Report from the Chair

Welcome to 2015

Greetings and Best Wishes for 2015, to all IEEE Members in Victoria and Tasmania.

After a flurry of activity in November and December, our tally of technical events held in the Section during 2014 reached an all-time high of 69, almost 50% more than in the previous year. This does not include Student Branch events - our students were busy setting their own records! We expect this buoyant level of Section activity to continue during the current year.

It is noteworthy that a number of conferences and symposia were hosted by Section subunits in 2014. These included the "1st Australian Microwave Symposium" (MTT/AP Chapter), the "3rd International Symposium on E-Learning, E-Management & E-Services" (Computer Chapter) and the 6th International ICMIC (Vehicular Technology Chapter). We congratulate all personnel involved in the planning and organisation of these events for a "job well done" in each case.

The Section program for 2015 is no less lively and challenging. Our recently formed SMC Chapter is continuing its pacesetting contribution to Section affairs, and at the time of writing has already held three technical seminars this year, with a fourth scheduled for the end of March. SMC events are typically well run and well attended, which adds greatly to their impact for presenters and attendees alike.

In May, we look forward to a Distinguished Lecture presentation by Dr John D. Norgard from NASA in Houston, USA. Dr Norgard's specialty is Electromagnetic Compatibility, a field of critical importance in all real-world electronics design.

In August, our WIE Affinity Group plans to run a Fashion Runway highlighting "wearable electronics" applications. This is the first such project ever undertaken in Victorian Section and we commend our female colleagues for their initiative, commitment and enthusiasm.

In September, we will have the "1st IEEE International Symposium on Big Data Visual Analytics (BDVA)", in Hobart. This event is being

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sponsored by CSIRO with IEEE Victorian Section as Technical Co-Sponsor. It will be the first IEEE-labelled symposium ever held in Tasmania and we are pleased to work with our colleagues at CSIRO in presenting this burgeoning new field of research and application.

In October, we are planning a one-day workshop on Intelligent Systems. The objectives of this workshop will be to provide a forum for local researchers and developers to outline their work in various areas of "IS", and to encourage interaction between these research groups. Further details of this event will be circulated shortly.

And of course, a wide range of lectures, seminars and visits of inspection of a more conventional nature will complement the items mentioned above.

On a rather different note, we have long sought to offer our members some form of post-graduate training or instruction to serve the strategic objective of continuing professional development. We are now moving more positively towards that goal and several short-course topics are currently under consideration. We hope to invite expressions of interest from prospective course providers by mid-year, 2015.

Finally, I make my periodic call for more volunteers. Our operations depend entirely on the commitment and enthusiasm of our members. If you would like to get more closely involved in Section affairs, please send us an email giving a brief outline of your background and professional experience (as appropriate). We can often assign tasks and responsibilities in accordance with your preferences and technical interests. Please direct enquiries to me in the first instance, at the email address below. Whether your career to date has been "short" or "long", we look forward to hearing from you!

Anthony E. Gascoigne
Chair, IEEE Victorian Section
aeg@gnsassoc.com.au

New Webmaster for the Victorian Section

Our new Webmaster, Ms Golnoosh Tajadod, received an Associate Degree in Information Communication Technology from the University of Applied Science & Technology, Iran, in 2008 and the Bachelor Degree in Information Technology from Deakin University in 2011. In November 2012 she completed her Honours degree at Deakin and received a High Achievement award for her thesis. Golnoosh has been active in professional women's affairs and has presented a paper to the Women in Science and Engineering group at the University of Melbourne.

She will now lead the website development team and thereby becomes a full member of the Section Executive Committee. We welcome her to Victorian Section and wish her well in her new appointment!

Society on the Social Implications of Technology

The Society on Social Implications of Technology (SSIT) of the Institute of Electrical and Electronics Engineers (IEEE) is concerned with how technology impacts the world and with how the application of technology can improve the world. SSIT focuses on issues such as: humanitarian engineering; environmental issues including climate change, green technologies, and sustainable design; privacy and security; other economic, health, and safety implications of technology; engineering ethics and professional responsibility; engineering education including k-12 and engineering education in social implications of technology; history of technology; public policy related to engineering, technology and science; health and healthcare technologies and impact; reliable energy and social issues related to energy, and social issues of information technology and telecommunications.

Activities include:
- IEEE Technology and Society Magazine, an award-winning journal containing both peer-reviewed and general interest items.
- The International Symposium on Technology and Society (ISTAs), held annually. Support and sponsorship of additional conferences. [Nov 11 and 12 2015, Dublin, Ireland].
- An active network of SSIT chapters spanning the globe.
- Awarding of the periodic IEEE Carl Barus Award for Outstanding Service in the Public Interest.
- A Guest Lecturer program on critical topics of interest.
- Online discussion of social impacts of technology through forums, website, blogs, and social media. In Australia, you can follow www.thesocialinterface.com.
- Support for members who speak, publish and advocate on SSIT topics within the Society or as participants in other IEEE societies and professional activities.

We are planning some exciting activities for 2015. We have already held two events in Melbourne, one on "Social Media and Cyber-Racism" (Andre Oboler), the other on "Future Challenges in Technology" (Greg Adamson).

The SSIT Australia Chapter is a joint chapter with the IEEE Australian Sections of Victoria (VIC), Australian Capital Territory (ACT), New South Wales (NSW), Queensland (QLD), South Australia (SA), and Western Australia (WA). It was established in Victoria in 2005, and expanded to cover other states in 2006. We are looking to become fully national with the inclusion of the Northern Australia Section in 2015.

Membership in SSIT is open to all IEEE members and student members. Affiliation with SSIT with all benefits except voting rights is available to persons who are not members of IEEE. For more information about joining SSIT, or to receive information by email about SSIT events, please contact the Chair of SSIT Australia Chapter, Lyria Bennett Moses (lyria@unsw.edu.au). You can also follow us on Twitter at @ssit_au or join our LinkedIn

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group "IEEE SSIT Australia Chapter" at http://www.linkedin.com/groups?gid=1843561. Our current committee is as follows (we are always looking for more volunteers, so please contact Lyria (lyria@unsw.edu.au) if you would like to become more involved.

- Chair: Lyria Bennett Moses, Associate Professor in the Faculty of Law, University of New South Wales (UNSW) Australia
- Vice Chair: Kieran Tranter, Senior Lecturer at Griffith Law School
- Immediate Past Chair: Philip Hall, Principal Fellow, The University of Melbourne
- Secretary/Treasurer: Michael Rigby, PhD Candidate, The University of Melbourne
- Communications: Tony Nolan, Risk Intelligence and Analytics Analyst, ATO
- NSW Coordinator: John Lewis, PhD Candidate, UNSW Australia
- VIC Coordinator: Michael Arnold, Senior Lecturer of Social Studies of Technology, The University of Melbourne
- SA Coordinator: Peter Smith, Strategic Consultant
- QLD Coordinator: Samuli Haataja, PhD Candidate, Griffth Law School
- Consultant: Greg Adamson, President IEEE-SSIT

An Introduction to E-textiles Using LilyPad Arduino - A Sewable, Programmable Microcontroller

Workshop Participants Learning about LilyPad Arduino

IEEE Victorian Women in Engineering Affinity Group

The IEEE Victorian WIE Affinity Group has put together an introductory workshop on e-textiles and wearable electronics. We aimed to use the LilyPad Arduino, a sewable microcontroller, to provide training to beginner and more advanced programmers in a creative environment that would be attractive to females. Our first workshop was held on Saturday 22nd November 2014. LilyPad Arduino can be sewn to fabric using conductive thread and programmed using Arduino software. During our workshop, participants were introduced to how this microcontroller and a set of sewable electronic modules can be used together to create interactive garments and accessories.

The workshop began by introducing participants to a number of e-textile applications and
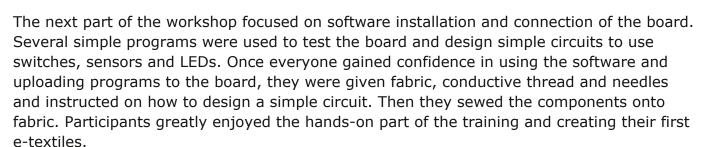
Participants creating e-textiles

different industries where they are used or are anticipated to be used. They were then given some background on the LilyPad Arduino and its hardware. To familiarise attendees with the versatile capabilities of this microcontroller, two of the projects the team had worked on were demonstrated. The first was a cycling vest with LED arrows sewn on the back which enables cyclists to indicate when they are turning left or right.

The second was a teddy bear with a beating (flashing!) LED heart. A temperature sensor sewn inside the bear's clothes senses when the bear is cuddled and the LED heart lights up.

The next part of the workshop focused on software installation and connection of the board. Several simple programs were used to test the board and design simple circuits to use switches, sensors and LEDs. Once everyone gained confidence in using the software and uploading programs to the board, they were given fabric, conductive thread and needles and instructed on how to design a simple circuit. Then they sewed the components onto fabric. Participants greatly enjoyed the hands-on part of the training and creating their first e-textiles.

This workshop will be held again on a monthly basis throughout 2015 with an advanced workshop also being organised by the Victorian WIE team. The culmination of the program will be participants showcasing their e-textile clothing in an e-fashion runway later in the year! The extension of the workshop to secondary schools to will also be tried.

New Compiler joins Uplink Staff

Marie van der Klooster joins the Uplink staff as compiler. Uplink has moved to a new software publishing platform Scribus and Marie will be working with the team to produce and proof read the contributions in Scribus.
Marie recently retired from Deakin University Geelong, where she taught Information Systems, concentrating on small businesses and their use of IT. She is convenor of the Australian Time Use Research Network, creates content for different media and writes occasionally for publishers on IT and IS.
Marie also volunteers at the National Surf Museum in Torquay, keeping their content database up to date and working in the archives.

Alan Harvey
Chair, Circuits and Systems Chapter

Medical Imaging Techniques for Improved Health Care Part 2 (Continued from 2014)

Applications of X-Rays

X-rays are used for imaging bone structure and detecting some diseases in soft tissue. The chest X-ray is used to identify lung diseases such as pneumonia, lung cancer or pulmonary edema. An abdominal X-ray is used to detect intestinal obstruction, free air (from visceral perforations) and free fluid (in ascites). X-rays are used to to detect gallstones or kidney stones. Sometimes they may be present in a form not visible to X-ray imaging.

Magnetic Resonance Imaging

In MRI or magnetic resonance imaging, a MRI scanning system or "nuclear magnetic resonance"" (NMR) imaging uses powerful magnets to polarise and excite the hydrogen single proton in water molecules in human tissue, to produce a signal which is spatially encoded. This produces an image of the body. In MRI, the machine emits an RF (radio frequency) pulse that excites only hydrogen. The system sends the pulse to the area of the body to be examined. The magnetic pulse makes the protons in that area absorb the energy needed to spin in a different direction. This is the "resonance" part of MRI. The RF pulse makes the one or two extra unmatched protons per million spin at a specific frequency, in a specific direction.

MRI uses three fields, firstly a strong field i.e. a few teslas static magnetic field, to polarize the hydrogen nuclei, called the static field. Secondly a weaker time-varying (on the order of 1 kHz) field(s) for spatial encoding, called the gradient field(s); and thirdly a weak radio frequency or RF field for manipulation of the hydrogen nuclei to produce measurable signals, collected through an RF antenna.

Like CT, MRI traditionally creates a two dimensional image of a thin "slice" of the body and is therefore considered a tomographic method. Up to the minute MRI instruments can produce images in the form of 3D blocks, which are produced from a set of 2D slices. Unlike CT, MRI does not involve the use of ionizing radiation so has low health hazards. In use since the 1980's, there are no known long-term effects of exposure to strong static fields and so there are no limits on the number of MRI scans per patient unlike X ray or CT scans. However, there are health risks from tissue heating from exposure to the RF field and the presence of implanted devices e.g. pace makers. Such risks must be carefully managed as part of the MRI procedure.
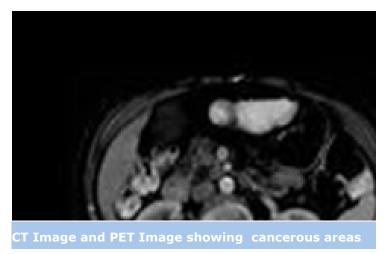
Costs of MRI devices range from $300,000 for limb extremity scans e.g. hands or feet

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images to full body devices. Full body MRI devices can cost $1 Million to perhaps $3 Million US for a unit producing 3D or 4D body scans. Such machines must generate considerable fee income to enable capital servicing at the least. On the revenue side such machines can generate $10,000 per hour in fee income, enabling further imaging services.

CT Image and PET Image showing cancerous areas

Applications of MRI

MRI is used for detailed imaging of the brain and the spinal cord, e.g. multiple sclerosis (MS), early detection of encephalitis. The images can reveal the limits of a tumour, contributing to a more precise surgery and radiation therapy.
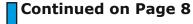
MRI can be used in cases of trauma, as trauma to the brain can be seen as bleeding or swelling. Other abnormalities often found include brain aneurysms and stroke as well as tumours or inflammation of the spine.

MRI can be used in evaluating the integrity of the spinal cord after trauma. It is also used when considering problems associated with the vertebrae or inter vertebral discs of the spine. An MRI scan can evaluate the structure of the heart and aorta, where it can detect aneurysms or tears.

It provides valuable information on glands and organs within the abdomen, and accurate information about the structure of the joints, soft tissues, and bones of the body. Often, surgery can be deferred or more accurately directed after knowing the results of an MRI scan.

PET Scanning Principles and Application

Positron Emission Tomography or PET scans provide a picture of metabolic and chemical activity in the body, instead of bone or tissue structure. These changes are detected by adding a radioactive tracer to a sugar, usually a type of glucose which is injected into the body. The signals emitted by the tracers as they travel through the body are picked up and assembled into an image. Cancerous areas tend to absorb higher rated of sugar which is reflected in the PET image. Due to its sensitivity and methodology, PET scans can pick up cancers at an early stage due to their higher rate of biological activity. This early diagnosis

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means that there is a better chance of treating this malignancy early and therefore a better chance of a cure. Full body PET imaging allows all the organs in the body to be checked for primary and metastatic disease together.

Ultrasound Imaging Methods and General Imaging.

Ultrasound imagers generate an image of the internal structure of the body in the vicinity of the high frequency sound generator. A receiver processes signals received from the patient's body.

An ultrasound machine creates images that allow various organs in the body to be examined. The machine sends out high-frequency sound waves, which reflect off body structures. A computer receives these reflected waves and uses them to create a picture. Unlike an X-ray, there is no ionizing radiation exposure with this test.

The basic principle of ultrasound images of flow, whether colour flow or spectral Doppler, are essentially obtained from measurements of movement. In ultrasound scanners, a series of pulses is transmitted to detect movement of blood. Echoes from stationary tissue are the same from pulse to pulse.

Echoes from moving scatterers exhibit slight differences in the time for the signal to be returned to the receiver. These differences can be measured as a direct time difference or, more usually, in terms of a phase shift from which the "Doppler frequency" is obtained. They are then processed to produce either a colour flow display or a Doppler sonogram. The cost of an ultrasound system may vary from $10,000 to $150,000 US for a device showing 3D body part images.

Applications result from the images of body structure showing anomalies or pathological conditions in the images body area. A prenatal scan of a pregnancy is a very well known application of ultrasound which shows the development of the unborn baby.

Effect of Socio Economic Patient Profiles.

In larger capital cities where there is a considerable cohort of citizens who can support high cost imaging such as NMI machines, it is feasible to purchase such machines to assist in the diagnosis and treatment of various ailments such as cancers and tumours. Since running costs are relatively low for NMI imaging, it is then feasible to apply NMI imaging to govt sponsored patients who do not have the money to pay for such treatment on a cost recovery basis. Applicable government rebates would be returned to the hospital under the govt sponsorship scheme but would be much lower than private patient charges.

X-Ray machines are a mature technology providing straightforward 2D images of bone 2D structure for diagnostic or investigative purposes. The extension of X-rays to computed tomography, giving 3D images of bone structure, was a breakthrough in medical imaging particularly for bone structure in the early 70's. This has considerably improved patient care

in relation to treatment of common bone health problems.

Medical Image Processing

Computational Image processing has dramatically improved the scope and range of medical imaging. Digital X-Rays have revolutionized the standard of imaging and ease of storage and dispatch of X-Ray images. While analog X-ray machines extract approximately 40% of the image data, digital X-rays extract 80% of the data and with digital processing of this data, the fraction improves to over 90%. Many imaging technologies, including MRI's and

Xray of Foot Structure Showing Screw

Data from imagers may be inspected visually and/or processed by computer algorithms to detect anomalies, e.g. lumps in a mammogram or other cancerous growths. However in some cases, pattern recognition techniques including structural and neural network methods may be applied to enable rapid screening of images on a highly consistent basis.

Editorial

A Happy New Year to all Victorian members of the IEEE! Let us work together to make 2015 a good year!

The IEEE has started the year with technical meetings, planning meetings and a student workshop. These meetings enable networking of engineers, programmers and students. We expect the fruits of their labours to be evident during the year. With the considerably reduced income from mining and the phasing out of the car industry, pressure to produce new products is stronger than ever. Should we become a design house for China ? What might we produce here? Are software products where we should direct our efforts? All these questions are legitimate topics for us as engineers and programmers. Companies will need to restructure and produce new products for the local or overseas markets. The lower dollar will help.

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Again many engineers and programmers are in a position to contribute to these areas. Please consider presenting a seminar on your work. The benefits are significant publicity for your company and of course new expertise to the attendees of your seminar. Consulting opportunities often flow from such seminars. Also publicity to the Victorian IEEE is valuable.

Thank you to our previous Uplink composer Peter Barrett for his sterling efforts during 2014. He has produced Uplink to a consistently high standard over several years. Peter continues to design and produce custom medical instrumentation through his company NCounters.

I welcome our new Uplink Compiler Marie van der Klooster to put together our Uplink issues who is introduced in a separate article.

We welcome articles for Uplink of interest to IEEE members and reports of past events and advertising for future events.

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