logic .They are found within FPGAs and subsequently be clocked by a flip-flop becoming an SEU.Logical masking occurs when an SET generated by a particle is not propagated to an output due the logic value on the input of a gate. Electrical masking occurs when an SET is attenuated because of the capacitive loading as it propagates along the signal path until it is no longer able to affect the output of a circuit .Temporal masking occurs if an SET reaches a memory element at an instant other than the triggering window's setup and hold requirements. Hardware redundancy duplicates or triplicates the combinational and/or sequential logic with the final output being a final decision.

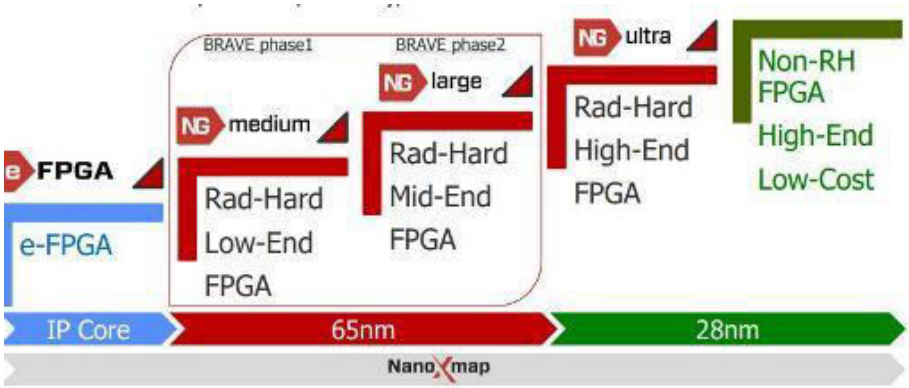

Figure 2. From eFPGA to BRAVE & beyond

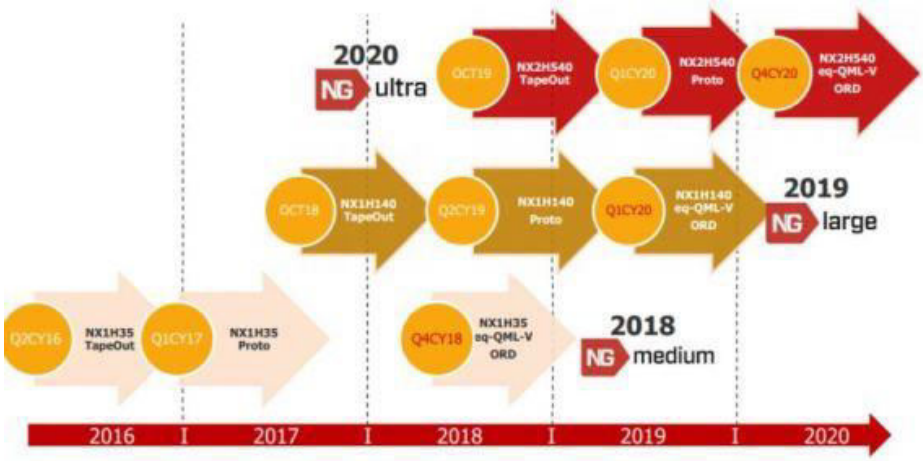

Figure 3-1. FPGA Schedule

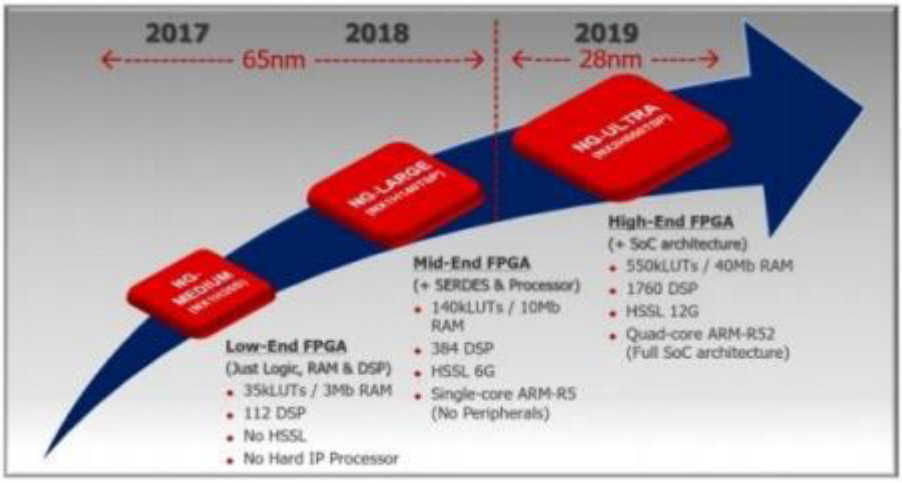

Figure 3-2. FPGA Schedule

About the author

Mr. V. P. Sampath works as a consultant that develops hardware/software co-design tools. Among his publications are technical articles and papers on FPGA and Embedded systems and methods as well as textbooks. He is an active Senior Member of IEEE and Member of Institution of Engineers. He is a mentor for the semiconductor industries. He has a passion to build India as a super power. He is currently a patron for Semiconductor Federation of India.

Electric Vehicles for India: Overview and Challenges

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Abstract

The global pollution is on rise and every effort made, being to reduce the CO2 emissions and save the planet. One such effort is the introduction of Electric Vehicles (EV). The transport sector is one of the biggest emitter of CO2 and hence it is very important to convert the sector to a green sector. Indian government has come up with ambitious plans of introducing the EVs to Indian market and keep in pace with the development of EVs globally. The National Electric Mobility Mission Plan 2020 (NEMMP 2020) has come with a detailed report on the EVs.

1. Charging Infrastructure

At present, India needs to provide adequate charging infrastructure to boost the adoption of EVs by Indian customers. The lack of charging infrastructure will put the customers under range anxiety, as the vehicle may not run long without charging infrastructure at regular intervals on the roadways. Charging infrastructure classified into following:

1.1 Home Charging:

This is the most common type of charging. The customer needs to have a 230V/15 A single phase supply in order to charge the EVs. They can deliver a maximum of 2.5 KW. The charging process takes time and it is expect that the customers will charge the EVs at night. The metering is connect directly with home metering and hence there is no separate billing for it. However, there may be soon a policy emerge to regulate the home charging also with separate metering and guidelines for builders to mandatorily include EV charging stations in flats and apartments.

1.2 Public Charging:

Public charging maintained by the government or its any of delegated bodies. Public places such as parking lots, malls, offices may be target to offer public charging. They are meter separately.

a) AC Charging: AC charging can be a slow or fast charging. They will employ a power converter to convert the ac power into dc power to charge the batteries. The slow charging will charge at 2.5 kW to 3 kW while fast charging will charge at the rate of 7.7 kW to 22 kW. The IEC 60309 Industrial Blue connector prescribed as the Bharat EV standard to be use in AC charging.

b) DC Charging: In this method, the output of the charging port directly provides high current DC power to directly fed to the batteries. The charging rates are very high upto 50 kW. The voltage rating of them is 48V/72V. DC fast charging infrastructure is very important for buses and cabs, which usually travel long distances. The connector recommended is GB/T connector standard.

2 Research and Development in Electric Vehicles

2.1 Battery Cell:

The battery cell forms the basic unit of the battery pack that is employed in the EVs. The battery cells together constitute a module and several such modules collectively form a battery pack. The batteries form the major cost in EVs. Their cost is nearly half of the cost of EVs. Hence, if the cost of batteries brought down, then cost of EVs will come down. The prices of electrodes and electrolytes needs to bring down to affordable prices. The research on battery cell involves increased thermal protection, higher power density, increasing the lifespan and coming with lightweight materials.

There are various battery technologies available for EVs. They are summarize as follows:

a) Lead-acid Battery: These batteries employ lead oxide as positive active material; spongy lead as negative active element and sulphuric acid used as the electrolyte medium. The advantaged of lead-acid batteries are that are very commonly available and cost very less. The technology has been around fifty years and has matured now. The disadvantages are that they have a limited life cycle and low power density. They also weigh heavier.

b) Nickel-Metal Hydride Battery: These batteries carry nickel hydroxide as positive electrode and titanium or nickel as negative electrode. The electrolyte solution is alkaline solutions. These batteries are resistant to wide temperature changes and their life cycle are long. They are also recyclable. However, they suffer from lower charge-discharge cycles.

c) Lithium ion (Li-on) Battery: Currently the lithium ion (Li-on) batteries developed for running the EVs. There are three main variants of Li-on batteries. They are

i) NMC (Lithium Manganese Cobalt Oxide)

These batteries employ graphite as anode. NMC batteries very commonly used because of less cost. The other features of the battery is that they carry the highest specific energy and they are lightweight. This gives a significant edge over other variants. The disadvantage with these batteries are that they cannot be charged very fast (less than an hour) and typically requires 6 hours of charging time for normal usage of EVs. They also cannot exposed to ambient temperature of 40 degrees or above. These batteries carry 80% DoD and last up to 2500 charge-discharge cycles. The normal discharge rate of battery is 2 hours.

ii) LTO (Lithium Titanate)

The LTO batteries can address the disadvantages of NMC batteries. These batteries can be charged fast (less than 30 minutes) and they are resistant to high ambient temperatures of 45 deg. They also can last up to 10000 charge-discharge cycles and hence they seem to be a very attractive. However, the downside of the LTO batteries are that that specific energy is lesser than NMC and they weigh more. However, there cost that is the main disadvantage. They cost around 3 to 4 time higher than NMC.

iii) LFP (Lithium Phospate)

The LFP batteries occupy an intermediate position between the NMC and LTO batteries. Compared to NMC batteries, there are more temperature tolerant, but lesser than LTO. They can also charge and discharge faster.

India's approach towards battery cell should be a collaborative research with the global players and not entirely on its own. Many countries such US, Japan, China, Korea have advanced battery technologies and hence it will be wiser for India to collaborate with them. This can be done by many ways. One way is to let the global players invest their infrastructure in India. This will help the country in gaining the needed much knowledge in battery technology. Another way is to let the OEMs (Original Equipment Manufacturers) and national labs to collaborate with global players. In either way, the need for India is to scale up the battery manufacturing on quantity scale.

3. Battery Management System:

Battery Management System (BMS) is the electronics that deals with binding the cells of a battery pack together and constantly monitoring the status of each cell. The temperature of each cell, charge-discharge status, short circuit protection carried out by BMS. The BMS leads to efficient use of the battery pack. The BMS is highly dependent on local weather conditions and hence it is very important of India to develop their own BMS rather than outsourcing them. An indigenous BMS will keep in pace with the cost affordability of Indian Customers. An EV suitable for EU nations may not be suitable for Indian conditions because of the differences in the weather conditions. In this case, the BMS plays the key role to make the EV suitable for Indian weather conditions.

3.1 Power Electronics:

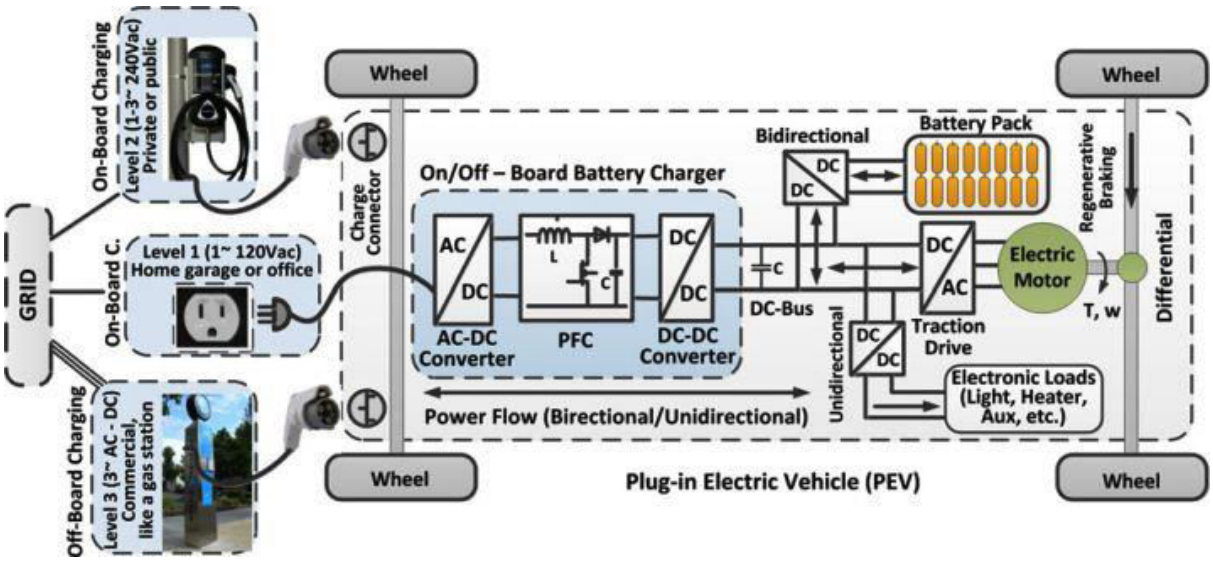

Figure 1: Power Electronics employed in a EV [2].

Power electronics takes care of the various power conversion process from the plug to wheel. The various power electronics converters employed in EVs are

a) AC-DC converter: The EVs conventionally charged from an ac outlet. However, but the batteries charge only with dc power. Hence, the AC-DC converter helps in converting the ac power to dc power, not only batteries, dc power is required by many electronics loads such as lights, heater within the EVs and hence it is a big network of power.

b) DC-DC converter: The dc power from the AC-DC converter is often variable and fluctuating. Hence, it is necessary to make the dc power constant and stable. In a DC-DC converter, it is important to provide the isolation between input and output. This makes sure that the power electronics converter are safe from any reverse flow of current.

c) DC-AC converter: The ac power is necessary to drive the electric motors in EVs. Hence, another DC-AC converter is necessary to convert the dc power from DC-DC converter to ac power. The ac power could be single-phase or three-phase depending upon the type of motor used.

d) AC-AC converter: This converter used for the purposes of changing the frequency of ac power. The electric motors when required to operate with variable speed based on frequency could employ this converter

There are wide areas of research in power electronics for use in EVs. The converters need to be compact and occupy very less space. This helps in providing more interior spacing within the vehicle; the converters also need to be lightweight. A heavier converter burdens the electric motors to carry more current to achieve high speed. The heat management in power electronics is also very important and process ventilation facility needs to provide.

4. Electric Motors

The electric motors convert the electrical power to mechanical power and drive the EVs. The electric motors also help in regenerative braking where the electric motor acts as generator and converts the mechanical energy into electrical energy. There are many types of electric motors and they classified as follows:

a) Brushed DC motor:

The stator of these motors made up of permanent magnets. The rotor consists of brushes, which provides supply to stator. At low speed, they have the ability to provide maximum torque, which is very much desirable. However, the disadvantage with these motors are that they are very bulky and operate under very low efficiency. Hence, they are usually not preferred in EVs.

b) Permanent Magnet Brushless DC Motor (BLDC):
These motors are smaller and light in weight. They have improved heat dissipation and carry higher specific power. There are no rotor copper loss associated with them. However, the cost of permanent magnet is high.

c) Permanent Magnet Synchronous Motor (PMSM):

These motors do not employ any gear system and have a wide operating speed ranges. They are efficient and very compact; the disadvantage is that they carry huge iron loss at high speeds.

d) Switched Reluctance Motor (SRM):

These motors are relatively simple and robust in construction. They are small and operate at high speeds. The disadvantages are that they are very noisy and operate at low power factor. The PM machines are also heavier and costlier.

e) Induction Motor (IM):

They have matured commutatorless motor drive system technologies and operated like a separately excited DC motor. India should encourage the indigenous manufacturing of motors. The kind of design needed for designing of motors for Indian road conditions is quite different from those of other countries. The average speed of vehicles in India is 25 Km/hr as opposed to 45 Km/hr in the western countries. Hence, it is important that the motors developed should have their peak efficiency at 25 Km/hr. This will help in power savings. Importing of motors for Indian EVs will increase the price of EVs and they are not assure of working efficiently for Indian road conditions.

5. Conclusion

India has a huge challenge in shifting the transportation sector from ICE engines to EVs. This requires a lot of planning, research and development. Government policies like FAME and few other policies needs to be updated on regular basis to

keep in pace with the development throughout the world. India should focus on improving the energy-efficiency of EVs. The power electronics, electric motors should planned for Indian conditions. A battery eco-system needs to be develop which can support many companies and start-ups developing battery pack up and cell manufacturing. Charging infrastructure needs to be adequately build to address range anxiety. The options of swapping also be explored. It is also very important to create demand generation by making all government buses electric and offering tax exemptions for private EV owners.

References

[1] GoI, "National Electric Mobility Mission Plan 2020," 2013.
[2] M. Yilmaz and P. T. Krein, "Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles," *IEEE Trans. Power Electron.*, vol. 28, no. 5, pp. 2151–2169, May 2013.
[3] F. Un-Noor, S. Padmanaban, L. Mihet-Popa, M. Mollah, and E. Hossain, "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," *Energies*, vol. 10, no. 8, p. 1217, Aug. 2017.
[4] http://electric-vehicles-in-india.blogspot.com

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Electric Vehicle Basics

Just as there are a variety of technologies available in conventional vehicles, plug-in electric vehicles (also known as electric cars or EVs) have different capabilities that can accommodate different drivers' needs. A major feature of EVs is that drivers can plug them in to charge from an off-board electric power source. This distinguishes them from hybrid electric vehicles, which supplement an internal combustion engine with battery power but cannot be plugged in. https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics

Electric vehicle industry in India

Electric vehicle industry in India. India unveiled 'National Electric Mobility Mission Plan (NEMMP) 2020' in 2013 to address the issues of National energy security, vehicular pollution and growth of domestic manufacturing capabilities. Reiterating its commitment to the Paris Agreement, the Government of India has plans to make a major shift to electric vehicles by 2030. E-commerce companies, Indian car manufacturers like Reva Electric Car Company (RECC), and Indian app-based transportation network companies like Ola are working on making electric cars more common over the next two decades. https://en.wikipedia.org/wiki/Electric_vehicle_industry_in_India

Internet of Things (IoT) and E-Healthcare System – A Short Review on Challenges

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Abstract

The Internet of Things (IoT) connects smart objects and devices, which provides large amount of data to be stored than analyzed for processing. IoT devices are useful in different categories from remote monitoring of industrial environment to industrial automation. Furthermore, healthcare applications are mainly showing interest towards IoT devices because of cost reduction, user-friendly and improve the quality-of-life of patients. The existing IoT-driven healthcare applications, analyzed and still there is a need for innovative technology-based solutions to face the challenges in medical environment. In particular, wearable and implantable devices with IoT architectures, investigated for data-transmission process. The usage of IoT in e-healthcare has tremendously increased in many areas such as to maintain vital equipment, monitor patient care, monitor medical assets, track equipment usage etc. Wearable IoT interlinks body-worn sensor devices to the medical environment; the physicians can monitor the health condition of patients remotely. Implantable devices aid in replacing the biological part of the human body, which damaged. Developing wearable and implantable body area network is significantly challenging due to miniaturization of sensors, integration of Integrated Circuits (ICs), less energy consumption, body-worn antennas, non-invasive wearable structures etc. This article provides the overall ecosystem of IoT based E-healthcare systems and its relevant components.

Keywords: IoT, e-healthcare, sensor devices, wearables, implantables'.

Introduction

In the starting of 21st century, no one predicted the immense impact of IoT in our daily life. Nowadays, the things have changed drastically with the exponential growth of IoT sensor devices. IoT connects heterogeneous objects to the internet, which permit data exchange rapidly never exists before [1]. An IoT device that interconnects different kinds of objects wirelessly to a network and transmits data seamlessly and it is perceive as the "things" in IoT. Large number of entities connected with the network in IoT based infrastructure that enables easy and effective communication. The embedded technology assists internal as well as external communication in order to make further decisions [2]. The 'thing' in IoT can be an automobile with built-in-sensors or a human with a heart monitor, i.e. once the objects are assigned with IP addresses and those are capable of gathering and transferring data with little or without any human intervention. IoT devices include thermostats, light bulbs, door locks, cars, fridges, wearable such as smart clothes, smart watches, implantable like pacemakers and RFID. The trend behind IoT is all about functioning in concert of users in businesses, industry, or at home.

The recent achievements in IT industry significantly improved the intelligence and communication and the devices with which we are interacting around. E-healthcare system plays a vital role as a dedicated ecosystem for medical treatment and supervision. It is obvious that the requirement of novel technologies is essential to permit the inter-communication between heterogeneous devices via internet. Healthcare services and medical supervision provisioning is about to change the entire world of innovative technologies. Various automation devices include intelligent sensors, regulators, actuators, PLCs exchanges data in order to direct control functionalities or monitor on a large-scale system. Devices do not exhibit autonomous behavior and the intelligent sensor be fixed in building automation system, secured e-health system as well. Such device activated as an individual "thing" under the defined access control policy. IoT provides appropriate solution in various domains such as traffic congestion, industrial sector, emergency services, logistics, waste management, smart cities, and e-healthcare.

Overview of IoT in e-Healthcare system

Sharp alertness about health and fitness is the significant factor that drives healthcare users' attention towards IoT devices that removes the fear of frequent hospital visits and expensive physician. The healthcare consumers in the medical industry is growing rapidly that the total market being lead to revamped. Business models need to restructure to cope up with the growing influence of huge number of healthcare customers [3]. Recently, the recent survey states that the extraordinary growth in the usage of IoT devices such as wearable and implantable devices. With the 'Internet of Things' users can have the control of their health in a personalized way and the major strength lies in data analysis and for decision-making. The diagnosed information gathered using electronic medical annals, imaging tools, monitors, hand-held devices improves the decision-making process of physicians to play an active role in maintaining the patient's health.

IoT-based personalized review of person's health will become very common at the end of the decade. Healthcare users would be more comfortable with appropriate plans to defend against diseases and intelligent devices would assist them to maintain their health. With the data generated by IoT devices, the significant decisions made instantly to improve the patient's health. The challenge of healthcare industry is not lies in developing new devices, technologies, although the great attention is required for e-healthcare users. The number of smart connected devices aimed to improve the person's health

and the related environment with the intellectual usage of data. Such devices can track the environmental air quality and the doctors' can provide the consultation for the patients remotely [4]. In particular, there are three main qualities to certify the sensor equipped "thing" to become a part of IoT healthcare.

- ✓ First, the device should sense and collect the data about the surroundings, such as humidity, temperature, light as well in the case of pulse rate / blood oxygen monitoring, blood glucose monitoring, electro cardiogram monitoring, etc.
- ✓ Second, the device should be acting autonomous in communicating the gathered data to the central coordinator automatically or with any other device or if meets any condition [5].
- ✓ At last, it should be in an active mode until the process is completed. For instance, if patients' blood pressure or blood sugar levels are at critical, alert information should triggered out for immediate action.

Irregular heart rate of a patient stimulates an alert message to the cardiologist and the patient informed to proceed with the prescribed treatment immediately. Miniaturized implanted device or skin patch monitor's blood sugar, skin temperature and alerts the insulin pump to regulate the dosage [6]. This kind of monitoring assists not only to maintain the health status, but also enables the physician's advice before the condition becomes critical. Sensors in patients those who are suffer from heart related issues help to track the heart rhythm continuously. The blood pressure, healthcare medical devices like CTs and MRIs, oxygen saturation levels can also be tracked remotely [7]. Patient's movement tracked efficiently with Radio-Frequency Identification [RFID] technology, sensor devices and process analytics done for identifying and monitoring the optimal process flow.

Nowadays, human health predominantly influenced by behavioral as well as environmental factors like smoking, polluted city etc. IoT assist in understanding the patient's life style and it has the potential to strengthen the predictive analytics. According to Gartner's Hype Cycle of Emerging Technologies report, another 10 years are required for the full usage of IoT in e-healthcare system. Body sensors combined with Arduino and RasberryPi boards to manipulate collected data from heterogeneous networks. IoT based e-healthcare systems are design to gather biometric information and it assists in monitoring the patient for current status or medical diagnosis can be performed using android application, web services and multi-protocol unit.

Architecture of IOT in Healthcare

IoT is a network of connected physical devices and objects, which help to sense, analyze, and control remote devices. A conceptual framework introduced for connecting the edge computing devices to enable the communication among wearable sensors and smart devices seamlessly. IoT applications are highly dependent on the middleware layer in IoT architecture for information processing. Some IoT applications are smart health, smart grid, smart city, smart home, smart agriculture, intelligent transportation, etc. The fundamental IoT architecture framed with three layers comprises of perception, network and application layers. Then, extended to have more layered architectures and it includes middleware and business layer.

1. ***Perception layer****:* The perception layer describes about the sensor devices and physical objects. The sensor device in the perception layer identifies and senses the object and gathers information about the object. Based on the sensor type, the gathered information can be about temperature, motion, orientation, humidity, vibration, location, acceleration, chemical changes, etc. The information then transmitted to the next layer for processing. If a lady is wearing a set of smart earrings in her ears and it assists in detecting the condition of different parts of the body and locates the position of the lady. Perception layer transmits the gathered information by the earring to the network layer for processing [8].

2. ***Perception layer:*** Also termed as, "Transmission Layer" and its major task is to connect different servers, smart objects and network devices. It transmits the sensor data, which is collect from sensor devices. The transmission medium can be the technologies such as infrared, Bluetooth, ZigBee, Wi-Fi, UMTS, and 3G. Then the information transmitted from the network layer to the middleware layer. Network layer combines the information received from both earring and forward the same to the processing layer.

3. ***Middlewave Layer:*** It is the main "processing layer", which stores, analyses the large amount of information received from the network layer. It has the responsibility for the database connectivity and service management. Since it is the middle layer, provides number of services to the lower layers. It is connect with big data, cloud computing, and databases for processing the huge amount of data. Information, which is collect by earrings is analyzed and to verify the body temperature of human. If there is any dissimilarity with the normal temperature, then it is report to the corresponding entity and intimated to the patient.

4. ***Application Layer:*** The significant role of this layer to deliver application oriented services to the end users. This layer communicates directly with the end user by enabling application layer protocols. If the information collected from lady's earrings inform that she is having fever and the concerned lady can be communicated with the application layer. This layer communicates with the person by passing a notification about fever to the smart phone.

5. ***Business Layer:*** The business layer controls the entire IoT eco-system with well-constructed efficient business models. It assists the end user to make decisions for further actions. For instance, if a person suffering from fever then the nearby clinics or hospitals would suggested by displaying the details.

Wearable devices

Wearable devices can be fix to the human body in items such as bracelets, pendants, badges, wristwatches, T-shirts, smart rings, glasses, fitness trackers and other accessories for the global gain of health benefits [9]. A wearable device in close contact with the user is capable of tracking illness, wellness of a person and the collected information transmitted to the centralized hub station for analysis. Wearable devices comprise of three components such as sensors, computing architecture and displays. Wearable gadgets are able to provide biological information such as calories burned, steps walked, heart rate, blood pressure, and time spent exercising, etc. [10]. There is a huge impact on these devices and it is quite powerful which gains good attention in tracking user's physical health.

Some wearable devices as listed below:

- ✓ ***Pulse Oximetry:*** The device helps to measure the oxygen saturation level in a human body, tracks the difference in the blood level of skin related to cardiac cycle. Particularly, a pulse oximeter is attach to a finger or an earlobe, which consists of photodetector and Light-Emitting Diodes (LEDs). It quantifies the amount of infrared, the red light that is send to or reverted by the human body. The difference between the absorption level and the oxygenated to deoxygenated hemoglobin level assists in measuring the oxygen saturation level. The periodic signal termed as PhotoPlethysmoGraph (PPG), which is use to locate the heart rate.

- ✓ ***Electrocardiography (ECG):*** A waveform that tracks the heart functioning persistently and provides the information with respect to time. Hence, ECG measurements based on wireless sensor devices are prominently suitable for ambulatory applications.

- ✓ ***Blood Pressure:*** It helps to measure the force exerted due to the blood circulation on blood vessels. These types of sensors fitted around the wrist and systolic, diastolic readings measured by using oscillometric method.

- ✓ ***Electromyography (EMG):*** It is the study of muscle functioning by monitoring the electrical signals exercised by the muscle. EMG is the spatio-temporal summation of all electrical signals. Hence, the EMG signal provides an effective means of tracking the human muscle activities.

- ✓ ***Electroencephalography (EEG):*** Electroencephalography (EEG) is the depiction of human brain activities. Wireless Intelligent Sensor (WISE) is a micro-controller based system and introduced for EEG signal acquisition applications for data acquisition, wireless communication, analog-signal conditioning, and low-level real-time signal processing.

Implantable devices

Implant devices that are implant under the skin of the human body and it help in repairing the part or the entire biological structure [11]. Nowadays, implants normally used for various purposes such as neural prosthetics, orthopedics, cardiovascular stent, artificial pacemaker, defibrillator, dental fillings and crowns, drug delivery system, cochlear implants, etc. [12]. The outer layer of implantable devices can be made of any biomedical material such as apatite, silicone, titanium, and the material should be select based on the requirement of the human body part. The materials used for implant devices can be of ceramics, metals, and polymers. Some implantable devices listed as below:

- ✓ ***Glucose Monitoring:*** The process accomplished by implanting the sensor device with the multilayered membrane in the abdominal tissue. Body glucose level can tracked for every 30s and the data transmission happened for every 5 minutes. If the sensors are implanted and the glucose level can be controlled by providing the varying amount of insulin.

- ✓ ***Implantable Neural Stimulators:*** These types of neural stimulators direct the electrical impulses into the human's spinal cord or the brain to provide the treatment for chronic pain.

Conclusion

E-healthcare system provides a technological framework that uses wearable and implantable health sensors to facilitate monitoring various factors such as health, wellness, behavior and other chronic information for the benefit of individual's everyday quality of life. The main objective of this article is to investigate how IoT can be associated with wearable and implantable devices in healthcare system. The wearable and implantable gadgets will surely revolutionize the smart technologies that are quite familiar nowadays and in near future. The sensors needs to be design in a precise way to be easily wearable and less power consumption. The clinical information gathered from the sensor devices need to preserve in

a secured data-warehouse. Promoting IoT devices will accelerate the adoption of e-healthcare system on a wider scale. The technologies for e-healthcare system should be safe, consistent, effective, flexible, power-efficient, and patient-centric. Moreover, designing IoT devices for upcoming e-healthcare system is challenging which determines the success of IoT based e-healthcare system.

References:

[1] J. Holler, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, and D. Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Amsterdam, The Netherlands: Elsevier, 2014.

[2] L. Tan and N. Wang, "Future Internet: The Internet of Things", in *Proc.3rd Int. Conf. Adv. Comput. Theory Eng. (ICACTE)*, vol. 5, pp. V5-376_V5-380, Aug. 2010.

[3] S. M. Riazul Islam, Daehan Kwak, Md. Humaun Kabir,Mahmud Hossain, Kyung-Sup Kwak, "The Internet Of Things For Health Care: A Comprehensive Survey", IEEE Access , Jun 2015.

[4] J. Ko, C. Lu, M. B. Srivastava, J. A. Stankovic, A. Terzis, and M. Welsh, "Wireless sensor networks for healthcare", *Proc. IEEE*, vol. 98, no. 11, pp. 1947_1960, Nov 2010.

[5] H. Alemdar and C. Ersoy, "Wireless sensor networks for healthcare: A survey", *Computing. Network.*, vol. 54, no. 15, pp. 2688_2710, Oct 2010.

[6] Y. J. Fan, Y. H. Yin, L. D. Xu, Y. Zeng, and F. Wu, "IoT-based smart rehabilitation system", *IEEE Trans. Ind. Informat.*, vol. 10, no. 2, pp. 1568_1577, May 2014.

[7] Wannenburg, J.; Malekian, R. "Body sensor network for mobile health monitoring, a diagnosis and anticipating system", IEEE Sens. J., 15, 6839–6852, 2015.

[8] A. Pantelopoulos and N. G. Bourbakis, "A Survey on wearable systems for monitoring and early diagnosis for the elderly", *IEEE Transactions on Systems, Man and Cybernetics, Part C: Applications and Reviews,* vol. 1, pp. 1-12, 2010.

[9] D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for visually impaired: A Survey", *IEEE Trans on Systems, Man and Cybernetics,* vol. 40, pp. 25-35, 2010.

[10] O. G. Morchon, H. Baldus and D. S. Sanchez, "Resource Efficient Security for Medical Body Sensor Networks, Wearable and Implantable Body Sensor Networks", BSN International Workshop, 4pp, Apr 2006**.**

[11] A. Pantelopoulos and N. G. Bourbakis, "A Survey on wearable systems for monitoring and early diagnosis for the elderly", *IEEE Transactions on Systems, Man and Cybernetics, Part C: Applications and Reviews,* vol. 1, pp. 1-12, 2010.

[12] D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for visually impaired: A Survey", *IEEE Trans on Systems, Man and Cybernetics,* vol. 40, pp. 25-35, 2010.

[13] Jovanov, E., & Milenkovic, A. "Body area networks for ubiquitous healthcare applications: opportunities and challenges", Journal of medical systems, 35(5), 1245-1254, 2011.

[14] Samaneh Movassaghi, Mehran Abolhasan, Justin Lipman, David Smith, Abbas Jamalipour, "Wireless Body Area Networks: A Survey", Communications Surveys & Tutorials, IEEE. 16, 2014.

[15] Benoit Latre, Bart Braem, Ingrid Moerman, Chris Blondia, Piet Demeester. "A Survey on Wireless Body Area Networks", Wireless Network. 17: 1-18, 2010.

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10 examples of the Internet of Things in healthcare

The next decade may well see a revolution in the treatment and diagnosis of disease. The Internet of Things (IoT) has opened up a world of possibilities in medicine: when connected to the internet, ordinary medical devices can collect invaluable additional data, give extra insight into symptoms and trends, enable remote care, and generally give patients more control over their lives and treatment. Here are 10 examples of IoT in healthcare that demonstrate what medicine is becoming capable of thanks to technology.
https://econsultancy.com/internet-of-things-healthcare/

India's health with AI, machine learning, and smart apps

From medical tourism to telemedicine, India's healthcare sector has been expanding at a healthy double-digit rate to include newer and better services powered by new-age technologies. The problem, however, is not availability, but access to these services. For every 1,000 people, the number of physicians in India stands at 0.7 (less than 1), a metric that places the country way behind the global average of 1.5 physicians per 1,000 people. And then, there are only 0.7 beds per 1,000 people, compared to the World Health Organisation's (WHO) recommendation of 3.5. These findings from the Deloitte and CII's 'Medical Technology, Shaping Healthcare For All In India' report highlight the grim reality of healthcare in the country. But, more importantly, it stresses on the challenges that people across the length and breadth of India – including rural parts and cities other than the Tier I – face when it comes to the access to "quality and affordable" healthcare. On the flipside, India's healthcare space is expected to grow at 23 percent CAGR to a $280 billion market by 2020. And with the 'Digital India' initiative, the government has been bolstering all efforts towards bridging the gap in healthtech, an area where Indian startups already have a momentum. On the heels of World Health Day, we take a look at five such startups making healthcare efficient and affordable for us.
https://yourstory.com/2019/04/startups-monitoring-india-health-machine-learning

A guide to healthcare IoT possibilities and obstacles

This essential guide will look at some of the current applications of healthcare IoT, including how it's being used in one Boston hospital to keep track of newborns in the NICU. Next, the guide explores some of the challenges of IoT in healthcare, such as the need to manage multiple connected devices and a lack of interoperability with EHR systems. Finally, this guide will posit the future of healthcare IoT, including how physicians can turn IoT data into actions.
https://searchhealthit.techtarget.com/essentialguide/A-guide-to-healthcare-IoT-possibilities-and-obstacles

Marine Autonomous Systems – Technology, Opportunities and Use Cases

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Introduction

Despite water covering two-thirds of the earth's surface, there are very few data that we have from the water cover. It is a known fact that we have more information about outer space than underwater. Our knowledge about underwater life and environment is very thin. There is a staggering 92% of the underwater surface that is yet to be explored or mapped. Various technologies have been developed for research and mapping purposes. The highlight of them is the usage of autonomous systems. The systems can be made use of in dynamic environments of the ocean without compromising human safety. Therefore creating a wide range of research opportunities and fields to explore.

Marine Autonomy

While land vehicles and airborne vehicles have a rather clear path for traversing when compared to underwater. The land and air vehicles can be localized, connected or mapped easily with various technologies such as GPS, Wi-Fi, and other wireless technologies. In the case of underwater systems, this luxury is not available since the generally used wireless technologies are rendered ineffective. These signals do not have the capability to function underwater and they become either non-penetrable or distorted. When compared to other modes of travel, water systems, and underwater systems require automation more as the environment is completely unpredictable and dynamic. These autonomous systems can thus replace human divers to do dangerous tasks and missions. Automating an underwater vehicle is a very challenging task as none of the variables can be predicted and the actions of the vehicle cannot be pre-programmed. The vehicle has to face a number of challenges and obstacles such as random floating objects, sea creatures and unforeseeable climate changes. These have to be avoided and bypassed for the system to complete the task successfully. The processor that is used for the integration of the data collected from all the sensors is served with a 'self-thinking' algorithm framework that can decide the course and track of the vehicle with respect to the data readings.

Untethered in the physical sense, but there remains an acoustic tether. There are advantages and disadvantages to this. Without external signals from a shore controller, ROV is dependent upon positioning input from vehicle-mounted marine sensors. In case of real time applications, a mother vessel to provide this input is therefore required. However, the presence of the mother vessel allows for continuous monitoring of AUV control and payload systems. This provides assurance that the system will return with adequate data and provides for more than a minimum of quality control information allowing for provisional data interpretation and mission re-planning.

The way forward is to build flexibility into the AUV control systems, to allow autonomous operations but also to have control and real-time quality control capabilities when required. For the ROV system, this will require improvements to the AUV navigation system. For the AUV system, significantly greater mission endurance is necessary. For both, the launch and recovery weather window should be carefully curated.

Some systems can all follow pre-programmed missions and have a (largely untested) collision avoidance capability. Their payloads may contain bathymetry, side scan sonar, and profiler. However, they do not address all areas of oil industry requirements where, with further development, there is potential for the AUV technology to be applied. Other potential applications include:

- Environmental inspection
- Engineering inspection.
- Underwater engineering intervention.

Inspection is undertaken using sonar, photography and physical measurement. Intervention currently uses tethered remotely operated vehicles (ROVs) for valve manipulation, component replacement, etc.

Types of Marine Autonomous Systems (MAS)

- Remotely Operated Vehicle (ROV)
- Autonomous Underwater Vehicle (AUV)
- Unmanned Surface Vehicle (USV)
- Autonomous Ships
- Research Vehicles

Sensing and Processing

- Multibeam Echosounder (MBES)
- Side Scan Sonar

- Synthetic Aperture Sonar (SAS)
- Differential Global Positioning System (DGPS)
- Inertial Measurement Unit (IMU)
- Underwater Acoustics
- Doppler Velocity Log (DVL)

Advanced Technologies in MAS

- Autonomous Marine Cloud Processing
- Subsea Artificial Intelligence
- Marine Big Data
- Marine Cybernetics
- Subsea Data Storages
- Collaborative Systems

Autonomously Taking ActiON (ATON)**

Every Autonomous vehicle requires a framework capable of making decisions without human support. It should be able to take the input from various sensors connected to the vehicle, process the information accordingly, and then control the vehicle motion with respect to the decisions made.

ATON is an indigenously developed framework for Underwater Robotics and Autonomous Systems. The features of ATON are:

- Identifies the best and safest model to which system can perform the Autonomous operation.
- Apart from understanding the risk, in the background, it derives alternatives to mitigate the unexpected risks.
- It works on a **Parallel Redundant Storage Algorithm**, in which numerous multi-core process run simultaneously, the risk factor is constituted from the data received and the actions will be forwarded accordingly.
- Every 18 seconds, it will formulate a reference safe model to keep updating system status.
- **Set Points** and **Risk Points** are the prime decision making factors.
- In the event of any failure, ATON will change the weightage to other sensors, which can manage the risk, and the system will remodel immediately for the maximum risk to be diverted with the current setup.
- ATON comprises of 124 internal algorithm to support any marine sensor attached with the vehicle.

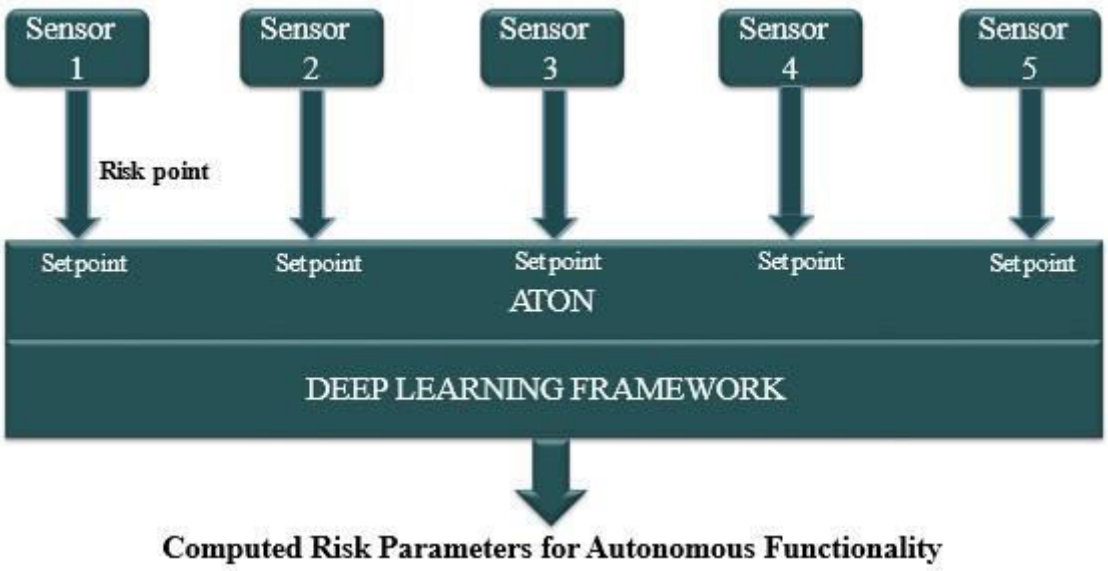

Figure 1 – ATON Framework Illustration

Set Points - The calibrated points or data

Risk Points - Fault characterized by ATON

Example - While obtaining the DGPS data, where PDOP* > 2, the data will be incorrect that leads to risk

**Position Dilution of Precision - PDOP is a risk and will become a risk point*

Experimental Setup

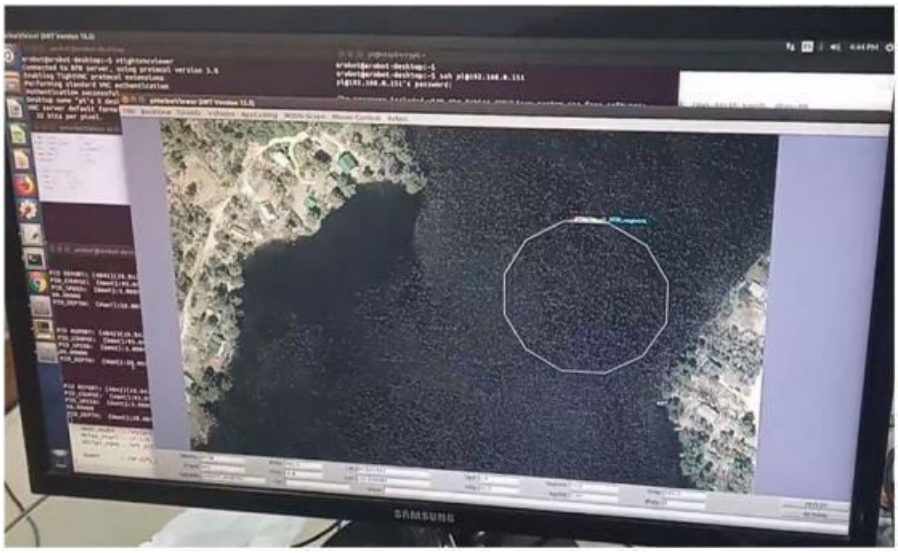

Figure 2 – ATON Framework Software Implementation

- The above figure shows the **Way Point** for a virtual mission.
- The mission is to complete the circular path without any support from the human controller.
- Though the path is circular, it is seen that the path resembles more like a polygon.
- Each point on the polygon denotes a Setpoint as illustrated in Figure 1.
- When the vehicle reaches each Setpoint, the path is evaluated for further maneuvering.
- This is done using the input obtained from various sensors attached to the vehicle.
- At this stage the risk evaluation and mitigation tasks (if any) are carried out.
- In case of emergency task abortion and in case of successful task completion, the vehicle returns to its **Home Set Point** that is the start point.

Figure 3 – ATON Framework Hardware/Vehicle Setup

- Figure 3 shows the hardware setup of the system.
- The trial is conducted using a self-built Remotely Operated Vehicle (ROV).
- The connections to the software and hardware with the necessary sensors are established with respect to the vehicle application.

Opportunities

Marine Autonomous Systems that includes AUV, USV, ROV and autonomous ships account for about $5 billion. As the automation in the systems increase, it calls for more sensors and computation. Each of the systems has its unique computations.

With the emergence of autonomous systems, other prominent technologies such as cloud computing and artificial intelligence have also gained traction in the marine industry. IT services for marine autonomy saves at least $1 billion by the year 2020 that leads to tremendous scope extension.

The amount of data collected from the marine surveys have to be processed to get valid information. The heavy data comprises the output of various sensors used in the mission. Fields like Machine Learning have had a huge impact on analyzing the data patterns, ocean patterns and for various other analytics. In the recent advancements along with Cloud and ML, Artificial Intelligence and IoT have been used extensively.

Use Cases

There have been numerous discoveries of shipwrecks and other debris in the recent past. This has proven to be decisive in knowing the history of various shipbuilding mechanics of the past along with other related discoveries. This has intrigued the marine archaeologists to survey potential areas for shipwreck discoveries. This, in turn, helps in widespread knowledge of the systems and the technology being used in the surveys.

Along with archaeological applications, the ROV's, AUV's along with the sensor suite have been deployed immensely for identification of debris. Numerous salvage operations related to flight crashes and oil spills have used these technologies to map the required piece of ocean area.

Since the existing mapped area of the underwater surface is very less, any new search operation requires a complete mapping from the basic levels. Therefore, for one search operation, it makes use of all available sensors for diverse data collection that in turn takes a completely new computation system for the particularly large dataset.

Along with these industries, the Oil & Gas industry, Defense, Environmental and Climatic applications usage of these latest technologies have been on the rise. The analytic methodologies have been vastly used for prediction of the data.

Note

References

- https://www.researchandmarkets.com/reports/4071016/risk-assessment-in-underwater-systems
- https://en.wikipedia.org/wiki/Autonomous_underwater_vehicle
- https://en.wikipedia.org/wiki/Remotely_operated_underwater_vehicle
- http://www.marketsandmarkets.com/Market-Reports/autonomous-underwater-vehicles-market-141855626.html

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Architecting for Strategic Outcomes

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Technology is increasingly important. Some very successful organizations are even "born digital." However, anywhere from 70 to 84% of initiatives involving technology fail, according to Gallup, HBR, and McKinsey. I agree with this terrifying finding based on my own exposure to 500+ projects. Why do most initiatives fail? How do you advance your initiatives from tragic to strategic?

Business risks due to current tech-focused approach

Whether it is a software project or a digital transformation initiative, almost all focus is on technology. If initiatives are so tech-focused, they often involve the mere introduction of one or more technology elements into the organization – and almost nothing else. This means there is little or no business innovation, which is key to creating real transformation that can deliver outcomes compatible with corporate strategy. We normally see organizations facing 3 big business risks due to this tech-focused approach.

Wrong tech: Here are some common reasons why we select tech that is inappropriate for the organization: (a) The technology is hot (b) Competition has that technology (c) The technology rushes to solve a problem reported by a few folks (d) The technology solves standard problems.

Recurrence: Recurrence is about business problems remaining even after the organization has invested money in new initiatives. Here's a simple example. The accounting process at a restaurant chain remains the same-old, same-old after the organization had developed and deployed an accounting software; the existing accounting process was simply embedded in the new software and so old problems remain. Problems also remain due to other reasons such as: Not making changes to the broader (or umbrella) process that uses the tech. If there's recurrence, a great opportunity to improve the organization was squandered.

Degradation: At the very least, some changes to the organization may be required to make sure everything (including the newly-added technology element) could work together as one. Such changes are often not foreseen and implemented. Result: One or more existing processes connected to the tech element may actually get worse in performance. In "Enterprise Architecture as Strategy," authors Ross, Weill, and Robertson describe the problem: "Individually, the applications work fine. Together, they hinder companies' efforts to coordinate customer, supplier and employee processes." Here's one of many symptoms of degradation: Different employees give different answers to the same question.

Blend tech and business innovations

Transformation initiatives must deliver strategic outcomes, that is, outcomes compatible with corporate strategy. Strategic outcomes are measured in terms of customer value and financial performance – things that matter the most to organizations. To deliver strategic outcomes, you need a certain combination of business innovations and technologies. How do you ensure you have the right blend?

Method to architect the right blend
CIOs have tried to reduce the three business risks. For example, CIOs improved IT Governance. But, the cause of the problem is elsewhere – in the transformation practice itself. The practice needs to be redesigned to enable the translation of strategy into a strategic architecture. The practice comprises a set of discovery and design tasks. The output would be an architecture that is composed of a blend of technology and business innovations. This strategy-driven discovery-and-design process that I created is called strategy translation.

Corporate strategy drives
What traditionally drives projects is either siloed department-level strategies or no strategy at all. But CEOs want corporate strategy to drive all significant initiatives. That's because corporate strategy is purposely devised to achieve corporate goals, which matter most to organizations. So, every step in strategy translation is driven by corporate strategy.

Discovery and design
Discover the right stuff. And design them right. Take a broad view. And you'll find several opportunities to blend the right technology and business innovations. Many organizations have dozens of silo technologies that may need to be combined in a new way. Internal tech may have to work with external tech used by customers and vendors. Multichannel (digital and physical) experiences work best when they're integrated.

In a recent initiative, Allianz looked far beyond the boundaries that defined traditional tech projects. They started with their "Simple, engaging customer experience" strategic theme. They identified 140 customer journeys, each spanning several touchpoints. From this initial set, they selected about 25 of the most urgent ones. Then they worked on this set and transformed it to give it the capability to drive strategic outcomes.

The result: predictably strategic architecture
The architecture becomes the business. It is that serious. Once implemented, the architecture becomes almost infeasible to fix. Therefore it is crucial that your architecture has in it the right things designed the right way.

You may want to avoid the two extremes. (1) Avoid adding a single, siloed piece of technology. Forrester Research founder George F. Colony has warned, "... if you inject technology and don't actually change the way you do work, you will get very low returns if any, and you may likely in fact disrupt ongoing, very healthy processes." (2) Avoid attempting an elaborate, enterprise architecture. Check out Gartner's list of pitfalls associated with enterprise architecture. A good architecture typically has neither too little, nor too much. It will have the right blend of technology and business innovations.

Since the strategy translation process is driven by strategy and requires you to do discovery-and-design integrally, the resulting architecture is predictably strategic. That is, it has the capability to deliver strategic outcomes.

SaaS to help
Given the terrifying percentage of failed initiatives, organizations definitely need help with strategy translation. Goodscore™ is a cloud-based software that enables the strategy translation process as well as the collaboration needed to make the process easy. Of course, a piece of technology cannot by itself deliver on organizational goals. And this is the whole point – you need the right blend of technology and business innovations.

References

1. Pradeep Henry, Outcome quadrants: Move initiatives from tragic to strategic, CIO, 2018, https://www.cio.com/article/3321416/outcome-quadrants-move-initiatives-from-tragic-to-strategic.html, accessed on May 28, 2019
2. Allianz, Where Customer is King, 2017, https://www.allianz.com/en/press/extra/digitalization/170406-global-digital-factory-where-customer-is-king.html, accessed on May 28, 2019
3. Gartner, Avoid the 13 Worst EA Practices and Navigate to EA Success, 2016, https://www.gartner.com/binaries/content/assets/events/keywords/enterprise-architecture/ea19/avoid-the-13-worst-ea-practices-and-navigate-to-ea-success.pdf, accessed on May 29, 2019
4. Goodscore SaaS for Strategy Translation, https://www.GoodscoreLabs.com

About the author

Pradeep Henry set up Goodscore Labs to bring strategy translation to the business world.

Previously a director at Cognizant, Pradeep is globally recognized for bringing business and user perspectives to technology-intensive projects.

To know about his top five strategic initiatives, check out www.PradeepHenry.com.

Why Design Thinking Helps Identify Great Artificial Intelligence Use Cases

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Introduction

Artificial Intelligence is a class of computer systems capable to performing tasks normally requiring human intelligence, such as visual processing, speech recognition & decision-making. It is a technology very much at its peak in the hype cycle. The advancement in this technology has enabled automation in multiple domains and in increasing depth over the last few years. Today, enterprises are aiming to automate almost anything, from simple monotonous, repetitive work to highly cognitive decision making processes.

Design thinking, on the other hand, is a human centric approach to solve problems. It brings structure to a problem solving thought process. The process runs through 5 main phases - Empathize, Define, Ideate, Prototype and Test. Each phase focuses on a particular aspect of the solutioning and the process can be iterative.

This paper aims to highlight how the design thinking framework compliments and encourages a mindset that helps in the Artificial Intelligence implementation process.

Design Thinking Process - The Artificial Intelligence Perspective

Design thinking has a set of concepts that inherently brings human centricity to problem solving. It follows from this human centric nature that it is open to uncertainty. This openness is vital to solutions built on rapidly evolving technologies like Artificial Intelligence.

Each stage in the design thinking phase provides importance to some aspect of the overall solution – from empathizing with the actual user to rapid prototyping. Each of these stages can draw a parallel with building a great AI solution.

1. Empathize

Benefit For AI: Helps in identifying the unarticulated AI opportunities, promotes a bottom up approach

Almost every enterprise is trying to automate their processes and AI is an unavoidable part of these initiatives. These initiatives are usually driven in a top down approach. However, the design thinking approach flips this on its head bringing the human user to the center of the solution, thus making it a bottom up approach.

The design thinking approach requires you to interact closely with the stakeholder and empathize with them to identify the pain points. During this interaction, the AI consultant, armed with the knowledge of the vast possibilities of AI can quickly identify opportunities for improvement. This means that even if the stakeholder does not articulate some concerns, one is still able to catch these and visualize a super-efficient future for them.

AI consultants needs to be capable of identifying human actions that leads to human decisions. This is key as it is important to create and collect training data which might not even exist today. The human centric approach of design thinking aids this facet of data creation for automation scenarios as we have a better understanding of how the various stakeholders. This may, at times, even lead to a modification of existing processes to capture subtle human actions.

It is also important to understand the current technological landscape of the enterprise. This is a critical step as the key decision makers would want to understand the technological shift that may be needed as part of our solution. Moreover, adopting AI into enterprise often needs a shift in mindset about how the operations are run. This phase gives you a chance to empathize with the various stake holders and understand their concerns about this shift.

2. Define

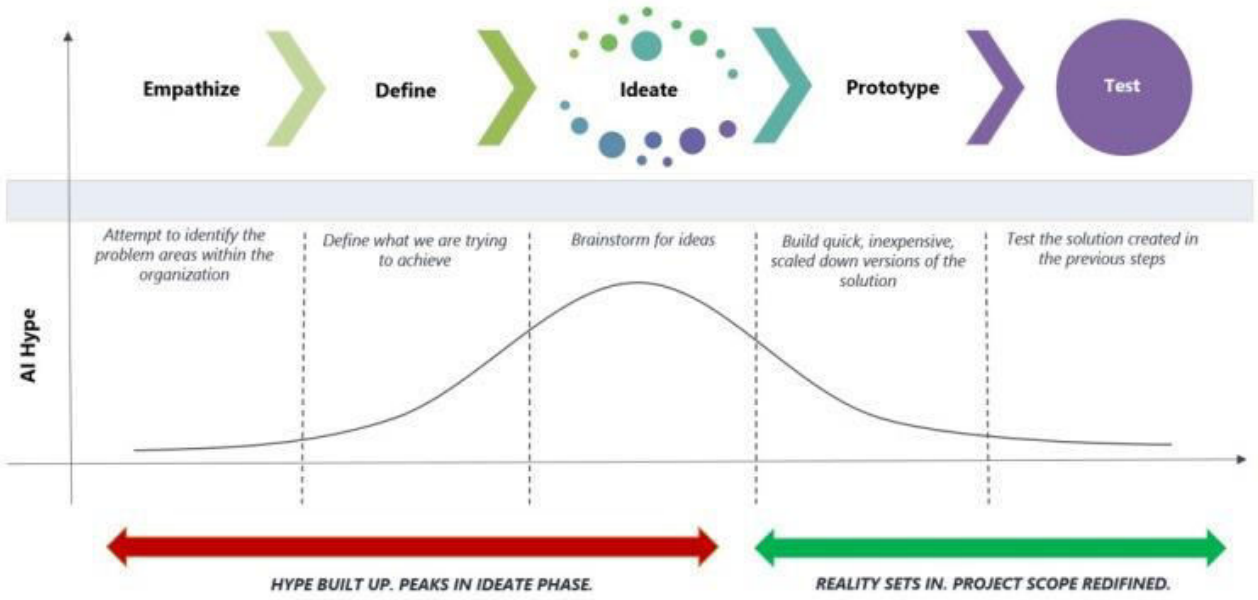
Benefit for AI: Helps in defining the problem statement in a human centric way, thereby reducing anxiety

AI is often associated with job displacement. As such, resistance of AI solutions are often felt while interacting with stake holders. However, AI today should be viewed more as a solution that augments the capabilities of the work force, enabling them to reduce their workload on them. As such, a human centric definition of the problem statement would convey to the stake holder what they get as part of the overall solution. A statement like "Reduce effort by 50%" would do little to motivate the users to collaborate for an AI solution. On the other hand, "*Enable a more convenient execution of work*" might strike a chord with the work force.

3. Ideate

Benefit For AI: Promotes out of the box thinking, challenging status quo, thereby aiding innovation

This is a phase that allows the team to explore all the incredulous ideas. This stage allows users to challenge status quo, explore the unexplored and bravely imagine solutions akin to science fiction. Though expected to mimic human beings, automation offerings can follow a different set of rules as compared to human being for better efficiency. For example, in most automated warehouses, items are randomly placed as against an ordered fashion required by humans to do the job. The ideate stages helps us to unearth such radical and "not so obvious" possibilities for automation.



AI hype is often criticized, but in the design thinking process it is actually encouraged in the ideate stage. This actually powers innovation and helps in building out of the box solutions. As depicted in the diagram above, the AI peaks in this stage. Luckily, within the design thinking process, there is a mechanism in place to contain it in later stages.

4. Prototype

Benefit For AI: Promotes a "Fail fast, fail safe" mindset. Letting reality kick in smoothly.

This phase involves building quick proof of concepts. Design thinking encourages the philosophy of "Fail fast, Fail safe". Many benchmarking solutions out there may not be practical in production level solutions. It is often said that if you torture data hard enough, it will give you what you want. However, this will rarely be replicable in practical use cases.

Identifying the right use case candidate is a critical part of this whole process. Many practical problems in automation space have long tails. Human In The Loop (HITL) is the way forward. Spending 20% of effort to solve 80% of work makes an ideal case for HITL. Prototyping cases that meet these criteria should be the focus.

This phase reveals what is actually achievable within the AI ecosystem, bringing some sanity from all the hype built up in the previous stage. Here we quickly test hypothesis in AI and reduces the hype drastically. Furthermore, it lets the team

understand what all can be achieved via AI, staying within the limitation of the current technology maturity. Design thinking promotes a mindset that it is ok for PoC's to fail, as a failed PoC is one step closer to a successful solution.

5. Test

Benefits For AI: Uncertainty is not frowned upon

Testing AI solution needs a completely different mindset. It is often not possible to promise a given accuracy or performance for an AI solution. So it is always a moving target. That is because, the accuracy of the solution is highly dependent on the quality and quantity of data available in the enterprise. Unless one actually plays with the data, it might not be possible to confirm the accuracy of a solution at the beginning of a project. However, this mindset is often viewed cynically in the business world. However, in design thinking uncertainty is not frowned upon. In-fact it is expected facet of the overall process.

Moreover, one should note that AI solutions are expected to learn over time. The accuracy and target keep moving based on incoming data and feedback loops. Testing stage provides a feedback mechanism, allowing the team to see whether the solution is actually improving over time and more importantly whether it is able to achieve the required KPI's or not.

Summary:

Design thinking provides a framework that enables us to ask the right question at the right time while building an AI solution. Moreover, it promotes a mindset that accepts uncertainty, a major component for most complex AI projects. Design thinking tackles complex AI related problems by:

- Understanding the in-articulated AI opportunities within a process
- Reducing the apprehensions of the stake holder of the "dangers" of AI, thereby enabling better collaboration
- Allowing AI hype to grow that aids innovation while at the same time containing it at later stages
- Encouraging *'fail fast fail safe'* methodology, that empower AI engineers to test uncharted waters
- Bringing in a mindset to accept uncertainty in results, with an anticipation that the solution learns over time

Artificial Intelligence is the future and is every much intertwined with our life's. With more are more AI projects being taken up, design thinking helps promote the mindset and culture, so much required for enabling a AI-pro future.

About the authors

Mr. Sojan George has over 11 years' experience in the IT industry and has been predominantly associated with the Artificial Intelligence domain. He currently works as a Business Development Manager at Tata Consultancy Services for the Artificial Intelligence Practice. Over the last 5+ years, he has interacted with multiple customers, across domains, in solving their pain points leveraging AI techniques (like Deep Learning, Shallow Learning, Natural Language Processing) and has helped shape their AI journey.

He has completed his BTech from Mar Athanasius College of Engineering, Kothamangalam, Kerala and his MBA from Leeds University Business School, United Kingdom.

Mr. Rajeev M Azhuvath is a hands-on technologist with 19 years of experience. Presently he is part of the Artificial Intelligence (AI) Program in TCS. Primary responsibilities include delivery of architecture focused on AI and building capabilities around shallow learning, deep learning, & natural language understanding.

The right mix of consulting experience, delivery experience, servicing experience, research experience, & futurism gives him the unbiased perspective of technology and its impact. Additional areas of interest include advances in Nano Technology, Bio Technology, Information Technology, & Cognitive Science (NBIC). Special interest in Convergence of Technologies & Technological Singularity and its impact to humanity.

"We must design for the way people behave,
not for how we would wish them to behave."
Donald A. Norman, Living with Complexity

Operating System Security – A Short Note

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1. Introduction

An Operating System (OS) is viewed as a Reference Monitor (RM) or a Reference Validation Mechanism (RVM) that provides basic level security. In [1], Anderson reported three design requirements for a Reference Monitor or Operating System. He suggested that an OS or RM should be tamper proof that means OS programs are not alterable, OS should always be invoked and OS must be small enough for analysis and testing purposes so that completeness of which can be assured. These OS design requirements became the deriving principle of OS development. A wide range of operating systems follow Anderson's design principles in modern time. It was also observed in [2] that most of the attacks are imposed either on OS itself or on the programs running on the OS. The attacks on OS can be mitigated through formal verification to a great extent which prove the properties of OS code on various criteria like safeness, reliability, validity and completeness etc. Also, formal verification of OS is an intricate task which is feasible only when RVM or RM is small enough for analysis and testing within a reasonable time frame. Other way of attacking an OS is to attack the programs like device drivers running on top of it and subsequently inject malware through these programs interfacing with the OS. Thus, a malware can be injected in to the sensitive kernel code to make OS malfunction. However, virtualization technology is one of the solutions to counter both kinds of attack on OS as well as the programs running on top of the OS. The virtualization technology initializes hardware resources efficiently and is related to all the design requirements of an RM or RVM proposed by Anderson [1]. Additional advantage of using virtualization is to provide basic infrastructure which are used for cloud computing these days. Section 2, 3 and 4 gives a bit detail about these technologies to give countermeasures to OS attacks. Section 5 gives what needs to be trusted to trust a kernel. Section 6 gives a short discussion on what needs to be done to ensure OS security. Finally, section 7 concludes the discussion.

2. OS Verification

An OS is nothing but a bunch of compact programs and routines that interacts with hardware and manages resources to serve applications running on top of it. It is therefore important to verify each line of OS program code to ensure nothing is executing out of specifications. There are several methods to verify an OS among which three methods are popular. First, a Theorem Prover which ensures safety and reliability of the OS kernel. It can leverage the kernel behaviour in terms of state transitions of an abstract state machine. Theorem Prover can help to prove that the OS kernel does not allow illegal memory operation, unexpected halting or infinite looping causing deadlock like situations. Advantage of using a Theorem Prover method is that it can verify any arbitrary properties that can be input to the system. However, it is limited by the huge cost of verification due to manual construction. Second, the Source Code Modelling method checks for a model to be extracted from the source code given as input and exhaustive search of states are carried out to verify and guarantee the program properties. Advantage of this method is that no manual construction is made like the Theorem Prover method and therefore, it is a comparatively easier method to perform. But this method demands huge computational resources. Nucleus part of Verve OS which is verified and guaranteed type safety is the example of kernel verification through source code modelling. Third, use of Safe Programing Language guarantees OS program against strict type checking. Advantage of this method is that OS verification becomes automatic and also requirement of computation resources is low as compared to source code modelling method. But this method has some disadvantages too like verification of the OS is limited to basic properties only and it imposes high load on OS developers. Also, verification of OS with huge code base is also infeasible.

3. Access Control Mechanisms

Objective of Access Control Mechanisms is to ensure confidentiality, integrity and availability of the OS modules and is provided at the top of a Trusted Computing Base (TCB). A TCB consists of RM or RVM component. An access control mechanism essentially provides security policy modes, security policy description languages, security policy verification techniques and list of access control mechanisms. However, it is a challenge [2] to formulate access control mechanisms in cloud environment with virtualization as well as in embedded systems.

4. Virtualization Technology

Objective of virtualization is to give OS isolation for security. There are four main aspects in which virtualization can be enforced. First is Virtual Machine Monitoring (VMM) which can be performed through hypervisors. A hypervisor sits between virtual machine (VM) and hardware to performs resource management and scheduling of virtual machines. Use of hypervisor tightens access control over general purpose OS. Benefits of VMM with hypervisor include simultaneous operation of multiple virtual machines (VMs) which allows hardware resources to be utilized dynamically according to the operational situations. Hypervisors allows construction of observations and analysis devices which are not detectable by malwares and hence security of OS is ensured through virtualization technique. Virtualization implementation can be done through virtual machine inspection (VMI) which is a process carried out through hypervisors to allow monitoring, observations, defence and isolation of VMs. VMI is a very crucial component of virtualization technique as it detects and

prevents unauthorized access by VMs to alter the code on the hypervisor side and let hypervisor be able to monitor all aspects of the VM. A VMI is invoked to externally obtain the VM status for analysis of a snapshot of memory.

Second, virtualization can be enforced by main memory devices in which physical address used by VM are the artificial address virtualized by the hypervisors. Coordinating access to true physical addresses therefore requires twice address conversions causing double paging. This double paging can be performed in either hardware or software in case of VM technologies.

Third, virtualization can be implemented in Input-Output (I/o) devices through hardware using Input Output Memory Management Unit (IOMMU) or software using device drivers to capture and interpret the requests made by I/o devices. The IOMMU implements address re-mapping in hardware during direct access memory (DMA) allowing VMs to directly manipulate addresses of physical devices. Virtualization of I/o devices provides access control and integrity verification.

Fourth aspect of virtualization is verification of the completeness of VM through integrity verification of structural elements of VM through Trusted Platform Module (TPM). TPM is used for integrity verification of physical machines while virtual TPM (vTPM) is used for structural verification of multiple VMs running on top of a physical machine.

5. What Makes a Kernel Trustable [3]
It is feasible to build small systems that can be guaranteed never to operate out of specifications. Following OS interfacing programs need to be trusted to trust the kernel as they can propagate malware into kernel code to make it malfunction:

i. VM Encapsulation
Virtualization is supposed to be a cure for all ills relevant to security and therefore, the idea also comes to build a complete OS based on a hypervisor using VMs to encapsulate individual activities. A formally verified hypervisor like seL4 [3] can provide real security using virtualization and based on that a system i.e. operating system like CubeOS can be made.

ii. Web Browser
A web browser renders engine for each page in separate process inside an OS sandbox. The rendered processes can only access the system resources and communicate with each other via browser's kernel. Encapsulating security policies in separate module called browser's kernel is a security assurance that kernel would be safe. A typical web browser architecture [3] is shown in Figure 1 below to explain how a kernel does not allow any malicious web page to bye-pass security policies invoked by the kernel.

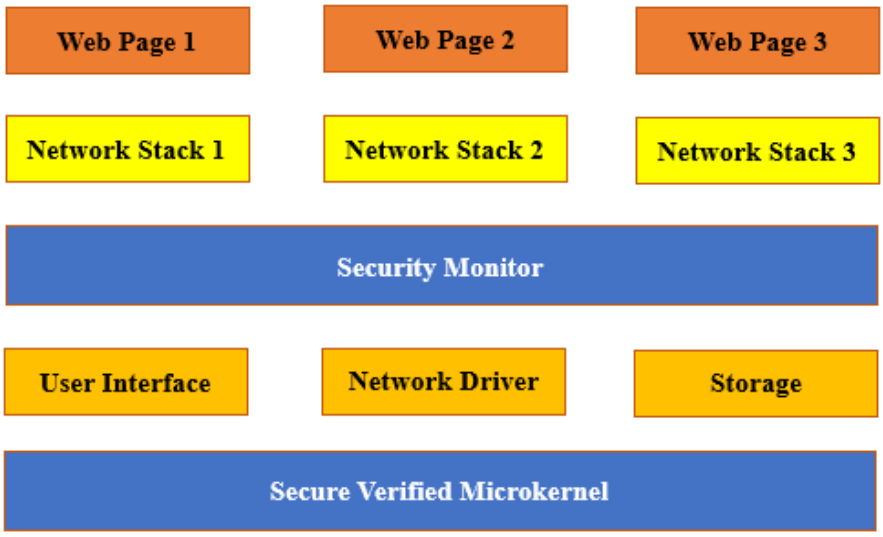

Figure 1: Secure Web Browser Architecture [3]

iii. Trusted Platform Module (TPM)
Trusted Computing Group has introduced the term TPM. A TPM enables secure boot, storage, authentication and remote attestation. Remote attestation ensures that system is running a well-defined software configuration and is achieved by accumulating hashes called measurements of software located in the system.

iv. Database
A database could pass atomicity, concurrency, integrity and durability (ACID) properties of transactions to ensure it would not harm the kernel programs.

6. How to Ensure OS Security?
The security of OS can be ensured through the following methods [4]:

i. By Proving Security
OS security can be proved through formal correctness. We need to specify the system i.e. OS as an Abstraction State Machine with completely defined input and output. Any variation in the expected output results violation in the OS integrity. A proof here identifies assumptions and ensures that the system is deployed under the right operating conditions.

ii. Safety
A Worst-Case Execution Time (WCET) Analysis is a powerful mechanism to ensure OS security through timing validations. WCET of an OS program code is the maximum time required to execute a given piece of code in a given application context (inputs, state) and on a given machine. The goal of WCET analysis is to derive upper bounds for the execution time of pieces of code [5]. WCET analysis is therefore performed to check reliability and functional correctness of the OS.

7. Conclusion
In this short note, we discussed about operating system design requirements in context of security. It was observed that an OS can be attacked either by attacking OS program code directly or through the application program interface to inject malware in to the OS. Some countermeasures like OS verification, access control mechanisms, virtualization techniques etc. were also discussed to prevent both kinds of attack on the OS. A brief note was also presented to arrive at what needs to be trusted to trust a kernel and what needs to be done to ensure OS security in general.

Acknowledgement
This note is an extract of cited research articles in the Reference section. We wish to thank the authors of [2], [3] and [4] for their commendable work which are reproduced in this article in the way to the best of our understanding.

Reference
[1] Anderson, J. P.: Computer Security Technology Planning Study, Technical Report Vols. I and II, USAF Electronic Systems Div., Bedford, Mass (1972)
[2] HASHIMOTO, Masaki. "A Survey of Security Research for Operating Systems."
[3] Heiser G, Ryzhyk L, Von Tessin M, et al. (2011) What if you could actually trust your kernel. In: 13th Workshop on Hot topics in Operating Systems (HotOS)
[4] G. Heiser, T. Murray, and G. Klein, “It’s time for trustworthy systems,” IEEE: Security & Privacy, vol. 2012, no. 2, Mar 2012
[5] https://ti.tuwien.ac.at/cps/teaching/courses/real-time-systems/slides/rts06_wcet_analysis-1.pdf

About the authors

Mr. Kunal Abhishek is a Scientist at SETS, Chennai with over 13 years of experience in design and development of Cryptographic and Network Security products/solutions. He also served as Software Engineer in Weapons & Electronic Systems Engineering Establishment (WESEE), an R&D unit of Indian Navy for 7 years. He was instrumental in framing "Digital Signature End Entity Rules, 2015" with inclusion of Elliptic Curve Cryptography (ECC) for Public Key Infrastructure (PKI) services under the IT Act of India. His research interest includes ECC based PKI and Secure Kernel Development. He holds an M.S. degree from BITS, Pilani and currently pursuing Ph.D. in Computer Science from Bharathidasan University, Trichy.

Dr. E. George Dharma Prakash Raj completed his Master Degree in Computer Science and Masters of Philosophy in Computer Science in the years 1990 and 1998. He has also completed his Doctorate in Computer Science in the year 2008. He has around twenty nine years of Academic experience and twenty one years of Research experience in the field of Computer Science. Currently he is working as an Asst. Professor in the School of Computer Science, Engineering and Applications at Bharathidasan University, Tiruchirappalli, India. Twelve of his PhD scholars have completed their PhD under his guideship. He is an Editorial Board Member, Reviewer and International Programme Committee Member in many International Journals and Conferences. He has published several papers in International Journals and Conferences related to Computer Science He has convened many National and International Conferences related to Computer Science. His Areas of Interest are Computer Networks, Big Data, Cloud Computing and Internet of Things.

Operating System – Security: Security refers to providing a protection system to computer system resources such as CPU, memory, disk, software programs and most importantly data/information stored in the computer system. If a computer program is run by an unauthorized user, then he/she may cause severe damage to computer or data stored in it. So a computer system must be protected against unauthorized access, malicious access to system memory, viruses, worms etc.
https://www.tutorialspoint.com/operating_system/os_security.htm

Data Privacy – Yesterday, Today & Tomorrow – An Overview

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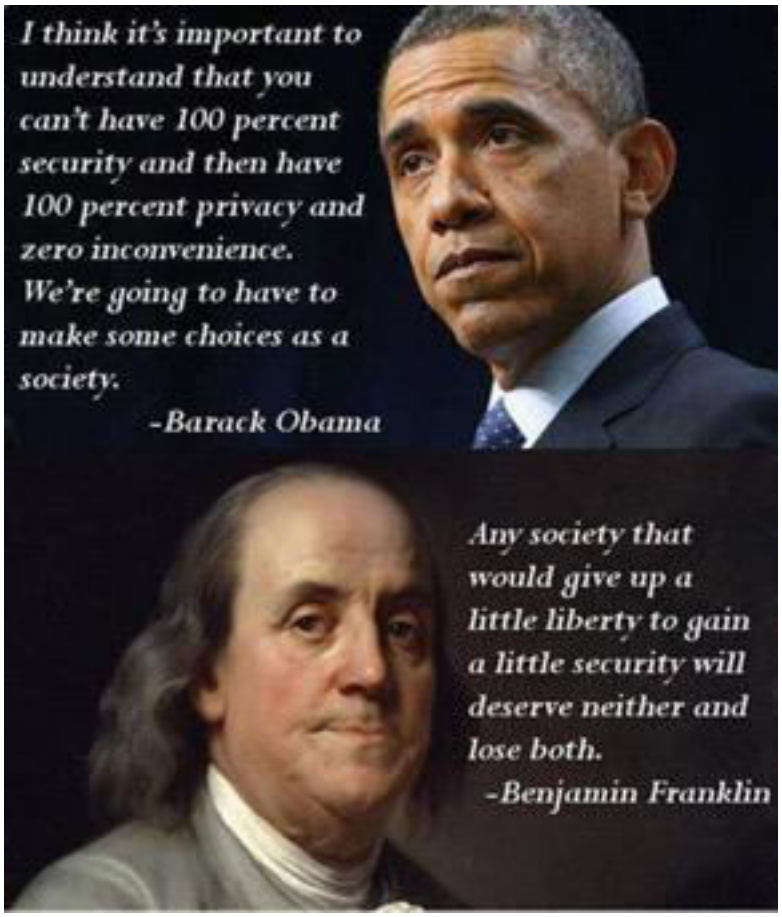


The most of vocal Data Privacy advocates would've been shocked when they first time saw the details captured by Google in terms of their movements. The image below is slightly hashed detail of my own Google account communicating where I've been travelling in a given month.

Like any other technology giant, Google 'technically' complies to law since somewhere somehow we have ticked that box providing our acceptance to track our movements. If you never knew this, right now log into your google account under accounts.google.com and have fun.

Privacy is becoming a hot debate in the current tech world. As it is told 'Privacy in Internet' is an oxymoron. Enough has been discussed on how our mobiles track us even if the GPS is switched off. Enough has been discussed about the types of data that is shared from our mobile that results in that call from a service provider, that mail for a loan, that search for a grey colored puppy.

This article is going throw light on the evolution of data privacy globally, specifically in US, EU and India. While privacy concerns has been there been long in the western world, India is catching up with its own Data Privacy law now. The next privacy demand from California Consumer Privacy Act (CCPA) is another monster waiting to prey on privacy violators.

McAfee study on Data Explosion in 2016 has given the following forecast: -

- There is huge data generated globally
- McAfee analysis tells 8.8 ZB in 2015 to 44.02 ZB in 2020
- Governments want to stop the abuse on data privacy
- Spam emails and Cold calls are taken seriously
- Data breaches leads to heavy financial loss
- Suits by victims due to data breaches is heavy
- Protectionism, is the name of the game

So, the rush in data collection has not attained any plateau, and is only conquering more new peaks.

Where it all Started in US

In US, Privacy Act 1974 was the first initiative towards securing the privacy of individuals data. Modern tort law, as first categorized by William Prosser, includes four categories of invasion of privacy

- **Intrusion of solitude**: physical or electronic intrusion into one's private quarters
- **Public disclosure of private facts**: the dissemination of truthful private information which a reasonable person would find objectionable
- **False light**: the publication of facts which place a person in a false light, even though the facts themselves may not be defamatory
- **Appropriation**: the unauthorized use of a person's name or likeness to obtain some benefits

The essence of the law is a person to have the 'right for privacy', which is defined 'the right to be let alone'. The privacy of US residents is addressed by more than 600 state laws and 12 Federal laws to address data pertaining health, student information and limiting surveillance electronically. Recently San Francisco became the first city to ban facial recognition technology. This means individuals cannot be identified by using facial recognition technology for any service provision.

US does not have a comprehensive data privacy law like EU. The protection of data varies from public to private sector. For governmental access of people data there are there are sweeping legislations like Privacy Act, Electronics Communication Privacy Act etc. In private sector there are few sector specific norms that exist like the Federal Trade Commission Act

After the May – July 2017 Equifax breach of 145.5 million US consumers, there was an attempt to improve the consumer privacy in US, which failed in Congress.

Evolution of EU Data Privacy

EU Directive on personal data 95/46 EC 1995 was the first European adoption of privacy law. This became EU Data Protection Act 1998. EU Data Protection Directive 1995 demands: -

- Comprehensive protection of personal information
- Clear restrictions of data transfer
- Allows data transfer to third country subject to adequate level of protection

A need for change in protection laws of EU was evidenced due to following reasons: -

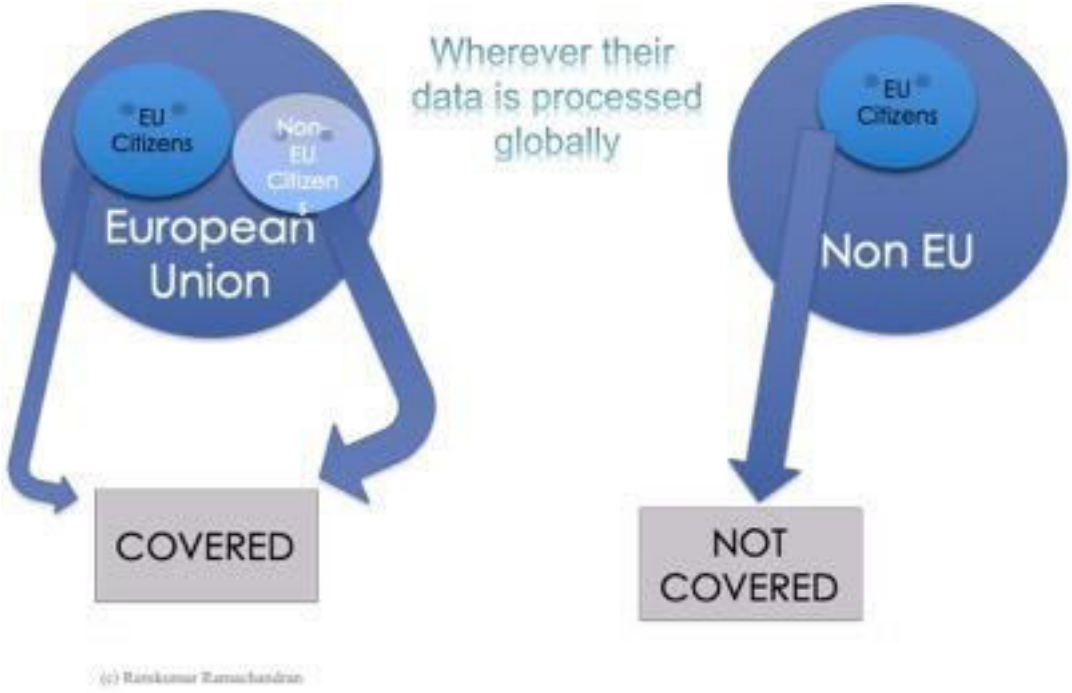
- Evolution of technology
- Internet
- Social Media

There was need to be more explicit in terms used, which led to the design of GDPR. GDPR chronological events happened as follows: -

The General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679) is a regulation

- By which the European Parliament, the Council of the European Union and the European Commission
- Intended to strengthen and unify data protection for all individuals within the European Union (EU)

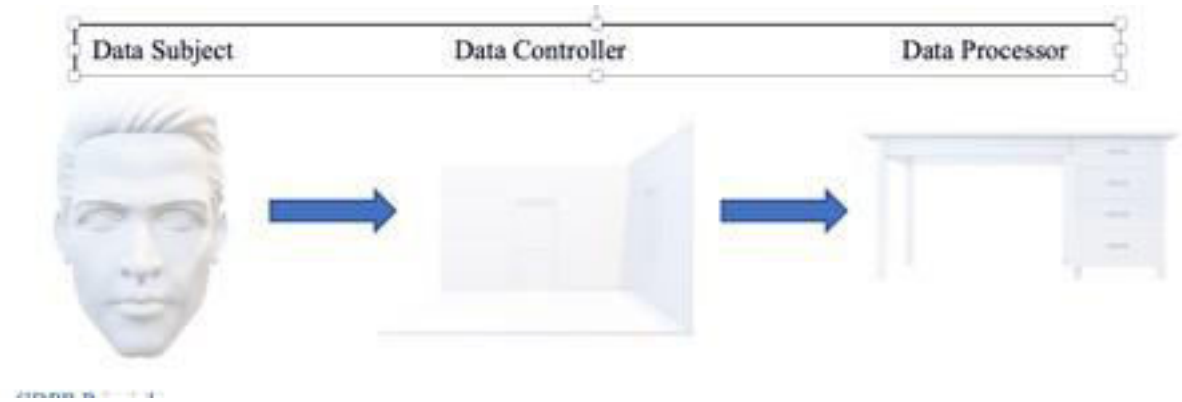
This updated Regulation applies to all member states of EU. It applies to all organization processing the data of EU data subjects – wherever the organization is geographically based. This Regulation will supersede national laws. Is meant to unify data protection and ease flow of personal data and all organizations processing PII of EU residents must comply.



GDPR talks about three distinct roles: -

1) Data Subject
2) Data Controller
3) Data Processor

Data Subject is the living person who gives their data for processing to Data Controller with formal conditions. Data Controller holds the personal data and commits to its safety. This data is processed internally by Data Processor or outsourced to another entity called Data Processor. Data Processor, based on the understanding with Data Controller processes the personal data.



GDPR Principles

GDPR operates with certain principles that are clear no-no for violation. In case of any breaches in an Organization, if it is evidenced that they've violated the GDPR principles, that may lead to maximum penalty. GDPR lists out six principles that are the core of the regulation: -

Rule # 1: Lawfulness, fairness, and transparency
Personal data must be processed in lawful manner, fairly and transparently. It shall be maintained with respect to the data subject.

Rule # 2: Limitation of purpose
Personal data must be collected for specific, explicit and legitimate purpose. Processing must be limited to the legitimate purpose only. Data collected to issue movie tickets should not be used to canvas for Star Nite celebration.

Rule # 3: Data Minimization
Personal data shall be adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed. To issue ticket for cricket match only name should be taken, and additional data like age, sex, occupation should not be collected.

Rule # 4: Accuracy
Personal data shall be accurate and, where necessary, kept up to date. All stored data shall be ensured for accuracy and provision for the Data Subject to correct the same should be allowed.

Rule # 5: Storage Limitation
Personal data processed for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes. The data collected for issuing IPL match ticket should not be used to sell World Cup tickets

Rule # 6: Integrity and Confidentiality
Personal data shall be processed in a way that ensures security, including protection against un-authorized and un-lawful processing, damage or loss. Safety of personal data should be ensured and the controls should be implemented after analyzing all possible risks to the same.

Data Subject Rights

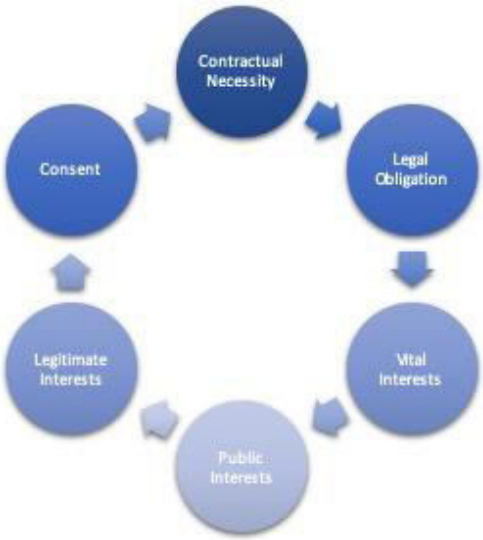
GDPR lays very high importance to the rights given to the Data Subjects whom's personal data is stored. The empowerment of Data Subject is very high and if he/she properly uses the same they can ensure the highest safety for their personal data. The Data Subject Rights are as following: -

1. **Right to information -** Right to ask what personal data of theirs is processed and with whom it is shared. Data Subject can ask which of their personal data is processed, which should sync with the consent taken from them
2. **Right to access -** Right to access their own data as well as request copies of the same. Data subject can demand access to their personal data any point in time.
3. **Right to rectification -** Right to request for change to their data if it not accurate. Data Subject may want to modify the data any point in time for any valid reasons.
4. **Right to withdraw consent -** Right to withdraw the previously given consent, so that company does not process their data anymore. Data Subject may want the consent given for processing to be stopped. The mechanism to withdraw consent should be clearly communicated to the Data Subject prior and cannot be turned down
5. **Right to object -** Right to object when his/her data is processed in variance to committed purposes. This is similar to 'Withdraw Consent'. The data collected for a given purpose being used for a different purpose can be objected by the Data Subject.
6. **Right to object to automated processing -** Right to demand only manual processing to understand the uniqueness of the data subject. Data Subject can request for their personal data from being included in automated processing which profiles individuals and decides on what to communicate to them
7. **Right to be forgotten -** Right to request for deletion of their data. To be in conjunction with retention period and retention schedule in-line with applicable laws. Data Subject can inform that their data need not be included for processing any more.
8. **Right for data portability -** Right to return the data or transfer it to another controller. Data Subject may want their data to be removed and given to another Data Controller.

Lawful Processing

GDPR provides six lawful way of processing the personal data of the Data Subjects. While many GDPR Practitioners talk about Consent as the only way, GDPR is clear and gives six possible channels to lawfully process personal data of Data Subject.

The six lawful ways of processing personal data are: -



1) Performance of Contractual Agreement
   - You can rely on this lawful basis if you need to process someone's personal data:
     - To fulfil your contractual obligations to them; or
     - Because they have asked you to do something before entering into a contract (eg provide a quote)
2) Legal Obligation
   - You can rely on this lawful basis if you need to process the personal data to comply with a common law or statutory obligation
   - Ex. An employer needs to process personal data to comply with its legal obligation to disclose employee salary details to Income Tax Department. The employer can point to the IT website where the requirements are set out to demonstrate this obligation. In this situation it is not necessary to cite each specific piece of legislation
3) Vital Interests
   - You are likely to be able to rely on vital interests as your lawful basis if you need to process the personal data to protect someone's life.
   - Ex: An individual is admitted to the Emergency department of a hospital with life-threatening injuries following a serious road accident. The disclosure to the hospital of the individual's medical history is necessary in order to protect his/her vital interests
4) Public Interest
   - You can rely on this lawful basis if you need to process personal data:
   - 'In the exercise of official authority'. This covers public functions and powers that are set out in law; OR
   - To perform a specific task in the public interest that is set out in law
5) Legitimate Interest
   - Legitimate interests is the most flexible lawful basis for processing
   - It is likely to be most appropriate where you use people's data in ways they would reasonably expect and which have a minimal privacy impact, or where there is a compelling justification for the processing.
6) Consent
   - The GDPR sets a high standard for consent. But you often won't need consent. If consent is difficult, look for a different lawful basis.
   - Consent means offering individuals real choice and control. Genuine consent should put individuals in charge, build trust and engagement, and enhance your reputation

Penalties for Violation

GDPR treats data breaches in two categories viz.1) Minor and 2) Major breach The penalty for less important (minor) breaches will be 10 million Euros or 2% of global turnover, whichever is higher. In case of major breach the penalty will be 20 million Euros or 4% of global turnover, whichever is higher.

The penalty is decided after considering various factors. GDPR checks the intent of the organization that has failed in safeguarding the personal data and then decides the penalty. Following are the considerations done before a penalty is decided: -

- The *nature, gravity and duration of the infringement* taking into account the nature scope or purpose of the processing concerned as well as the number of data subjects affected and the level of damage suffered by them;
- The *intentional or negligent* character of the infringement;
- Any *action taken by the controller* or processor to mitigate the damage suffered by data subjects;
- The degree of responsibility of the controller or processor taking into account technical and *organizational measures implemented* by them pursuant to Articles 25 and 32;
- Any relevant *previous infringements* by the controller or processor;
- The *degree of cooperation with the supervisory authority*, in order to remedy the infringement and mitigate the possible adverse effects of the infringement

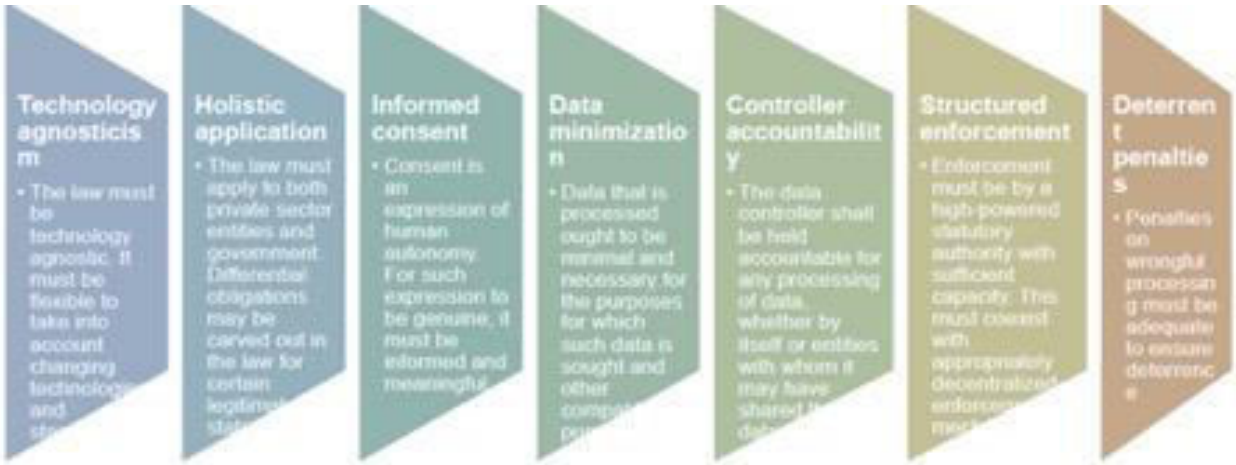
Security By Design

GDPR expects organizations to foresee risks and implement appropriate controls. Based on the type of data that is handled and other related parameters, the risks to the data should be identified and effectively mitigated. This ensures that the security is implemented by default than reacting as and when the breach happens.

This effectively means that 'data protection' should be built-into the business processes and should not operate in silos. Data Protection by design effectively means considering data protection and privacy anything you do. Ex. We create a new product campaign, then discuss about whom you are going to approach and their consent for the same. New privacy measures should not be invented for each data that comes in, but data privacy principles should be automatically applied during the same

The Indian Context

Currently protection of personal data in India is governed by SPD Rules (Sensitive Personal Data information, 2011). This is becoming very inadequate, due to which the latest personal data protection bill is getting tabled. Data Protection in India is based on the following principles: -



Justice Srikrishna Committee submitted the report on Data Protection and Draft Personal Data Protection Bill 2018 to MeITY on 27th July 2018. This bill predominantly reflects the GDPR requirements.

Features of Indian Privacy Law

Certain salient points of the Indian Personal Data Protection Bill 2018 are: -

1) All the organizations who need to protect personal data needs to appoint Data Protection Officer
2) Exemptions have been provided for processing data for journalistic purpose, or for purely personal / domestic purposes
3) Penalties range from 2% to 4% of company's global turnover or INR 5 Crores to INR 15 Crores, whichever is higher
4) Data Protection Authority of India will be the equivalent of Supervisory Authority in EU
5) Organizations should store atleast one copy of the personal data in India
6) Critical personal data shall be processed only in a server or data centre in India
7) Part of the penalties would go the Data Protection Fund and Data Protection Awareness Fund

Demands of California Consumer Privacy Act

The California legislature passed AB 375, the California Consumer Privacy Act of 2018, on Thursday, June 28, 2018, effective January 1, 2020 (the "CCPA").

It is important to look into the last 40+ years history of California to understand the privacy legislation of California. Way back in 1972, California voted to include privacy amongst the 'inalienable' rights to all people. This gave the individuals the ability to control the use and sale of their personal data.

The state followed with adopting privacy measures that include:

1) Online Privacy Protection Act
2) Privacy Rights for California Minors in the Digital World Act
3) Shine the Light, a California law intended to give Californians the "who, what, where, and when" of how businesses handle consumers' personal information

It's quite logical that California has now come up with the upgraded privacy law that considers the latest technological developments.

Under the new law, residents of California will be able to:

- Know what personal information is being collected about them
- Access that information
- Know if their personal information is disclosed, and with whom
- Know if their personal information is sold and the right to opt out of the sale
- Receive equal service and price whether or not they exercise their privacy rights

CCPA would apply to organizations that would fall in one or more of the following categories: -

- Has annual gross revenues in excess of $25 million;
- Possesses the personal information of 50,000 or more consumers, households, or devices; or
- Earns more than half of its annual revenue from selling consumers' personal information

Sanctions that is possible under CCPA are: -

- Companies that become victims of data theft or other data security breaches can be ordered in civil class action lawsuits to pay
    - statutory damages between $100 to $750 per California resident and incident, or
    - actual damages, whichever is greater, and
    - any other relief a court deems proper, subject to an option of the California Attorney General's Office to prosecute the company instead of allowing civil suits to be brought against it
- A fine up to $7,500 for each intentional violation and $2,500 for each unintentional violation

Where will we be in 2025 on Data Privacy

In the years to come Data Privacy will mature and could transform into controls that are reasonable to comply. The data privacy laws could also change based on regional demands, where 'exhibitionism' could lead to lesser control of privacy and 'conservatism' could lead to stronger controls.

The judicial activists crowd may exploit organizations through class suits and make more money, while organizations could build a strong compliance framework to prove they are right. With increase of data by the second, it could become more costlier to safeguard data.

Data Privacy is here to stay, it could evolve into a new animal, but it will remain an animal that should be tamed…!

About the author

Ramkumar 'Ram' Ramachandran is a veteran in the IT industry with global service delivery experience across 10+ countries, which includes US, UK, France, China, Singapore, Malaysia, Indonesia, Thailand, Taiwan, Philippines, Kuwait, Bahrain, Qatar, Saudi etc. He is a IIM-Calcutta Alumni and a qualified PMP, CISA and CSQA. He is also a Lead Auditor for QMS, ISMS, BCMS and ITSM. He is a certified Systems Thinker from MIT Sloan Institute of Management. He provides services in the areas of Information Security, Data Privacy, Agile, DevOps, CMMI and ISO standards. He also happens to be the past President of SPIN Chennai and currently on its Board. He runs his Consulting Firm 'Ascentant Corporation' which is primarily into IT consulting. Prior to starting his own Firm, he has worked with organizations like HCL, Polaris, KPMG and Renault-Nissan. He started his career as a Programmer and has been in various responsibilities in software delivery. He later moved into Software Quality and Security. He has taken many organizations into successful ISO and CMMI journeys. He is an avid reader of books and boasts a great collection of fiction and non-fiction in physical and e-forms. He loves travelling and would like to visit places of heritage importance. He loves music and his Alexa helps him get the best.

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7 principles of the GDPR and what they mean

1. Lawfulness, fairness and transparency: Obtain the data on a lawful basis, leave the individual fully informed and keep your word.
2. Purpose limitation: Be specific
3. Data minimization: Collect the minimum data you need
4. Accuracy: Store accurate up-to-date data
5. Storage limitations: Retain the data for a necessary limited period and then erase
6. Integrity and confidentiality: Keep it secure
7. Accountability: Record and prove compliance. Ensure policies

https://www.amara-marketing.com/travel-blog/7-principles-of-the-gdpr-and-what-they-mean

EU GDPR.ORG

The EU General Data Protection Regulation (GDPR) is the most important change in data privacy regulation in 20 years. The regulation will fundamentally reshape the way in which data is handled across every sector, from healthcare to banking and beyond. https://eugdpr.org/

Universal Acceptance

The concept that all domain names should be treated equally

Universal Acceptance is the concept that all domain names should be treated equally. Domain names and e-mail addresses should be Accepted, Stored, Processed and Displayed in a consistent and effective manner.

Universal Acceptance is a foundational requirement for a truly multilingual Internet, one in which users around the world can navigate entirely in local languages. It is also the key to unlocking the potential of new generic top-level domains (gTLDs) to foster competition, consumer choice and innovation in the domain name industry. To achieve Universal Acceptance, Internet applications and systems must treat all TLDs in a consistent manner, including new gTLDs and internationalized TLDs. Specifically, they must accept, validate, store, process and display all domain names.

USAG -- Universal Acceptance Steering Group (https://uasg.tech/) was founded in February 2015 and tasked with undertaking activities that will effectively promote the Universal Acceptance of all valid domain names and email addresses. The group is made up of representatives from more than 120 companies (including Afilias, Apple, CNNIC, Eco, i2 Coalition, ICANN, Google, Microsoft, NIXI, THNIC and Yandex), governments and community groups.

The Universal Acceptance Steering Group is a community-based team working to share this vision for the Internet of the future with those who construct this space: coders. The group's primary objective is to help software developers and website owners understand how to update their systems to keep pace with an evolving domain name system (DNS).

To create awareness on Universal Acceptance, the USAG has published the following posts.

UASG101 - Introduction to Universal Acceptance: http://get.uasg.asia/docs/UA101-Intro-2019-03-20.pdf
UASG102 - Email Address Internationalization (EAI): http://get.uasg.asia/docs/UA102-EAI-2017-05-17.pdf
UASG103 - Programming Language Hacks: http://get.uasg.asia/docs/UA103-Hacks-2019-03-20.pdf

Recently, IEEE Spectrum, the flagship magazine of IEEE has also published the following article related to Universal Acceptance
,
Creating a Better Online Experience for Billions is Just a Fix Away
https://spectrum.ieee.org/at-work/innovation/creating-a-better-online-experience-for-billions-is-just-a-fix-away

Though bit dated, the post at https://uasg.tech/2017/02/universal-acceptance-india/ deals with Universal Acceptance in India.

Some interesting related documents include:

Action Plan for Universal Acceptance of Domain Names and Email Addresses (FY20: July 2019 - June 2020)
https://uasg.tech/wp-content/uploads/2019/05/UASG-Plan-20190522.pdf

Looking Ahead to a Bright Future for the Universal Acceptance of All Domain Names: . A month into my new role as Chair of the Universal Acceptance Steering Group (UASG), I am more energized than ever about the work we are doing to help build the inclusive Internet of tomorrow. As the next billion Internet users come online, it is critical that all domain names and email addresses – regardless of language, character or length – work with all applications. Read the full message by Dr. Ajay Data, chair of the UASG; founder and CEO of XgenPlus at http://bit.ly/2wIAKVU

UA: Information for IT Leaders: Learn how a routine "Bug Fix" can increase revenue potential and bring millions online. https://uasg.tech/information/it-leaders/

UA: Information for Developers. Learn how updating your systems to keep pace with the evolving domain name system results in business and social benefits. https://uasg.tech/information/developers/

UA: Information for UASG Members. https://uasg.tech/information/members/

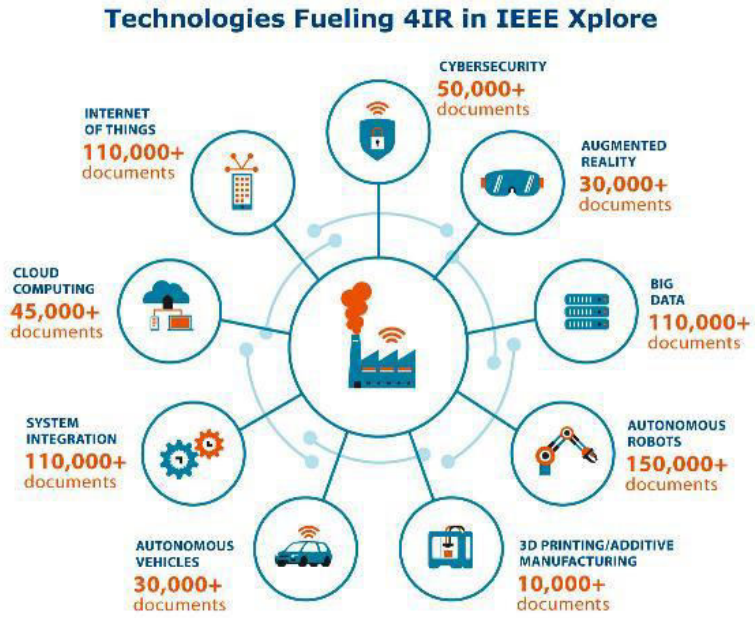
IEEE *Xplore*® Digital Library Continues to be Your Career Partner

Dr. Dhanukumar Pattanashetti
IEEE Client Services, IEEE India Operations Center, Bengaluru
d.pattanashetti@ieee.org

The world is now undergoing a digital transformation where the use of technology in every field is gaining momentum. The technologies itself are evolving for solving many of today's complex problems. In the era of emerging technologies, the need for highly curated scientific literature and information on patent disclosures are a necessity to address today's challenges and to stay relevant.

IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. The Fourth Industrial Revolution (4IR) is coming, and IEEE is at the heart of all of these. Described as a range of new technologies that are fusing the physical, digital, and biological worlds, this revolution is certain to alter the way the human race lives, works, and relates to one another. A number of technological fields will see major advances over the next few years that will affect all disciplines, economies, and industries. These fields include robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the Internet of Things, 3D printing, autonomous vehicles, 5G, and more. The World Economic Forum states that due to the Fourth Industrial Revolution, 65% of children starting primary school will eventually work in jobs that do not exist. The 4IR is upon us, and IEEE is leading the way.

Education is key for adapting to the changes 4IR technologies will bring. The employment landscape will undergo a massive shift, making advanced skills increasingly important. IEEE is helping to educate future leaders on their role in fostering innovation and shaping technological breakthroughs.



Technical information for education, research or otherwise is available easily at our fingertips on demand. But the problem is the information is enormous, and one may ponder if the available information is reliable or not. So there is a big question mark on the credibility of the available information. This is where the IEEE *Xplore*® Digital Library plays an important role.

IEEE *Xplore*® Digital Library is a powerful repository of authoritative content for discovery and access to scientific and technical content published by the IEEE and its publishing partners. In terms of credibility, IEEE peer-reviewed content continues to be the most cited publisher in US and European new technology patents. The authors publish with IEEE because the journals are highly valued in the chosen disciplines, for the heightened visibility, research activity, and industry credibility. Also, the authors find that publishing with IEEE enhances professional development and provides a scholarly platform to showcase their work.

As technologies are evolving, IEEE is continuing to add many new journals and also initiate conferences in new technological areas. Around 20,000 new documents are added to IEEE *Xplore*® each month. IEEE *Xplore*® continues to add new publications and published content from its publishing partners. It provides web access to close to five-million full-text documents from some of the world's most highly-cited publications in electrical engineering, computer science,

electronics, and allied fields. The sheer size of the resources makes it even more challenging to provide the user with a way to conveniently access the resources. Hence, the platform plays a crucial role in delivering the content.

IEEE Xplore® has evolved over a period of time. The articles used to be delivered to the institutions, readers in print format. In 2005, IEEE launched IEEE *Xplore*® and started moving all documents to pdf format. With the advent of technology, HTML articles were introduced. Designed for quick navigation and discovery, the new features in the IEEE *Xplore*® help users find the content they need. Easier-to-use discovery and search tools, remote access functionality, and other valuable features have been incorporated into this powerful interface.

Many options such as multiple pdf downloads, saving a search query, setting an alert in an area of interest, setting alerts to receive new journal issue notifications, an enhanced experience with advanced and command search were also introduced. Interestingly, the users can now download the algorithms associated with an article, with the help of Code Ocean. IEEE and Code Ocean have partnered to enable IEEE authors to upload, share, and run their code on the Code Ocean platform, accessible through IEEE *Xplore*® to provide a seamless experience.

Another important milestone was the launch of a mobile application for the IEEE *Xplore*® and stepping into API space. This enables the users to access the content on the move. One can also get notified on the latest research topics in their fields of interest with the help of *MyXplore* app. Recent enhancements to the mobile app include more search filter options and the ability to perform a custom search, and also view results before saving searches or setting notifications. IEEE *Xplore*® API provides access to metadata for over 4 million documents from IEEE journals, conference proceedings, and technical standards. One can register for access to the new IEEE *Xplore*® Metadata API on the new IEEE *Xplore*® API Portal.

The search engine forms the backbone of the digital library by assisting the user in fetching the data that is needed. The latest IEEE *Xplore*® search engine upgrade offers users a more integrated search experience. It comes with the ability to include wildcards with phrased searches and search operators via the basic search, optimized search functionality for a variety of file types, and an improved process for saved searches. IEEE Xplore digital library now has enhanced security measures being implemented along with the transition to HTTPS.

IEEE recognizes that the authors are an integral part of the journals and hence it provides users access to more information about the authors in IEEE *Xplore*® and easily navigates to other documents they have published in the library. Authors can also submit pictures, details of their biography, the number of articles they have published, and more.
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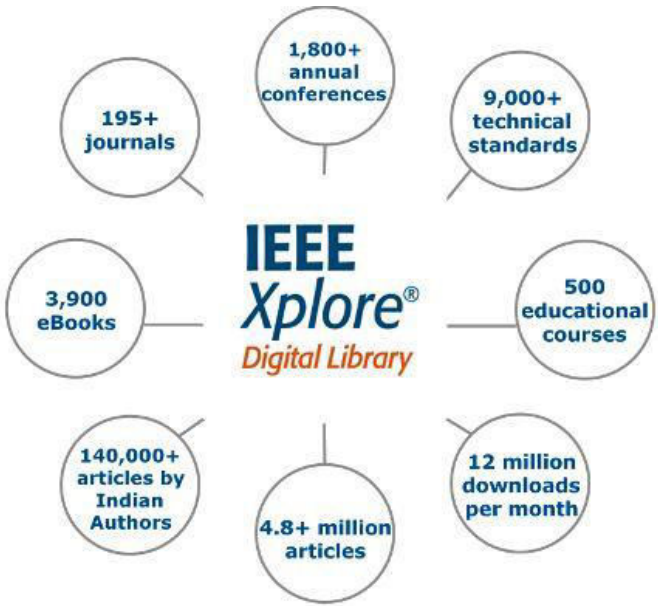

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About the author

Dhanukumar Pattanashetti is the Client Services Manager at IEEE and works at the IEEE India Operations Center in Bangalore. Dhanu works with IEEE Xplore Digital Library subscribing institutions in Sri Lanka, South and Western regions in India. He handles IEEE Xplore learning sessions (both onsite and via webinar) on how IEEE Xplore can benefit the technical community. He works with students/faculty/researchers in academic, government and corporate sectors and advises effective data use for their endeavors. He closely works with libraries in the institutions for internal IEEE promotions to include IEEE content within library web pages, intranets and other work-flow applications. He has published two papers in journals and presented a paper at an international conference in Indonesia. He has a PhD in Library and Information Science from University of Mysore; Master's degree in Library and Information Science and a Bachelor's degree in Engineering.

How to Effectively Discover and Use IEEE Information to Further Your Research

In this instructional video, Professor Gaurav Sharma guides an engineering student in India through the research process using the IEEE Xplore Digital Library. Professor Sharma provides essential tips to help users quickly find the relevant information they need, how to evaluate the source and quality of the information they find and save valuable time in the research process. https://www.youtube.com/watch?v=UQoOtBXsppk

Why Standards Matter?
IEEE Standards Development Initiative in India

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In today's world every citizen, every human being comes across standards developed by the IEEE one way or the other. In the connected world that we are living today, the usage of WiFi™ (IEEE 802.11™) is ubiquitous. There are millions or WiFi connected devices that are shipped each and every day. The growth of Internet of Things and the convergence of several emerging technologies (Artificial Intelligence, Machine Learning, Software Defined Networks, 5G, Electric Mobility, …) and the automation it brings to each individual's personal and professional lives means that systems are becoming more complex. In today's world driven through millions of sensors constantly collecting data and software algorithms processing the data to make decisions its very important that each individual component or a system are able to interconnect and interoperate with each other within a bigger system to deliver the full value and potential to the users. The importance of non-functional requirements are also becoming critical in today's systems where there needs to be serious considerations cybersecurity, data privacy, data integrity, to name a few.

IEEE Standards Association (IEEE-SA), the standards development body of the IEEE, is a global SDO with over 900 standards in active publication and more than 400 standards in active development across various technical societies. These standards are developed by over 20000 volunteers globally, and 300 corporate members. The IEEE-SA is an independent organization where participants (volunteers) come together to develop standards independent of any government organization and is governed by volunteers.

Before discussing IEEE-SA's engagement in India, it will be important to understand about standards and its importance. What are Standards? Standards are published documents that establish specifications and procedures designed to ensure the reliability of the materials, products, methods, and/or services people use every day and they form the fundamental building blocks for product development by establishing consistent protocols that can be universally understood and adopted. In today's market where systems are made of sub-systems and the complexities of the systems are increasing, Standards establish compatibility, interconnectivity, interoperability, simplify product development, and enables faster time-to-market. Apart from product developers, there is also a significant benefit that standards bring to the consumers and end users. Standards makes it easier to understand the features of a product and also thus enables customers to compare competing products in the market. Standards developments also bring economic benefits to countries as when these standards are globally adopted and applied in many markets, they also help with international trade. It helps government and regulatory agencies to set appropriate procurement process and also there are number of standards that establish safety norms for the public which are critical as technologies are being adopted and used ubiquitously. IEEE understands the critical role that standards play and through the IEEE-SA bring the expert community together and provides a consensus based platform for world-class standards to be developed and used by the community.

From a regional context within India, IEEE-SA recognizes India and its growing R&D engineers as a key community to work with as part of its global standards development program and started a focused engagement in 2012 in line with the increasing commitment of IEEE-SA to the Indian market. The growth of new standards working groups with leadership in India has been steadily growing and the technical expert community recognises the importance of standards development, driving standards development in core emerging areas. IEEE-SA is also actively forging partnerships in the region with government institutions, corporates and industries, R&D labs, academia and other relevant stakeholders important to the standards development activity in India. This focused engagement will not only enable a 2-way dialog between IEEE and the Indian entities with regards to standards requirements including regulation and policy, but also disseminate IEEE's vast experience in standards development with key stakeholders and most importantly encourage development of future global standards from India. A good standard provides a balanced blend of technical alternatives, economic needs and ensures that the standards are able to be adopted across regions and countries globally. I would like to highlight that the only way that standards can become global and global standards be relevant for India is for the Indian engineering community to participate actively in standards working groups and contribute to the development of these standards providing their expertise, guidance that addresses the requirements of the global as well as local markets. This will enable engineers to understand the evolution and growth of various technologies and also ensure that the standards capture the Indian requirements adequately.

There are several use cases and example where IEEE Standards are playing a critical role both from a global perspective as well regional and Indian perspective. For example, in the area of Smart Grid, IEEE-SA with over 100 standards and standards-in-development spanning the entire Smart Grid spectrum is playing the role of an ecosystem facilitator in India investing in awareness and education initiatives as well. IEEE-SA also collaborates with other key standards and research organisations around the world in developing harmonised standards and frameworks. Also, IEEE-SA, as a lead standards

developing organization participated in the development of the "US NIST framework of standards and protocols for the Smart Grid". More standards are in the pipeline in these areas with advent of new DC technologies, wireless charging, security standards, utility automation, new technologies on battery and advent of renewables, providing among the most comprehensive, globally accepted and validated set of standards that enable better interoperability, connection, communication and management of the various elements that go into a Smart Grid system. Smart grid ecosystems mean different viewpoints for different communities. For example in some regions the primarily focus of smart grid implementation is focused around Advanced Metering Infrastructure – AMI which is integrated system of smart meters, 2-way communication networks and data management systems including the software applications. The focus of AMI can be around demand response (DR), enabling appropriate management of the loads amongst other things. In some regions the primary focus is around distribution automation (SCADA). Renewables play a critical role in smart grid systems and the integration of renewable energy such as wind or power is becoming an integral part of the overall power distribution network. Managing these complex systems and its individual components, including the interface of different technology perspectives such as fundamental power T&D networks, with 2-way communication protocols along with software is driven through key standards development activities such as IEEE 2030 (Smart Grid Interoperability Standards) and IEEE 1547 (Interconnection standards that define the interconnection of distributed resources to the electric power supply) series of standards to name a few.

The impact of the IEEE standards is already being experienced through WiFi™ (IEEE 802.11™). Today every citizen connected to ICT experiences WiFi™ and the impact it has had on ICT, connectivity and human behaviour has been tremendous. In this context, I would like to mention another important standard IEEE 802.3™ and its impact and how new applications, industry verticals see the importance of these standards and have contributed significantly to the roadmap and development of standards development activities. Every new revision of the IEEE 802.3™ standard which is also known as the ethernet standards addresses new requirements driven by specific industry needs. The first 6 "speed revisions" of the standard took 27 years and the next 6 speed revisions have taken just 5 years. Ethernet standards were originally established to drive high speed data through twisted pair and the primary focus on the earlier revisions was focused on driving higher data rates driven by the requirements of data centers, Enterprise and carrier ethernet. However more recently other industries have started using ethernet technologies such as Automotive as well as Industrial systems focused on factory automation. With new industry verticals, there has been multiple focus areas within IEEE 802.3™ which has resulted in several physical (PHY) options to address different speeds. For example, for automotive industry one of the primary focus is on the weight of the overall vehicle rather than very high speed that is required for date centres. Hence a single twisted pair PHY with appropriate speed requirements are being established for the automotive sector under the IEEE 802.3™ standards development activity. One of the other more recent focus areas for ethernet is what is termed as "Power Over Ethernet" (PoE) where power can also be driven along with data. The IEEE Std 802.3bt-2018™ 4 pair PoE can drive upto 90W of power at the power sourcing equipment (PSE). This highlights the evolution of standards and the impact of different industry verticals and their inputs in shaping the future of these standards.

I would like to thank the IEEE India Council for providing me an opportunity to write about IEEE-SA's standards programs and include couple of use cases which highlight the importance of standards and why they matter and to provide me an opportunity to engage into a discussion with the IEEE members and technical experts in India. Please feel free to reach out to me at sri.chandra@ieee.org if you have any queries, or comments.

About the author

Sri has been associated with the IEEE Standards Association and the IEEE India office for the past 6 plus years as a Sr Director, with focus on the emerging technology programs within the IEEE-SA and driving strategic standards engagements in India and the region. Currently Sri is leading the IoT & Infrastructure Practice as part of the Global Business and Strategic Intelligence department within IEEE-SA. In this strategic role, Sri drives the industry & standards related initiatives focused on IoT, Sensors, & Blockchain and also engages with the Indian engineering communities to drive regional standards initiatives. Sri also manages IEEE Blended Learning Program (BLP), an IEEE training platform, focused on training and skills development for students as well as professionals.

Prior to joining IEEE, Sri was associated with Freescale Semiconductor Inc. (formerly Motorola Inc.) for 18 years, managing a global Electronic Design Automation R&D team focused on modelling of mixed signal designs and Electro-magnetic compliance for Freescale products. Sri received the Accellera Technical Excellence Award in 2009 for his leadership and contributions to design automation standardisation activities. Sri holds a Bachelor of Science degree in Physics from Madras University, India and a Post Graduation degree in Electrical Communication from Indian Institute of Science, Bangalore, India.

e-commerce -- Past, Present and the Future

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First they ignore you, then they laugh at you, then they fight you. Then you win."

Mahatma Gandhi's famous quote has striking similarities to how e-commerce has panned out in the world.

Most of us wrongly assume that pure-play online technology firms are the key drivers of ecommerce. This was true in the early days but is no longer so; going forward offline retailers (who were the competitors of online retailers) will be the most important driver of global ecommerce in the coming decade.

Globally (and in India on similarly parallel lines with a slight lag) e-commerce can be broadly divided into three distinct phases - Surprise, Realisation, Pushback. The first phase from the mid nineties till (say) around 2005; the second phase till around 2015 and we are in the midst of the third phase now.

The first phase (worldwide 1994 - 2005, India 1999 - 2008) - Surprise

The five year period from 1994-1999 triggered the e-commerce revolution globally when Jeff Bezos and Pierre Omidyar founded Amazon.com and Ebay.com in the USA followed quickly by Hiroshi Mikitani and Jack Ma who launched Rakuten and Alibaba in Japan and China respectively. During this phase, the visionary founders focused on: (1) building an ecosystem of infrastructure, merchants, online payment systems, logistics systems and processes from scratch since nothing existed (2) evangelising the benefits of e-commerce and attracting customer trials and (3) create an impression that e-commerce will sound the death knell for offline retail in the coming years.

While the first two were critical steps that set the phase for explosive growth of e-commerce, the third was really the most strategic. In reality, e-commerce is just another channel to retail products and services. Digitally integrating an e-commerce site or app with offline assets like stores and warehouses will significantly enhance customer experience. Pure-play e-commerce companies were the first to realise this and quickly understood that they were at a grave disadvantage. To counter this, they smartly crafted a competitive "Us vs Them" narrative. I daresay if Walmart had realised the significance of e-commerce in the previous century, Amazon may never have become the powerful force they are today.

Unfortunately, offline retailers initially ignored online retail as a passing fad and when it suddenly took off, they were all taken by surprise. Worse, many of the large retail chains swallowed the story put out by online retailers and assumed that all their offline assets including stores and warehouses were no longer assets but liabilities. It took them over a decade to realise how wrong they were.

In India, this first phase lasted till around 2008 and was quite similar. Apart from India's first e-commerce site Fabmart (which I co-founded along with five friends), the only other e-commerce startups of note were auction site Baazee and air-ticketing website MakemyTrip (which shifted focus to the overseas market), in addition to the Shopping Channels in portals like Rediff, Sify and Indiatimes. We faced a unique set of infrastructural challenges - lack of payment gateways, no content providers, no third party logistics firms, limited availability of merchants and merchandise and everything had to be built from scratch. Even the market was virtually non-existent - less than 3 million Indians were online and hardly 20,000 people shopped online, primarily for books shipped into India from Amazon USA. Essentially we were trying to squeeze water from stone using our bare hands and all that came out was blood.

The Second Phase (worldwide 2005-2015, India 2008 - 2018) – Realisation

It took a decade from 2005 onwards for offline retailers worldwide to realise that their offline assets like stores, warehouses, depots, offices which seemed to have transformed overnight into " expensive liabilities" were still strong assets and if anything critical for online commerce and they started their own digital journeys in great earnest, thus starting off the second phase of global e-commerce which lasted till around 2015. The big story of this period was offline retailer brands led by the likes of Walmart and Tesco playing digital catch up rapidly with online retailers.

In complete contrast to the first phase in India, the second phase from 2008 till 2018 has been overwhelming. Driven by a set of young entrepreneurs who founded new e-commerce ventures like Flipkart, Myntra, Snapdeal, Bigbasket etc.; supported by aggressive overseas risk capital and venture funds and coinciding with the smartphone boom, over 50 million new shoppers went online with a vengeance. Global giants like Amazon and Alibaba started investing billions in their quest for market leadership. Offline retail chains and brands like the Future Group, Reliance and Tata, after initial hesitation, started devising their own digital strategies.

The seminal moment was Walmart's acquisition of Flipkart which in a sense brought the curtains down on the second phase and signalled the beginning of the third.

The Third Phase (worldwide 2015 onwards, India 2018 onwards) - Pushback

This third phase will be the most crucial for the future growth and development of e-commerce both globally and in India. The underlying theme will be the integration of offline and online assets to deliver a high quality hyper-local, omni-channel customer experience while leveraging new technologies like DML, AI, Big (or small and medium) Data, Chatbots etc.

Here's a telling statistic. In the first decade and phase of e-commerce, any top 10 listing globally was dominated by pure-play e-commerce firms whereas in the second phase, a few big offline retailers started making their appearances in such listings. The next phase will see more of this and I won't be surprised if there are more offline than online retailers in future top 10 lists of e-commerce firms. Look at Amazon's moves - an offline bookstore, a hi-tech offline grocery store, the Whole Foods acquisition. These small steps are part of a large strategic play globally and are representative of the critical role offline assets are likely to play in future ecommerce success.

Even in India, while Amazon is investing big money to win online against Flipkart and Alibaba, there are crisp offline moves like investment in Shoppers Stop, a significant stake purchase in More chain of stores and talks of some stake in Future Retail as well. Amazon realises that continued leadership in global e-commerce will require strong offline integration and companies like Walmart with immense offline assets could take a lead here. Hence the urgency. In fact, all big players in India including Walmart / Flipkart, Alibaba are likely to make such moves while offline retail giants will keep investing into or acquiring digital assets.

Twenty Five Years of Ecommerce - Turning Full Circle

In a sense, ecommerce has turned a full circle. In the mid nineties, e-commerce was first ignored by offline retail giants while burgeoning online stores treated offline assets as "old economy" businesses with a dismal future. Today, the name of the game is a partnership and both offline and online players are getting locked into tight embraces.

"First they ignore you, then they laugh at you, then they fight you. Then we all win together."

If the Mahatma was around today, maybe he would have said this about e-commerce!

The bugbear though continues to be sustainability. E-commerce is now 25 years old and despite so much hype and investments, profits are inconsistent. Amazon makes most of their money from other lines while Alibaba benefited from a protected market. Amazon, Alibaba, Walmart, Reliance, Tata and other big daddies have to figure out how to continue to deliver great customer experience while making money. The "it is still early days and we are not thinking of profits" excuse is starting to wear thin now.

About the author

K Vaitheeswaran is referred to as the "father of ecommerce in India" and the best-selling author of "Failing to Succeed - the story of India's first ecommerce company" He is a serial entrepreneur who co-founded India's first ecommerce company. He also co-founded the Fabmall chain of supermarkets which subsequently got acquired by the Aditya Birla group and re-branded as "More" which has been recently acquired by Amazon. Vaitheeswaran's latest startup is an FMCG venture in beverages called AGAIN drinks. He lives in Bangalore and his twitter handle is @vaitheek

Jeff Bezos, Founder of Amazon on e-commerce

"We see our customers as invited guests to a party, and we are the hosts. It's our job every day to make every important aspect of the customer experience a little bit better."

We want eCommerce especially when people are shopping from our store and buying our product to have a seamless and enjoyable experience. The more people feel at ease the more they shop, that is why shopping malls are planned in such a pleasant way. Also, as the 'host' as Mr. Bezos calls retailers we need to ensure that:

- Customers get what they paid for in a timely fashion
- Are satisfied and know how to operate our products
- Are updated at every point of the purchase and shipping process

Starvation Deaths, Migrant Labour, Gypsies and Blockchain

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(Views expressed here are personal)

The heart rending news of death of three young children of a migrant family in Delhi has shaken the whole country. The reports suggest that Mangal's family fell on hard times after he was evicted from his tea shop. Yet, somehow the family managed to enrol their eldest daughter in school. Mangal had turned alcoholic after losing his tea shop, and had an untreated chronic injury in his leg. Three innocent lives - Sukho, Paro and Manasi – were extinguished even before they could get a fair chance in the world.

It is grim reminder of the hardships migrant families face. Driven by poverty and dim prospects of earning in their native place, millions migrate to cities each year in search of employment. For some this is their only chance to bring their over-strained lives back from the brink. A terminally sick family member back home or a mounting debt burden from a loan taken earlier for daughter or sister's marriage, make the migrants suffer the sub-human conditions of the slums in cities. While some migrate alone, some bring the whole family. Bihar, Uttar Pradesh, West Bengal, Chhattisgarh, Odisha and Rajsthan are the states sending the most blue collar migrants. The destination states are Gujrat, Maharashtra, Karnataka, Kerala and Tamil Nadu.

The estimates on number of migrants vary. While Census 2001 estimates some 40 Million people as inter-state migrants (Census, 2001), the 2017 World Economic Forum report "Migration and its impact on cities" estimates the number close to 9 million. The report identifies access to government run health, education and housing programs as key challenges for the migrants and suggests DBT (direct benefit transfer) as a way out. The report surprisingly, doesn't mention food security as a challenge, whereas this should have been listed as the topmost challenge.

It appears that the untimely deaths of three children in Delhi could have been avoided had the family had access to Public Distribution System and Public Health Services. This was a family of migrants from West Bengal - father unemployed, alcoholic and with an untreated injury in leg, mother – illiterate, mentally disturbed, the eldest daughter - 8 year old Manasi studying in third standard in a government school and used to be absent for long periods at a stretch, two other daughters- aged 2 and 4. The post-mortem report, according to newspapers, confirms death due to starvation.

Why migrants are Invisible:

Migrants are the reason for much of the glitter around us. The new shiny malls, stores, apartment complexes, factories, IT parks, offices are the result of back breaking hard work of migrants. Many industries which require hard labour or long hours of work such as mining, metal industry, textile, hotel and food industry, and many medium and small enterprises depend upon migrant labour. In many states farming, food processing and horticulture activities would come to a standstill sans the migrant labour. By one estimate migrants contribute to about 10% GDP nationally. Then why are they invisible?

They are invisible and inaudible because in a democracy the citizen's vote is his/her voice. Most migrants are not registered as voters in their destination state. The reasons could be many – circular migration, language barrier, illiteracy, lack of identity proof, high transaction cost (not having the time, energy or money to pursue registration in the voter list). Migrants as a result, are largely invisible to the people living around them. Challenges of daily survival and uncertainty stares them in the face every morning. Registration as a voter would never ever occur in their daily priority list.

PDS and Food Security of Migrants:

After National Food Security Act 2013, GoI (Government of India) has introduced TPDS (targeted Public Distribution System) which limits the subsidy support from center only to the BPL (Below Poverty Line) families. Moreover there is a prescribed ceiling for every state's BPL population. States, unable to suddenly terminate subsidised ration eligibility for its excess BPL card holders beyond the prescribed ceiling, have taken on the extra subsidy burden onto their books. In some states this extra burden is as large as few thousand crore rupees. This is the key to understanding the issue of Food Security for migrants. Migrants having moved from another state, do not get access to the PDS system of their new state even if they hold BPL ration card of their home state. There are three reasons for this-

First, the destination State finds it difficult to include the migrants into their system because it would need to spend its own, already stretched, resources in supporting such population. Since each state's BPL foodgrain quota is capped at a certain level (in all cases below 50% of urban population) and almost all states have claimants already over this level, any additional BPL numbers would directly impact the State's subsidy burden. The GoI subsidy is capped at the foodgrain

quota fixed for the state and for any extra allotment from the center, state has to pay the economic price (typically a much higher price).

Second, the BPL list is prepared by each state independently and there is no centralized list of BPL families. Moreover, the socio economic variations across the states are just too many to even attempt formulating a central list. A particular group or community could be in the lowest socio economic strata in one state whereas they may not even find a mention in the disadvantaged list of another state.

Third, even if the destination state wanted to support BPL migrants from other states, it doesn't have a reliable way of verifying their BPL status. Allowing other state's BPL families to draw subsidised food could lead to misuse and leakages in the PDS system of the destination state. The records from home state would, in all probability, be in a different language and a different format. Even in today's on-line world it would be highly unreasonable to expect that every tiny PDS outlet in a city would be technically equipped to reliably verify other State's BPL ration card, issued in a different language and different format. This function could possibly be done at some central office in a State but then it serves no purpose as it just puts the whole design out of the reach from those for whom it is designed.

Blockchain to help:

If every migrant labourer's data such as his/her 'aadhar number', BPL status, existing ration card (PDS card), along with his/her monthly PDS transaction data is built onto a blockchain, it could potentially open all the closed doors for the hapless migrant in the destination state. This would need be backed by a multiparty agreement between GoI and all state governments, allowing PDS access to each other's BPL migrants.

This would work beautifully because it would be a trusted undisputed PDS transaction record for all the parties. The Govt of India can aggregate the migrant's foodgrain allocation by the destination state and they can debit the respective home state's allocation to that extent resulting in no extra financial burden on the destination state. The home state can pause the foodgrain allocation on the migrant's ration card till the migrant is back; the destination state can allocate foodgrains without having to worry about eligibility, misuse and extra financial burden; and the migrant gets his/her much needed subsidised foodgrain from the nearest ration-shop wherever he goes without having to fill any forms or visiting any government offices. A blockchain supported smart card in the hands of a migrant family would be their insurance against all adversities. Come what may they would certainly not starve!

This kind of a blockchain based system would be completely transparent and fool proof. No state would have to use any extra resources, neither would there be any extra subsidy burden on the GoI. Migrant would just need to show up to the nearest PDS outlet, wherever he/she is, and present his/her smartcard. Today most states have connected their PDS shops to a centralised state server and all transactions get captured there. This migrant's smart card data would go to the destination state's central server, which would verify the details using blockchain technology, and would authorize the transaction for the PDS shop.

Blockchain for Education & Health of Migrants:

The blockchain can incorporate the migrant children's school record allowing them to seamlessly transfer and get admission in Govt run schools wherever their parents' job takes them, even mid-session. Instruction language could still be an issue but children pick up the language like a sponge soaks up the water, and in any case it would always be a superior solution than having them out of school. This system would create other safety nets for the family as well. The school going children would automatically enrol in the Mid-day-Meal program of the new school. Their scholarships can continue without break. A pregnant mother could access the Janani Suraksha Yojana's monetary and health incentives across the country. The family's medical history can also be stored onto it. All social welfare schemes such as old age pension, or infirmity pension etc can also be brought onto this platform.

Why Blockchain:

First, Data Protection and Privacy: Most blue collar migrants are semi-literate at best, and possibly unaware of data theft. Their data protection and privacy can only be ensured if it is encrypted on blockchain. They could easily give out all their details to an unscrupulous agent who could misuse this information.

Second, migrants and gypsies wouldn't be capable of carrying multiple documents like their children's birth certificates, school enrolment details, aadhar cards, ration cards, driver's license, medical records. Let alone carrying these records they would have lost many of these due to frequent shifting across cities and states. This solution safely keeps it all together for them.

Third, transparency, reliability and verifiability of transactions which all governments can trust and accept. This system would protect against any misuse or leakages in the PDS system.

Detecting fake news and information

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Fake news has always been around. Under the guise of mis information, fake news has earlier operated in small circles, among known people and connected circles as incorrect information. What has now changed the gamut and influence of such news is technology. Technology like Facebook, Twitter, WhatsApp and other info sharing apps like Instagram have become the conduits through which such misinformation spreads and since there are more than millions of users on each of these social sites, the sphere within which misinformation may be circulated has also increased manifold. In India today, fake news is more than just misinformation.

As the BBC (2019) reported, "WhatsApp, India's most popular messaging platform, has become a vehicle for misinformation and propaganda ahead of the upcoming election. The Facebook-owned app has announced new measures to fight this, but experts say the scale of the problem is overwhelming.**"** Fake news in India has caused people to be lynched and influenced voting behavior. As The Atlantic reported, recently, "Misinformation is endangering India's election (2019)." India has various fact checking organizations like BOOM, which partners with Facebook to check videos and posts, and Alt News. Just as technology today has enabled the flow of such news, it also has certain tools that can be used to combat the menace. But before we consider the technology, it is important to understand the different ways fake news disseminates online. CNN disinformation reporter Donie O'Sullivan (https://www.youtube.com/watch?v=1vS5dXfBLmg) says, "There is normally two main motivations. One is financial and two is political and ideological." Writing for Medium (https://medium.com/1st-draft/fake-news-its-complicated-d0f773766c79), Dr. Wardle, says, to combat misinformation, we must understand the motives of those of who create it. Elliot Higgins, Founder of Bellingcat, says, "Poor Journalism, Parody, to Provoke or 'Punk', Passion, Partisanship, Profit, Political Influence or Power, and Propaganda" are the main motives of those who crate misinformation. Mis information is shared every time we share information without checking it. So deliberately created misinformation, gets shared when we retweet stuff without checking, between closely connected groups or close-knit sets of people where the information posted is trusted since its coming from a known source, the person who shares it.

As the Verification Handbook (https://journalismcourses.org/courses/VRFY0419/verification.handbook.pdf) says, "…journalists and humanitarian and emergency workers must become adept at using social media and other sources to gather, triangulate and verify the often conflicting information.." Dr. Claire Wardle agrees. A leading expert on social media, user generated content, and verification and co-founder and leader of First Draft (https://firstdraftnews.org/) the world's foremost nonprofit focused on research and practice to address mis- and disinformation, she says when news is breaking journalists "different accounts, pages and groups on social networks." In recently taught course (MOOC) in association with the Knight Center for journalism in the Americas, she outlined some strategies for detecting fake information. Key among them were using internet tools to verify facts and information.

Using the internet and social media to verify facts

Often the only search engine most use is Google. But social media, especially Twitter can lead to a wealth of information. Dr. Wardle says that Boolean search queries on Twitter (just like search queries on Google) and the advanced Twitter search are helpful tools. What do you search for when you are fact checking? Twitter can handle complex search queries and hashtags can lead to sources and information that be used to verify. As Dr. Wardle advices, "Twitter lists which are really powerful." Steph Nissen (https://www.stephnissen.com/what-twitter-list/) describes them as, "A list is a curated group of Twitter accounts. You can create your own lists or subscribe to lists created by others. Viewing a list timeline will show you a stream of Tweets from only the accounts on that list. The simplified version is that Twitter lists organize your Twitter followers." On Google, tying in the words, site:twitter.com/*/lists, and then putting in keywords will throw up Tweetdecks that be followed. Michael A. Caulfield, author of the Web Literacy for Student Fact-checkers (https://webliteracy.pressbooks.com/) says, most web content is usually not original and thus look for previous versions of the content. He has a list of sites (https://webliteracy.pressbooks.com/chapter/fact-checking-sites/) where content can be checked for veracity. Another tool to monitor social media and the internet is CrowdTangle (https://www.crowdtangle.com/features). This is a licensed tool available to newsrooms to track "individual pieces of content, you can also see what's trending on Google Search." With CrowdTangle you can also search comments and shared news on Facebook. Journalists create a dashboard to monitor social media and the internet, focused on different news they are covering, and check information as the stories come in.

Dealing with scrapes: Scrapes are images and videos that are downloaded, modified and re-uploaded online. Being skeptical of the information you have found is always a very useful place to begin with. Such products can be verified by reverse image searches enabled by websites like TinEye (https://www.tineye.com/).TinEye helps find "duplicate and modified copies of an image in your image collection. Perfect for identifying duplicate images, image verification, and

deploying reverse image search solutions." The Google Reverse Image Search works on similar principles. As the https://www.labnol.org/internet/mobile-reverse-image-search/29014/ says, "Google Reverse Image Search helps you quickly discover visually similar images from around the web. Upload a photograph from your desktop to Google Images and it will show you related images used on other websites and also different sizes of the same photo almost instantly. Journalists can use the reverse search option to find the original source of an image or to know the approximate date when a picture was first published on the Internet. Photographers can use 'search by image' feature to know about other websites that are using their photographs."

How date and time stamps work on social posts: Finding the date and stamp on social media posts helps identify where the post originated from. For example, as Raymond Wong says, on Mashable, "Instagram app now shows the exact date (month, date and year) a post was published on both our own and other peoples' posts." By checking the date and time on the post, images can be checked for the original time they were posted and whether they have been scrapped and reposted. Geo locating photos often shows the time and location of where the original photo was taken. For example, the site http://osxdaily.com/2015/05/08/view-exact-location-photo-taken-preview-mac/ shows how the Preview function leads to the info tab and GPS section where the location and date of the original file can be checked. Geo location can be very important. In an incident, ISIS supporters across Europe were encouraged to take photographs with the ISIS social media campaign's hashtag on a piece of paper but as the FirstDraft reported, users inadvertently gave away their positions (https://firstdraftnews.org/how-twitter-users-tracked-down-4-isis-fanboys-from-a-pr-campaign-gone-wrong/), allowing Twitter users to track down the exact location where each photograph was taken and inform the local police. Verifying tweets can also be done through websites like Who Tweeted It First (http://ctrlq.org/first/) and http://verificationjunkie.com/.

Identifying photos and videos: Other tools that can help determine when the photo or video was taken include the Wolfram Alpha (https://www.wolframalpha.com/about/) which is a knowledge engine that brings in available information from across the web. As a tool, one of its main strengths is that it allows fact checkers to look for the weather at the time and day the time stamp on photos or videos show. This can then be used to check if the background of the photo or video matches the weather as shown on the day and date by Wolfram Alpha. As the BellingCat says, "The first thing to look for is landmarks that might help narrow down the search." FindExif (http://www.verexif.com/en/) helps extract exif data from any jpg online photo. Simple and easy to use, all it needs is a simple url to work with. There is no need to upload the photo. The GeoSearch tool (http://youtube.github.io/geo-search-tool/search.html) needs an address or location with a time frame to find videos uploaded from different areas. It is a tool designed for fact-checking locations and crowdsourcing.

Advanced google maps can also help. For example, photos can be checked against the street view imagery available. Another useful tool, another which allows you to look up who might own a domain name, how long the name has been registered and the location of the owner is https://viewdns.info/. Besides Google maps, Tencent Maps (formerly SOSO Maps), a desktop and web mapping service application and technology provided by Chinese company Tencent, offers satellite imagery, street maps, street view (coverage) and historical view perspectives, as well as functions such as a route planner for traveling by foot, car, or with public transportation. Android and iOS versions are available.

Algorithms too are now being refined for use to help journalists' fact check reports. Naeemul Hassan of UT Arlington and Bill Adair of Duke University in their paper, present a tool called ,ClaimBuster (https://idir.uta.edu/claimbuster/) have automated fat checking. In a recent white paper (https://www.blog.google/around-the-globe/google-europe/fighting-disinformation-across-our-products/) Google said that it was working very hard to ensure that audiences had access to safe and correct information. The company was doing this by adding more "context" for searches to help audiences check for themselves the background of the results, including links to related information, as well as different ways of notifying users that certain results have been fact-checked by reliable organizations (https://support.google.com/websearch/answer/7315336?hl=en).

The Journalists ToolBox (https://www.journaliststoolbox.org/2019/04/12/urban_legendsfact-checking/) has different ways journalists can use Google Search, YouTube, Google Chrome, Google Earth and Google Translate to check for facts. The Google chrome can become "a verification dashboard that helps you investigate, debunk or confirm the authenticity of a photograph or video" with added extensions that and help check the veracity of information. Other Verification plugins like invid-project.eu are designed to help journalists verify images and videos. The http://reveal-mklab.iti.gr/reveal/index.html can help to detect still images alterations. Videos can be verified by Amnesty International: YouTube DataViewer https://citizenevidence.amnestyusa.org/ and all it needs is a video's thumbnails to do a reverse image search in one click. The Media Cloud is an open-source platform for media analysis (https://mediacloud.org/) that can create an instant analysis of how digital news media covers different topics. Newsworthy (https://www.newsworthy.se/en/) is a system developed in Sweden, that monitors open government data and data analyses them to find leads by identifying outliers and trends.

Information especially during a crisis, can be easily manipulated. Here the Google Crisis Response Map (https://newsinitiative.withgoogle.com/training/lesson/5402052981161984?tool=Google%20Crisis%20Map) can be useful. The google team works directly with authoritative emergency organizations such as the Red Cross, NOAA and many others

to create and update the Google Crisis Map, which features helpful information regarding disasters all over the world. **A Field Guide to "Fake News" and Other Information Disorders** (http://fakenews.publicdatalab.org/index.html) has other digital resources to help reporters check information for facts.

Resources that are useful include:
https://www.bellingcat.com/resources/how-tos/2014/07/09/a-beginners-guide-to-geolocation/
https://firstdraftnews.org/stunt-geolocation%E2%80%8A-%E2%80%8Averifying-the-unverifiable/
http://verificationhandbook.com/
https://firstdraftnews.org/en/education/curriculum-resources/

About the author

Dr. Paromita Pain is an assistant professor of Global Media at the University of Nevada, Reno. USA. Her research focuses on alternate media and global journalism practices from feminist perspectives. A former journalist with The Hindu Newspaper, India's most respected broadsheet, she has also written for The Guardian and Al Jazeera. Interested in epistemological concerns raised by emerging forms of media that are hybrids between old and new forms, between citizen and professional news practices, she has published various book chapters on the intersection of gender and social media besides looking into areas of online commenting and uncivil behavior and its impact on journalistic practices. She uses use qualitative and quantitative methods and has recently started focusing on computational methods of data collection and analysis. Her research has been published in refereed journals like the Journalism and Mass Communication Educator, Journalism Studies, Journalism Practice, Media Asia and Feminist Media Theory. As an Assistant Professor of global media studies, at The Reynolds School of Journalism, University of Nevada, Reno, her particular focus at the moment is digital feminist activism in the global south.

Explained: What is Fake News?

Lots of things you read online especially in your social media feeds may appear to be true, often is not. Fake news is news, stories or hoaxes created to deliberately misinform or deceive readers. Usually, these stories are created to either influence people's views, push a political agenda or cause confusion and can often be a profitable business for online publishers. Fake news stories can deceive people by looking like trusted websites or using similar names and web addresses to reputable news organisations.
https://www.webwise.ie/teachers/what-is-fake-news/

How to Spot Real and Fake News

Alice rushes to work with her cell phone in one hand and a coffee in the other. Scrolling through her social media feed, she's stopped in her tracks by the news that her company is about to be bought out by its biggest rival.

She quickly posts a response, shares the story with her contacts, and emails it to her team so that they can discuss it later.

But then Alice has a troubling thought. What if the story wasn't true? What if she just shared a "fake news" story? After all, she didn't check the source, and it was from a website she'd never heard of before.

If she has been a victim of fake news, and then added to the rumor mill herself, how will people ever trust her again?

Fortunately, there's lots you can do to avoid making the same mistake as Alice. In this article, we explore how you can separate fake news from the truth.
https://www.mindtools.com/pages/article/fake-news.htm

Fake news website

Fake news websites (also referred to as hoax news websites) are Internet websites that deliberately publish fake news—hoaxes, propaganda, and disinformation purporting to be real news—often using social media to drive web traffic and amplify their effect. Unlike news satire, fake news websites deliberately seek to be perceived as legitimate and taken at face value, often for financial or political gain. Such sites have promoted political falsehoods in Germany, Indonesia and the Philippines,Sweden,Myanmar, and the United States. Many sites originate in, or are promoted by, Russia, North Macedonia, Romania, and some individuals in the United States.
https://en.wikipedia.org/wiki/Fake_news_website

Neuromarketing: An Overview

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Abstract

Advances in neurosciences are re-defining and enhancing our understanding of how we make decisions in general and how consumers make decisions from a marketing perspective. Laboratory and field based applications are contributing new insights on consumer behavior that have a direct impact on marketing plans. Courses in consumer neuroscience and Neuromarketing are now offered by many IIM's. How the brain processes and generates responses when viewing an ad is now the subject matter of research. A preliminary study in the eighties showed that subjects preferred Pepsi if they didn't know what they were drinking, but preferred Coke if they did. Brain scans however showed different activity in different parts of the brain in each case. Today using (Functional MRI) fMRI, (Electro Encephalo Graphy) EEG, (Magneto Encephalo Graphy) MEG, eye tracking, face scanning and other objective methods of measurement some neuroscientists claim that they will soon be on the way to identifying the location of the **" Buy Button"** in the brain and eventually perhaps this area of the brain could even be stimulated and manipulated. The complex neuronal network which is active during a "simple" decisional process connected to the purchase of a product is now being studied in detail that is what actually happens in the brain when we see an advertisement. What finally presses the " Buy button" . Can this be predicted and even manipulated. Would this be ethical ? In one study of neural responses to sips of wine, medial Orbito Frontal Cortex response were higher when subjects were told that the wine was expensive ($90 per bottle) versus inexpensive ($5 per bottle). If an ad does not produce functional changes in the brains of the intended audience, then it has not worked! New vistas on marketing and glimpses into the future of neuro marketing are on the horizon

Introduction

Neuro marketing is the branch of neuroscience research that aims to better understand the consumer through his cognitive processes and has applications in marketing, explaining consumer's preferences, motivations and expectations, predicting his/her behavior and explaining successes or failures of advertising messages. Neuro science can help Marketers by Providing confirmatory evidence about cerebral changes. Generating more fundamental (i.e., a neural level) conceptualization and understanding of underlying processes, refining existing concepts of various phenomena, and providing methodologies for testing new as well as existing theories are in the offing.

The term neuromarketing was first used in a June 2002 press release by an Atlanta advertising firm, BrightHouse, announcing the creation of a business division using fMRI for marketing research. The annual advertising market in the USA alone in 2014 was 475 Billion US $. Traditionally marketers have watched what we do in stores or tracked how purchases rise or fall in response to promotional campaigns, changes in pricing, endless surveys and focus groups, asking us what we buy and why. In Neuromarketing one understands patterns of brain signals (electrical, blood flow, O2 and blood utilisation in specific regions) as a function of time (milliseconds) during observation of commercial advertisements , leading to information about cognitive and emotional processing of information in the brain . The neurophysiological changes in the complex neuronal network , during a simple decisional process, involved in purchase of a specific product is studied. The response to advertising (how the message is encoded) matters more than the stimulus (the ad itself) because the response is what the ad leaves behind.

Advertising productivity will increase if managers knew how advertisement stimuli (the Unique Selling Proposition) were received and stored by the brain, and how they affect brand choices. Individuals with a high BMI prefer a thin-shaped bottle, even if this drink is higher in price. Brains in obese people respond differently to nutrition labels. When given an identical milkshake , there is an increased brain activity in reward areas if the label reads 'regular' compared to 'low-fat'!!. Neuroimaging has been used to identify structural and functional brain markers associated with racial biases, trustworthiness, moral reasoning, economic cooperation, social rejection, sexual preferences and even consumer brand attachment. While one school of thought says " Don't just advertise. Neurotise ", others believe that Brain Scans are only Brain scams !!

Basis of Traditional Marketing:

The main objective of marketing is to match products with people. - guiding design and product presentation to suit consumer preferences – *is it possible to examine what the brain does while making a purchasing decision*

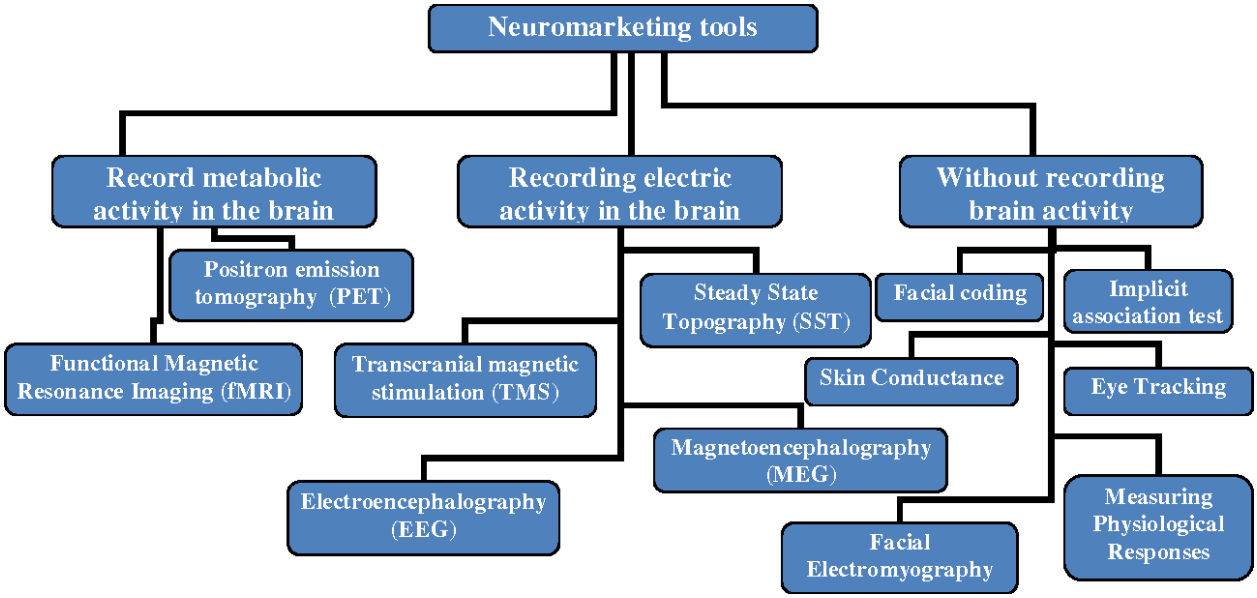
Basis of Neuromarketing

Cognition describes the way our brain thinks, reasons and solves problems. Changes that occur in the brain while we focus, concentrate, maintain or divide attention can now be qualitatively and quantitatively measured. Learning, remembering

new things, planning, executing and regulating activities, understanding and using language, assembling and grouping things together all form the basis of neuromarketing studies.

Neuromarketing Tools

This is represented pictorially below. However these studies can only be done in well equipped neuro labs with considerable infrastructure and technical expertise.



Source: Sharad Agarwal IIM Ranchi

Techniques of Neuromarketing

Eye movement tracking is a standard tool deployed for understanding interaction with both online and bricks-and-mortar environments. Eye movement (fixed and interrupted) reveals focus and attentional bias, distribution and gaze time (of the look) and pupil dilation. These are surrogate markers of the subject's attention and cognitive processing. A longer blinking interval would correspond to better processing of information. ERP ANALYSIS: An Event-Related Potentials (ERPs) analysis, revealed that visuo cortical processing shows an increase in the early positive component (P1 of an ERP), at central and parietal sites, along with increase of the later negative component (N2 of the ERP), at parietal and occipital sites, related to the observation of disliked logos. Brain fingerprinting includes identification of the p300 wave in EEG and MEG and correlating this with observed responses when exposed to a marketing stimulus. Transcranial magnetic stimulation (TMS) a neuroenhancer could even have potential for altering " Neuro responsiveness" to Branding. The brain is the ultimate business frontier and technology is now letting marketing managers peek inside our heads. An EEG allows neuroscientists to track the electrical changes occurring in the brain when watching a commercial. Miniaturization and portability of the equipment has made evaluation of potential customers easier.

Illustrations of Neuromarketing

Subjects preferred Pepsi if they did not know what they were drinking, but preferred Coke if they did. Brain scans showed different activity in different areas .When tasting blind, **the ventromedial prefrontal cortex** responded more actively to Pepsi. When told they were drinking Coke, there was more activity in the **medial prefrontal cortex** — a part of the brain dealing with higher cognitive processing and memory. *Positive brand associations could almost literally be seen overriding the basic pleasure response (taste)*

Specific Documented Brain changes when seeing an Advertisement

Strong activation of the Right Inferior Frontal Cortex (Vocalisation), at 500 ms, latency and in the Left Orbitofrontal Cortex (Judgement) between 600 and 1200 ms after stimulus presentation has been recorded. Active involvement of **Anterior Cingulate Cortex (ACC)** and **Cingulate Motor Area (CMA)** have been correlated to liking or disliking particular advertising logos. **Ventromedial Prefrontal Cortex (VMPC**) is critically involved in emotion and emotional regulation, playing a pivotal role in brand preference. The Prefrontal cortex discriminates cognitive processes, encoding new complex stimuli (e.g., logos, products, testimonials, payoff, etc). Amount individuals were willing to pay (a measure of decision utility) correlated with activity levels in the Medial Orbitofrontal Cortex (OFC) and Prefrontal cortex (PFC). Similar activation in the OFC was observed when subjects anticipate a pleasant taste, look at pretty faces, hear pleasant music, receive money and experience a social reward. In a study of neural responses to sips of wine, medial OFC response

were higher when subjects were told that wine was $90 per bottle vs. $5 per bottle!!! If an ad does not modify the brains of the intended audience, then it has not worked . This would be the way a marketing campaign is assessed

Neuromarketing: a Peep into the Future

MRI scans for neuromarketing studies are at present not regulated by FDA or IRB. *Neuro-caution* must be used in deploying the new *neuro culture* of neuro marketing, while appreciating the exciting discoveries about human behavior using neuro technologies. Commercial effectiveness indicators could be measured including emotional engagement, memory retention, purchase intention, novelty, awareness and attention. We make decisions based on our emotions. Emotional engagement is secondary to the emotional excitement. What happens in the brain when consumers respond differently to an ad, brand or campaign will be understood. Cerebral changes during the Emotional Reaction and Cognitive Processing component of seeing an advertisement can be studied. This is correlated with remembering /forgetting the Ad, attention sustenance, like/dislike . Marketers could exploit these tools in an ad pretest. The exact location/s of the "Buy Button" could be identified. Using. principles of reverse engineering the BB could be stimulated and consumer behaviour modified !!! Improbable Yes. Impossible No

About the Author

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Director, Apollo Telemedicine Networking Foundation & Apollo Tele Health Services, is a Former Secretary & Past President Neurological Society of India, Telemedicine Society of India & the Indian Society for Stereotactic & Functional Neurosurgery.

Emeritus Professor Tamilnadu Dr MGR Medical University. He was formerly Adjunct Professor IIT Madras &Anna University Homepage:: www.kganapathy.com

Few Neuromarketing Books

Hooked
Author: Nir Eyal (@nireyal)

This book explains the Hooked Model: a four-step process embedded into the products of many successful companies to subtly encourage customer behavior and form habits. Hooked is not abstract theory, but a how-to guide for building better products. Nir Eyal masterfully weaves his insights of technology, business, and psychology into his four-step model that reveals the formula for creating habit-forming products.
https://www.amazon.com/Hooked-How-Build-Habit-Forming-Products/dp/1591847788/

Neuromarketing for Dummies
Author: Stephen Genco (@sjgenco)

Don't be put off by the title of this book, it's one of the better neuromarketing books on the market. Although the content is presented in the format used by all books in Wiley's Dummies series, there's a ton of well-researched information in the book. Neuromarketing for Dummies (my review) is a readable intro to both non-conscious effects on decision-making and the more technical side of neuromarketing.
https://www.amazon.com/Neuromarketing-Dummies-Stephen-Genco-ebook/dp/B00EO3ZIIS/

Buyology
Author: Martin Lindstrom (@MartinLindstrom)

The lessons in Buyology (my review) are pulled from a three-years, $7 million research project which Lindstrom started in 2004. This might still be the largest neuromarketing study ever conducted' Lindstrom worked with organizations around the world to test what people actually feel about certain advertising techniques and products using fMRI. Some of the findings about tobacco warning labels and red Formula One cars will surprise you. One of the first neuromarketing books to be a true bestseller.
https://www.amazon.com/Buyology-Truth-Lies-About-Why/dp/0385523882/

Neuromarketing Books: The Ultimate Reading List:
https://www.neurosciencemarketing.com/blog/articles/neuromarketing-books-reading-list.htm

Management Lessons from a Rural Indian Water Project

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Motivation

The motivation behind this article is three-fold:

- *to share the story of a ponds restoration project with the engineering enthusiasts across the globe.*
- *to present the project's detailed blueprint so that it can be adopted by socially conscious corporates as part of their Corporate Social Responsibility (CSR) initiatives across India.*
- *to encourage environmentally conscious citizens to come forward in resolving the water crisis faced by India.*

Background

Thappalampuliyur village, situated in Thiruvarur district of Tamil Nadu in India, is home to over 1500 families and has over 1000 years of rich heritage. The villagers primarily depend on agriculture and livestock rearing for their living. For centuries, three water tanks (ponds) of this village have served as vital sources of water for the villagers. These ponds have historically served as drought mitigation structures to meet drinking water needs during distress periods. However, by the year 2016 continuous reduction in ground water levels, absence of sufficient spells of rain and the prevailing drought situation left the ponds to dry up

Restoration of the Village Ponds

Over the past 2 years a core team comprising of Mr.T.P.Venkataraman, Mr.Seetharaman Kalyanaraman, Ms. Vaidehi Krishnamurthy, Mr.T.S.Balasubramanian and myself worked towards the desilting and restoration of these ponds – an activity that was carried out after eight decades. The effort that spanned over 18 months, has offered phenomenal environmental, and economic benefits. It has increased the water level and extended the water retention capacity of the ponds. It has elevated the ground water levels of the surrounding areas as well.

By replicating this model across villages in Tamil Nadu and similar water-sparse states of India, there is a good chance of increasing ground water levels across the country, thereby efficiently and sustainably addressing lack of water supply from rivers. The before and after pictures of these two ponds are given below.

Project Details and Lessons in Management

The ponds restoration initiative saw immense levels of passion, process optimization, cost optimization, meticulous planning and innovation - a combination that many professionals in the management field aspire for. I have outlined some of my key takeaways in management from this project, along with illustrations.

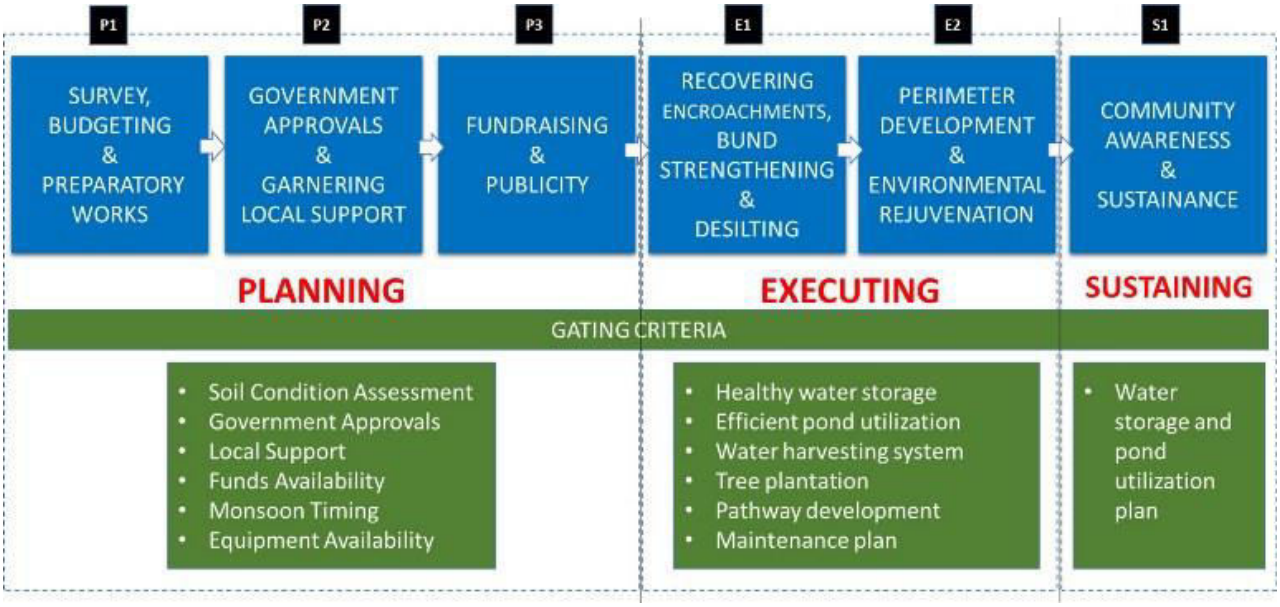
1. Attain clarity of purpose before embarking on the initiative

The foremost factor that resulted in the success of this initiative was the clarity of purpose. The anticipated benefits of desilting the ponds spanned across four areas – **Environmental**, **Societal**, **Economic and Wellness**. Some of the benefits aspired for were, to improve the water table, provide natural replenishment of ground water, strengthen the community in and around the village, improve agricultural productivity and most importantly provide clean water for current and future generations. With this powerful vision, the intent to carry out the initiative was quite compelling and provided the impetus to the subsequent planning and implementation stages.

2. Draft a blueprint, by involving relevant stakeholders

Once the purpose was established, a blueprint or a draft plan was put in place. For this, various stakeholders were engaged, and this helped in building consensus around the initiative. The stakeholder set included the villagers, village well-wishers, desilting and civil works experts, ecologists, geoscience experts, corporate donors, individual donors, NGO partner and local government authorities.

This also served as a good pulse check to evaluate what head-winds and tail-winds the project would face during execution. The draft plan also allows for identification of key tracks for the initiative and owners to drive those tracks.



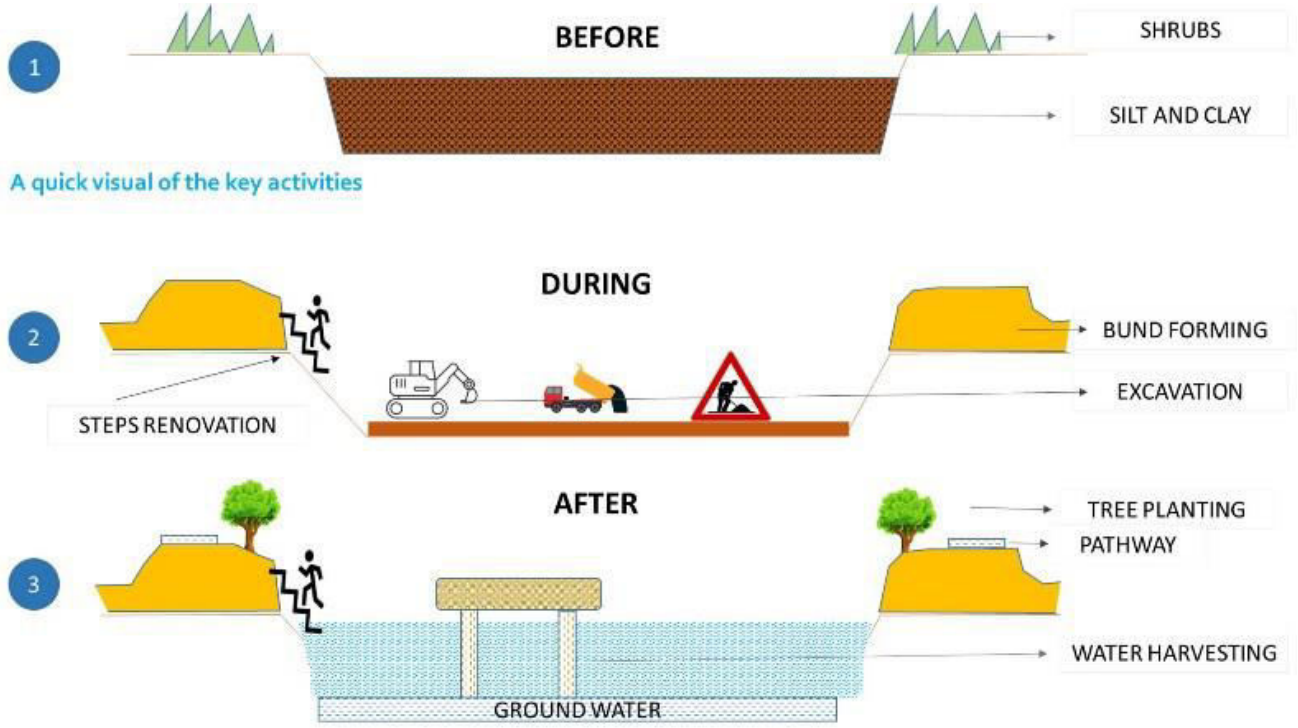
3. Study feasibility and visualize action plan to get it right

A scientific approach was adopted to assess the feasibility of the initiative. Established professionals from the geological discipline conducted a Total Station Survey of the ponds to study the soil quality and water management experts were consulted to propose measures to be taken for long term sustainability. The study also helped visualize the end-end process, assess the cost of restoration of each pond, and the administrative support needed.

The following interventions were recommended as a result of the survey.

1. Conduct a topographic survey covering the total extent, water spread, bund length and height, inlet and outlet channels, intake well and its dimensions etc.
2. Establish a baseline on the presence of groundwater extraction structures such as open wells and bore wells, their depth, usage, yield and water quality. Document the ponds' history by interacting with village seniors.
3. Clear the weedy and thorny vegetation around the water bodies, so that new vegetation cover with trees of good canopy can be developed on the bund of the pond.
4. Clean, desilt and deepen the water spread area to increase the water holding capacity. Utilize the desilted material to be used for shaping and strengthening the bund.

5. Investigate the sub-surface to assess the nature of aquifer and its groundwater potential so that groundwater extraction structure can be provided to maintain the vegetation.
6. Introduce a groundwater recharge system based on the nature of sub surface, that will harvest the excess water in the pond and recharge the groundwater system.
7. For future sustainability, protect the pond with proper fencing to avoid encroachment in future.
8. Provide walk ways around the bund for easy access for the local community.
9. Explore fishery as a pilot in the ponds and use the groundwater extraction structures to maintain water level during water distress periods.
10. Engage the local villagers and students in rejuvenating the water bodies.
11. Provide a notice board covering all the structural aspects of the water body.
12. For the long term, create the ability to increase the water bed and water quality, thereby improving the quality of life amongst the village community.



4. Build consensus and secure necessary approvals to understand boundaries and achieve autonomy

Since these tanks were public property, it was important to secure approvals from the authorities. Based on consensus among the village, a requisition letter was submitted by the village locals seeking approvals. The approvals given by the authorities were time-bound and extendable based on progress achieved. This helped reveal the boundaries within which the project can be carried out such as dates approved, desilting criteria based on permitted depth/area etc. The approvals not only give better confidence and full autonomy to the team, but also helped with more detailed planning.

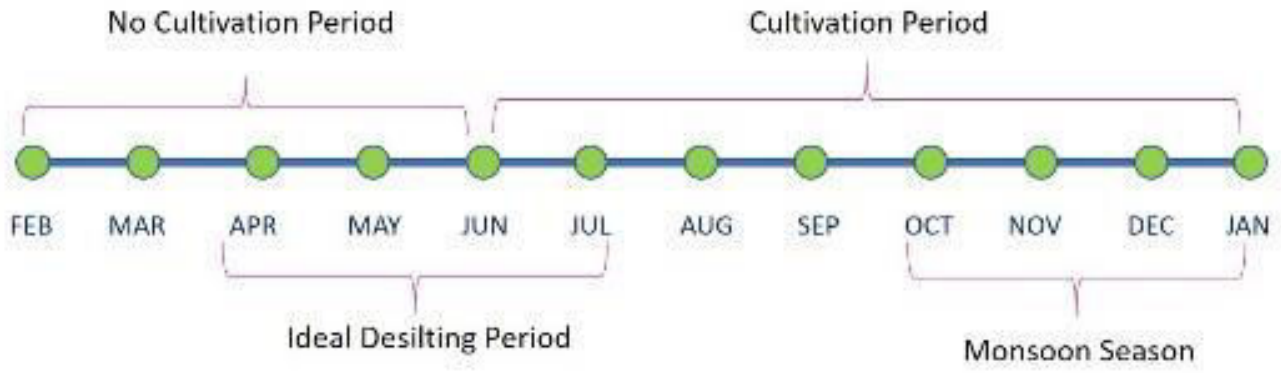
5. Prepare a comprehensive, conservative and collaborative plan with budgeting, resourcing and timelines.

It was determined that the vital part of successfully executing this initiative lied in the detailed planning. Since this was the first time it was being done in 8 decades, unearthing the unknowns were more crucial at the earlier stage. In addition to surveying the ponds and reassuring the support of authorities, budgeting and fundraising were key factors that were seriously considered.

Budgeting - With help from experts in the field, budget needs were determined and distilled in a detailed manner.

Fundraising – A non-profit partner, Rotary Club, was identified as a partner to serve as the channel to raise funds. Funds were raised from individuals, corporates, organized/family trusts and village community. It was largely due to the CSR funds raised from environmentally conscious corporates, that a project of this magnitude was possible. Piecemeal donation options comprising of daily donations, activity specific donations, lump sum donations and machinery time contributions were instituted. Fundraising avenues included outreach to people with connects to the village, social media channels like Facebook and WhatsApp, and outreach to foreign nationals.

Timing: Given this initiative can only be carried out during summer months and months where agricultural activities were minimal, timing of the project was quite important.



Resourcing: We involved the village community from the initiation stage, and as a result locals actively participated in the supervision and execution of this initiative with adequate guidance. A daily report of on-ground activity was shared with the core team and the key stakeholders.

6. Explore avenues to constantly innovate on cost and effort

While determining the plan to dispose off the desilted soil, the villagers came up with an optimal, yet innovative plan. Instead of letting the soil accumulate in mud-piles, they reached out to the local farmers, who in turn brought their own tractors for removing the decades old fertile soil that was rich in nutrients and minerals. Hundreds of loads of soil were spread on the fields for cultivation, resulting in a much richer yield in the following cultivation season. Surplus soil was also used to lay roads and construct houses. In addition to saving the cost of soil removal, this also boosted agricultural productivity.

Reuse of the sand for agriculture purposes

Sand used for construction

Fixing Potholes on the street

7. Focus on sustainability beyond the initiative, to create true impact

The impact created did not end with completion of work. The ponds got a fresh flight of steps, elevated embankments were laid out to around the pond to prevent water overflow, a water harvesting plant was set up to ensure the surplus water is harvested as ground water, palm tree seeds were planted around the embankments to prevent soil erosion, and awareness was created within the village about the importance of maintaining and sustaining the initiative.

8. Monitor, Report and Communicate often

In order to provide visibility and transparency, the daily status update on the project was shared over simple channels like WhatsApp. Frequent visits by the core team members from the city boosted the confidence of the local team. Field experts also visited the site periodically to guide, enrich and course correct the activities as needed. Cost, effort and key milestones were tracked and recorded for documentation purposes. Donors were kept constantly updated on the ongoing progress and impact.

9. Establish a sense of community to nurture engagement and strengthen purpose

More than the successful execution of the project, the community that it nurtured and sense of purpose it established were the true indicators of meeting its vision. The project infused tremendous confidence among the village locals and has

resulted in a positive change in their mindset. Thanks to the constant engagement with the local community they now firmly believe that with support from individuals and corporates, and by adopting a structured professional approach they can create a much better life for themselves and their children. They have now started the next impactful initiative of desilting water canals which form the vital irrigation framework of the village, covering approximately 5 sq.km of the village's cultivable land, in addition to additional ponds in an around the village.

The greatest of management lessons are not always taught in B-School classrooms or corporate workshops. They are often experiential in nature and are taught on the field, while undertaking projects with a strong sense of purpose and long-standing impact.

PS: A more detailed presentation is available at: http://bit.ly/tplponds

About the author

Sathish Vaidyanathan is a core team member of Thappamalpuliyur Ponds Restoration Project. He has been associated with this initiative in planning, publicity, marketing and fundraising for this project.

An engineer by profession, Sathish Vaidyanathan works for PayPal India and heads the engineering team that launched PayPal's payments platform for the India domestic market. Before joining PayPal, he had stints in engineering at eBay, Sun Microsystems, Mentor Graphics, Ramco Systems, and two early-stage startups in the US. He is deeply passionate about empowering non-profits and social enterprises through technology, innovation, entrepreneurship, intrapreneurship, mentoring and leadership development and authored articles on these topics on LinkedIn. Sathish has a Masters' degree in Software Systems from BITS Pilani and an engineering degree in Computer Science from SRM Engineering College, Chennai

Status of Drinking Water and Sanitation in rural India

In Budget Session 2018, Rajya Sabha has planned to examine the working of four ministries. The Ministry of Drinking Water and Sanitation is one of the ministries listed for discussion. In this post, we look at the key schemes being implemented by the Ministry and their status.
https://www.prsindia.org/theprsblog/status-drinking-water-and-sanitation-rural-india

76 Million Don't Have Safe Drinking Water: India's Looming Water Crisis

Nearly 76 million people in India do not have access to safe drinking water, as polluted rivers and poor storage infrastructure over the years has created a water deficit which may become unmanageable in the future
https://swachhindia.ndtv.com/76-million-dont-have-safe-drinking-water-indias-looming-water-crisis-5606/

India's water and sanitation crisis

India is the second most populous country in the world, with more than 1 billion citizens. Roughly half of India's population, a staggering 522 million, practice open defecation.

The World Bank estimates that 21 percent of communicable diseases in India are linked to unsafe water and the lack of hygiene practices. Further, more than 500 children under the age of five die each day from diarrhea in India alone.

With its strong microfinance sector and extensive need for improved water and sanitation solutions, India provides a great opportunity for Water.org to scale our WaterCredit solution. Monitor Deloitte estimates that the rural sanitation market in India is worth US $25 billion. https://water.org/our-impact/india/

Water In Crisis – India

With a diverse population that is three times the size of the United States but one-third the physical size, India has the second largest population in the world. According to the World Bank, India has taken significant steps to reduce poverty but the number of people who live in poverty is still highly disproportionate to the number of people who are middle-income, with a combined rate of over 52% of both rural and urban poor. Although India has made improvements over the past decades to both the availability and quality of municipal drinking water systems, its large population has stressed planned water resources and rural areas are left out. In addition, rapid growth in India's urban areas has stretched government solutions, which have been compromised by over-privatization.
https://thewaterproject.org/water-crisis/water-in-crisis-india

Building tech startup culture through colleges for generating National and International Opportunities

Mr. B. Parameshwar Babu
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Why India needs more startups

Nearly 10 million youths reach employable age every year in India. They may be graduates, diploma holders, vocational graduates and so on. However, are there enough jobs for these young adults? No!! Frankly speaking, a problem of this scale does not exist in any other country. We cannot arrive at a solution for this easily since we do not have any similar models in other countries to compare, learn and apply. Since 1990s, after liberalization happened in India, foreign investments have led to creation of jobs in a phenomenal way. However, job creation has not been consistent and stable in recent times. Obviously, a better solution for this would be to create numerous startups nationwide. Therefore, the best exercise would be to arrive at new mechanisms to accelerate the creation of quality startups.

While there are plenty of schemes/funds coming up for startups and entrepreneurship training, one should remember these schemes will not be effective if there aren't any mechanisms to nurture pre-startup activities in colleges/schools especially engineering colleges. The article provides a broad outline of **why** we need startup culture, **what** pre-startup activities can be brought in and **how** such pre-startup activities can be run through college infrastructure/resources.

Foreign investments, exports and employment opportunities

No doubt, foreign investments and export of IT services have provided enormous job opportunities for software engineers, automobile, electrical / electronic engineers, diploma graduates, etc. for nearly three decades since 1990. Of course, it led to the growth of various industries like real estate, hospitality, travel services, etc. because average salary levels of working population were increasing steadily. Media has been consistently going gung-ho over impressive growth rates in India since 1990s. In fact, India's branding in the international market has improved over the years because it is seen as a large country with better growth rate than most countries.

However, excitement over growth rates and large consumption market powered by huge working age population has actually eclipsed so many issues that are beginning to show up in detrimental ways in India. In recent times, the most visible consequence of this negligence is the disturbance in IT sector and its impact on engineering education.

Engineering education and IT industry

During 1990s, engineering education was seen as a privilege because of limited number of engineering colleges across the country. Either a person would have to spend substantial amount of money for paid category admission or should have some academic excellence to gain admission to engineering colleges. So, not everyone was aspiring for admission into engineering colleges. However, IT outsourcing to India picked up steam after 1995. Though the employability of engineering graduates was not that great, the sheer demand of IT manpower simply skyrocketed and large companies thought it would be okay to spend money to train and nurture fresh engineering graduates for one year or so. **The cost of training engineering graduates was miniscule compared to the amount of revenues these IT companies were generating. In fact, this trend continued till 2015.** Though this practice was becoming unaffordable for companies since then, college management started feeling the negative effect of this change only recently. Large tech. companies are drastically cutting down campus placements and overall hiring.

Before we delve deeper into the intricacies of engineering education in India, it's worthwhile for us to understand how engineering/technical education runs in most countries. For extremely complex problems, it's also better to zoom out and view them like an outsider.

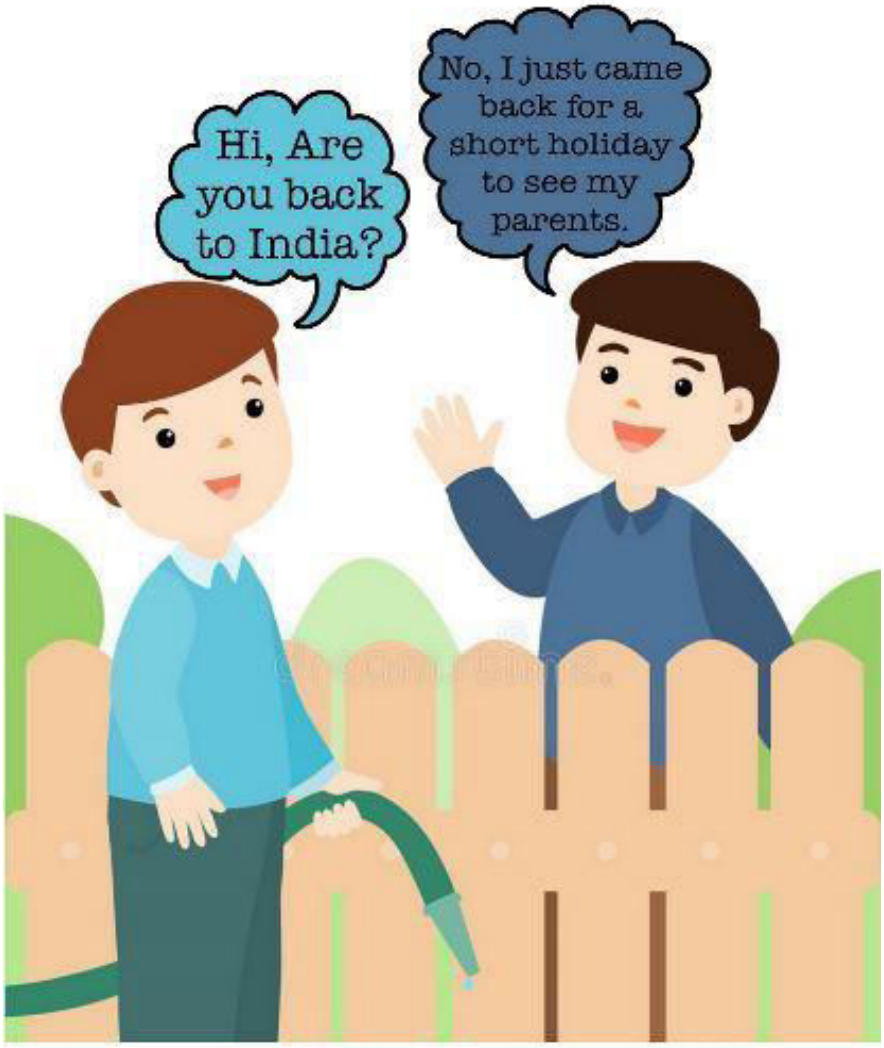
Engineering education in other countries

It may not be possible to compare Indian engineering education system with all countries of the world. However, we can just do a quick analysis of systems prevailing in in rich, middle-income and poor countries.

Rich countries of the west have a mix of private and government aided educational institutions. Most of these countries established a strong financial foundation during Industrial revolution. They have a fairly good employment opportunities in a variety of sectors and hence multiple opportunities for a stable life. Perhaps, this is one reason why there has never been a mad craze for an engineering degree there. They have never witnessed mushrooming of engineering colleges for this

reason. Also, only those students who had analytical/mathematical mindsets during high school days opted for engineering education. Whereas in India, a student who may not have had any involvement in scientific or engineering projects may simply opt for engineering college just for the sake of peer pressure or status symbol. I am not talking about students who do this because of parental pressure, rather I am talking about students who simply want to get an engineering degree because they have seen some friends/relatives or neighbors go abroad and lead a great lifestyle. In other words, they have seen friends who had very little technical inclination during high school, obtain engineering degree and work for popular IT or tech companies. **Notwithstanding this trend, it's worthwhile to note that non tech. businesses in rich countries have always been quick to spend good amount of money and resources far higher than non tech. businesses in India**. Managers in such non-tech businesses of western countries may be Arts/Humanities graduates but they maybe in-charge of handling complex business processes involving implementation of top-notch software tools like ERP, etc.

Figure below shows the conversation between a school kid and a professional with overseas job.



In middle-income countries, number of engineering colleges is likely to be lower and the standard of education may not be that great. **However, those students opting for engineering education in certain Asian countries may have a strong attitude towards problem solving**. Even if quality of the faculty or curriculum is not top class, when students who have the determination to grasp societal/industry problems are likely to acquire better skills and become entrepreneurs or be quickly absorbed by the industry as employees. Also, these countries depend on various sources of income like natural resources, tourism or some specific niche industry. Because of diverse nature of their incomes, they may not have the pressure to depend on IT sourcing income like India. However, **non tech. businesses in upper middle-income countries may still spend some amount of money and resources somewhat higher than non tech. businesses in India**.

Finally poor countries in Africa or in Latin America/Central Asia may have very little resources to offer high quality education. Students from these countries will definitely be willing to come to India for higher education. Though majority of the businesses may not have the budget for buying IT and engineering resources from India, there are considerable number of large enterprises in these poor countries that can provide decent revenues for tech. companies in India.

Peculiar Fabric of Engineering Education In India

As of today, majority of engineering colleges are worried about maintaining revenue streams whereas tech. companies cannot afford to hire large pool of manpower from engineering colleges. On the other hand, Governments face enormous challenges to provide livelihoods to graduates through employment or entrepreneurship route. To understand the causes of this dilemma, one has review the history of engineering education for the past three decades. Engineering colleges in India have been built based on spurts in demand during the boom period. **While it's always a good idea to build any business based on demand and supply, education does not always work that way**. Education sector simply did not worry about the yardsticks for measuring the quality of technical education but was simply carried away by demand and supply logic. Education sector is not a simple commodity to be governed by simple demand and supply logic alone but we also need to understand what format of engineering education would make sense from time to time. **If this validation of format of education is not reviewed on an ongoing basis, we need to face dire consequences like how a person suffering from diabetes would face slow and steady killer symptoms.** We had several warning signals during the last three decades but

we did not see that as a wake-up call and use that as an opportunity to fix a proper foundation for engineering education. In the next section, we will see how the format of engineering education can be tweaked based on industry trends, international practices and experiences.

Engineering and software projects for Startup Culture

As mentioned in the beginning of the article, doing pre-startup activities/exercises would be more essential for nurturing startup culture rather than simply creating startup funds, hackathons, grand challenges, etc. **Many investor groups often claim that there is no shortage of funds for Indian startups; it's only the shortage of investible ventures that's preventing investment growth in India. In this context, what the author implies by the phrase "Nurturing Startup Culture in colleges" is a series of activities/exercises in colleges to create a proper mindset amongst students leading to faster creation of quality startups.**

Let's see what format of engineering education would make sense for nurturing Startup Culture. We can classify various engineering and software projects into two broad categories:

1. **Patent winning or high intellectual property value types**
2. **Process driven projects based on preset standards and practices**

For a very long time, employers in India were focused on type #2 projects. Hiring of engineers for this type of work has been dominant. In recent times, employers for type #1 are beginning to increase but for a country of India's size, they are not enough. **In many countries, students are exposed to type #2 projects during college or sometimes during school days. In fact, these project activities are treated as learning exercise in these countries** whereas in India, candidates are involved in both types of projects only after employment. Even more alarming is the fact, candidates typically consume one or two years after employment for attaining basic tech. skills and maturity of mind to face the world. **This is a huge cost burden for companies/startups for imparting basic skill training**. Current skill training schemes are not sufficient as they are still based on rote learning rather project-based activities.

Any project with decent intellectual property value(type #1) involving scientific, engineering or software development typically may require a team of varied skill levels. This is also true for many **research and development projects** involving multi-disciplinary approach. In developed countries, engineering students experience type #1 projects during college days and Arts/Humanities students involve themselves in type #2 projects. This is one reason why it's easier to allocate substantial funds for research and development funds in these countries while India is still struggling to increase R & D spending beyond IITs. Of course, considerable amount of IP creation happens in IITs but a country of India's size would need different flavors and varieties of startups that cannot be exclusively engineered from IIT's ecosystem. Of course, IIT's ecosystem generates startups that attracted the best of big investors probably because investors found them safe to invest. However, there are considerable number of non-IIT innovators and entrepreneurs who have left India but they found support from places like Harvard (USA), etc. To quote another example, billionaire tech. entrepreneur, Peter Thiel often says things like **Education is optional for successful entrepreneurs** and he does not give much importance to the education of founders while identifying ventures to invest. In fact, Peter Thiel funds students to drop out of college and join the coveted and controversial fellowship program funded by his foundation. Young entrepreneur from India, Ritesh Agarwal dropped out of college and opted for this Peter Thiel fellowship to earn $100,000 from USA. Ritesh Agarwal later became India's youngest billionaire. Eco-system in India does not lend great support for such thinking and hence we do not have sufficient flavours of startups that would be expected from a large country like India.

Even when Ritesh Agarwal's company, OYOROOMS had made it big, Agarwal was the only dropout heading a team of 10-20 people from IIMs, more than 200 people from IITs, Harvard Business School and Ivy leagues. What I am trying to say is that fast growing Unicorns like OyoRooms do need teams from IITs, IIMs and Ivy Leagues; India has the mechanism to produce such team members, however, mechanism to nurture people like Ritesh Agarwal came from Silicon Valley people like Peter Thiel. If we build similar mechanisms in India, we can nurture / accelerate more startups in India to generate huge employment and fuel economic growth in an unimaginable way.

The author has been pushing for certain activities in colleges that will help not only in the identification of right people like Ritesh Agarwal but also create nurturing eco-system (nicknamed "**Startup Nectar**") around such people to grow and scale up.

Obstacles for Startup Nectar

In India, despite massive propaganda for startups, there has been some resistance against the implementation of any form of **Startup Nectars.**

- Skewed attitude and aptitude of aspiring engineers
- Enforcement of new learning techniques by the faculty and college administration

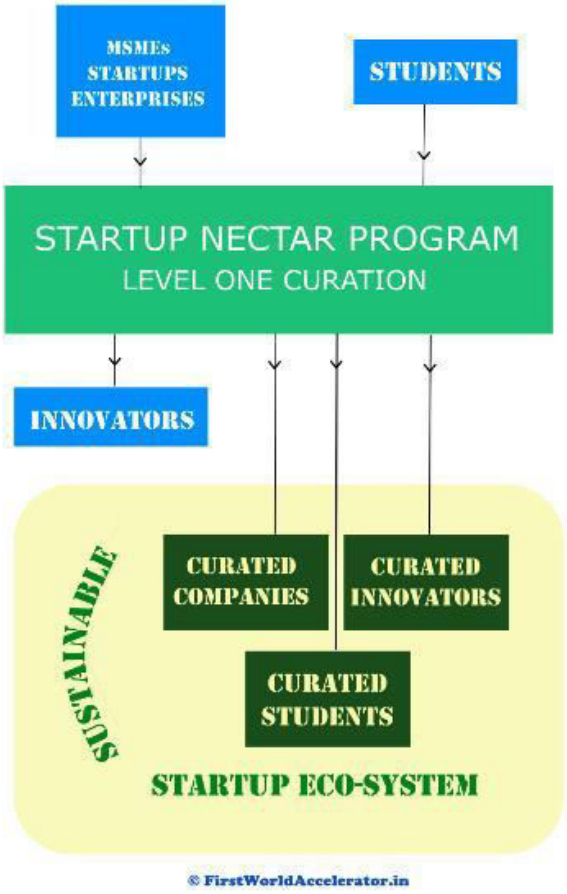
- Resources needed by companies to engage students/interns
- Orientation for Parents to allow kids for work based learning methods
- College Management's addiction to affiliation as opposed to producing real results

The resistance level was very high when the author tried to inculcate any form of startup culture in colleges several decades ago. However, in recent times, co-operation from college management has been steadily building up though very slowly in baby steps. Since colleges have been mostly accustomed to perform purely for affiliation purpose, they take just baby steps rather than giant leaps. Despite this general trend, there have been some colleges in India who have tried small but significant ways to nurture startup culture without waiting for schemes and affiliation points.

Framework of Startup Nectar

As mentioned in the beginning of the article, series of pre-startup activities are needed in college campuses to create a pre-startup eco-system code-named Startup Nectar. This eco-system will gradually overcome resistance from various fronts and will create new believers and contributors for the startup eco-system. Also, it will make governments and industry associations to bring out new policies and schemes. Based on the interactions of the author with college owners and industry associations during the last couple of years, there are signals of growing positivity and some real action.

Based on various experiments conducted by the author, the framework that works for Startup Nectar is outlined below:



The above diagram is the output of several decades of research and pilot projects. Also, the most effective output can be seen if innovators, scientists, startups, enterprises and students are brought in from different parts of the globe. This is usually time-consuming and expensive but from the author's experience, it is worth the effort to reap substantial dividends.

Conclusion

We need more educational institutions to spend more time and resources to accommodate new frameworks like **Startup Nectar** as part of their overall activities in the college. They need to understand it will also help in getting worldwide recognition and branding in the long run far better than short time programs. Many of the educational institutions in developed countries have been doing this for several decades and they can easily derive inspiration from them while remembering to make local orientation to suit Indian students.

References

1. Boy from Naxal area scripts incredible story - https://economictimes.indiatimes.com/news/company/corporate-trends/sim-card-seller-college-dropout-millionaire-at-22-boy-from-naxal-area-scripts-incredible-story/articleshow/64678808.cms
2. The dropout who dined with Peter Thiel - https://economictimes.indiatimes.com/magazines/panache/meet-oyo-rooms-ritesh-agarwal-the-dropout-who-dined-with-peter-thiel/articleshow/48536789.cms

About the Author

Parameshwar Babu is a serial entrepreneur and mentor who has more than 20 years of experience in running various tech. ventures. He created award-winning Java software that became a popular product across the globe bagging orders from NASA, US department of defense and also resulting in mushrooming of Internet Cafes/Browsing centers across India. After 2006, he was instrumental in creating various e-commerce frameworks for a variety of industries like retail, fashion/garments, entertainment/music, education, manufacturing and hospitality. Since 2010, he has mentoring and nurturing entrepreneurs from diverse backgrounds across India and also helping overseas companies to establish collaborative projects India. Some of the startups mentored by him have been winning awards in India and abroad every year. He plays a very active role as committee member in various industry associations and chambers of commerce in India and abroad. He has been pushing for international support for Indian Startup eco-system through such committee activities and has been delivering talks as a key speaker for events organized by CII, AICTE and various business associations/chambers of commerce.

Top 25 Marketing & Entrepreneurship Books For 2019

There are countless lessons to learn as a business owner, entrepreneur, marketer, or manager. It's always helpful to gain new perspectives and learn from the business mistakes of others instead of learning the hard way. Business books from the best experts in their industries can be an effective and low-cost way to gain additional insight that will benefit your company. They can also help to keep you motivated during the many challenges that you'll face in business in 2019 and beyond. Here are 25 of the top business books for entrepreneurs and marketers from some of the top business minds in the world (in no particular order) in 2019.
https://www.myfrugalbusiness.com/2018/08/top-books-entrepreneurs-marketers-managers.html

The Science Of Entrepreneurship: Assessment, KPIs And Measured Tactics

Businesses nowadays are very competitive and fast phasing. The drastic changes in business world needs better strategic planning and actions in order to reach its potentials along its organizational goals and ambitions. Every day is an opportunity for every venture to make itself on the top, and this has been part of every business' aspirations. To attain this, better strategies must be developed. There are planning tools that are always available to help managers and their team create, monitor and assess their goals and the actions taken to achieve it.

Along with other strategic planning that is appropriate for your business, the Key Performance Indicators (KPI) and other business metrics is a big help for any venture to identify, recognize and understand the goals that are striving to reach, and how every actions taken can contribute to its fulfillment. Anyone does not want to become blind and clueless on everything that is happening on their organization, that is why they need to have business measurements specially to aid them in decision- making process.

Generally, metrics are used to measure particular points for a particular period of time, However, KPIs exist to symbolize an organization's certain objectives, at the same time measure an action or performance against a specific target. Every target has its own definition whether in strategies, planning or budget categories and with it comes its range of performances that needs to be done. These are comprehensive measurements that are used as guidance in any business objectives. Moreover, KPIs can also be used when dealing with people or clients outside the workplace. With this, it can be analyzed that any KPIs are metrics, but not all metrics can be considered as KPIs.

Every KPI stipulates emphasis on improvements in operational and strategic perspectives of the business, essentiality of creating analytical foundations in decision-making, and the need to just focus on every detail that matters most.

https://www.myfrugalbusiness.com/2019/05/science-entrepreneurship-assessment-kpi-metrics.html

Startups as an investment asset class

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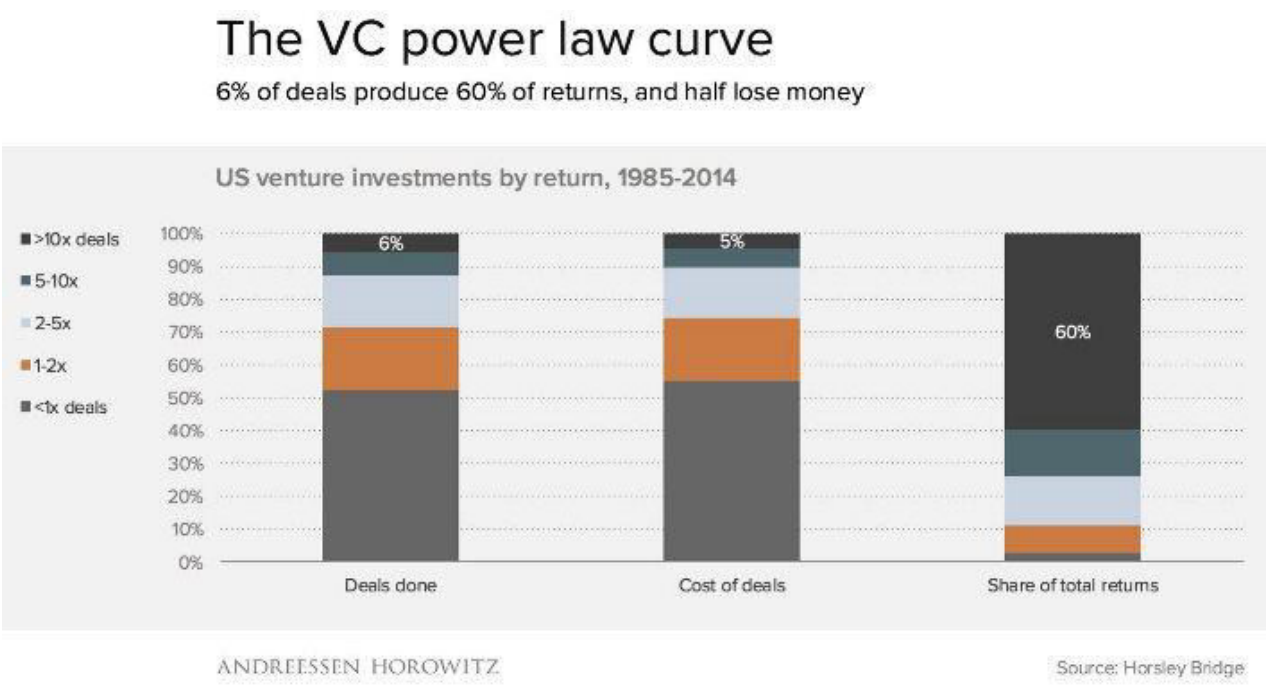
Funding startups is glamorous, but the big question is how much returns it can generate as an investment asset class.

Start-ups are young emerging companies working on breakthrough innovations that would fill the need gap or eradicate existing complexities in the ecosystem. These companies are in constant endeavor for new development & research new markets. They have agility embedded in their inventive thinking. Angel investor funds a startup for several reasons but the first & foremost reason is that they believe in that idea, project or passion. They want to the make the entrepreneur start-up successful with help of disposable capital available at their end. Investing in startups is more an art less of science - it isn't meant for everyone, is subjective. There is no method to this madness nor a defined college degree to help you learn venture investing. Every deal, experience and strategy shared in public domain is anecdotal. **Angel investor provides capital for small entrepreneurs but are not in money lending or financing business.** The finance they provide is for that first round of seed capital to make the idea vision in a reality. Entrepreneurs can also find angel investors in its family and friends who will support them with capital on terms favoring entrepreneur. Angels risk their money in people, team & idea which are fragile in nature. Hence it is called as risk capital investment.

Angels are individuals who are with good successful background, their names evoke trust in minds of customer or future investors. They back the Start-up by associating their name which provided entrepreneurs required creditworthiness in market.

Why I love startups as an asset class for investment is because I can offer my time besides capital. In other investments like public equities or real estate I can't influence an outcome. **Venture investing is a people business** so if you like meeting, working & helping people then your chance of success are very high. With early stage startups as their lead investor I work closely with founders to create a positive outcome. So before beginning a discourse on the merits and demerits of investing in startups, let's first understand investing in startups from the bottom up.

What is investing? It is the process of putting money into various physical or abstracted assets with the expectation of making a profit. One can expect to make a profit on the money invested by seeing an increase in the value of the asset - whether real or perceived - and selling off the asset at the increased value. When you invest in a company - public or private - you invest in the asset that is the company itself; you get a part of the ownership of the company. As the value of the company increases, so does the profit you can make by selling off your stake. A key difference between investing in public companies and private ones like startups is that in public companies, selling off your stake is much easier and near instantaneous. The same cannot be said about private investments - hence it is one of the most illiquid asset classes. It can give you huge profits, but those profits will be only on paper for the most part as realizing an exit takes a lot of time. **It is an illiquid investment**



One basic fundament that every early stage investor should know is that startups follow the law of power - a small percent of the startups you invest in will give you the majority of your profits. Take for example Andreseen Horowitz's portfolio. They're one of the top VC firms - and about 60% of their returns comes from about 6% of their deals. What does this tell us? It means to truly make a profit from startup investments, one should be able to access that 6% of deals. The rest of your investments may or may not materialise significant returns for you - but that 6% of your portfolio is where the return is. If you invest in few startups it's like buying lottery; it's the portfolio approach which helps the early stage investor create mega returns.

Having given this background, let us come to the question at hand - "Are startups a good investment?" Startups are high risk high return investments which follow the power law. It is not about the number of hits you have, but the magnitude of those hits. That's where we find the answer to our question. The wealth creation opportunity that startup investments provide is nearly unparalleled. But it is also extremely risky, and conditional. So when are startups good investments?

It is a good idea to invest in startups when one has the appetite and the capacity for the high risk involved. Investor with mission to give first, help founders and build business will win this game. One must be capable of creating a significantly sized portfolio of investments in the hope that some of the investments are part of the 6% and give one huge return. One can create a startup portfolio by investing about 5 - 10% of their total investment capacity in such an illiquid asset class. It is worth noting that the money invested here must be thought of as a sunk cost - until and unless an exit is realised. The investors must be able to stay patient with their capital - the best companies can give returns after 10 years.

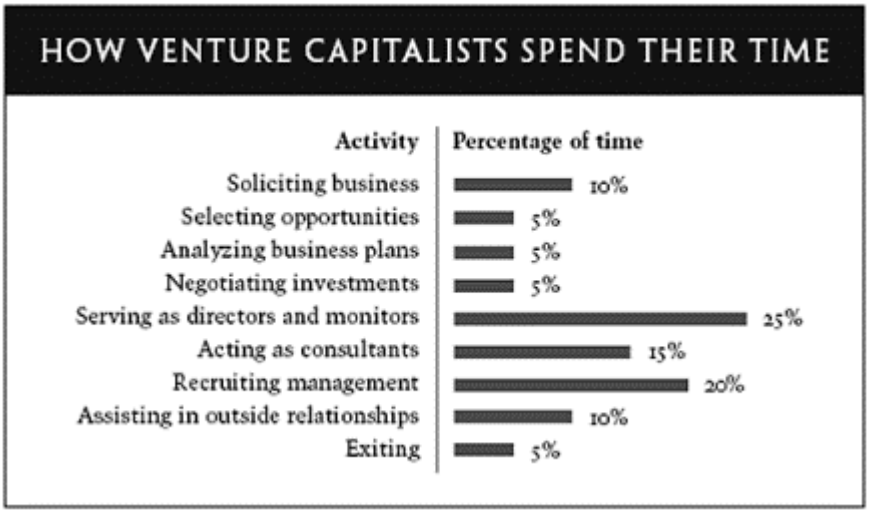
The toughest part of investing in startups is gaining access to the top tier of deals that can give you the huge hits. When one has access to those 6% of deals, it is a great idea to invest in startups. One cannot ascertain at the get go if a particular investment will provide the returns you hope - but one can invest in startups that can give unparalleled returns you hope for if they work out. To gain access to the top startups, one has to put in time and effort to become a part of the startup ecosystem, become a part of various investor networks, and collaborating with other lead investors and VC firms.

Startup Investments can provide disproportionate wealth creation opportunities. Before investing in startups, every investor should ask themselves - Am I ready to take on the capital risk? Do I have the required time & effort to build a portfolio? And last but not the least - Do I have the patience to wait for the disproportionate return?

Investing in early stage companies is about capturing the value between the startup phase and the public company phase.

About the author

Private Investor, Mehta Ventures-Family Office Investments, Director Rainmaker360, Startup, Estate, Crypto, CORE-Media. Awarded Angel Investor Of The Year 2017 by Let'sVenture. Investor in Block.one EOS decentralized platform & societal infrastructure for deploying smart contracts. More at https://www.linkedin.com/in/mehta-sanjay/



Source & Courtesy: https://hbr.org/1998/11/how-venture-capital-works

The Progress and Value of Patents in India

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Over the last decade, intellectual property (IP) has emerged as an important business tool for companies in India. Many companies have during the period managed to overcome the challenges posed by the Indian IP regime and devise strategies to derive business and competitive value from their IP assets. The progress of intellectual property law, policy and systems has instilled confidence in IP holders and noticeably furthered their commercial interests. Intellectual property awareness, knowledge and culture improved significantly during the period, and IP has now become an important assessment parameter for research and educational institutions, academics and corporate employees. Among researchers, engineers and technologists, intellectual property registration is today recognized as a valid criterion to measure ability, achievement and progress.

Intellectual Property

At a general level, intellectual property is understood to protect products of the mind or intellect. There are however some variations to the general rule, and protection of knowledge, information, association, representation and others have over the years been incorporated within the scope of IP protection. As it stands today, there are more than 10 forms of IP that protect different manifestations of the mind and other subjects as well. Inventions are protected as Patents, aesthetic product designs as Industrial Designs, business representations as Trade Marks, expressions as Copyrights, secret information as Trade Secrets or Confidential Information, and so on.

With some exceptions, Intellectual Property grants exclusive rights for a limited period of time. Once the term of IP expires, the subject of protection enters the public domain. The term of IP protection varies from one form of IP to another. For example, the term of patents and industrial designs are twenty and fifteen years, and the term of trademarks and trade secrets, if maintained, can be perpetual. Registration is compulsory for forms such as patents and industrial designs, and is not mandatory for forms such as copyrights and trade secrets. Also, protection afforded by most forms of IP is territorial, which means it is limited to the country in which it is registered. Some exceptions to this general rule are copyrights, famous trademarks and trade secrets, whose protection extends beyond boundaries if certain conditions are satisfied.

Patents

Patents are considered to be the most important forms of intellectual property for scientists, technologists and engineers as they protect inventions. Unlike in the United States, the scope and extent of patent protection is not very broad in India. It is limited by exclusions to patentable subject matter in the form of a long list of non-patentable inventions. Irrespective of their novelty, inventiveness and usefulness, inventions that fall within the scope of excluded subjects are not patentable. 'Computer programs Per Se,' 'Business Methods,' and 'New Pharma Forms' are examples of some contentious subjects that are excluded and not patentable. Though the meaning of a few exclusions such as 'Computer Programs Per Se' have been interpreted narrowly to allow patentability of many types of computer program inventions, the scope of patentable subject matter continues to be relatively narrow in India when compared to other countries such as United States, United Kingdom, and Australia.

If it is not an excluded subject, an invention is granted patent protection if it satisfies the requirements of novelty, usefulness and inventive step. The Indian Patent Office (IPO), which has offices at Delhi, Mumbai, Kolkata and Chennai, examines patent applications and grants patents only to inventions that satisfy all the patentability requirements. The term of a patent is twenty years from its filing date, and has to be renewed every year to keep it alive. It takes about three to five years to acquire a patent in India through the normal route. However, by filing for expedited examination, which route is available only for start-ups and certain PCT applicants, a patent grant may be acquired much faster. During the last two years, IPO has granted patents in as short a period as 7 months through the expedited route.

Patent Process

The process of acquiring a patent involves four basic steps before the patent office; filing, examination, publication and grant. A patent application may be filed by the inventor or the company where the inventor is employed. The application may be a provisional application or a complete application. A provisional application is normally filed when the invention has been conceived, but has not been perfected yet. If a provisional application is filed, the applicant gets twelve months to file the complete application. Provisional specifications cover the invention broadly and may be filed quickly and inexpensively. Many applicants file provisional applications to get an early priority date, and take time to file the complete application once the date is secured.

After filing, the patent application will be examined by the IPO. Unlike in the United States, the process of examination is not automatic in India. It will be initiated only if the applicant requests for examination within forty-eight months of filing. Most applicants file the request for examination at the time of filing the patent application to kick start the examination process immediately. After examination, a patent will be granted only if the invention satisfies all patentability requirements and other statutory requirements. If the applicant does not satisfy any of the requirements, the application will be rejected.

A patent application will normally be published within eighteen months of filing. Once a patent application is published by the IPO, the application will be open for opposition by third parties. A granted patent will also be open for opposition by persons in the field of the invention for a period of twelve months from the date of grant. Once a patent is granted, it must be renewed every year in order to keep it alive for twenty years. Many patents lapse and expire due to non-payment of renewal fee. For example, in the financial year 2016/17 alone, more than 19 thousand patents lapsed, expired or ceased.

Patent Statistics

As per the Annual Reports of the IPO, 4,39,590 patent applications were filed between the financial years 2006/07 and 2016/17. The number of patent applications increased by 57% from 2006/07 to 2016/17. Electronic/electrical patent applications increased during the said period from 8193 in 2006/07 to 10584 in 2016/17, which is an increase of about 29%. In 2006/07, the share of filings originating from India was 18%. This increased to 29% in 2016/17.

The table below shows year wise patent filings between 2006/07 and 2016/17. The data has been extracted from the annual reports of the IPO, which are available until 2016/17.

Table 1 – Year Wise Patent Filing Statistics

Sl. No.	Year	Total Patent Applications filed	No. of patent applications relating to electrical technology	No. of patent applications relating to electronics
1	2006-07	28940	2371	5822
2	2007-08	35218	2210	4842
3	2008-09	36812	2319	7063
4	2009-10	34287	2376	7646
5	2010-11	39400	2719	9594
6	2011-12	43197	4160	4225
7	2012-13	43674	3568	4424
8	2013-14	42951	4371	4410
9	2014-15	42763	4031	4285
10	2015-16	46904	4102	5988
11	2016-17	45444	4141	6443

Overall, the number of patent applications filed in India increased steadily until 2012-13, but has been stagnant thereafter. Compared to 2006, the IPO is today more transparent, organized and technologically advanced, but its traditional lethargy, apathy and inaction continue to subsist in some quarters.

Patent Fee

The fee for acquiring a patent is divided into two types, statutory fee, payable to the IPO and professional fee, charged by the patent attorney. The basic statutory filing fee for individuals and startups is 1600 INR and it is 8000 INR for large entities. This fee is for patent specifications that do not exceed thirty pages and ten claims. The fee charged by an attorney varies based on the experience, expertise and stature of the attorney and ranges between 1 to 5 lakh rupees. For startups, attorneys empanelled by the IPO offer services without charging any professional fee, which may be claimed by the attorney from the Government.

The Table hereunder provides the basic statutory fee applicable to different entities.

Table 2 – Basic Statutory Fee

Sl. No.	Entity	Action	Statutory Fee
1	Start-up / Individuals	Basic filing fee	1600 INR
2	Start-up / Individuals	Fees for each page in excess of 30 pages	160 INR
3	Start-up / Individuals	Fees for each claim in excess of 10 claims	320 INR
4	Start-up / Individuals	Filing a request for examination	4000 INR
5	Small Entity	Basic filing fee	4000 INR
6	Small Entity	Fees for each page in excess of 30 pages	400 INR
7	Small Entity	Fees for each claim in excess of 10 claims	800 INR
8	Small Entity	Filing a request for examination	10000 INR
9	Large Entity	Basic filing fee	8000 INR
10	Large Entity	Fees for each page in excess of 30 pages	800 INR
11	Large Entity	Fees for each claim in excess of 10 claims	1600 INR
12	Large Entity	Filing a request for examination	20000 INR

The specific statutory fee applicable may be accurately calculated based on the type of applicant and number of pages/claims in the specification.

Commercialization and Enforcement

Though the patent protection system has improved appreciably in India over the last decade, the extent of commercialization and licensing of patents has not progressed significantly. With a few exceptions, the patent licensing/commercialization market has not matured enough to facilitate and enable licensing transactions. Experts attribute quality of patents, weaknesses in the enforcement system, dearth of professionals and other reasons for the same. Though licensing transactions are few and far between, some companies have started using patents effectively as a part of their marketing, financial, and corporate transactions.

Like other countries, India also witnessed patent actions around Standard Essential Patents relating to mobile technologies during the last 5 years. Ericsson sued Micromax, Intex and others for infringing its patents that form part of standards relating to 2G and 3G technologies. Following initial orders in its favour, Ericsson was able to convince some companies to acquire licenses over its patents.

Recent judgments indicate that the understanding and perspective of Indian Courts with respect to patent disputes has changed over the last decade, and they are no longer perceived to be biased against enforcing patents. Several patent holders were able to get favourable judgments against infringers, and many companies have developed patent strategies specific to the Indian IP system. Though it is not as easy as it is in the United States or United Kingdom, patent holders have shown that patents can be enforced effectively for business benefit in India as well.

Value and Performance

Patents have today emerged as indicators of value and performance among corporates and academic institutions in India. Number of patent filings and grants are recognized by corporates and research institutions as indicators of innovation, technological excellence and product quality. Patents are today important parameters in valuation and evaluation of organisations. They are used to measure progress in several aspects ranging from Research and Development output to standards of education.

At the individual level, patents are recognized as important parameters for making hiring decisions, measuring employee performance, and deciding on promotions/increments. They have also been recognized as valid alternatives to publications, and form part of parameters for performance review of academics and researchers at educational institutions. The awareness of patents among the general public has significantly increased during the last decade, and many people have started relating patent holdings to the quality and credibility of products, companies and individuals.

Acknowledgements

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References

- Dr. Kalyan C. Kankanala, Fun IP, Fundamentals of Intellectual Property, Literators Publishing, first published in 2012, available at https://www.bananaip.com/wp-content/uploads/2018/07/FUN-IP-Fundamentals-of-Intellectual-Property.pdf, visited on May 2, 2019.
- Dr. Kalyan C. Kankanala et al, Indian Patent Law and Practice, Oxford University Press (2010), available at https://www.flipkart.com/indian-patent-law-practice/p/itmdccfwsjzzquk5, visited on May 2, 2019.
- Patent Grant in Record Time, available at https://www.bananaip.com/ip-news-center/patent-grant-in-record-time/, visited on May 4, 2019.
- Annual Reports of the IPO, available at http://www.ipindia.nic.in/annual-reports-ipo.htm, visited on May 2, 2019.
- Patent Statistics from BananaIP's Intellepedia, available at https://www.bananaip.com/ip-news-center/patent-and-design-statistics-in-india-recap-2018/, visited on May 2, 2019.
- Ericsson Standard Essential Patent infringement cases, available at https://indiankanoon.org/search/?formInput=ericsson+patent+infringement, visited on May 2, 2019.

About the author

Dr. Kalyan Kankanala is an accomplished and respected IP attorney in India. He is the Managing Partner of BananaIP Counsels, a top ranked Intellectual Property (IP) firm headquartered at Bangalore. His book on Indian Patent Law and Practice published by Oxford University Press is among the highly referenced and cited books in patent law. Dr. Kalyan holds honorary positions with centres of IP excellence, ethics committees and non-profit organisations working for persons with disabilities. He also teaches at renowned institutions such as IIMB and NLSIU, and writes legal fiction.

With the vision of offering high quality, technology, and business driven IP law services following international standards, Dr. Kalyan Kankanala co-founded BananaIP Counsels (formerly Brain League) in 2004. The firm incubated from IIMB's entrepreneurship cell (NSRCEL) and has today emerged as a top ranked and premier IP firm in India. BananaIP differentiates itself from other firms through its achievements and accomplishments in IP services, contributions to the law and policy framework, and business-driven IP research. The firm and its partners are recognized and ranked as leaders in the IP industry. They hold honorary positions with national and international IP committees and research centres, and their views are regularly cited by leading news organizations, journals and research publications. BananaIP's Technology Team & Patent/Trademark and IP Attorneys would be happy to support the members of IEEE network on IP Strategy & Protection at special discounted pricing.

Intellectual property is an important legal and cultural issue. Society as a whole has complex issues to face here: private ownership vs. open source, and so on.
Tim Berners-Lee

Stealing things is everybody's problem. We [Apple Inc.] own a lot of intellectual property, and we don't like when people steal it. So people are stealing stuff and we're optimists. We believe that 80 percent of the people stealing stuff don't want to be; there's just no legal alternative.
Steve Jobs

Making an Impactful Presentation

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It is a challenging task to create, design and make an impactful presentation. Further, it is even more challenging to create a positive influence on the audience if the presentation has a tight timeline. Presentations are made for multiple purposes such as project proposals, business plans, scientific discoveries, budget plans, product releases and lectures. Regardless of the type of the presentation, it is a Herculean task to grab the attention of audience to convey your points across. In this article, we have illustrated few P's that are required in making an impactful presentation:

P1- Purpose: It is highly important to understand the purpose of the presentation? To understand the importance, ask yourselves the following questions: What is the purpose of this presentation? Is it to inform? Is it to stand for an evaluation? Is to train the audience? Is it to propose a business? Is it for an approval? Because, understanding the purpose of the presentation enhances the clarity in the thought process. This further will enrich the things to be mentioned and points to be articulated during the presentation.

P2- People: Secondly, it is important to know the targeted audience of the presentation. To understand your audience, ask yourselves the following question: The presentation is addressed to whom? This will help us to prepare the presentation as per the expectation of those people. Further, this analysis will also bring clarity on points to emphasize, questions that may arise, etc. This understanding on the audience of the presentation such as number of audiences, their interest, background, their level of knowledge on the topic and their preferences will facilitate the articulation of thoughts. It is equally important to observe the interest and focus of the audience during the presentation. This may help of dynamic personalization of the presentation.

P3-Plan: Planning the presentation can bring visualizations about the presentation to your mind which will answer the following questions: What is to be communicated at which slide? What are the points that need to be highlighted? How much data that need to be provided on each slide? This analysis will be identify the points that meets the purpose and that do not. The substantial points that meets the purpose contributes for the better score of the presentation. This planning helps us to identify the points to narrate with and connect with. One important outcome of planning is the identification of appropriate number of slides and the content for the presentation.

P4- Prepare: Planning of the presentation is followed by its preparing. This P is very essential and has no shortcuts. Preparation is essential for any proper presentation. It should be noted that expertise in the domain can only bring down the time required for presentation. However, preparation cannot be skipped. The complexity and the significance of the presentation matter also decide the time required to prepare the presentation. The importance of the preparation can be understood from the following phrase: "If you fail to prepare, then prepare to fail"

P5-Picturize: Picturization yourself, your thought process together with the content of your presentation in the people's mind is an essential logical process required for presentation. One may picturize on how people would read, understand and infer on the content presented. This is because, the presentation is not about you but about them, the audience. It is important that they should be able to understand what you intend to convey. The core ideas of the presentation should resonate with your audience. Picturization of the presentation will certainly help in this aspect.

P6-Preference: Your preference on the presentation need to be identified. What are the points that you wish to highlight? What is your focus and stress upon? What is the main point that you wish to convey? To satisfy the purpose of the presentation with the plan you have made, what are your preferences? This will facilitates for identification and understanding the points that need to be highlighted in your presentation.

P7-Priortize: Contents of the presentation need to be prioritized considering the purpose, people and preferences. People should follow the flow of ideas in your presentation with ease. Similar to contents, time also need to be prioritized. Deciding on what is to be presented, what points need to be stressed, what need to be skipped, what need to be kept in appendix, what need to be jumped, etc., is the process of prioritizing. Creation of appendix is another important aspect of prioritization. Supporting items such as data, facts, etc. can be kept in appendix. The different between the preference and priorities need to be understood. Preference allows understanding the contents of the presentation from your perspective while priority allows understanding the contents of the presentation from audience's perspective.

P8- Plot: Identify a plot for your presentation. It is a relevant storyline that establishes the context of your presentation. A good plot would help you to connect to the people quickly in the first few minutes of the presentation. This will help the audience to relate themselves to your presentation. However while choosing a plot you should be careful in selecting a plot that is relevant to the context of the presentation and also the audience.

P9-Practice: From P1-P7 discusses about the preparation of content while this P discuss on organizing yourself towards the presentation. It should be noted that slides do not speak but the individual does. One should make a rigorous practice for the effective delivery of the material prepared. Practice can be rehearsing the presentation to oneself multiple times. This can help the individual to know about the voice, enunciation, body language, etc. However, experienced personals would have already understood this aspect that contributes of best presentation.

P10-Pre-Presentation: Once everything is ready, it is important to make Pre-presentation. Presenting your contents to your peers or new audience will gives us feedback. This feedback will help to be prepared for any random questions. This kind of interaction would keep the individual mentally ready for handling unexpected questions or situations.

P11-Persuade: While making a presentation, do not just read the contents of the slides. Provide your logical reasoning or argument to the contents in the slides. Further, your logical reasoning should convince the audience that you are in full belief of what you are presenting and your confidence. They may either agree or disagree with your arguments. But your presentation effort should involve them in your presentation and make them to think.

P12: Performance: The performance is the biggest moment. With the identified purpose and audience, after a thorough planning, preparation and practice, one can make an impactful presentation with confidence. Set the context and start the narration. Some thumb rules on the performance day such as arriving to the venue in well in advance, understanding the surroundings and interacting with people. During the performance, stand confidently, present firmly & invite the people to participate in the discussion. Encourage your audience to ask the questions. During your performance again focus on few P's. They are Pitch of your voice, Pace of your presentation and Posture of your body. All these are important.

P13: Peroration: Conclusion aspect of the presentation is another important aspect which should not be neglected. Conclude your presentation with an inspiring note that kindles interest and enthusiasm among the audience to explore more on the topic of your presentation. By igniting their curiosity, it is a good opportunity even to you to connect and collaborate with your audience later.

These are the P's you can consider while designing, creating and making a presentation. These Ps help in not just delivering the presentation but in connecting with people. Finally, it is important to remember that slides are not the presentation. They are the aids for your presentation. One should remember your presentation than the slides that are displayed.

Thank you for reading it. If you find it useful, please share it across.

About the author

Dr. Ch. Aswani Kumar is currently a Professor at School of Information Technology and Engineering, Vellore Institute of Technology, Vellore, India. He holds a PhD degree in Computer Science from VIT, India. He also possesses Bachelor's and Master's Degrees in Computer Science from Nagarjuna University, India. Aswani Kumar's research interests are Information Security and Machine Learning. He has published over 100 refereed research papers so far in various reputed journals and conferences. He has received Young Scientist Fellowship from Tamilnadu State Council for Science and Technology for his research at Tata Institute of Fundamental Research (TIFR), Mumbai.

Dr. Aswani Kumar was the principal investigator to a major research project sponsored by the Department of Science and Technology, Govt. of India, during 2006 - 2008. He was also the principal investigator to a major research project funded by National Board of Higher Mathematics, Dept of Atomic Energy, Govt. of India during 2011-13. Currently, he is the principal investigator to a major research project funded by Dept of Science and technology, Govt of India under Cognitive Science Research Initiative Program.

Dr. Aswani Kumar is a senior member of ACM and is also associated with ISC, CSI, ISTE. He is an editorial board member for several international journals.

"If you have an important point to make, don't try to be subtle or clever. Use a pile driver. Hit the point once. Then come back and hit it again. Then hit it a third time - a tremendous whack."
Winston S. Churchill

"If you're not comfortable with public speaking - and nobody starts out comfortable; you have to learn how to be comfortable - practice. I cannot overstate the importance of practicing. Get some close friends or family members to help evaluate you, or somebody at work that you trust."
Hillary Clinton

5 Key Types of Workplace Harassment and Ways to Stop it.

Ms. Viji Hari
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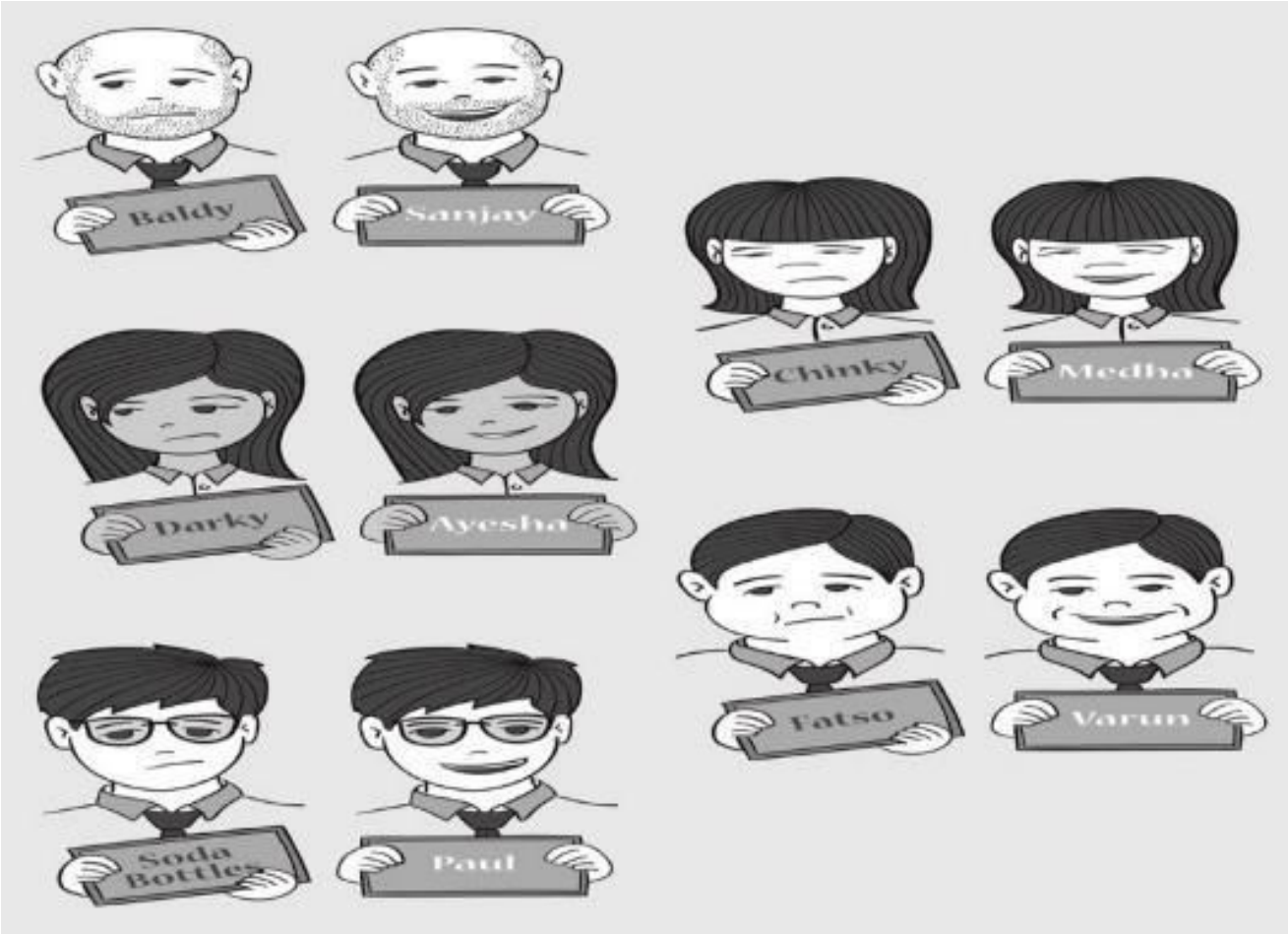
- You are so fat, why don't you skip your breakfast?
- Anila is pretty, she will do a good job in handling clients
- You are 41, when do you plan to get married?
- Jo is gay, it will be odd to invite his partner to the family day.
- Not Sure if Maya will comeback after her maternity, let us defer her promotion to the next cycle.
- Your presentation is as sexy as you are.
- I just don't want to hire women in my team, they take too many leaves.

Aren't the above common comments that we over hear at work? Filled with stereotypes and bias, they are hurting and are classified as workplace harassment.



Harassment on the basis of the following prohibited grounds of discrimination: race, colour, religion, national origin, ancestry, place of origin, age, physical disability, mental disability, marital status, sexual orientation.

Because our unconscious bias has caused us to assume that someone who speaks slowly is unintelligent, we assume the speaker is unintelligent. Everything they say or do for the rest of the conversation, is clouded by our judgement

5 Different forms of Harassment

Discriminations:

The more common and recognizable forms of discriminatory harassment are on the basis of Race, Skin Colour, Religion, Gender , Disability, Sexual Orientation, Age based Harassment. Any preferential or detrimental treatment can be reported and calls for Disciplinary action based on the gravity of the incident.
E.g.: Preference to a fair skin person; male over a female;

Power-Play:

This is a common form of harassment based on the differences of the Superior and the Subordinate. A manager could be giving all important tasks to the most talented person as it will be executed to perfection. This may over a period of time may cause over load and stress to the best performer in the team and the others will be demotivated as they don't get good opportunities to work. Alternatively, a subordinate also gives specials gifts to the manager, hoping for some favors at work in terms of Work scheduling/promotions/performance ratings/travel opportunities/project allocations etc.

It is essential for the Manager to be fair to all the team members and not have any relationships with subordinates.

Bullying:

It is a personal form of harassment of passing hurting comments based on one's appearance and looks. Bullying in its most basic form is not illegal but can be damaging nevertheless.
Personal harassment includes:

- Inappropriate comments
- Offensive jokes
- Personal humiliation
- Critical remarks
- Ostracizing behaviours / Blackmails
- Intimidation tactics / frightening tactics
- Or any other behaviour that creates an intimidating and offensive work environment for the victim
  Cyberbullying and online harassment are a serious concern for employers.

- Share humiliating things about the victim on Social media or WhatsApp
- Spreading rumours, lies or gossip about the victim on social media
- Send harassing instant messages or text messages directly to the victim
- Uploading, downloading and distributing of pictures without their permission
- Virtual stalking

The above are considered as a punishable Offense under the Information Technology Act of our country and calls for fine and jail term.

Retaliation:

The following are considered acts of retaliation if they happen because you reported or supported a charge of sexual harassment

- Isolation or exclusion from any normal work activity
- creating a hostile work environment

Retaliation harassment occurs when a person harasses someone else to get revenge and to prevent the victim from behaving in such a way again.

Retaliation harassment could be a subtle form in terms of excluding a colleague from team outings. Or can be grave as to fire a junior employee for having filed a complaint against a senior person.

Sexual Harassment:

Workplace Sexual Harassment is a **behaviour** defined as **unwelcome** and **sexual in nature, a subjective experience, IMPACT** is what matters not intent, often occurs in a matrix of **POWER,** whether **directly or by implication.**

Any behaviour that is

- Unwelcome
- Sexual in nature (Physical, verbal, non-verbal)
- Has an Impact on the victim whether or not the Harasser intended to harass

Sexual Harassment against women is punishable as per the Prevention of Sexual Harassment Act, 2013. In the wake of the #metoo movements a lot of victims have come forward to report these incidents and this the most prevalent form of harassment at most workplaces. Organisations take this seriously and Act on this immediately.

Where to Report Workplace Harassment?

Document and capture the incident specifics, along with any evidence, time of incident, witness present and report it to the specific authorities as per your organisation.

- The disciplinary Action policy of your organisation should clearly list the forms of harassment that can be report and the consequences or penalties for different forms of harassment. For grave instances Whistle Blower or grievance redressal can also be approached
- For any sexual harassment related complaints, report to
    - The Prevention of Sexual Harassment (PoSH) Internal Committee
    - **SHe-Box** **www.shebox.nic.in** Online Complaint Management System, This Sexual Harassment electronic Box (SHe-Box) is an effort of Government of India to provide a single window access to every woman, irrespective of her work status
- When in Doubts always approach your manager and HR to seek clarification on the next steps

What do you do, if you are a Victim?

- **3S tips for a Victim:**
    - **Speak up:** Make it clear to the harasser that you consider the behaviour as harassment
    - **Say No:** Say a firm 'NO' and tell the person to stop contacting you
    - **Stop:** Stop answering the person's calls, emails, and other messages
- Delete or mark the number as spam in your phone and social media accounts
- Inform your friends and family what's going on
- Don't publicize your location and daily habits
- Keep records and evidences
- Talk to the HR, Internal Complaints Committee or Harassment cell at your institution or workplace

What do you do, if you are a Witness?

Many a times, witness keep quiet for the fear of the impact on their job status and don't want to get in the bad books of their managers. Most witness prefer to ignore the incidents that they have witnessed. But witness do play a key role in getting justice to the Victims. If you are a witness to a harassment incident:

- First step is to get the victim out of the situation
- Encourage the victim to report the incident

- Document and report the incident to respective HR or the committee
- Do not spread rumours or gossip of what you have seen, confidentiality is crucial

What do you do, if you are a Harasser?

How do you know if you or your behaviour is harassing someone or not, intentionally or unintentionally? Follow the **4-check challenge** and stop if you think you may be harassing someone.

- Watch for the body language, are colleagues uncomfortable or take a step back when you are around?
- Will you exhibit the same behaviour or language even if your family was present?
- Will you like it if the same behaviour was done to you or to your loved one?
- Would you like it to be reported to the media under #metoo now or 20 years later?

What do you do, if you are a Manager?

Managers and supervisors have an additional responsibility in maintain the organisations Culture. They are the first and single point of contact for the employees. Hence managers need to:

- **Set an Example** - Do not participate in any inappropriate behaviour **Zero Tolerance Policy** to any behaviour that is harassing in nature
- **Do not ignore** a case of Harassment
- **Act** on any complaint of Harassment **immediately** - as per the guidelines laid out and regardless of your personal opinion
- **Treat everyone** you manage **fairly**
- Encourage your members to speak up
- Do not cross **personal boundaries**
- **Do not retaliate**

What to do, if you are the HR?

HR plays a very crucial role; it is important that they are seated among the employees to understand the pulse of the employees. They need to

- Implement, update and review the company policies time and again.
- Train the employees
- Look out for preventive measures
- Create more awareness among employees on a frequent basis
- Ensure employees are trained well during the induction
- Ensure the complaint process and the complaint committee is robust
- HR team should also be trained and empowered to handle such situation

Workplace harassment often impacts the productivity of the team, hurts the morale of the employees and impacts the work environment. It is best to prevent and arrest at the earliest stage.

Author notes: if you have faced any form of workplace harassment or if you found this article helpful, or need more inputs, then please do share your thoughts with Viji Hari – viji@kelphr.com.

About the author

A Professional Speaker, an active blogger and columnist on various online HR forums. Viji is actively involved champion in creating awareness about Diversity and Inclusion, PoSH at work place and setting up prevention and redressal committees in the corporate world. With 19 years of industry experience in MNC's in India & USA, she has Co-Founded KelpHR in 2013 and authored the book BCC:Behind Closed Cubicles. Viji helps in enabling safer workplaces across India. She aim's to impact not just a brand but also the enhance productivity, work culture, the values of the organisation. She has been associated with 100+ organisations across India in creating Diverse, safe and Harassment free workplace.

The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 is a legislative act in India that seeks to protect women from sexual harassment at their place of work. It was passed by the Lok Sabha on 3 September 2012. It was passed by the Rajya Sabha on 26 February 2013. http://bit.ly/2I9bBtR

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Please follow the general guidelines given below for the articles sent to IEEE India Council Newsletter.

Article content: The article should be of general interest, explaining the concepts, using cases, and/or illustrating technological trends or other areas of interest to IEEE.

Length: 4-5 pages in about 2500 words. (longer articles will also be considered)

Format:

- Word document file format.
- Single Column
- Single Spacing
- Times Roman Font in size 10 Point.

Please keep minimum level of indentations while formatting the article. Aligning to the left is always welcome.

Pictures: Apart from embedding the pictures in appropriate places in the article, please send them additionally as individual jpg files.

References: To be listed at the end of the article (please do not include in individual pages)

Please provide also, the following for inclusion in the article.

1. Full affiliation of the author(s) with email id.
2. Author(s) picture in jpg.
3. Author(s) profile (as running text), a brief one in about 150-200 words.

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The Editor's decision is final

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