

Unmanned Aerial Vehicle - A Sky Boon

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Unmanned Aerial Vehicle (UAV) or Remotely Piloted Aircraft System (RPAS), is one of the top emerging technologies today which opens up new opportunities in solving delivery issues. In recent years, many drone makers have developed technologically superior drones in various sizes for a variety of applications such as aerial photography, aerial surveillance, aerial promo movies, aerial panorama and so on. These drones are put to use in various industries which include construction, mining, roads and highways, solar, surveying, railways, oil and gas-pipelines, power lines, telecommunications, agriculture and wind. Most of these applications are commercial but the question which always remained in our hearts was, what about the application of drones for use of mankind. This article surveys the paramount impacts of UAV both nationally as well as globally.



Figure.1 Drone accessories

Features of Drones: Fig.1 shows the advanced hardware present in most of the commercial drones out of which few of them are retrofitted. These includes Vertical Take-off and Landing (VTOL), Radar Positioning and Return to Home, Gyro stabilization, Inertial measurement unit, Flight controller, On screen real time flight parameters, No fly zone technology, GPS ready to fly mode technology, Internal compass and fail safe function, First Person View (FPV) live video transmission technology, Firmware and flight assistant port, LED flight indicators, Range extender UAV technology, Smart phone app featuring ground station function, High performance zoom cameras, Gimbals and Tilt control, Multispectral, Lidar, Photogrammetry, low light night vision and Thermal vision sensors, Obstacle detection and Collision avoidance technology, Anti-drop kit and Parachutes.

A drone flew chilled human blood for 160 miles over the hot Arizona desert — smashing records for transport of biological samples on a remotely operated vehicle. The blood was still in good condition after the three-hour flight, which means that the growing role of drones in rural medical care really could have the potential to save lives. For people who live in remote areas, going to the doctor or getting lab tests can be challenging. That's why using drones to drop off medical supplies or pick up blood samples for testing could be a game-changer. Some companies, like California-based Zipline, have been in the game for a few years, delivering blood for transfusions by drone in Rwanda, and soon in Tanzania.

Facebook's solar-powered, internet-providing drone successfully completed its second test flight over the Arizona desert during the month of May, 2017. The aircraft, called Aquila, aims to provide internet access to remote corners of the

world by transmitting a signal that can be received on the ground within a 60-mile radius. Meanwhile 'Alphabet', the parent company of Google, has shut down the firm's project to create solar-powered drones that could provide internet connections to rural areas.

The forest fire is one of the major threats to humanity and climate. Countries like U.S spend lump sum of dollars for damage control measures. Recent wildfire at California raised many questions about disaster management techniques and the needed improvements to prevent. In the era of Artificial Intelligence, the integrated mission using cooperative technologies could make it possible. The combination of Wireless Sensor Network (WSN) and Drones may be a wild guess. The pored sensor nodes over a wild region form a WSN and starts monitoring the abnormal wind pressure and blaze. This information can be sent to the miniones (mini drones) deployed randomly in the forest. Upon detecting abnormally, these drones could form a swarm possibly providing a visual communication like a smoke signal used at olden days and fly to a nearest base station. This may caution about the situation well in advance and help the mission SWAOT (Stop Wildfire Aerially On Time). Issues related to the deployment of sensor nodes, their life time, spot selection for miniones could be argued but while comparing with the devastation, it makes us to find the possibilities.

The aerial video footage and images captured while a fire is burning can be crucial in after-action assessments, in which firefighters critique their own efforts so that they can improve their approach and identify future training needs. These materials can also be used to train new firefighters, providing real life examples of how a fire might unfold, and where decisions on the ground were made well or could have been made better.



Figure .2 Drones on Habitat Monitoring

Nowadays drones are used for habitat monitoring. One such recent example has been captured in fig.2 where VolAero Drones has demonstrated that drones equipped with state-of-the-art thermal imaging equipment can effectively spot and track pythons at night – their prime hunting time. Over 100,000 Burmese pythons infesting the Florida Everglades have decimated 90 percent of small wildlife while surviving all attempts at eradication. This drone and thermal technology is light-years ahead of shining a flashlight into the darkness and hoping for the best. The thermal imagery picked up not just the monster pythons, but also native snakes as small as 18 inches. This suggests that we'll be able to spot and eliminate clusters of python hatchlings, which will help curb their reproductive cycle.



Figure .3 High Altitude UAV's

The European Space Agency (ESA) has announced that it is considering extending its activities to a new region of the sky via a novel type of unmanned aerial vehicle (UAV), a 'missing link' between drones and satellites. As shown in fig.3, High Altitude Pseudo-Satellites, or HAPS, are platforms that float or fly at high altitude like conventional aircraft but operate more like satellites – except that rather than working from space they can remain in position inside the atmosphere for weeks or even months, offering continuous coverage of the territory below.

ESA regards the vehicles as a valuable way of establishing applications that complement its satellites while also accelerating space technologies through early, high-altitude flight testing.

Indian Government Initiatives

After years of prohibiting the public from flying drones, India's aviation regulator, the Directorate General of Civil Aviation (DGCA), on Oct. 30, 2017 unveiled draft norms for the usage of aerial vehicles. Until now, owing to safety concerns, it has been illegal to fly drones in India without a nod from the authorities. The new rules aim to tap the myriad opportunities in the commercial and recreational space, while ensuring the safety of other vehicles in the airspace and people on the ground. The government has designed the rules according to the size of the drone being flown.

The rules will come as a relief for Indian e-commerce companies who can potentially skip the country's crowded roads and traffic jams to make timely deliveries. Commercial use of drones has so far been limited mostly to video and photography, but according to experts these can be utilised for many other applications as well, from delivering packages to emergency services, environment monitoring and providing wireless Internet in remote areas. American ecommerce giant Amazon has already designed a system, Prime Air, using drones to deliver packages to customers within 30 minutes of placing an order.

The Indian government wants to extend the 'Make in India' initiative to planes and drones and not just import the entire requirement in the coming years. India is recording a healthy growth in passenger traffic as compared to China, which is the largest aviation market in the world. The government has launched **Udaan scheme**, which is a regional connectivity scheme under which the government plans to provide connectivity to remote areas and enhance access in under-served regions. Indian Institute of Technology (IIT)-Kanpur, has signed a Memorandum of Understanding (MoU) with 'VTOL AVIATION INDIA PVT LTD' to help in developing Vertical Take-Off and Landing (VTOL) aircrafts for Civil Defence and Civil Aviation. These aircraft will be used as air taxi for civilians. Vertical Take-Off and Landing (VTOL) aircrafts are becoming popular in both civil and military aviation sectors. It could be a milestone under the 'Make in India' initiative.

Agricultural drones are UAVs used for precision agriculture, which is a modern method of farming that uses big data, aerial imagery and other means to optimise efficiency. The drone collects the farm's image and makes a colour-coded map based on its health, which is then assessed by the UAV Company. Agriculture Insurance Company of India along with Skymet, a weather forecasting company, has conducted a few pilots in parts of Gujarat and Rajasthan to see how drones can be used to survey crops and help map crop diseases along with helping insurance companies settle claims.

The Maharashtra government turns to technology to ensure timely intervention and compensations for farmers in an area notorious for farmer suicides. Private weather forecaster Skymet is using drones, or unmanned aerial vehicles (UAVs), to map 51 villages of Marathwada under a pilot project. The state government has decided to carry out pilot projects for assessing crop yields using different technologies from four different companies. Reinsurance giant Swiss Re and Climate Change for Agriculture, a not-for-profit organisation based in Delhi, are also participating in the project to assess 186 villages in the state, using drones and satellite imagery. Madhya Pradesh and Uttar Pradesh governments, too, are expected to soon start using low cost drones to assess crop losses.

The experimental move of Tamil Nadu Government:

Tamil Nadu Government as a part of its regular developmental activities taken an initiative of drone project where the drones help Greater Chennai Municipal corporation (GCMC) to prevent land encroachment and property tax evasion. GCMC became the first municipal body in the country to commission drone mapping of properties and utilities. They Initiated 6 drones which were capable of collecting photos from 79 wards of Chennai, the drones are capable of covering 7 Square kilometres a day with an accuracy of 5 cm resolution, the drones in the air can clearly see the potholes signboards and small encroachments of footpaths and also the officials could count the number of trees without reaching the actual place.

Apart from government institutions, Chennai based few private engineering colleges such as Agni College of Technology and Panimalar Institute of Technology (PIT) also rendering their notable contributions on UAV technology. The Aerial Robotics Team of PIT was born on small casual talk in a small lab by a few students from ECE with an illustrious Professor which later on moved on to be **TeamDronix**. <https://www.teamdronix.com>



Figure .4 Drone developed by Dronix in action



Figure 5 Team Dronix with a group of engineers from Aeronautical Research Centre of Sudan trained by them.

Conclusion Note

The eyes in the air have their own challenges like safety issue of the state and the country, key areas like the defence, military, airports and research centres are not covered by the drones for the security reasons. The drone operations are not always at the moment but we have a systematic approach on how to make maximum use of the technology keeping the security factors in mind.



About the Author: Dr. Ganesh Subramanian has completed his Ph.D. degree in “Electronics Engineering”. He is working as a Professor in the Department of Electronics and Communication Engineering at Panimalar Institute of Technology, Chennai. Also he is the Chief-Operations for Chennai based Aerial Robotic Company called Aero 360 where he handles Operations, team coordination and R&D activities. He is the mentor of Team Dronix, an aerial robotics student’s start-up. The teams led by him have participated in International ROBOSUB competition held at Sandiego, CA, USA, under the sponsorship of Indian Government during the month of July 2012, and in Singapore Autonomous Underwater Vehicle Competition (SAUVC) during the month of March 2013, March 2015 and March 2016, Singapore Robotics Game (SRG) 2014 as well as 2016. He had been Invited and presented as a speaker for “The Commercial UAV show Asia 2016” at Singapore , in “Small Unmanned Business System Exposition 2017” at San Francisco, CA, USA , in “Drone Tech Europe 2017” at Bristol, U.K, WF-IOT, Singapore- Feb 2018 and Next Generation Summit -NYC, USA-June 2018.