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You Can Travel In Drones And Eat Them Too

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WEEKLY NEWSLETTER

Thanks for the good news from EFY (about weekly newsletters introduced) and other contributions! I appreciate the articles published in weekly newsletters. Please continue.

Ramani M.

EFY. Thanks! We are trying to keep readers informed in advance about interesting content in coming issue(s) of Electronics For You and Electronics Bazaar magazines through these weekly newsletters.

...

INDIA TECHNOLOGY WEEK

ITW@Home was great and very informative. Attended many presentations. Very innovative idea and need of the hour. Recommendation: If you could add live chat facility with the exhibitors, it would be easier to analyse the products and their features. Best wishes for the next event!

Muneer KThazha
GWT Ilc
Dubai UAE

Well organised online exhibition! I personally believe these are the first steps of a new era we are going through and coming up to know. So I fully support your efforts and am looking forward to attend the following events as well. All the best from Vienna to India; stay healthy!

Enis Yorulmaz
Industrial Ethernet Solutions
TTTech Industrial Automation AG

It was my first time ever to experience ITW and my first time in a remote expo. My experience was great, and I will surely attend the next one as well. I talked with companies that are related to the nature of my business. People were open, polite and willing to explore opportunities. Keep me posted for the event of June as well; I will surely be attending as I am keen on participating.

Angelos Liapas
Fieldscale, Greece

A very informative and excellent online expo and conference! Feeling somewhat astonished; this is the strength of *Naya Bharat* in digital mode 5.0, surpassing all the digital technologies globally. My thanks to the respected organisers! Can we try this with student community and start-ups? With best wishes!

KPVSr Vinay Kumar
Associate professor
Ramachandra College of Engineering
Eluru (Andhra Pradesh)

...

EQUIPMENT CONTROLLER

In the 'Equipment Controller Using MATLAB-Based GUI' DIY project published in June 2019 issue, can I replace PCB design with a relay module?

Rohit

EFY. Yes, the given PCB is basically for the relay driver section, so you can replace it with a 4-channel relay module that may be readily available in the market.

...

LED TORCHLIGHT

I have a doubt regarding Schottky diode used in 'LED Torchlight' project published in June 2019 issue. Please explain the use of Schottky diode in this circuit.

Vikram

The author A. Samiuddhin replies: The purpose of the Schottky diode is to extract more energy from the cell. Initially, when switch S2 is closed, IC2 is powered from the cell through diode D1 till the internal switching transistor is turned on (i.e., ON time). After the internal transistor turns off (i.e., OFF time), the inductor reverses its polarity and diode D2 gets forward biased. Now, IC2 gets powered by the energy from the inductor through diode D2 till the OFF time. This cycle continues repeatedly. This helps to extract more energy from the cell. Normally, IC2 operates at 0.9V. By using two Schottky diodes, IC2

starts operating off 0.7V. This helps to keep using the battery cell for more time. For more information, read the datasheet available at <https://www.diodes.com/assets/Datasheets/ZXSC380.pdf>

...

ESP8266 PROGRAMMER

The 'Make Your Own ESP8266-12E/F Module Programmer' DIY project published in August 2019 issue is a cool circuit. May I know why you have used flash button across transistor T1 (between DTR and GPIO0)? In NodeMCU, it is between GND and GPIO0 with a 470-ohm in series.

Sibin KS

The author Ashok Baijal replies: The flash button and reset button are to be used only if you wish to program the ESP chip in traditional way. As per the circuit design, there is no need to manually press buttons S1 and S2 as this process is automatically handled by transistor T1 (mimic S2 flash button) and T2 (mimic S2 reset button).

...

IR REMOTE CONTROL

In 'This IR Remote Can Control Up To Eight Devices' project published in May issue, the footprint of ATmega328 (IC3) in both PCB and component layouts are 20-pin DIP, which is wrong. It should be 28-pin DIP.

In the same article, the 230V AC supply for the load is connected in a wrong way. Normally, the live (L) wire should be connected to the load through switch and the neutral (N) wire to the load directly.

A. Samiuddhin

EFY. Thanks for pointing out the mistakes you would have noticed in e-magazine! Printed copies of this issue got delayed due to Covid-19. We will try to make up delay in printing magazines and their dispatch within 2-3 months, but e-magazines will continue to reach you in time as before.

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Q1. How important is the Python language in today's smart era in the IoT domain?

Prathamesh Iyer

A1. Python is a general-purpose, high-level programming language, and is currently among the most popular programming languages in the world. Python is used in many applications ranging from developing desktop GUI applications, website applications, and embedded systems to IoT (Internet of Things) applications. It supports both object and structure-oriented language. As compared to other high-level programming languages, Python has simple programming syntax. Hence, it is easy to read and maintain the code.

Python is frequently used by developers as it is more flexible than Java or C programming language. Most developers use Python language in applications using Raspberry

Pi, Intel Edison, NodeMCU, ESP8266, ESP32, Arduino, and other boards, which are very common in IoT applications.

Python has a large number of pre-built libraries in areas such as Web service tools, machine learning, deep learning, etc. Python's clean syntax is suitable for database arrangement and data analysis in IoT systems. It has a large community that can help you with solutions and libraries as and when required.

For further detail on the use of Python in IoT applications, you may refer the following links:

<https://digitalconquerer.com/dev-corner/role-of-python-iiot-development/>, <https://techbeacon.com/app-dev-testing/top-6-programming-languages-iiot-projects>, and <https://www.pythontraining.net/usage-of-python-in-iiot>

Q2. Explain network-on-chip (NoC). What are the advantages of NoC design over system-on-chip (SoC) design?

Ashish Mulajkar

A2. NoC is a network-based communication subsystem on a semiconductor integrated chip, mostly between SoC modules. SoC is a chip that integrates components of a computer including a central processing unit (CPU), graphics, and memory interfaces. In the SoC designs, pre-designed intellectual property (IP) cores/blocks are becoming an important part. As dimensions of semiconductor chips are shrinking and more IP cores are added to them, many SoC chips are too complex to utilise a traditional data bus or crossbar interconnect approach. The physical resources carrying data on the chips and quality of services begin to crumble.

NoC technology brings notable improvements over conventional data bus and crossbar communication architectures. NoC scheme is to organise communication between operating modules located on the same chip. The scheme improves the scalability and power efficiency of complex SoCs. A typical schematic multiprocessor design with SoC/NoC is shown in Fig. 1.

Some of the advantages of NoC over SoC are given below:

1. NoC provides structured architecture, lowering complexity and cost of chip design
2. Allows reuse of components, architectures, design methods, and tools

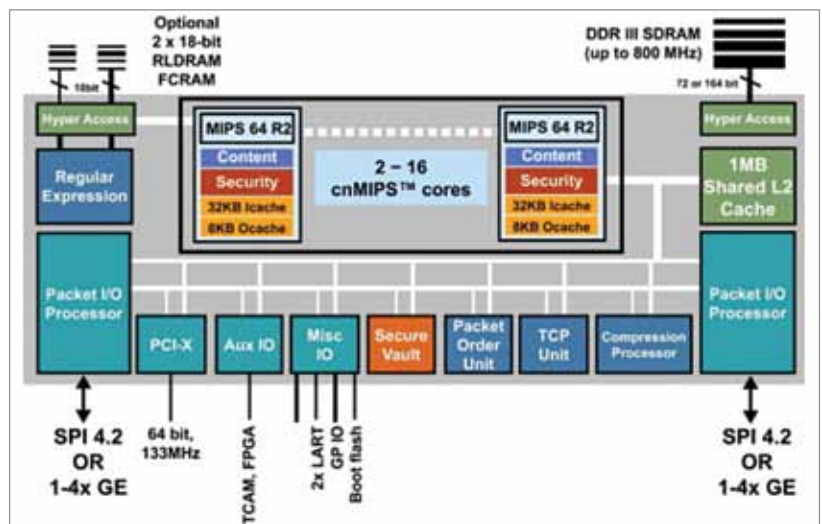


Fig. 1: A typical schematic multiprocessor design with SoC/NoC (Credit: www.sciencedirect.com)

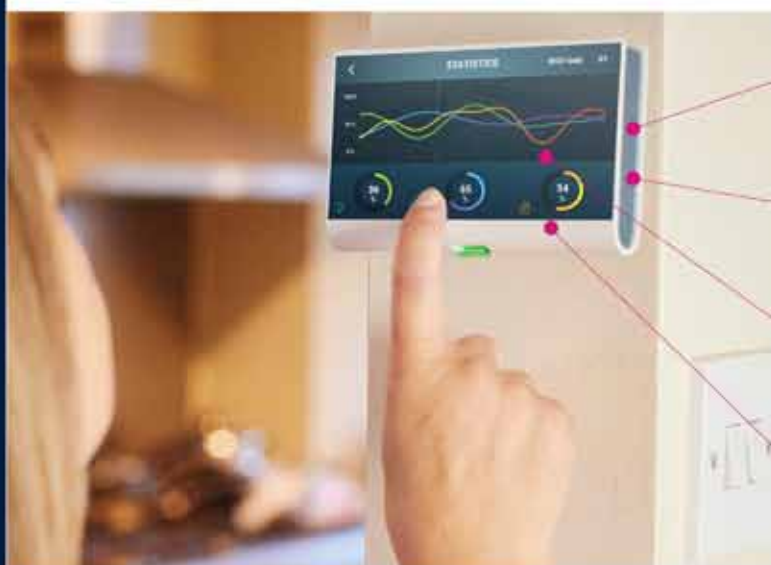
3. Provides efficient and high-performance interconnect
4. Improves scalability of communication architecture
5. Establishes a relationship between the processor blocks by routing the data packets, providing flexible and easy accommodation of changes
6. Reduces wire routing congestion and avoids timing closure issues
7. Simplifies switching and routing functions to achieve higher operating frequencies

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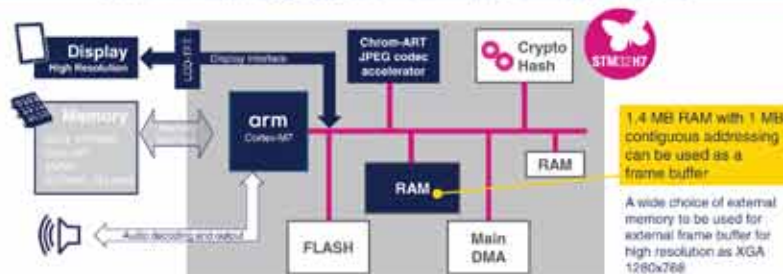
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RAIL-BOT robot to assist hospital staff in Covid-19 patient care

In light of the Covid-19 pandemic, Indian Railways has developed a robot to assist the management of medical wards in

serving medicines and food to patients. The robot, named RAIL BOT (R-BOT), has been developed to assist in hospital management functions towards patient care.



RAIL-BOT being used to provide medical accessories or equipment, medicines as well as to serve food to patients in Central Railway hospital (Credit: ANI)

According to a press release, before being deployed for use in Central Railway hospital, Secunderabad, R-BOT underwent extensive trials and demonstrations. The robot is now used to provide medical accessories or equipment, medicines, and serve food to patients in the hospital without any need for physical contact.

With the help of this robot, doctors, nurses, and other medical staff can stay away from the risk of contracting Covid-19 infection. R-BOT is operated through a unique mobile app that has been developed as part of the innovation, supported by the Wi-Fi facility. It supports sensor-based features, which are capable of reading patients' body temperature and transmitting the same for displaying on mobile phones. In case of any abnormal high-temperature reading, R-BOT is capable of raising an alarm to alert the medics attending patients.

Beware of phishing attacks in the name of Aarogya Setu app

Phishing attacks in the name of Aarogya Setu app are on the rise, as cybercriminals are taking advantage of the Covid-19 pandemic for their vested interests. In its latest warning, Indian Computer Emergency Response Team (CERT-IN) says there has been a major increase in phishing attacks in the name of this contact tracing app, as well as video calling apps such as Zoom, Microsoft Teams, and Google Meet.

It turns out that scammers impersonate World Health Organization (WHO), HR divisions and top corporate executives, or anyone else you may know to spread fake apps and links to those famous apps that indicate your neighbour is infected, someone who came in contact with you tested positive, recommendations to self-isolate and guidelines to use Aarogya Setu app.

The most common type of phishing comes from websites that impersonate the bank or credit card company of a recipient, hoping to obtain personal financial information. Phishing is a cybercrime in which someone posing as a legitimate entity approaches a target via email, telephone, or text message and is tricked into sharing personal information such as banking

and credit card data.

Aarogya Setu app has been in the controversy surrounding its security of the data provided by the users as well as privacy concerns. The app, however, has crossed a hundred million milestone after it was launched to enhance the country's contact tracing capabilities amid the widespread coronavirus infections in the country.



Aarogya Setu app has been in a controversy surrounding its security of the data provided by the users as well as privacy concerns (Credit: Google Play Store)

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● High power performance

Long cycle life ●

Extensive temperature usage conditions



Feature	Green-Cap
Charge time	Sec. unit
Temp. Characteristic	-40 ~ 85 °C
Power Density (W/kg)	10,000 ~ 20,000
Charge/Discharge Cycle Life	500,000 ~ 1,000,000
Environment	Environmentally friendly

- An energy storage device with rapid

Charge & discharge characteristics and semi-permanent cycle life / Supply of eco-friendly products in single-cell and module form

- **Application:** Renewable energy (wind power, solar power), Hybrid cars, improvement of energy efficiency, ESS (energy storage device) etc

Microsoft offers free online course on Internet of Things

Microsoft has launched a new online course for developers who are looking to venture into the Internet of Things (IoT). The company has announced Azure IoT Developer Specialty training, which is free of cost. This course will allow developers to work with data engineers and other stakeholders to provide business solutions right from the setup of the IoT device to the end of its life cycle.

After completing the course, candidates will know how to

implement Azure services that form an IoT solution, including data analysis, data processing, data storage options, and platform-as-a-service options.

However, to get certified, you need a certain amount of prior knowledge. The official blog states, "Candidates for the Azure IoT Developer Specialty certification should have subject matter expertise developing cloud and edge components of an Azure IoT solution."

Google AI to predict eye condition behind vision loss

Google has developed an artificial intelligence (AI) based system that could help in predicting the progression of an eye condition called wet age-related macular degeneration (AMD). AMD is an eye disease that causes vision loss. It is the third-largest cause of blindness in the world after cataract and glaucoma. Around 75 per cent of patients with AMD have an early form of the disease called 'Dry AMD' that has a relatively mild impact on vision.

A small fraction of patients, however, develop the more sight-threatening form of the disease called 'Wet AMD', wherein abnormal blood vessels develop underneath the retina. These

vessels can leak fluids, which can cause permanent vision loss. This condition affects around fifteen per cent of patients.

Wet AMD affects one eye first, which makes patients heavily reliant on the other eye for their day to day functioning. Now, Google in collaboration with its DeepMind subsidiary and Moorfields Eye Hospital NHS Foundation Trust, has developed an AI model that has the potential to predict whether a patient will develop wet AMD within six months. This system could potentially help doctors plan studies of earlier intervention as well as contribute more broadly to the clinical understanding of the disease and disease progression.

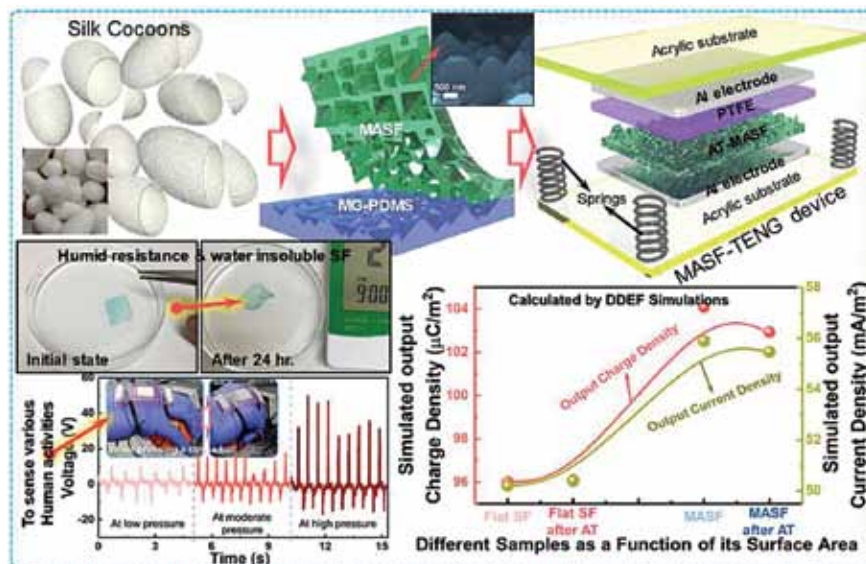
Implantable biosensor that operates without batteries

Researchers from the University of Surrey have revealed their new biodegradable motion sensor—paving the way for implanted nanotechnology that could help future sports professionals monitor their movements in a better way to aid rapid improvements.

In a paper published by Nano Energy, a team from Surrey's Advanced Technology Institute (ATI), in collaboration with Kyung Hee University in South Korea, has developed a nano-bio-medical motion sensor, which can be paired with AI systems to recognise movements of distinct body parts. The ATI's technology is built on its previous work around triboelectric nanogenerators (TENG), where researchers used the technology to harness human movements and generate small amounts of electrical energy.

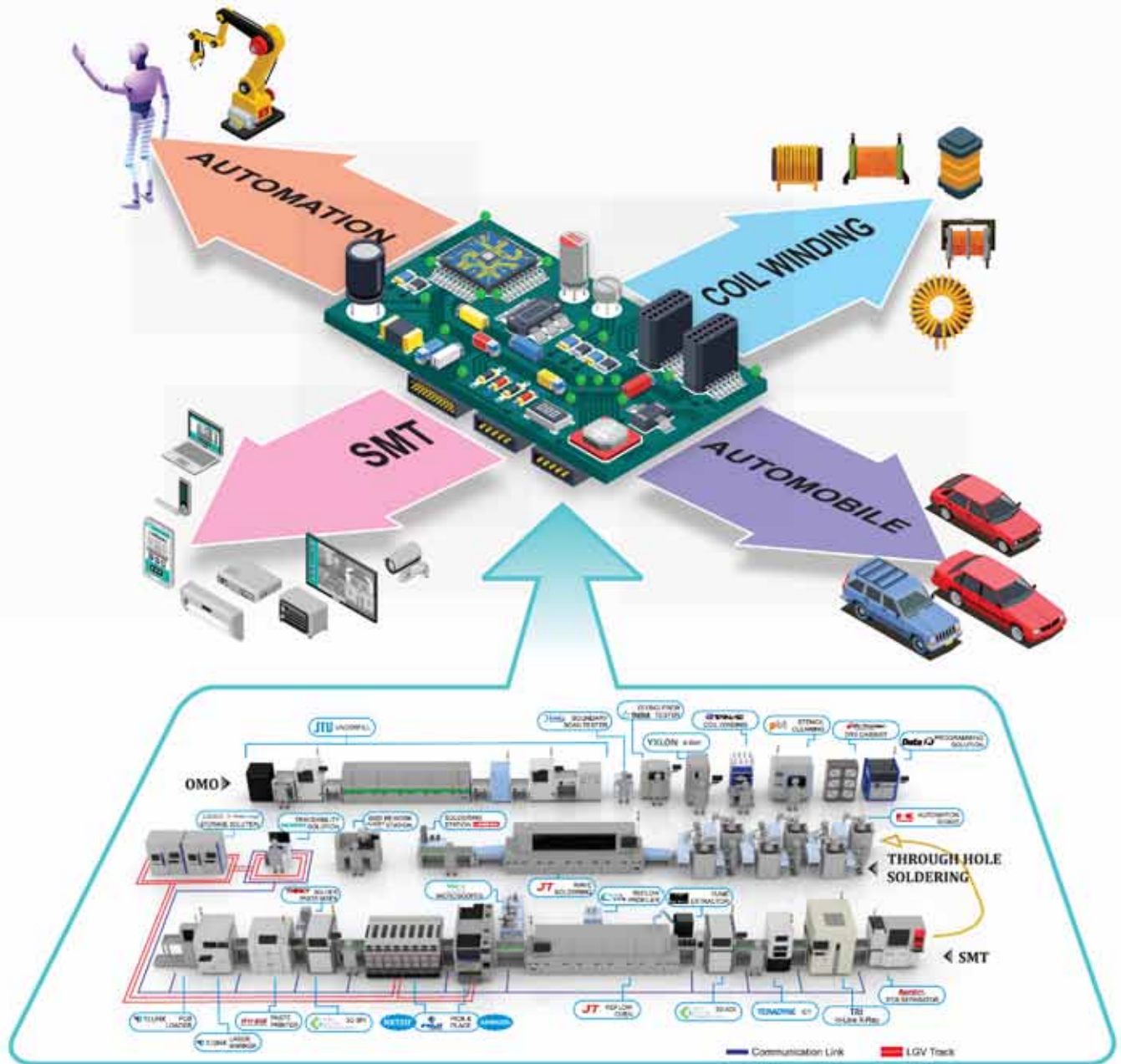
In their new research, the team from ATI developed a flexible, biodegradable and long-lasting TENG from silk cocoon waste and used a new alcohol treatment technique, which leads to greater durability for the device, even under harsh or humid environments.

Dr Bhaskar Dudem, project lead and research fellow at the ATI says, "We are excited to show the world the immense potential of our durable, silk film based nanogenerator. Its ability to work in severe environments while being able to generate electricity and monitor human movements positions our TENG in a class of its own when it comes to the technology."



The team from the ATI has developed a flexible, biodegradable and long-lasting TENG from silk cocoon waste (Credit: University of Surrey)

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AI can identify your personality based on your selfies

Russian researchers have revealed that AI can infer people's personalities from selfies better than human raters do. The study, published in the journal *Scientific Reports*, revealed that personality predictions based on female faces appeared to be more reliable than those for male faces. The technology can be used to find 'best matches' in customer service, dating or online tutoring, the researchers from HSE University and Open University in Russia, said. Studies asking human raters to make personality judgments based on photographs have produced inconsistent results.

According to the study, there are strong theoretical and evolutionary arguments to suggest that some information about personality characteristics, particularly those essential for social communication, might be conveyed by the human face.

After all, face and behaviour are both shaped by genes and

hormones, and social experiences resulting from one's appearance may affect one's personality development. However, the recent evidence from neuroscience suggests that instead of looking at specific facial features, the human brain processes images of faces in a holistic manner.

For the findings, the researchers teamed up with a Russian-British business start-up BestFitMe to train a cascade of artificial neural networks to make reliable personality judgments based on photographs of human faces. The performance of the resulting model was above that discovered in previous studies, which used machine learning or human raters. The AI was able to make above-chance judgments about conscientiousness, neuroticism, extraversion, agreeableness, and openness based on selfies the volunteers uploaded online. The resulting personality judgments were consistent across different photographs of the same individuals.

Vodafone Idea launches voice-based contactless recharge option

Vodafone Idea has launched a voice-based contactless recharge facility for its prepaid users. This new feature allows users to recharge their phones without contacting a retailer. Customers or retailers can simply mention a ten-digit mobile number on the device, and the Google voice-enabled feature will capture the command from a distance of up to three metres, according to the telecom major.

When customers come to a retailer for recharge, the retailer usually hands over the phone (with the Smart Connect Retailer App opened) to them to type in their mobile number to ensure accuracy in entering the number. However, it is not a practical option in the current times of social distancing.

"As a customer-oriented telecom operator, it is our

constant endeavour to come up with products and services relevant to the times and keep our customers connected at all times. In line with our digital-first approach, we are digitising our processes to offer convenient and efficient services to our nearly 300 million customers. The industry-first, voice-based contactless recharge enables recharges without touch and is extremely relevant in these times when maintaining social distancing is the need of the hour to stay safe," Ambrish Jain, chief operating officer, Vodafone Idea, said in a statement.

Currently, the voice-based recharge feature supports Hindi and English languages and can take commands of mobile numbers in different variations.

Bluetooth flaw allows impersonation of trusted devices

A flaw in a Bluetooth protocol is leaving millions of devices vulnerable to attacks, according to a study released by a Swiss research institute. The vulnerability, called Bluetooth Impersonation AttackS (BIAS), allows an intrusion by an attacker posing as a previously trusted Bluetooth device.

"In this paper, we demonstrate that the Bluetooth standard contains vulnerabilities enabling an attacker to impersonate a device and to establish a secure connection with a victim, without possessing the long term key shared by the impersonated device and the victim," researchers at the Swiss Federal Institute of Technology Lausanne mention in their report.

The stealth attack does not require great sophistication. Researchers say that a hacker needs little more than a Raspberry Pi to hijack a laptop, smartwatch, cellular phone, or earphones. More than 28 Bluetooth chips on nearly three dozen devices were found to be vulnerable. These include chips from Apple, Cypress, Qualcomm, Intel, Samsung, and CSR. The vulnerability was reported to manufacturers last December. Some developed workarounds immediately and

provided updates for users.

When two Bluetooth devices enter pairing mode, a persistent (long-term) encryption key is exchanged and stored. That is why smartphone users, for instance, see a list of previously established connections on their Bluetooth setup screens that permit instant connection to known sources and bypass lengthy, repetitive setup procedures.

The flaw rests with a device's failure to ensure the authenticity of a malicious device posing as a known player utilising a captured long-term encryption key. For one thing, the Bluetooth secure connection is not encrypted; in addition, mutual authentication is not required on subsequent hookups, and devices using secure connections can rely on older, less secure connection protocols that allow access to hackers. The attack focuses on the Bluetooth Classic protocol supporting basic rate and enhanced data rate modes. The Bluetooth Special Interest Group (SIG) that oversees Bluetooth protocols says it will be updating the Bluetooth core specification covering mutual authentication rules and tightening security protocols.



1 Drone Deliveries Thriving Amid Covid-19

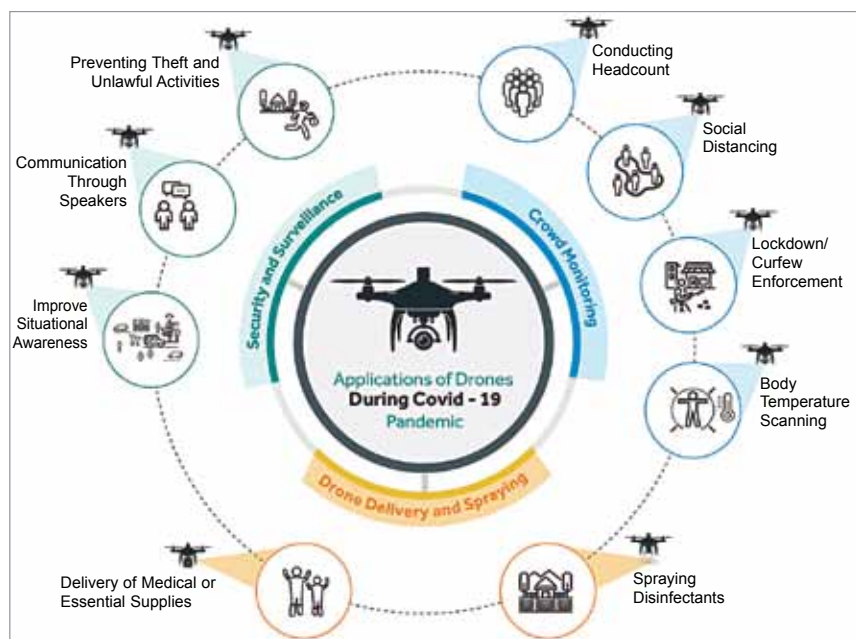
2 Aerial Revolution In Construction Sector

3 Latest Technology In Space Race: Satellite IoT

4 What Impact Will 5G Have On Healthcare?

1 DRONE DELIVERIES THRIVING AMID COVID-19

As India continues to tackle the ongoing crisis, drones have been playing a key role in combating the novel coronavirus. Drone startups in India are working alongside authorities to provide services such as disinfecting contaminated areas, managing crowds and delivering medical supplies



(Credit: www.cyient.com)

The novel coronavirus is transmitted via respiratory droplets and can spread by touching contaminated surfaces like metal, floors, objects, and other surfaces indoors and outdoors. Remotely piloted drones are becoming vital tools in the fight against Covid-19 as they help to minimise human interaction and keep human operators safe from getting infected.

The law enforcement agencies across India are using drones to moni-

tor crowded areas, ensure social distancing, disinfect contaminated areas, oversee cargo, and provide medical supplies. The drones are equipped with HD thermal cameras for surveillance, police sirens, flashing lights, and loudspeakers to reach places where people are congregating. Wireless technology is enabling the police to make lockdown-related public announcements over speakers, supply medicines, or other essential goods for families living in quarantine.

The drone based surveillance is assisting ground forces to take correct decisions on moving forces to sensitive or congested areas. Visuals from the cameras of drones are helping monitor the situation, condition of the streets, and rooftop of the buildings to know if there are any projectiles, missiles, or stones kept there.

The governments of Telangana and Kerala are using a variety of drones for monitoring the public on roads, disinfectant spraying, and delivery of services. Similarly, Assam is using drones to keep an eye on religious places and large gatherings at markets and public places. Maharashtra is using data analytics and drones to deal with containment in crowded places like wholesale markets. To make sure citizens are safe and are inside their homes, Hyderabad is also using drone technology for surveillance of the city. The Gujarat police have deployed drones in Rajkot, meanwhile, Uttarakhand police also monitored the situation in Dehradun with the help of drone cameras.

Jammu and Kashmir police have also deployed drones for service in Srinagar as well as other parts of the valley to monitor the Covid-19 situation and make people aware of the restrictions imposed by the administration. To check whether there are any violations of prohibitory orders, the Delhi police and civic agencies have adopted drones as an extension of their forces. They are using drones

extensively to watch ration shops, banks, and religious places in every subdivision, where people gather.

Many cities like Lucknow, Raipur, Agra, Guwahati, and Meerut are using drones to ensure the effective implementation of Covid-19 lockdown and mitigate the spread of the virus in the towns.

Drone startups in India are working alongside authorities to provide drone services. FlytBase drones are delivering medicines, first aid kits, and emergency

supplies to homes and hospitals, and aerial disinfection at scale. Marut Drones are now helping the Telangana government. GarudaUAV is working with the local police and administration in Noida. Navi Mumbai based ideaForge, a manufacturer of drones for defense, security, and industrial applications, has provided the equipment to Maharashtra government.

The biggest challenge during this opportunity is to assemble the right kind of drone in this lockdown when spares

and parts are not immediately available. Also, payload customisation for non-regular use cases is another challenge.

A drone's small size and flight capability allow it to access areas that otherwise may not be easy or possible. Typically, they are equipped with computer vision, camera, face and object recognition, and a combination of networking, robotics, and artificial intelligence (AI) to perform as demanded by the situation.

—Deepshikha Shukla

2 AERIAL REVOLUTION IN CONSTRUCTION SECTOR

Unmanned aerial vehicles (UAVs) or drones are playing an important role in the construction industry. In recent years, they have become an ideal choice for land surveying, building inspections, security surveillance, marketing, monitoring on-site activities, and so on

Unmaned aerial vehicles (UAVs) or drones have emerged as extremely viable tools for various sectors, ranging from geographic mapping and disaster management to climate change research, precision agriculture, and much more. Even while flying at lower altitudes, drones can capture aerial data with high accuracy at better speeds and lower cost when compared to manned aircraft or satellites.

In the construction industry too, drones allow easy access to difficult-to-reach sites and structures, such as unsafe steep slopes. This makes them an ideal choice for land surveying, building inspections, security surveillance, marketing, mapping data, monitoring on-site activities, logistics, demolition, and so on.

Selection of the right drone for an application results in better performance. Various parameters like camera resolution, quality of different components and the height of flight can affect the accuracy. Components of a commercial drone include flight controller, motors (preferably brushless for noise mitigation), propellers (standard/pusher), receiver and transmitter, batteries (lithium polymer), electronic speed controller (ESC), landing gear, flight controller, sensors such as light detection and ranging (LiDAR), and the like.



(Credit: www.lhsfna.org)

The flight controller is the brain of a drone where all the decisions are made. The transmitter is responsible for the transmission of the radio signals from the controller to the drone, while the receiver is responsible for their reception. These components along with sensors need to work properly in order to issue commands to the drone on time while flying. An ESC interprets signals from the flight controller, and converts them into phased electrical pulses to determine the speed of the motor. A motor with a lower rating will usually produce more torque and that with a higher rating will spin faster. A heavier propeller will require more torque from the motor for motion than a lighter one. Finding the right balance between the specifications of these components makes all the difference.

In a drone survey, aerial data is captured with RGB or multispectral cameras in cases where colour and near-

infrared imaging needs to be performed simultaneously, and LIDAR payloads for measuring distances remotely. Images are taken several times from different angles based on site area and are usually saved on a memory card. They are geo-tagged with coordinates using a geo-tagging software. The images are then imported into photogrammetry software that processes this data to create elevation and 3D models, geo-referenced orthomosaics, volumetric measurements, and so on.

In one such example, a construction and asset management company, Graham construction, saved time and money by employing eBee Plus automated mapping drones to do topographic surveys for building and civil engineering projects. This is important for tracking progress in real-time without missing any corner of a site. Pix4D photogrammetry software is used to process the drone's imagery and create digital point cloud and contour model outputs.

The previously used terrestrial surveying methods were not only expensive but also risky at times, such as while working on the on-site quarries. The tedious task of data processing and volume calculation, which had to be done separately by specialists, is reduced using drones. It also saves surveyors from traversing dangerous sites, as aerial photography can be

done at the same time without separate equipment, according to *sensefly.com*.

Chasco Constructors is another company that started using drone technology for construction and site monitoring. For one of the projects, they used DJI Phantom 3 Pro drone and drone-mapping software from DroneDeploy, which resulted in the completion of the project before the estimated schedule. According to data sourced from *dronedeploy.com*, the total budget for the construction of the 6,500 square-

metre structure was 29 million dollars. The replacement of most manual tasks with drone mapping slashed the survey costs by 75 per cent.

Startups like DroneBase and Garuda Robotics also offer services like aerial surveying to architecture, engineering and construction (AEC) industry, among others.

Extreme temperatures and wind can affect drone operations. Another issue is that battery power may not be enough for complete inspection of big

sites. Also, since a malfunction such as a damaged propeller can cause the drone to crash, an operator should avoid flying over areas where people are present. A qualified person must pilot a commercial drone to prevent damage and necessary permissions need to be obtained. With enough precautions, drones are capable of shifting the overall paradigm in the construction sector and bring in innumerable benefits for the industry.

—Ayushee Sharma

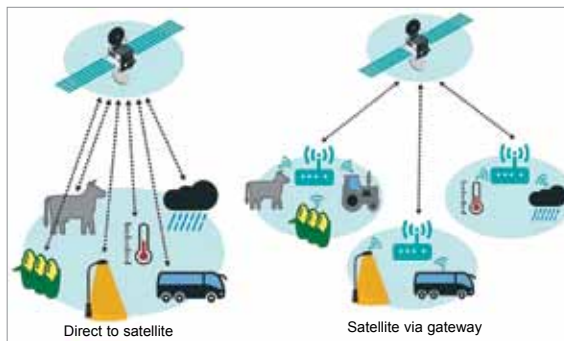
3 LATEST TECHNOLOGY IN SPACE RACE: SATELLITE IoT

The Internet of Things (IoT) is now globally proliferating to intelligently connect devices in order to meet increasing consumer demands as well as improve productivity. IoT further helps to increase the accuracy of data-based forecasts and trends

From home to industrial applications, the deployment of Internet of things (IoT) systems is globally proliferating to intelligently connect devices and gaining useful information in an attempt to meet increasing consumer demands as well as improve productivity. As the total number of connected sensors increases, so do the data points, thereby increasing the accuracy of data-based forecasts and trends.

This requires consistent and ubiquitous coverage to reach even the remotest assets so that every business gets a reliable IoT connectivity service. For this, satellites are a suitable option to connect sensors and IoT devices to the cloud and communicate even in harsh weather conditions (via L-band).

Unlike most of the present terrestrial infrastructure options that are complex, satellite connectivity enhances coverage in areas with limited or no cellular and Wi-Fi connectivity along with easier device management via an IoT connectivity platform. For example, Iridium Edge is a satellite IoT communications device that can be rapidly deployed and complements terrestrial based solutions. The company's satellite cloud-based



(Credit: www.ttp.com)

solution CloudConnect offers global IoT coverage through Amazon Web Services (AWS) and is a singular communications platform to manage connected devices.

In direct configuration mode, satellite connectivity can either be used only when necessary in conjunction with terrestrial IoT access networks (like cellular, LPWAN), or be solely used where it is the only possible means of connectivity for transmitting data. Hybrid terrestrial satellite systems result in lower cost due to terrestrial-only IoT devices, while satellite-connected terminals ensure coverage. Myriota is one such startup that provides direct satellite connectivity for IoT uses, for purposes like environment monitoring. Its advantages include security and scalability.

For sensors and devices that do not

use much data, a direct satellite connection can be expensive in terms of equipment and power consumption. In backhaul configuration, satellite connects to a tower which then connects to devices via other suitable wireless communication technologies.

Since the deployment needs to be done in areas that are off-grid or have an unreliable power supply, the service needs to be designed for low power

operation so that renewable energies like solar can suffice. The deployment should be preferably flexible enough to match hybrid connectivity needs. Apart from this, maintenance can be made easy with over-the-air (OTA) firmware upgrades.

Low Earth orbit (LEO) maintains low power consumption and is a cost-effective option. It is also well-suited to narrowband requirements of IoT but needs steerable antennas due to moving satellites. On the other hand, geostationary orbit (GEO) satellites need large terminal antennas and sufficient directivity to prevent interference with satellites in their vicinity.

This opens a plethora of opportunities for satellite operators like deploying new LEO or HEO (highly elliptical orbit) constellations and selling additional capacity in different bands (like

C, Ku, Ka). For instance, Inmarsat, a satellite communications provider has collaborated with Vodafone IoT, doing away with the complexity of handling multiple connectivity providers and roaming agreements.

Sectors benefiting from this technology include energy and utilities (smart grids), medical (wearables), transportation (connected cars), retail and banking (remote ATMs), oil and gas (pump and pipeline monitoring, distribution monitoring), environment monitoring and

agriculture (weather stations, natural disaster monitoring), safety and security, infrastructure and construction, telecom, and more. The efficient use of energy also drives the development of sustainable cities.

Satellite and IoT operators will need a complete understanding of the different components utilised in IoT applications, including the integration of IoT dashboards in business infrastructure to offer end-to-end services. Although a satellite has good bandwidth, many

options come with larger equipment and higher battery usage than most terrestrial ones, which poses a challenge to large-scale adoption. One such example is Dutch startup Hiber's nano-satellite powered solution that aims to resolve such issues. Also, advancements in communication satellites are slowly making it possible to provide a greater range for transmitting data to the cloud via a single robust network of satellites.

—Ayushee Sharma

4 WHAT IMPACT WILL 5G HAVE ON HEALTHCARE?

With the introduction of 5G network in healthcare sector, more patients are being treated at the same time. 5G helps providers in giving improved care to patients outside hospitals and clinics through high-quality real-time video

4G, the current standard of cellular technology, is nearly five hundred times faster compared to 3G due to which applications such as high definition TV on mobile and video conferencing could be possible. However, due to an increasing number of users sharing the available capacity, actual speed experiences are much lower. It is applicable in both situations—when the device is stationary and non-stationary. As this network of users grows further and the Internet of Things (IoT) applications increase, the connected devices will increase to such an extent that 4G would not be able to support them.

5G New Radio (NR), the generation succeeding 4G, comes with a wider bandwidth to allow these devices to connect to the network. Additionally, multiple data streams can be transmitted without much interference. Speed is ten to a hundred times faster compared to the current standard. Their ultra-low latency means that there is a reduction in time taken for data to travel from sender to receiver.

These features make 5G suitable for mission-critical applications that require high reliability. In healthcare sector, 76 billion dollars revenue opportunity is expected in 2026 for operators addressing transformation with 5G, according to Ericsson's report

titled The 5G Business Potential.

Whenever there is a need for medical attention, patients need to visit a doctor which can be troublesome. If the doctor is not in the vicinity, like in rural areas, it can consume a lot of time and be life-threatening. Even when the patients reach, they have to wait for treatment as an analysis of their health status takes time. 5G enables fast download and upload speeds for quick and reliable transmission of massive files consisting of medical imagery generated by MRIs and other bandwidth-intensive imaging equipment to remote specialists. This also allows more patients to be treated in the same period. Veterans Affairs hospital in California is among the first 5G-enabled health facilities. While the work is not complete, some of the portions have become operational.

5G networks can help providers in giving improved care to patients outside hospitals and clinics. Real-time data is necessary to make quick decisions which require high speed and low latency. Telemedicine appointments through high-quality real-time video allow healthcare professionals to collaborate with patients as well as each other with ease. In partnership with Barcelona's San Raffaele hospital, Vodafone has developed 5G ambulances for paramedics so that they can stream real-time HD video

support from remote specialists while transporting patients. Preventive routine and post-operative care can be done by remotely monitoring patients through IoT devices like wearables and gathering necessary data related to medications and vital signs.

The use of futuristic and emerging technologies for better treatment is also possible with 5G. AT&T is working with VITAS Healthcare to study the effects of augmented reality (AR) and virtual reality (VR) for hospice patients. Artificial intelligence (AI) requires rapid learning in real-time from large amounts of datasets. 5G makes it possible to utilise AI tools anytime and anywhere. Even a successful remote robotic surgery procedure was attainable with a 5G network in China last year. The surgeon placed a brain stimulation device in a patient with Parkinson's disease while being nearly 3,000 kilometres away.

5G services have not been rolled out in India yet. Sandeep Aggarwal, chairman, PhD Chamber of Commerce and Industry, says, "While auctions should be held at the earliest, a lot of things need to be kept in mind. We need to look at whether 4G itself has been used to full capacity, and need to keep in mind that 5G standards have not been set." **EFY**

—Ayushee Sharma



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You Can Travel In Drones And Eat Them Too

With the introduction of artificial intelligence and hybrid technologies, the future of drones is not just limited to taking great live aerial photos and videos, now these can also be used for personal transportation and commercial aviation, and even as food in case of emergency

Sani Theo

Is it not exciting to see a manned drone flying with a person onboard rolling and looping above buildings in mid-air? Yes, this is already happening in some countries. The first commercial drone capable of carrying a human was introduced by a Chinese company in 2016. Since then many companies across the globe have been designing and building various types of manned drones. Some companies have already succeeded in building passenger drones, while many are still into testing with humans onboard.

The future of drones is now not just limited to taking great live aerial photos, images, and videos, but these can also be

used for personal transportation and commercial aviation. Imagine your daily commute with no more traffic jams, no traffic lights, no road rages, and no delays. It wasn't that long ago when all this was just a dream or fiction, but thanks to artificial intelligence (AI) and hybrid technologies, it's all turning into a reality. This article covers the role of AI in drones, different types of hybrid drones, and their manufacturers.

Drones and AI

There are different types of drones including conventional drones, autonomous drones, hybrid power drones, hybrid vertical take-off and landing drones, and edible drones. It's



Fig. 1: Airbus Hybrid drone
(Credit: italdesign.it/project/popup)

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not necessary that all drones require AI technology. But almost every company that deals with autonomous unmanned aerial vehicles (UAVs) or drones claims the use of AI, machine learning or deep learning. Drones often generate large amounts of data. The faster and more accurate the data that drones generate, the faster the images can be evaluated by the system and the better for the drone to fulfill the mission or meet the requirements.

AI technology enables machines to interact with the inbuilt system and operators in an intelligent way. Through AI and machine learning, the drone can perform object detection, image processing, face detection and recognition, counting, segmentation, tracking, thermal detection, fire detection, motion planning, and others.

Machine learning algorithms are designed in such a way that they can learn and improve over time when exposed to new data. Since many AI-related tasks for drones are dealing with image processing, the drone must be able to perceive the environment or objects in some way. This process is referred to as machine perception, which is an important part of any autonomous drone. Computer vision is concerned with the automatic extraction, analysis, and understanding of useful information from one or more images. Once the drone has captured raw sensor data, it usually needs to be analysed to extract meaningful information.

Many companies are trying to develop a drone to fly Beyond Visual Line of Sight (BVLOS) for maximum efficiency. For that, motion planning is an important part. The prerequisite for motion planning is usually machine perception that captures the environment. The drone visualises the environment, identifies its surroundings and the distance. Here, deep learning is deployed to detect and recognise objects including humans, vehicles, trees, buildings, and subsequently create a corresponding flight route.

The use of AI technology makes drones smarter and gives ground-level operators a human-like eye-in-the-sky. With AI algorithm, drones can sense their surroundings, which empowers them to map areas, track objects,



Fig. 2: Ehang hybrid drone (Credit: www.ehang.com)

and provide analytical feedback in real-time. AI technology helps drones increase efficiency and safety.

Hybrid power drones

Hybrid drones are almost similar to what we have seen in hybrid-electric vehicles (HEV) powered by internal combustion engine (ICE) systems and electric propulsion systems. In conventional drones, batteries (often lithium polymer or LiPo) are used as a power source. One of the problems with LiPo battery is that when it gets exhausted after use, it takes long time to charge up. So, you cannot put the drone into a continuous flying mode for longer operations.

One of the solutions to overcome this problem is hybrid technology. You can build a hybrid drone by adding the ICE and DC generator in the conventional drone. DC generator runs with the miniature ICE, which is used for charging the battery. ICEs are usually powered by energy-dense fuels such as gasoline or diesel, or liquids derived from fossils. In most hybrid drones, gasoline is used along with LiPo batteries.

The capabilities of any drone are defined by endurance and range. The endurance for a drone can be described as the total time for which a drone can fly non-stop. It depends on many factors including the capacity of the battery and the motor current, aircraft size, and payload weight.

The range indicates the total distance a drone can fly. The range depends on various factors such as

List of some hybrid drone manufacturers

- eHang
- Foxtech
- ITRI
- Quaternium
- Skyfront
- Top Flight Technologies
- ULC Robotics
- Volocopter
- Walkera
- Workhorse Surefly

the amount of current the aircraft is producing, battery, radio controller/transmitter range, endurance, flight speed, and aerodynamic performance. Note that some hybrid drones are controlled by radio-controlled transmitters or smartphones, while others are controlled through a computer or laptop. The range of this controlling device is also an important factor for the drone to cover a longer distance.

The advantages of both fuel power and electric power are used in a hybrid drone for increasing the endurance ten times more than a normal drone. When the battery is discharged, it gets charged through the DC generator while the drone is flying. Other benefits of hybrid power include higher payloads, more powerful, and higher reliability.

Applications of hybrid drones

Hybrid drones will find applications not only in the military but in several

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existing industries as well for such purpose as personal transportation, air taxis or passenger drones, goods delivery, and inspections. Hybrid drone technology will revolutionise delivery for e-commerce companies like Amazon, Alibaba, eBay, etc.

Hybrid drones are designed with longer endurance and range for outdoor use. For example, Foxtech GAIA 160HY hybrid drone is a hexacopter equipped with a gasoline-electric hybrid power system. It has an onboard 2000W generator that drives high-efficiency motors to ensure a long flight time of about three hours. Besides the internal combustion engine, a 12S lipo battery package is installed onboard to offer emergency back-up power.

The exact scope and future of passenger drones remain uncertain since this technology is new. Advancement in aerial drone technology could result in a rapid proliferation of passenger drones for civilian use like air-taxis and air-ambulance services. Manufacturers of passenger hybrid drones are working to overcome many challenges including noise pollution, short flight times, airspace regulations, safety, and general operations. Some of the popular manufacturers of passenger hybrid drones include Ehang, Volocopter, Workhorse and Top Flight Technologies.

Ehang. The Ehang 184 was one of the first hybrid drones built for human transportation. Already tested extensively with human passengers, it is one of the most compact passenger drones.

Volocopter. The Volocopter from Germany probably looks like a tradi-



Fig. 3: Volocopter hybrid drone (Credit: www.volocopter.com/en)

tional helicopter. It is one of the few drones to use fibre-optic cables for its communication networks.

Workhorse Surefly. It was introduced in 2017 and uses both a gasoline generator and electric battery packs as power backups.

Top Flight Technologies. Their Airborg H6 1500 drone has good endurance capabilities and an advanced payload, providing an approximate flying time of over two hours. This drone can reach a maximum speed of 64km per hour while supporting a maximum payload of about 9kg. It can cover a range of 160km, withstanding unfavorable wind conditions up to 56km per hour. It has an advanced autopilot system responsible for calibration and tuning. This drone also consists of a 5000W rated hybrid engine, a tank with a 11.3-litre capacity, and a 16,000mAh LiPo battery.

What is an edible drone?

Don't be surprised when you hear that someone is eating a drone! That will be perfectly alright under cer-

tain circumstances! A special type of unmanned aerial vehicle (UAV) called Pouncer has been developed by Windhorse Aerospace that will be loaded with food, water, and medicine, and would fly independently to its pre-planned destination such as disaster-hit areas. It is a one-way flight drone whose pre-formed shell can be reused by the victims in disaster-hit areas for shelter and the frame can be burnt safely to cook food.

The company is planning to replace the drone structure with special materials like edible food components. That is, it will soon be getting an upgrade that allows some of its body parts to be consumed along with its cargo. Yes, it is possible but with some extra caution because after the coronavirus disease outbreak everything is not the same, especially in areas such as food hygiene and sanitation. Victims need to follow the WHO guidelines including hand hygiene before getting a bite or chunk of the edible drone.

The Pouncer will come in different sizes and capacities. The three-metre-wide drone was designed for hard-to-reach areas during disasters, natural calamities, and conflicts, delivering aid to the victims while saving time, money, and human lives. The drone will be launched from a catapult, balloon or aircraft depending on the area it is trying to reach. Frazer-Nash Consultancy and Windhorse Aerospace are in collaborative partnerships to develop a Pouncer made from a variety of materials to deliver humanitarian edible food aid to remote areas and war-torn locations. **EFY**



Fig. 4: Pouncer—edible drone (Credit: www.windhorse.aero)



The Case For Responsible AI

Artificial Intelligence is becoming quite popular nowadays as it gives us significant technological power. However, it is important to use it with more responsibility to overcome its disruptive impacts such as loss of privacy, and increased biases in decision-making. Responsible AI would ensure ethical and transparent use of AI technologies



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In my view, tools and systems are not hurtful; people using them are! The thing with technology is if you learn to use it, it works for you. But, 'who' you are decides 'how' you use it.

One of the things that distinguish humans from others is our freedom to decide how we act. Whatever we choose, we could always have chosen differently.

Responsible artificial intelligence (AI) is not a better technology—it is how we choose to make it and use it.

AI is giving us significant technological power, which begets greater responsibility.

These days, AI is raising more concerns because of the potentially disruptive impact it can create on many fronts. Matters such as massive workforce displacement, loss of privacy, increased biases in decision-making, and general lack of control over automated systems or robots. These issues are significant, and

they are also addressable—if we approach with the right planning, oversight, and governance.

Responsible AI is a framework for bringing several critical practices together, where we can ensure ethical, transparent, and accountable use of AI technologies. Their use in a manner that is consistent with user expectations, organisational values, as well as societal laws and norms.

For example, under normal circumstances, mis-selling, especially in the financial services domain, is dealt with utmost caution. The government would step in if the consequences are grave. If a person, i.e., a human does it, you may reprimand them or have some consequences attached. How would you do that when so-called intelligent chatbots are being used to sell something to customers? Suing the salesperson is already stressful, can you think of doing that to a chatbot? Mis-representation is about what a person said to you. What happens when we're not being sold to by a human at all?

So, understanding and acknowledging that these types of scenarios may exist with your product or service and taking adequate steps to deal with them in the ethically right manner is Responsible AI.

The foundational elements of Responsible AI

Some of the foundational elements have to be timeless and deeply rooted in organisations' fabric.

Elements such as—moral purpose and society benefit, accountability, transparency and



Fig. 1: Three core aspects of a good solution design

explainability, fairness and non-discrimination, safety and reliability, fair competition, and privacy are part of foundational elements of Responsible AI.

Some of the elements also come from the supply side of AI systems. We see AI vendors continually pushing for faster adoption of AI solutions. I think this is greedy and not at all customer-centric approach. I can understand that vendors want to sell AI by making it easier and frictionless, but they seem to ignore inherent risks in their system as well as their solutions' ecosystem that is not in vendor's control. It is becoming more like a cart before the horse situation.

It only benefits ven-

dors, while enterprises often lose money and time. Because once companies start, there is no turning back. So they go deep in the rabbit-hole and keep bleeding through the nose. Cautious steps are of utmost necessity, by vendors as well as by enterprises.

However, in general, I think, it must cover three core aspects of a good solution design, i.e., you are designing the right solution, the solution has been designed right, and most importantly, you have covered all the risks.

Designing solutions as Responsible AI

While most of the companies understand the need for Responsible AI, they are unclear on how to go about it. Designing solutions as Responsible AI is still a complex and mysterious act.

While researching for my book on AI, *Keeping Your AI Under Control*, I created a 10-step approach or a framework, The Leash System. This system expertly guides solution development on the correct path, which then would help in designing the solution as Responsible AI. The ten steps are as follows:

1. Defining the problem correctly. Define what are you trying to achieve

with the AI system, what is your short-term purpose and how does it align with your overall long-term purpose as well as values.

2. Establish correct levers or drivers of that problem. Without identifying the right drivers, it is highly challenging to have a correct solution in place.

3. Validate issues and its drivers. It is also crucial that by way of simulation or any other mechanism, the problem and its drivers should be validated. Not only that, you will also find it useful to identify which drivers are significant contributors and which ones are not.

4. Link AI solution with problem drivers. This advice might sound counter-intuitive, but you see, we don't solve a problem with solutions, we fix drivers of that problem with solutions, and when we set those drivers, problem automatically gets fixed.

5. Verify that fixing key problem-drivers will indeed fix your problem. Sometimes, we come across confounding variables, which appear to be drivers of a problem, but they are not. By validating thoroughly, you can ensure that you are not wasting your efforts and resources that are not fit for AI solution.



Fig. 2: A 10-step Leash System

6. Understand risks. Risks can come in all sizes—small, medium, large. Regardless of that, understanding and acknowledging that it exists is the key.

7. Quantify risks. By quantifying risks, you can prioritise your approach towards risk mitigation. And, if not, you will at least be aware of potential issues.

8. Establish controls. Once you have identified and quantified risks, establish appropriate control systems, and minimise risks, or better yet eliminate those risks wherever possible.

9. The Red Team. It is not anymore just a cybersecurity paradigm. If you want a robust and trust-

worthy AI system, get your Red team operational.

10. Manage residual risk. And finally, despite doing all the above, if anything or any risk remains, manage that residual risk by other possible means.

When companies follow this 10-step framework, designing and deploying better AI solutions becomes entirely possible.

Designing responsibility and building trust

However, another critical question remains, "How do we design responsibility and build trust in systems?"

Let's take real-life analogy here. To trust someone in real life, we typically rely on three things:

- We rely on how someone was taught, their upbringing or education, etc.
- We test them thoroughly to ensure that they have learned it well and understand the rules of society.
- We make sure to provide them with the right operative environment to do their best.

Similarly, for AI to be trustworthy, we must ensure that:

- AI solution is trained well, which means useful data and proper training methods were used. All pos-

sible scenarios have been covered, and training lasted for a reasonable duration.

- AI systems are thoroughly tested before deployment, and we keep checking them regularly.

- Things surrounding the AI system are also well integrated with it because, sometimes, the AI system may be good enough, but other interactive systems may throw it off.

By covering these three aspects, I believe we can have reasonable level of trust in an AI system.

Governing automated decision systems

What about the automated decision systems, especially the ones that may have a profound impact on social or personal life? How can we oversee such systems?

I think the best way to implement governance for any automated decision-making system is by making it follow the fundamental rules of the law.

The rule of law says that decision-makers must be transparent and accountable—make an AI system transparent and fix accountability.

The rule of law also says that the decision-maker must be predictable and consistent—make sure that the AI system is predictable and consistent, too.

And finally, the rule of law also says that as a decision-maker, you must always put equality before the law—so, the AI system must be free of bias and discrimination, even if it means diverging from some of the set rules in that case.

In general, I strongly feel the need to have a responsible human being always in the loop when crucial decision making is required. An automated decision system should always recommend not to decide.

Responsible AI practices

There are five practices that each company can follow to ensure the responsible use of AI systems.

1. Keeping a balanced scorecard for AI systems' training and monitoring or say governance. When you have several metrics in a stable scorecard form, you can easily understand how they interact with each other.

How maximising or minimising one metric can affect other parameters, and so on.

2. Keeping humans in the loop, always. Technology systems may know how to achieve a goal, but they lack common sense, they lack human-level reasoning. So, unless you have a responsible adult who is in charge of this juvenile AI system, there are many ways it could go wrong.

3. Keeping a close eye on inputs. There is a reason why we say—*garbage in garbage out*. If your data has flaws, your AI system will manifest them in output, but at scale. Minor flaws would get amplified to cause problems. There are a few characteristics of a unique full-spectrum dataset—it is timely, complete, correct, integral, accurate, appropriate balance, and it is sufficient. So ensuring that full-spectrum data is available is the key.

4. Knowing its limits. AI systems are not all in one solution. Even narrow AI solutions have limitations; they have asymptotic points, that is, situations where the system fails to function. By understanding those limits, everyone can avoid them or manage them effectively.

5. Testing thoroughly and keep doing it regularly. First of all, you should always check your AI system for all the potential scenarios. Even if they are only remotely possible or are long-tail cases—testing the system for those cases will ensure that everything is in order.

I often talk about 'Concept Drift.' It is the phenomenon where the machine learning model characteristics can change over some time. It means, if you trained and built your system by referring to a particular dataset, it may no longer be relevant. With the change in time and several external factors, the model may be invalid or suboptimal. It is the best practice to test your AI system for concept drift, regularly.

Business challenges in ensuring the responsible use of AI

Many of the businesses are confused as to what to do when it comes to Responsible AI. Simply because there are too many people out there advising companies with Responsible

AI and Ethical AI frameworks. The problem with most of them is a conflict of interest. When there is such a conflict, i.e., you are advising and providing AI solutions, too, it rarely yields positive results.

At the same time, many businesses are not even there yet. They are merely ensuring that best practices are followed; they are using standard protocols or frameworks and are maintaining project management hygiene. The issue is that people haven't understood the vastness, and the scope of the risk when AI goes wrong.

The fact that we don't know what we don't know is a significant impediment. It is restricting companies from visualising this problem.

Unlocking the full potential of the workforce

While we take care of risks and other issues related to Responsible AI, how do we unlock the full potential of the workforce?

It is a relatively sensitive issue. There is constant unrest amongst the workforce in several companies. The concern of losing jobs is real and challenging.

However, first, I would recommend that companies should use the AI system only in places where the workforce is complaining about hard work. Whatever your workforce is happily doing, why touch it?

Second, you can use AI solutions, where the time is an essence, and adding more members to the workforce is not a solution. Millisecond decisions or similar ones are good candidates for automation with AI.

Third, use AI solutions where unpredictability is costing more or not bringing more revenue. For example, use it for top-line improvement. If you focus on bottom-line improvement, it will only give measurable efficiency gains.

And for everywhere else, I don't see an immediate need for an AI solution.

Several years ago, I was working with a company on a time-saving project and even after three months in, we did not achieve any headway. I wasn't clear what were we missing until one day, one of the colleagues

commented - he said, “Even if you give us two hours back in the day, what will we do with it? And because that question is not being answered, we will end up consuming that time in just expanding our existing work.”

That was a light bulb moment; we realised that while we were freeing up their time, we must also ensure that their free time is repurposed for something else, something better.

On the same note, I believe that people are not afraid of losing jobs as such. They are uncomfortable because they do not know what to do with excess time at hand—it bothers them!

So, the best way to unlock the full potential of the workforce would be to gift each of your employees one of the AI bots, like a personal AI assistant, that can do their grunt work. Then, enable your employees to control those systems effectively and allow them to spend the rest of their time ideating or working strategically.

You can encourage their creativity by taking away mundane and grunt workload. And then provide autonomy to come up with ideas, and also offer them with testbed to validate those ideas.

Responsible AI versus Explainable AI

Some people often confuse Responsible AI with Explainable AI. So, let me give an analogy here. Explainable AI is much like Air Crash Investigation, which is necessary and useful after the fact, but of no use at all to avoid that accident.

Responsible AI is about avoiding that crash in the first place.

When we talk about explainable AI, it is still about being technically thorough. It is about being able to understand what happened, how it happened, and why it happened. And, having an auditable system in place, where you can investigate, after the fact, find out how every step was carried out.

Responsible AI, on the contrary, is being ethically, socially, and morally thorough. It is about being able to control desires, put them second by placing human and societal interest first.

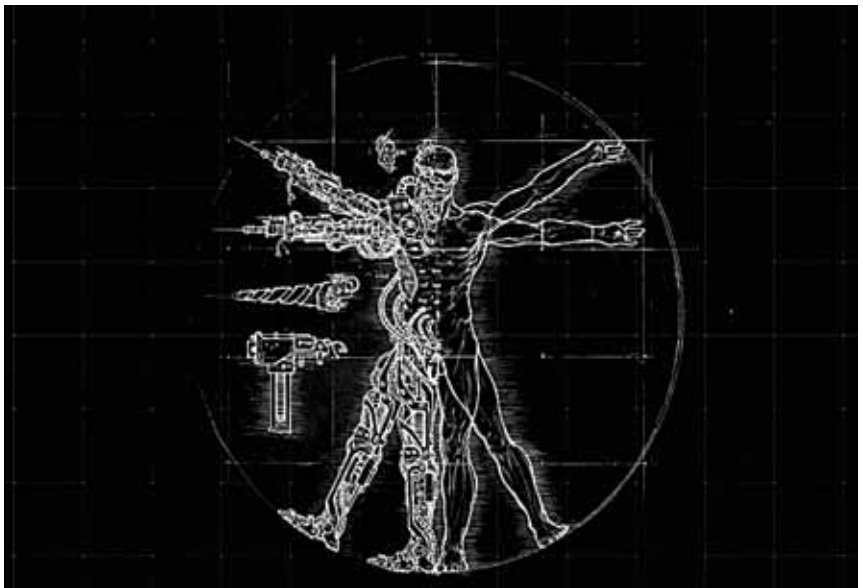


Fig. 3: You can develop and use AI responsibly if you know the risks. But first, you must understand them better and specific to your use case or context

Both are indeed necessary and have an essential place in the ecosystem.

The case for Responsible AI is stronger

Whenever technology intersects with humans—it calls for attention. Not only attention but ethical and responsible approaches.

In the last couple of years, I realised that there is a lot of AI hyperbole. And, this hyperbole has given rise to ‘AI solutionism’ mindset. This mindset makes people believe that if you give them enough data, their machine learning algorithms can solve all of humanity’s problems. People think that throwing more data is the answer, the quality of data is not essential.

We already have seen the rise of a similar mindset a few years ago - something that I would call as “there is an app for it” mindset. We know that it hasn’t done any good in real life to anyone.

Instead of supporting any progress, this type of mindset usually endangers the value of emerging technologies, and it also sets unrealistic expectations. AI solutionism has also led to a reckless push to use AI for anything and everything. And because of this push, many companies have taken a fire-aim-ready approach. It is not only detrimental

to the company’s growth, it is also dangerous for customers on many levels.

A better approach would be to consider suitability, applicability, and apply some sanity, do what is necessary. However, this fear of missing out (FOMO) is leading to several missteps, and that is, in-turn creating a substantial intellectual debt, where we do first and think later.

Fear of missing out often creates substantial intellectual debt.

One of the many ways to handle this is by being responsible with technology, especially with AI.

The problem with the Responsible AI paradigm is that everyone knows ‘why’ it is necessary, but no one knows ‘how’ to do it. That prompted me to write a book, *Keeping Your AI Under Control*.

In this book, I explain ‘how’ part of the Responsible AI. If companies agree that Responsible AI is necessary, this book will guide them on how to achieve it.

I also talk about AI insurance in the book, where, in some cases, it would be helpful to provide remediation to some of the effects of stupid AIs out there.

Remember, you can develop and use AI responsibly if you know the risks. But first, you must understand them better and specify to your use case or context. **EFY**



Kitchen Appliances Get A Technology Makeover

Over the years, touch screens and the Internet of Things (IoT) have become immensely popular as the cost of producing them has decreased. The touch buttons, sliders, and wheels used in kitchen appliances have become a good substitute for mechanical buttons and knobs, as they are more reliable and also reduce the overall cost of the system

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Touch screens on washing machines or refrigerators were just concepts as recently as five years ago. Concepts that induced a ‘wow’ factor at events such as the annual Consumer Electronics Show held in Las Vegas were a demonstration of the capabilities and vision of the exhibiting electronics companies. Today, home appliances have taken the leap and touch screens and the Internet of Things are increasingly evident in the common places as the cost of producing them is decreasing every day. Internet connectivity has become more affordable, its reach is ever-expanding and appliances are now being augmented with app-enabled features such as the human machine interface (HMI), without compromising on the aesthetics and being more environmental friendly.

Bringing capacitive touch technology to appliances

Mechanical buttons in kitchen and home appliances were not durable or very user friendly as they would break or stick to the user’s fingers with time. Grease and water are common factors in kitchens, and mechanical buttons were not adaptable to these substances. Capacitive touch buttons, sliders and wheels are a good substitute to these buttons and knobs, as they are more reliable and also reduce the overall cost of the system. Touch sensors located beneath or behind a glass or plastic surface also make it easier to clean the surface and allow for more aesthetic and stylish design options (See Fig. 1).

HMI capacitive touch screens on appliances have the same advantages as touch



Fig. 1: Touch screen buttons and sliders (a) are already popular on appliances, but a refrigerator (b) with a large display to interface with the Internet provides a minimal, functional yet elegant look using touch screen technology

screens and sliders. Users are able to communicate with their appliances better via the Internet. Capacitive touch screens driven by IoT give a slew of benefits to appliance manufacturers including:

1. Remote maintenance
2. Better understanding of usage with data mining and analytics, which can lead to product improvements or customisation
3. Power management—syncing high current appliances to avoid spikes on the power line

4. Firmware updates for remote bug fixes and product enhancements

But IoT enabled home and kitchen appliances can also benefit the end-user. Manufacturers, for instance, can provide:

1. 'How to use' instructions for some appliances, or recipes and even some best practices that could be by way of videos or easy downloads. Laundry appliances such as washing machines or dryers could come with their own instructions on usage of washing machine powder, type of washing powder or liquid and quick troubleshooting instructions. Firmware updates to add new features and improve performance.

2. Weather, news and other updates based on user preferences.

However, with all of these benefits for suppliers and users, there are a few design issues that must be addressed.

Addressing white goods application issues

Appliances that are fitted with touch screen HMIs are challenged when it comes to noise, moisture or recognising touch screen commands from a user wearing gloves. If manufacturers of these appliances can address some of these issues with their IC or touch screen controller, then their products will definitely have the edge.

Noise. For noise immunity, patented technology allows the controller to be more immune to the noise coming over the power lines. In several areas, power lines generate a lot of noise because of the lack of an earth ground or poorly connected grounds. That noise conducts into the power supply through the power cable and gets routed to the touch controller IC.



Fig. 2: Behind the touch screen, an array of drive electrodes receives electrodes and the circuitry in the touch IC faithfully detects a user's touch

Being an extremely sensitive component that measures nanocoulombs of charge, pulling even a tiny amount of charge away by simply touching the touch screen with a finger needs to be interpreted consistently and accurately. Noise can inject significant charge into the sensor and hence a touch controller without sufficient noise immunity can lead to confusion in the interpretation of signals, which is critical to the proper functioning of the appliance. In case of a ghost touch or false touch event, there's an erratic behaviour of buttons where they start pressing themselves randomly. Imagine if you are using an oven and this were to happen, it can have dangerous consequences. The same randomness could affect other appliances and lead to unstable and dangerous scenarios. This is an issue for every capacitive touch controller, but patented technology circumvents conducted noise and can help control the issue.

To solve the noise problem, the controller filters common-mode noise and avoids noise issues through a frequency hopping scheme. The patented approach utilises self-capacitive touch as well as mutual capacitive touch scanning and involves differential touch sensing. Instead of treating each sense line as its own individual element, the IC measures the difference between pairs of sense lines and is able to eliminate noise common

to both sense lines. If, for instance, the same noise occurs from a similar region of the display, it is cancelled, retaining only the valid signal. This differential touch sensing provides a very effective level of noise cancellation/rejection.

Washing machine motors, refrigerator compressors or inductive cooktop burners radiate noise that is within the acceptable noise cancelling frequency band, and hence touch screen displays for these appliances are more robust. False touch events are thus avoided in these instances. However, in the case of a legitimate touch, it must be reported and detected to the host controller to avoid a missed touch event from noise, so that user expectation of a response is met.

Moisture. It is natural for moisture and wetness to occur in laundry rooms and kitchens, which are a necessity while cooking or washing. Imagine boiling water for tea and it spills over on to the touch screen, a false event could also occur. Mist, droplets of water, liquids of any kind could affect the responsiveness and functionality of the touch screen. This means, touch screen designers of HMI appliances need to create designs that can detect a touch despite water or moisture. Multi-touch operations, from the standard two touches to perhaps ten or more by multiple users at the same time, must be made avail-

able by appliance designers for larger displays. If water is pooling when the user touches the screen or if a larger drop falls onto the horizontal screen, false touches induced by water should be suppressed and normal single finger operation should be supported. Designers should design to avoid false touch events from highly conductive liquids like salt water and even cleaning solutions like bleach. Fig. 2 provides a brief look at what happens behind the display panel.

Gloves. Users use thin or thick gloves fairly often in the kitchen or laundry rooms, especially when a kitchen sink needs to interface with a refrigerator or stove touch screen. HMI touch screen technology needs to start supporting glove use. Today, several such capabilities on touch screen ICs used in home appliances are often overlooked but could provide significant value to the end-user. When turned on and tuned during the development stage, the optional glove support feature in the controller could provide multi-touch (up to ten touches) for gloves typically used in

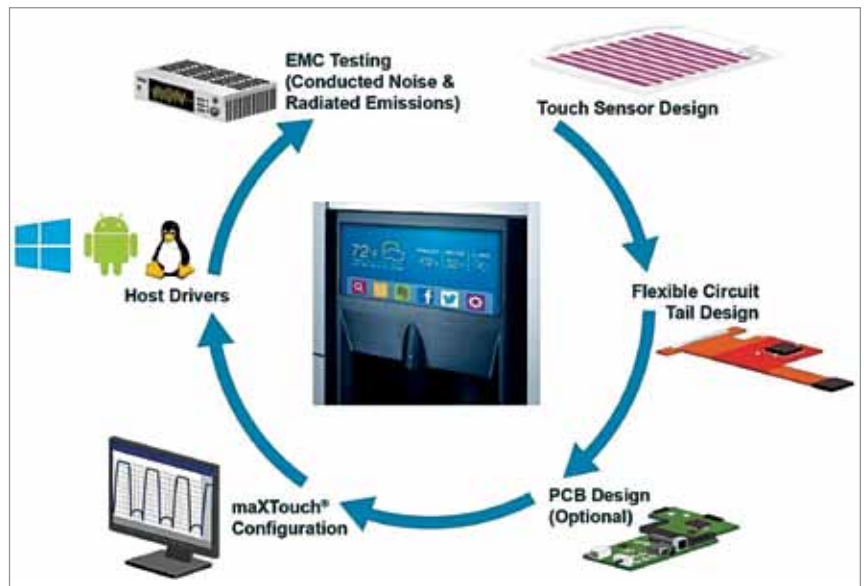


Fig. 3: In addition to the touch IC, the touch IC provider performs many functions behind the scenes to bring a successful touch screen to the market

kitchens (about 1.5mm thick). For cooking, thick (up to 5mm) gloves or oven mitts often made of silicone are used. With glove support, the controller can still provide accurate input to the HMI. This can occur

automatically without the need to enter a separate mode and return to the normal sensing level when a glove is not used.

In contrast, some controllers require users to select between modes

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Some of the Design Parameters for Industrial-Grade Appliance Displays

Typical screen size	Device	Number of touch sensor nodes (max.)	Packages	Interfaces	HID (Windows)	Passive stylus
2.5cm-10.2cm (1"-4")	MXT144U	144 (12X×12Y)	QFN38 & WLCSP36	I2C	No	No
7.6cm-17.8cm (3"-7")	MXT336U	336 (14X×24Y)	QFN56		Yes	Yes
12.7cm-25.4cm (5"-10")	MXT640U	640 (32X×20Y)	UFBGA88			
20.3cm-30.5cm (8"-12")	MXT1066T2	1066 (41X×26Y)	UFBGA144 & UFBGA117			
25.4cm-40.6cm (10"-16")	MXT1664T3	1664 (32X×52Y)	UFBGA162 & UFBGA136	I2C & USB		
33.0cm-61.0cm (13"-24")	MXT2952T2	2911 (41X×71Y)	UFBGA162			

like moisture, bare finger, stylus and glove rather than automatically detecting and adjusting settings on the fly for natural, intuitive user interactions in all environments.

In such applications, the user interface tends to be simpler with larger buttons and needs to be incorporated at the design stage of the touch screen, for appliances that take advantage of glove support.

Choosing the right touch controller/sensor/screen

Depending on the size of the kitchen or laundry appliance, there are a variety of screen sizes that can be used ranging from 7.6cm (3-inch) displays for coffee makers to 12.7cm (5-inch) for microwave, stovetops and washing machines and up to 55.9cm (22-inch) and larger for refrigerators and freezers.

In the appliance supply chain, the chip supplier provides the chip and the design of the sensor in partnership with a sensor supplier. Together they perform the system integration and typically a module/display manufacturer integrates the system including the touch sensor and the touch interface, which is then provided to the appliance manufacturer (see Fig. 3). This is an example of how a semiconductor supplier today not only provides just the chip but also services such as tuning the chip, making it easier to use in the entire supply chain.

Operating in the industrial -40°C to 85°C temperature range, the standard IC ships with standard firmware and is able to address a variety of

display sizes and different appliance manufacturer requirements. Touch screen designs are more scalable, thanks to the wide range of screen size options available in the appliance touch screen controller family. The ready availability of the right screen size reduces design time and lowers system and development costs. Table here shows some of the design parameters for industrial-grade appliance displays.

In addition to screen size, other parameters can impact the choice of the chosen controller, especially if there is an overlap in screen sizes.

One final consideration is electromagnetic compliance (EMC). Obviously, the design must support EMC. Then testing must verify that it achieves the desired results for both conducted and radiated emissions.

The design touch

For early engagement and improved awareness of touch screen capabilities, a designated evaluation kit is available for each of the controllers in the appliance touch screen family. The kit includes a printed circuit board (PCB) with a touch screen controller that has a passive flexible printed circuit (FPC) tail that connects the touch IC to a touch sensor on a glass/plastic lens. The kit connects to the host PC via USB and includes all necessary cables, software and documentation.

Used with the maXTouch Studio Development System Integrated Development Platform (IDP), a full software development environment (a free download from the Web), the evaluation kit enables appliance designers to develop and debug appliance touch

controllers. Fig. 4 shows what appliance manufacturers can expect to find in an evaluation kit.

The final touch

IoT is here and now, appliance manufacturers need to think about improvements that can benefit the end-user. Touch screen enabled appliances must be equipped to read or input information in any context. Appliance manufacturers need to work with an IC supplier, or touch screen or module supplier who in turn works with an IC supplier, where touch controllers are designed specifically for appliance applications. With the right touch controller, appliances can provide internet connectivity and have noise immunity, moisture immunity and glove support. **EFY**



Fig. 4: Microchip's ATEVK-MXT2952T2 evaluation kit contains a dedicated sensor with a flex connector and an electronic control board



Digital Twin And Its Applications In The Internet World

Digital twin is a cloud-based virtual model of a process, product or service. Billions of things will be represented by digital twins in the next five years, showing the tremendous potential of this technology



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A digital twin is a digital replica of a living or non-living physical entity. Digital twin refers to a digital replica of physical assets (physical twin), processes, people, places, systems and devices that can be used for various purposes. Digital twin is a real mapping of all components in a product life cycle using physical data, virtual data and interaction between these data.

Digital twins integrate the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML) and software analytics with special network graphs to create living digital simulation models. These

models update and change as their physical counterparts change. A digital twin also integrates historical data from past machine usage into its digital model.

In various industrial sectors, twins are being used to optimise operations and for maintenance of physical assets, systems and manufacturing processes. Digital twins are also called Cyber Objects or Digital Avatars.

Digital twin to improve several sectors

Digital twin technology finds applications in several sectors such as energy and utilities, aerospace and defence, machines manu-

facture, automotive transportation, healthcare and consumer goods. On the basis of global market, digital twin technology is segmented into system twin, parts twin, process twin and product twin. Oracle, General Electric, Microsoft, PTC, ANSYS, Siemens, IBM and Dassault System are some of the leading players in digital twin sector.

NASA was the first to implement digital twin concept. Today, NASA uses digital twins to develop new recommendations, roadmaps, the next-generation vehicles and spacecraft. NASA has used digital twin technology to repair spacecraft travelling outside the range of physical monitoring. For instance, digital twin technology helped NASA engineers and astronauts to repair the ill-fated Apollo 13 mission, bringing the craft and crew back to earth safely.

Future generations of NASA and the US Airforce vehicles will require lighter mass while they are subjected to higher loads and extreme service conditions. NASA spacecraft in future would need to operate for longer periods than the present generation. Conventional approaches used by NASA and the US Airforce have several drawbacks. Digital twin integrates ultra-high fidelity simulation with the vehicles on-board. These are integrated with vehicle health management system, maintenance history and all available historical and flight data to mirror the life of its flying twin, and provide extremely high level of safety and reliability.

Digital twin simulations have been used for development, testing and various other challenges encountered in autonomous vehicle sector. In case of architectural and construction sector, digital twin has arrived as an upgrade of building information modelling.

Digital twin allows analysis of data to identify a potential problem before it occurs, prevents downtime, develops new opportunities and even plans for the future by using simulations. Simply put, digital twin is a bridge between digital and the physical world.

Digital twin helps to create, test and build an equipment in virtual environment. It can be used to train a person to operate a product virtually, even before the actual product is produced, so that the person can learn to handle the product efficiently when it is made available.

Thus the product can be produced

only after ensuring that it would meet the required performance. Today, machine intelligence and connectivity to the cloud allow us a greater potential for large-scale implementation of digital twin technology for companies in a variety of industries.

Improving the performance of the IoT

As more powerful nano sensors are added to devices and processes for improved performance, some standard tool is required to analyse the data collected by the IoT sensors. Digital twin is one way to counter this problem.

The IoT sector is slowly gaining momentum, but it cannot survive without the help of other technologies such as digital twin technology. This technology already has a good track record and has enabled efficient processes that may prove to be better adapters to change and provide efficient services to the IoT sector.

An industrial machinery may have a number of sensors that collect a variety of information like how old it is, how long it has been in use, its production capacity last year/month/week, number of interruptions it had, number of defective units it produced, etc. Such data is sent to the digital twin applications, which process the data, turning it into intelligence and actionable output, so that the defects can be minimised.

Same type of products may face different working conditions. For example, earth moving equipment are subjected to different geographic rock structures at different locations. As such, life span of same-capacity earth moving equipment supplied by a company will be different at different places. Using sensor data, digital twin can easily predict life span of each equipment and can avoid their sudden failure.

Suppose, compressor of an air-conditioning equipment in a shopping mall or office building breaks down. The repair time will be more if this spare part is not available onsite, which can have a huge negative impact on business. Using digital twin technology it is easy to predict such components' failure and send an alert signal to the users or suppliers before such failures. Thus predictive main-

tenance can be done to increase life span and service time of the product.

There will be billions of things represented by digital twin within the next five years. This technology will help companies improve customer experience by enabling better understanding of their needs and develop enhancements to the existing products, operations and services, and even help in further innovation.

General Electric is already using digital wind farms to improve their productivity. This helps them configure each wind turbine prior to its construction. Even the sensor data monitoring wind farm turbines and environment around it can be used to compare with digital twin data. This helps predict failure of a wind turbine before it actually breaks down, so that machine downtime can be considerably reduced.

Prediction is the key feature of the digital twin. For example, digital twin can be used to predict the remaining life of a turbine blade of a specific aircraft engine with great accuracy. This allows the use of condition-based maintenance to manage a specific engine, rather than wasting time with a conventional approach. It also determines the remaining life of the turbine blade after each flight or set of flights, by evaluating operational and environmental data. This way maintenance scheduling becomes more efficient and greatly helps to increase the aircraft engine's life span.

Rolls Royce, Siemens and a few other companies are also using this digital technology since several years now. Tesla uses digital twins to send regular updates about their customers' cars.

Giving new look to digital electronics

Introduced in 2012, digital twin technology has an extremely broad and segmented market that is witnessing a number of exciting trends. With rise of the IoT, digital twins are about to get more attention. According to a report by Gartner, thirteen per cent of organisations have already started using digital twin technology across the globe, and another 62 per cent say they are planning to use it within next twelve months. It is predicted that by 2022, over two-third companies will

be using digital twin technology in production.

Digital twin technology is valued presently at US\$ 1.88 billion and is expected to have an exponential growth to reach US\$ 13.5 billion by the end of 2025, growing at a CAGR of 32.4 per cent during the forecasted period. This smart technology is one of the most profitable technologies at present. However, rising cyberattacks and less awareness about it may affect the growth of digital twin technology in the coming years.

Recently, the US government allocated a large portion of their budget to digital twin technology for implementation in defence sector (especially in modular advanced armed robotics, XM2010 sniper weapon system, etc).

In 2015, companies such as Xerox and HP brought heavy-duty printers into the IoT environment to facilitate their maintenance. To take this further, digital twin can improve design of such products to a great extent. Digital twins use data, machine learning and the IoT to help companies optimise, innovate and deliver new services. Certainly digital twin is the future of Industry 4.0.

Advantages

Industry can derive major advantages by using digital twin technology, some of which are mentioned below.

- Monitor a constant stream of usage and performance data in real time
- Combine end-to-end asset or product life cycle data into digital threads
- Support new products as a service business model
- Drive innovations in manufacturing, R&D, supply-chain management, service and logistics

Digital twin in healthcare sector

With digital twin, lives can be improved in terms of health, sports and education by taking a more data-driven approach to healthcare. Healthcare is rapidly embracing digital twin technology. The main aim here is to deliver data-driven personalised medicine.

Digital twins are built on computer-based or crypto models that can create individual and group data for medical purposes. Researchers are aided by these digital representations of human physiology in their studies of diseases, new drugs and devices. Digital twins also help to accelerate medical innovation.

In future, these tools may even help doctors accurately optimise the performance of patient-specific treatment plans. In short, this technology can bring life-saving innovation to market faster, reduce medical cost and increase patient safety.

Digital twins are helping in research of tumours and development of new drugs. A digital twin virtualises a hospital system to create a safe environment for testing the impact of a potential change on system performance. Healthcare delivery is massively complex. Today, common-sense, spreadsheets and statistics are just not enough for strategic decisions to be taken by doctors. By creating a digital twin of a hospital, they can observe potential changes in operational strategy, capacities, staffing and care delivery models. **EFY**

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How Special Robots Can Train Children With Autism

Autism is increasing at a tremendous rate among children in India. Children with autism suffer from varied deficiencies in skills and learning disabilities. It's important to detect it at early stages, or else, children might suffer for the rest of their lives

Dr Ramya S. Moorthy
and **S.A. Srinivasa**
Moorthy

One of the most worrying aspects among children in India is the increase in the incidence of autism in recent times. From what was thought to be one in 500 children having autism, today, the number is standing at a staggering one in 68 children. To compound the issue, 40 per cent of children with autism don't speak, and this leads to chances of non-detection or late detection. Autism is visible from the age of one to three years of a child's life. In a few instances, it is visible even earlier. If autism is not detected at early stages and addressed, children suffer later in their lives. Some of the myths and the reality related to autism is shown in the box below.

Defining autism

Treating autism is effective when it is detected earlier in a child. Some of the symptoms that a child with autism exhibits are:

- Sticks to a set of behaviours and resists change in daily activities
- Struggles to make sense out of the day to day activities

- Gathering of people at events and places confuses the child and causes anxiety

In general, these are called 'Triads of Impairments.' The level at which autism spreads across a spectrum varies from person to person. Evaluating the children with a country-specific evaluation process will help in identifying the level to a large extent. One key aspect that we need to keep in mind is that 80-90 per cent brain growth happens in childhood, so unless the detection and training are done in the early stages, things can become more difficult.

Impact of autism

Children with autism suffer from varied deficiencies in skills and learning disabilities. In simple language, autism interferes with the child's:

- Social interactions
- Social communication
- Activities and interests (social imagination)

These impairments are typically explained by a simple graphic shown in Fig. 1.

One of the most important skill sets that mostly affect the children is psychomotor skills. Psychomotor learning is the relationship between cognitive functions (consciously involved in functioning) and physical movement. Psychomotor learning

*Myth 1 – Autism is not prevalent in India
It is highly prevalent and growing*

*Myth 2 – No one knows what causes it
The problem lies in the way brain cells connect*

*Myth 3 - Therapy can't 'rewire' the autistic brain
Therapy can open new neural pathways of learning*

*Myth 4 - Autism is not genetic
There is clearly a genetic angle to autism*

*Myth 5 - Autism cannot be reversed
It has been reversed on animals in labs*

is demonstrated by physical skills such as the movement of limbs, coordination, manipulation, dexterity, grace, strength, speed. Most children with autism have challenges in these skills at different levels.

Psychomotor skills deal with the actions using hands, fingers, wrist, etc. These skills have a great impact on the day to day life of children with autism. Improving these skills to a level so that they can manage their daily activities is a must for the better future of the child. Children with autism encounter objects that vary in shape and size daily. Unless they have good psychomotor skills, they face challenges in using those objects in their day to day lives. Normally, these skills are imparted and enhanced through training with special educator's help, who is trained in this.

Conventional training

Conventional training of children with autism is done by special educators. Psychomotor skills are usually imparted by special educators (also called occupational therapists), and they are trained in educating children

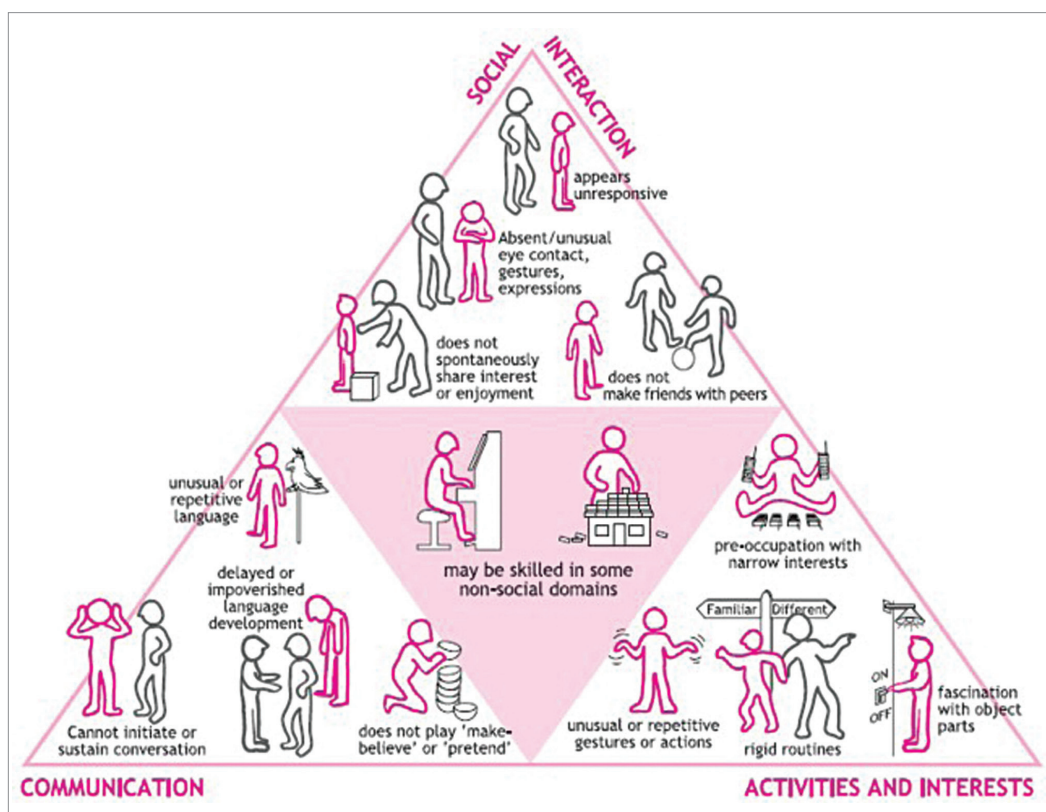


Fig. 1: Communication activities and interests (Credit: www.autismtopics.org)

with dedicated training tools. The best way to understand conventional training is explained in Fig. 2.

Conventional training of a child with autism involves a three-step process.

1. In the first step, the trainer demonstrates a child on how a particular activity, which involves a specific psychomotor skill, is done (violet dotted line and numbered as 1)

2. In the next step, the trainer holds the hand of the child and teaches him/her how to perform an activity

(red dotted line numbered as 2)

3. In the last step, the trainer makes the child perform an activity with or without verbal cues (blue dotted line numbered as 3)

The important point to note is the absence of feedback to the child for its actions. This leads to longer training duration and also relatively lesser retention of the skill learnt. It is also very important to note that the role of the trainer is more of a facilitator, and he is not directly responsible for the outcome of training. The challenges



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Fig. 2: Conventional training of a child

in this training process are mainly due to the lack of feedback to a child for his actions.

Robot based training (Genesis and development)

It is observed that there are a few important factors that affect the psychomotor skills of a child with autism and these are:

- Psychological feedback and task complexity
- Motive-incentive conditions
- Amount of practice
- Work distribution
- Environmental factors

As we can see, there are three factors that play a key role in the conventional training process. The search for additive methods to improve the training leads to the use of robots in training children with autism. Unlike the common imagination of 'humanoid robot' training the child, research proved the need was for specific (dedicated) robots for training in specific psychomotor skills. The authors spent five years in this field and developed a series of robots to train children with autism in most of the skills needed for day-to-day living.

The research that was carried out on over sixty children with autism proved the effectiveness of the training. This robot-based training improved the training efficiency by sixty per cent and, in addition, it resulted in the child's ability to retain the skill learnt. The reasons for improvements in the training process using robots are:

- Uses the trainer (OT/special educator) as the anchor and child in its comfort zone. The additional

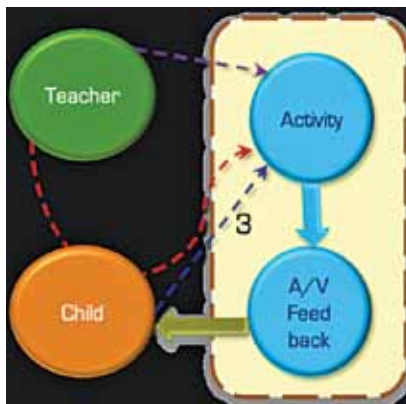


Fig. 3: Robot-based training

benefit of the robot-based training is that the parent of the child with a little training can augment the sessions to improve the effectiveness as the robots are easy to use, thereby increasing the comfort level of the child

- Whole training process is 'gamified' and the children look at these robots more as toys and fear of new things (which is normal in children with autism) is removed as they treat these robots as toys for them
- Immediate audio-visual feedback by way of lights, sounds (like claps, appreciation, etc) reinforces the skill executed and the child is encouraged to try again and it leads to retention of the skills learnt.

Robot-based training

Robot-based training of children with autism is through special educators but augmented with special-purpose robots. The best way to understand the robot-based training is explained in Fig. 3. The process is the same as the conventional three-step process. However, in every step, feedback is given to the child, which improves the effectiveness of the training.

This robot-based training system augments the conventional training process with two major unique functions. One is the activity interface and the other is the audiovisual feedback.

1. Every robot used is unique and specific for activity and its associated psychomotor skills. It is custom designed and uses a dedicated user interface

2. Every robot has been designed for a specific skill or set of skills. It also has specially designed audio-

visual feedback mechanism designed for the particular skill or set of skills to make the child happy with the feedback

What is unique with these robots?

Typically, developing children have a multitude of psychomotor skills, which they pick up as they grow; sometimes through training or even toys and games. However, in the case of children with autism, they need a lot more help with it as they have to be trained specifically. They are basically not aware of what they are capable of.

There are 28 to 32 psychomotor skills that are essential in the day-to-day life of a child. Instead of putting all the skills into one single robot, which increases the complexity of use as well as the load on the trainer, these robots are designed to address one activity each so that the child learns it quickly.

Uniqueness is also driven by the fact that the feedback mechanism needs to be unique and customised for each skill. In addition, these robots should have measurement mechanisms to measure the performance of the child by way of measuring the time spent on each activity and log them for analysis and to monitor progress.

In addition, since the robots should be capable of being distributed on larger geography, they need to be intelligent. These systems should use the Internet of Things (IoT) architecture to run and manage the whole set of robots. This approach also should be driven by the fact that owning a robot for each child can be an expensive proposition.

Conclusion

The output of this research proved that the use of robots for training children with autism resulted in three important outcomes:

1. Efficacy of the training increased by more than fifty per cent over time
2. Retention of skills learnt is commendable and children were able to remember the skills for a longer duration and apply in day-to-day life
3. Extended training ensured children can develop long term skills to make their day-to-day life easy **EFY**



Challenges In Running AI On Embedded Computers

This is an extract from a speech presented by Nikhil Bhaskaran, Founder, Shunya OS, at [iotshow.in](#) 2019. Shunya OS is an operating system that optimises AI libraries for embedded systems, to enable developers to build AI on edge solution very fast and at a very low cost. In the next five years, AI is going to be inside everything; and edge analytics is going to be the next big thing for AI



Nikhil Bhaskaran has more than a decade of experience in core electronics from design to production. He has lived in Shenzhen, China for eight years and has deep experience of embedded hardware. He is also the founder of [IoTIoT.in](#)—the largest IoT and AI innovators community in Pune

The work going on in the artificial intelligence (AI) space nowadays is more on the application side to solve industry problems. And people want to get the solution into the market as fast as possible. For this, most of the AI libraries

are built into the cloud. In that, there is a large stack, where the first challenge starts with data.

You need to train a model. It is not creating a model that is the biggest challenge, but finding data and arranging it in a way to efficiently train your

model is. So, there is a large market for getting the right data.

The second part is building a model. There are many applications that do not require creating a model like face recognition and object detection. Because these common applications already have ready models available out there—one just needs to choose the right one for the application. And after that, you need to further train your model, as most models are usually trained for different sets of data which do not give a good output.

As each and every library is good at one thing or the other, one needs to carefully choose the right one that is suitable for the application.

After having a working model, it must be used purposefully to generate enough money. Some of the questions which the money-making guys should focus on are: What should it (the model) be used for? What is the market looking for?

Apart from all this, there is a major competition since everyone in AI is working directly on the cloud with respect to model training and data. However, AI can run equally well on embedded computers. This is commonly unknown to people.

All AI will happen on the edge

When running your model on the cloud, usually Google engine API or Amazon's object recognition models are used for which certain amount is paid. Once the solution is built, over a period of time you have to pay a lot of money.

Instead, the same model can be coded onto hardware. On the embedded system you can get the performance of the cloud without having to pay on a long term basis. All analysis happens on the embedded device and it sends only limited data to the cloud.

Edge analytics is going to be the next big thing for AI. All of the data which the AI library is sending down will have computation done by the processor and give results. Example, in the past, when gaming came in, all the mathematical computation was done in GPU. Now, there are vector processing units on the chips which can process vectors (data) coming from the cloud very fast.

The GPU is also good at doing floating-point calculations.

People are unaware that a lot of AI applications can be built on a chip which the companies can optimise.

The number of libraries available for AI today stands at approximately 800 plus. And this is also the amount of competition in the AI space. This might sound unbelievable, but when computers came in, people never imagined it to turn out to be this big. Gradually, it became a necessity in our lives. And AI is going to be much bigger than that. In the next five years, AI is going to be inside everything. A lot of products will come with AI built into them.

Currently, there are twenty plus companies dealing with AI technology. Some of the popular ones are Tencent, TensorFlow, Caffe, Chainer, ONNX and PyTorch.

Challenges faced in embedded

Challenges such as model size, choosing the appropriate model and framework are commonly faced by people who work on AI. The system side challenges are something that most people are not aware of. These include:

Platform. In the cloud, the code is pre-installed. But for embedded, you need to fetch the source and compile it into the machine.

Fetching. Finding the right source is also a challenge. One needs to do a lot of research to find the right source, the correct patches and configure them.

Architecture support. Mostly ARM is used, which can be either ARM7 or ARM8. With the help of Neon support in ARM8, hardware FPUs (floating point units) provide 5x performance. It is very advantageous but challenging as well.

Compilation. Cross-compiling does not give the required performance. So, to derive performance and make a library work optimally on hardware, you need to do a native compilation. This requires a very long duration of coding and consumes a lot of time.

Installation. You may encounter several error messages after compilation. Care needs to be taken to install libraries correctly, especially for new machines.

Not just these, all libraries usually

have some dependencies. Dependencies are some additional packages that are needed to run a library. Each tool/framework/library on an average has 4-5 dependencies.

Those packages also need to be compiled to get optimal performance natively from the AI libraries installed on your embedded system. Software called *Docker* is the quickest way to run packages, but it is not optimised while it is running and must be used with care.

There is this perception in the industry that to run AI on the edge, you need a lot of computation or one needs to have better computing power so that enough performance is obtained. However, this is not correct. When that solution is sold, your cost is going to be higher. So, the focus should be on better engineering, which makes the price come down. This should happen without compromising on the latest technological advances.

OpenGL and OpenCL libraries

In an embedded system, while a CPU will be obviously present, GPU and NPU are optional. If you have GPU, then it will have OpenGL or OpenCL library. OpenGL is a graphics library which passes on to GPU the graphic calculations it receives. OpenCL is a compute library which checks the amount of computational power on the hardware; whatever computational request it gets is distributed among the system. By adding OpenCL, your performance goes very high. It is an additional layer which handles requests much better than OS.

There is still a lot to be done on the application side. After writing the code in the cloud, when you run it, the analysis process begins. In this process, the code generates an unknown number of threats which can cause hardware failure if the system cannot handle them. But in embedded, it is custom.

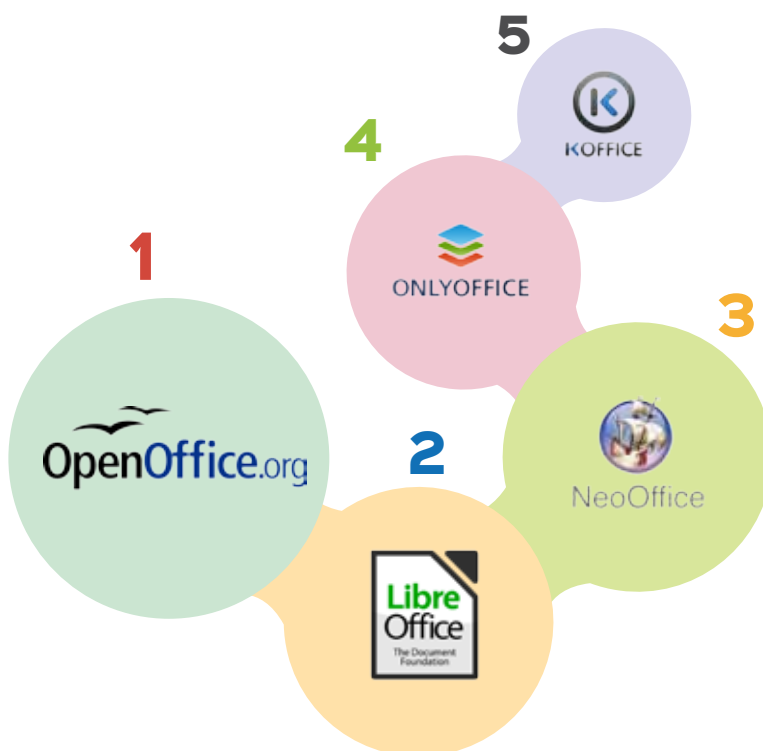
Here, edge computing plays a major role by taking computing actions directly on the hardware instead of sending data to the cloud for computation.

As embedded AI space is coming up, there are some frameworks which are getting built only for this side. Currently, TVM is doing the best in this area. **EFY**



Top Five Open Source Alternatives To Microsoft Office

Office suites have become common organisational and productivity tools. While Microsoft Office is the most popular suite today, there is a growing demand for more affordable alternatives. Numerous open source office suites have hit the market. Here is a selection of the top five that users can explore and use



Anand Nayyar works at Duy Tan University in Vietnam. He loves to explore open source technologies, sensor communications, network security and the Internet of Things

For the past several years, Microsoft Office has remained the leader in office productivity software offering integrated applications for word processing, spreadsheets, presentations, database management, email handling and, above all, desktop publishing. An office suite is a mandatory part of any operating system's ecosystem. It is difficult to imagine a desktop operating system without office software. Windows has the Microsoft Office suite, which now dominates even the Mac market with Office for Mac. But for the Linux operating system, there are many choices available.

Some of the open source or free alternatives are even better than Microsoft Office when it comes to minimising costs

and their capability to work with office files. However, all office suites are not the same and each has some limitation or the other. One also needs to bear in mind that the formatting of one file type can be saved in different ways for different programs. This can cause problems when sharing files with those using different software. Therefore it's important to ensure that the formatting is retained accurately. On top of that, you also need to ask which types of office software you actually need. Most packages offer documents and spreadsheets as standard, but some providers may not provide database or presentation software in a bundle. So it's important to check what you need and evaluate this against what providers will actually supply.

The Components of OpenOffice

Table 1

Name of component	Description
Writer	Word processor analogous to Microsoft Word or Word Perfect
Calc	Spreadsheet analogous to Microsoft Excel
Impress	Presentation program analogous to Microsoft PowerPoint
Draw	Vector graphics editor
Math	Tool for writing mathematical formula and equations, analogous to Microsoft Equation Editor
Base	Database management program analogous to Microsoft Access

Here, we'll list the best open source office software alternatives to Microsoft Office for both home and business users.

1. OpenOffice

On July 19, 2000, at OSCON, Sun Microsystems announced it would make the source code of StarOffice available for download. The intention was to build an open source development community around the software, and provide a free and open alternative to Microsoft Office. The new project was known as *OpenOffice.org* and the code was released as open source on October 13, 2000. *OpenOffice.org* became the standard office suite on Linux and spawned many derivative versions. It quickly became a competitor to Microsoft Office, achieving 14 per cent penetration in the large enterprise market by 2004. The development of *OpenOffice.org* was sponsored primarily by Sun Microsystems, which used the code as the basis for subsequent versions of StarOffice.

After acquiring Sun in January 2010, Oracle Corporation continued developing *OpenOffice.org* and StarOffice, which it renamed Oracle Open Office. In June 2011, Oracle contributed the trademarks of this software to the Apache Software Foundation. It also contributed Oracle-owned code to Apache for relicensing under the Apache License, at the suggestion of IBM, as the latter did not want the code put under a copyleft licence. This code drop formed the basis for the Apache OpenOffice project.

The Components of LibreOffice

Table 2

Name of component	Description
Writer	Word processor analogous to Microsoft Word or Word Perfect
Calc	Spreadsheet analogous to Microsoft Excel
Impress	Presentation program analogous to Microsoft PowerPoint
Draw	Vector Graphics editor
Math	Tool for writing mathematical formulas and equations, analogous to Microsoft Equation Editor
Base	Database management program analogous to Microsoft Access. Like Access, it can be used to create small embedded databases that are stored with the document files (using Java based HSQLDB and C++ based Firebird as its storage engine). For more demanding tasks, it can also be used as a front-end for various database systems, including Access databases (JET), ODBC/JDBC data sources, as well as MySQL, MariaDB, PostgreSQL or Microsoft Access.
Charts	Powerful chart-creation module. LibreOffice can create and embed charts. Their style, colour and size can be customised in a variety of ways – pie charts, square and round columns, trend graphs, dots, 2D and 3D charts, etc.

OpenOffice.org (OOo), commonly known as OpenOffice, includes a word processor (Writer), a spreadsheet (Calc), a presentation application (Impress), a drawing application (Draw), a formula editor (Math) and a database management application (Base). Its default file format is the Open Document Format (ODF), an ISO/IEC standard, which originated with OpenOffice.org. It can also read a wide variety of other file formats, particularly those from Microsoft Office. Apache renamed the software Apache OpenOffice.

OpenOffice.org was primarily developed for Linux, Microsoft Windows and Solaris, and later for OS X, with ports to other operating systems. It is distributed under the GNU Lesser General Public License version 3 (LGPL).

Latest version: 4.1.7

Website: www.openoffice.org

2. LibreOffice

On September 28, 2010, it was announced that The Document Foundation would be the host of LibreOffice, a new derivative of *OpenOffice.org*. The Foundation's initial announcement echoed users' concerns that Oracle would either discontinue *OpenOffice.org*, or place restrictions on its use as an open source project, as it had done with Sun's OpenSolaris. The alternative name LibreOffice was picked after researching trademark databases and social media, as well as after checking to see if it could be used for URLs in other

countries too. Earlier, *OpenOffice.org* had been distributed as *BrOffice.org* in Brazil by the BrOffice Centre of Excellence for Free Software because of a trademark issue. LibreOffice 3.3 beta used the ooo-build infrastructure and the *OpenOffice.org* 3.3 beta code from Oracle, then adding selected patches from Go-oo. Later, Go-oo was discontinued in favour of LibreOffice.

Since the office suite that was branded *OpenOffice.org* in most Linux distributions was in fact Go-oo, most users moved immediately to LibreOffice. It was forked in 2010 from *OpenOffice.org*, and uses the international ISO/IEC standard Open Document File format (ODF) to save documents for all of its applications. LibreOffice also supports the file formats of most other major office suites, including Microsoft Office, through a variety of import/export filters.

LibreOffice is available for a variety of computing platforms, including Microsoft Windows, macOS, and Linux (including a LibreOffice Viewer for Android). The LibreOffice project uses a dual LGPLv3 (or later)/MPL 2.0 licence for new contributions in order to allow the licence to be upgraded. Since the core of the *OpenOffice.org* codebase was donated to the Apache Software Foundation, there is an ongoing effort to get all the code rebased to ease future licence updates.

LibreOffice supports third-party extensions. It lists more than 320 extensions and scripts for LibreOffice, which can be written in C++, Java, CLI, Python, and LibreOffice Basic.

LibreOffice Basic is a programming language similar to Microsoft Visual Basic for Applications (VBA) and is available in Writer, Calc and Base. It is used to write small programs known as macros, with each macro performing a different task, such as counting the words in a paragraph.

LibreOffice has the same six applications as Apache OpenOffice—Writer, Calc, Impress, Draw, Base and Math—but the two suites differ in terms of the applications' features, usability and community support. Specifically, LibreOffice is often considered to be more actively developed than OpenOffice; the standard package, for example, offers PDF import, a presentation minimiser and a Wiki publisher. Users can expand functionality with extensions and templates as well.

LibreOffice Portable is a full-featured portable version of LibreOffice for Windows. It includes a word processor, spreadsheet, presentation tool, drawing package and database. It is packaged as a portable app, so you can take all your documents and everything you need to work with them, wherever

The Components of NeoOffice

Table 3

Name of component	Description
NeoOffice Writer	Word processor analogous to Microsoft Word
NeoOffice Calc	Spreadsheet analogous to Microsoft Excel
NeoOffice Impress	Presentation program analogous to Microsoft PowerPoint
NeoOffice Draw	Vector Graphics editor
NeoOffice Math	Tool for writing mathematical formulas and equations, analogous to Microsoft Equation Editor
NeoOffice Base	Database management program analogous to Microsoft Access

you go. It is packaged in the *PortableApps.com* format; so it can work with the PortableApps.com platform and its automatic updater and app store, as well as with other portable menus. It can also work by itself from a USB, the cloud or local drive.

Latest version: 6.3.2

Website: www.libreoffice.org

3. NeoOffice—An office suite for Mac

NeoOffice was the first *OpenOffice.org* fork to offer a native Mac OS X experience, with easier installation, better integration into the Mac OS X interface, and use of Mac OS X's

fonts and printing services without additional configuration and integration with the Mac OS X clipboard and drag-and-drop functions.

NeoOffice began as a project to investigate methods of creating a native port of *OpenOffice.org* to Mac OS X. The project, now called NeoOffice, was originally dubbed NeoOffice/J, reflecting its use of Mac OS X's Java integration to enable a native application. A related project was NeoOffice/C, which was a simultaneous effort to develop a version using Apple's Cocoa APIs. But NeoOffice/C proved very difficult to implement and was highly unstable,

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The Components of OnlyOffice

Table 4

Name of the component	Description
Document	Documents module is a document management and sharing system for OnlyOffice files. The integrated audio and video player allows playing media from files stored in OnlyOffice (it supports .AAC, .FLAC, .M4A, .MP3, .OGA, .OGG, .WAV, .F4V, .M4V, .MOV, .MP4, .OGV, .WEBM formats).
Projects	This module has been developed for managing project stages: planning, team management and task delegation, monitoring and reporting. The module also includes Gantt Chart for illustrating the project stages and dependencies between tasks.
Mail	Mail module combines a mail server for creating own-domain mailboxes and a mail aggregator for the centralised management of multiple mailboxes.
CRM	This module allows users to maintain a database of clients, as well as transactions and potential sales, tasks, and client relationship history. This module also provides online billing and sales reports.
Calendar	This allows the planning and monitoring of personal and corporate events, task deadlines in Projects and CRM, sending and receiving invitations to events, etc.
Community	This offers corporate social network features—polls, corporate blogs and forums, news, orders and announcements, a messenger, etc.

The Components of KOffice

Table 5

Name of the component	Description
KWord	This is a word processor with style sheets and frame-support for DTP-style editing of complex layouts.
KSpread	This is a spreadsheet application with 100+ mathematical formulas.
KPresenter	This is a presentation program.
Kexi	This is a data management application and is used for creating, inserting, processing and performing queries on data.
Kivio	A flowchart program.
Karbon14	A vector drawing application.
Krita	A digital painting program.
KChart	A report and chart generator.
KFormula	A mathematical formula editor.
KPlato	A project management application that supports Gantt-chart creation.

so the project was set aside in favour of the more promising NeoOffice/J. All versions from NeoOffice 3.1.1 to NeoOffice 2015 were based on *OpenOffice.org* 3.1.1. In 2013, NeoOffice moved to a commercial distribution model via the Mac App Store. The source code is still available for free, but the software package is only available with the purchase of a commercial licence.

NeoOffice's most basic version is free and is capable of viewing and

printing PDF files as well as exporting other documents into the format. It is a commercial fork of the free/open source *OpenOffice.org* that implements most of the latter's features, including a word processor, spreadsheet, presentation program, and graphics program, and adds some features not present in the MacOS versions of LibreOffice and Apache OpenOffice.

Latest version: 2017.20

Website: www.neooffice.org

4. OnlyOffice

In 2009, a group of software developers, headed by Lev Bannov, launched a project called TeamLab, a platform for internal team collaboration. In March 2012, TeamLab introduced the first HTML5 based document editors at CeBit. In July 2014, Teamlab Office was officially rebranded to OnlyOffice and the source code for the product was published on Sourceforge and GitHub. In February 2017, the app for integration with ownCloud/Nextcloud was launched. In February 2018, OnlyOffice desktop editors became available as a snap package. In January 2019, OnlyOffice announced the release of end-to-end encryption functionality.

OnlyOffice is an open source office suite developed by Ascensio System SIA. It is delivered either as a SaaS solution or as an installation for deployment on a private network. Access to the system is through a

private online portal. OnlyOffice is divided into several modules: Documents, CRM, Projects, Mail, Community, Calendar and Talk.

OnlyOffice includes an online editing suite. It combines text, spreadsheet and presentation editors that include features similar to Microsoft desktop editors (Word, Excel and PowerPoint). Since version 5.0 of the editors, the interface has been renewed with a tabbed toolbar. OnlyOffice Desktop is an offline version of the OnlyOffice editing suite.

Latest version: 10.0.1

Website: www.onlyoffice.com

5. KOffice

In 1997, Reginald Stadlbauer first developed KPresenter, and this was followed by KWord, in 1998. The first official release of the KOffice suite was on October 23, 2000, when it was launched as part of the K Desktop Environment 2.0. KOffice underwent a major transition as part of the release of KDE Software Compilation 4 (SC4). The KOffice team prepared a major new release—KOffice 2.0—which used the new KDE Platform 4 libraries. Although version 2.0 was released in 2009, this was labelled a 'platform release'.

In May 2010, version 2.2.0 was released, with an unprecedented number of new features and bug fixes. In mid-2010, the KOffice community split into two separate communities, KOffice and Calligra. KOffice forked the KSpread spreadsheet utility to KCells, the KPresenter presentation tool to KOffice Showcase and the Karbon14 drawing tool to KOffice Artwork. KOffice 2.3 was released on December 31, 2010. Beginning with KOffice 2.4, the developers aimed to release new KOffice versions every six months in sync with SC4 releases.

KOffice is a free and open source office suite. It contains a word processor (KWord), a spreadsheet (KSpread), a presentation program (KPresenter), and a number of other components that have varied over the course of its development history.

Latest version: 2.3.3

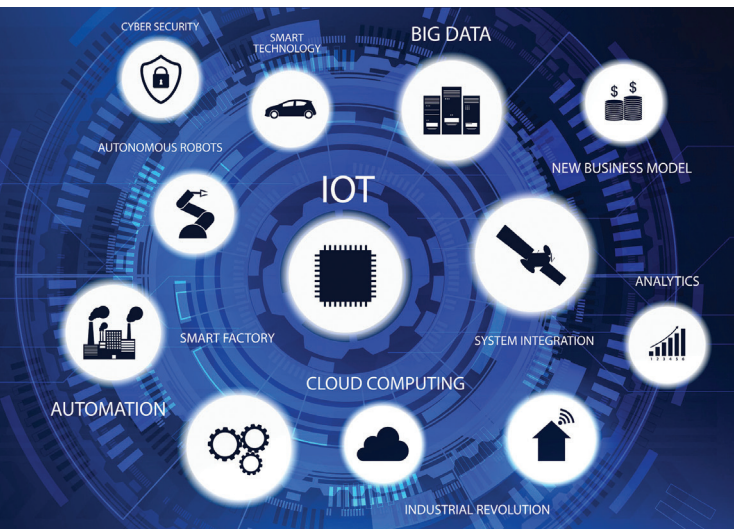
Website: www.calligra.org **EFY**

This article was first published in November 2019 issue of Open Source For You



Emerging Trends In The Design Of Cognitive IoTs

This is an extract from a speech presented by Dr Manjunath Iyer, principal consultant, Wipro, at *iotshow.in* 2019. It describes the emerging trends in the design of cognitive Internet of Things (IoT). Rather than just capturing data, these cognitive IoT devices can think, understand and accordingly provide data to the user



Dr Manjunath Iyer
has over two decades of experience and has filed about 82 patents, authored 180 research papers and a book

Things were there even before the term Internet of Things (IoT) was coined, but these were not connected to the Internet. Today, with the introduction of the Internet, everyday objects (things) have become smart and capable enough to take decisions on their own.

The next step is transformation of these IoT devices into cognitive IoT devices. So, rather than just capturing the data, these devices should also have the ability to think, understand, and accordingly provide data to the user. IoT devices can be turned into cognitive IoT devices by incorporating cognitive computing technologies.

Living IoT devices

Yes, even an animal like buffalo or cow can be transformed into an IoT object. How? Just connect a location sensor to the ear of the animal. Based on the animal's roaming information, the user can know grazing pattern of the animal on a particular day, how much milk it will provide, and thus calculate the amount of profit it will generate.

A living being as small as a honeybee can also be transformed into an IoT object.

A small nanosensor can be placed on the body of the insect and, based on its flight path, one can deduce what kind of flowers that honeybee is interested in. This can lead to planting more of such flowers and production of greater amount of honey, resulting in more profit generation.

IoT is not free from issues, however. You cannot put anything and everything, anywhere and everywhere; there are a lot of connectivity issues that you need to deal with.

Let us first understand what all an IoT system consists of. It mainly has an object or thing to be connected, connectivity through wireless standards, and the Internet.

The object (things, organisms, etc) to be connected is the main component of the entire IoT system. Connectivity comes in various forms such as Bluetooth, Wi-Fi, Zigbee, NFC, RFID, and many other wireless standards. The data is put on the Internet for storage, processing, and analytics.

When 5G becomes operational, it will be easier to connect many more devices and put massive amount of data into a network.

IoT is a culmination of such technologies

Communication Protocols of IoT

Protocols	MQTT	CoAP	XMPP	SOAP	UPnP
XML based	No	No	Communication protocol for message-oriented middleware based on XML	Relies on XML information set for its message format	No
TCP/UDP	TCP	UDP	TCP	Both TCP and UDP	UDP
IPv4/IPv6	IPv4/IPv6	IPv4/IPv6	IPv4/IPv6	IPv4	IPv4/IPv6
M2M support	OASIS standard	ETSI standard	—	—	—
USAGE	From pervasive devices to servers	Simple electronic devices, Resource-constrained device	Video transfer	Implementation of Web services	Permits networked devices to seamlessly discover others

as augmented reality, signal processing, big data, mobile computing, object and voice detection, and many more. It can be used in various sectors like banking, energy, industrial, vending, security and surveillance, medical, consumer, telematics, etc. Due to such huge diversity, the chances of it going wrong increases. Therefore the right combination of components should be selected keeping in mind the end result and its applications.

Example of IoT based solution

Consider a mobile phone that remotely monitors when and how the home lights get operated.

This can happen by first registering the objects to be monitored (home lights in this case) on an app installed on the phone. Next, by object identification. Each and every object (light) can be subscribed to the installed application running on the Internet. Through this, one can easily control all the lights.

Sensors are at the lowest level in an IoT system. These can be temperature sensors, position sensors, velocity sensors, etc. They are connected to the nearest point to track data.

Once the data is collected from the objects through the sensors, it is processed and used in various applications. Application areas include surveillance, clinical infrastructure monitoring, health monitoring, smart transportation, etc.

IoT protocol layers

Now let us look at IoT's working in a bit more detail. An IoT system comprises an application layer, information processing, a network, and sensing and identification. All these four components together make an IoT solution.

The hardware for an IoT system has the following:

Input/output devices. Sensors, actuators, LEDs, relays, motors, linear actuators, lasers, solenoids, speakers, LCD, plasma displays, robots, etc.

Network devices. Modem, gateway, router, satellite, tower, etc.

Processing devices. Grid, cloud, embedded processor, quantum computing, etc.

Memory devices. Cloud memory, flash memory and quantum memory.

The software for an IoT system requires a wireless sensor network (WSN) that has following characteristics:

- Smart and autonomous
- Can be configured automatically
- Self-monitoring and self-healing
- Capable of anomaly detection and tracking

The event notification service (ENS) of an IoT system acts as a common collector and distributor of events. Events come from multiple heterogeneous sources. Devices can subscribe to specific subsets of events.

In publish-subscribe software architectural style of ENS, whenever there is a change in an event, a notification is published stating the same. Then, accordingly, messages are generated to be sent to the user. For example, for a voltage change or current change, the event will be interpreted as switching on or off. This will be then conveyed to the subscriber (user) to act upon.

In object as a (Web) service ENS, this is an emerging paradigm. Nowadays, services such as food delivery happen over the Internet. Moving forward, thanks to AI, robots will be aligning themselves with Web technology to provide this service in a faster and efficient manner.

UPnP + protocol for IoT

This protocol is extensively used in present-day high-end IoT solutions. Going forward, it will be required in cognitive IoT because the objects adhering to this protocol can interact better.

UPnP + protocol involves following steps:

Discovery. Device advertises itself within a network and enables discovery.

Description. After the discovery, the control point hits the URLs to get the description.

Addressing. Then the address is auto-generated for ease of use.

Presentation. The focus is on human-machine interfaces.

Eventing. This step is closely coupled with control actions.

Control. Here the device is required to perform some action over other devices.

However, some issues are faced by the presence of a multitude of IoT devices. In a large distributed system this can sometimes create confusion. Besides, sensors that are placed on a moving object are not made robust enough and at times provide low output.

Issues can arise because of:

- Multiple services, multiple users
- Heterogeneous services
- Bursty traffic requests, that is, people sending large amounts of data to the cloud at the same time. This causes an overload resulting in system/server crash.

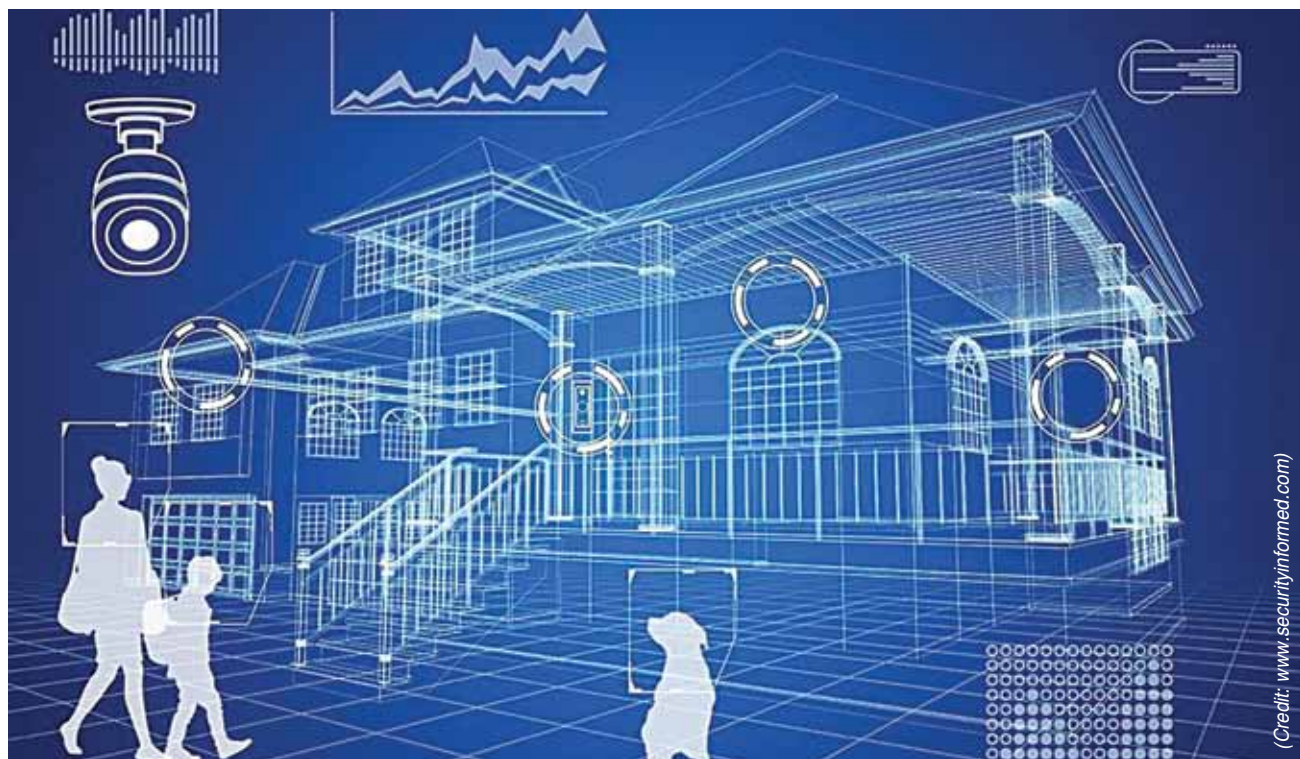
How to handle these issues?

Do not put all applications to use at once. Put some applications to use first so that the moment the device captures data, it also processes it. And divide the data into parts before transferring it to the cloud. **EFY**



Artificial Intelligence For Upgraded Surveillance And Better Security

Artificial Intelligence has been playing a key role in surveillance and achieving better security by preventing dangerous situations. AI cameras make real-time monitoring and intelligent analysis of the footage possible that can prevent occurring of events such as theft



(Credit: www.securityinformed.com)

Ayushee Sharma

Artificial intelligence (AI) has brought about startling developments in numerous sectors including manufacturing, automotive, healthcare, entertainment, finance, among others, while still being in its nascent stage.

Of all the applications, the use of AI

along with deep learning and machine learning in surveillance is growing by leaps and bounds due to its profound impact in achieving security by preventing dangerous situations. According to a recent report by ResearchAndMarkets.com, the global video surveillance market



Smarter AI-based surveillance cameras boost security and work efficiency (Credit: www.hanwha.com)

size is expected to grow at a CAGR of 10.4 per cent from 45.5 billion dollars in 2020 to 74.6 billion dollars by 2025.

AI taking over passive surveillance solutions

While the installation of CCTV cameras to stream live videos on screens has been done on a massive scale globally, be it in retail stores, hospitals, offices, among others, they are usually passive and only paid attention to after an incident of breach has taken place or there is information about a potential threat. Also, interpretation can be a daunting task as the massive data obtained cannot be utilised to full extent in conventional systems. AI cameras are more intrusive and make real-time monitoring and intelligent analysis of the footage possible that can prevent occurring of such events.

Mostly, low-resolution cameras are utilised for recording, resulting in poor quality images. AI can be used for sharpening unclear images to draw meaningful insights. No matter, the resolution, facial, object, and event recognition become much easier. Recognition can even be done from someone's physical characteristics like height, posture, and build as well as activity patterns.

This is also beneficial since human operators tend to miss out on crucial details, which can have serious consequences, due to reasons such as mental and physical fatigue from continuous monitoring. AI ensures that there are no errors and attention span issues. When remote monitoring in places like factories is required, ideal conditions and performance param-

eters can be programmed into the AI system and it can alert operators, save costs, and prevent machine failures.

Behind the functioning of AI

Machine-based learning algorithms are used to monitor and analyse the images, videos, and data recorded from surveillance solutions. The most common type of AI is rule-based wherein the programmers feed the system with pre-designed rules that must be true in an ideal situation. But slowly the use of behavioural analytics that does not need pre-defined rules is growing. The self-learning system works by auto-detecting and classifying data related to the target environment.

Automated platforms allow smooth collection and storage of information coming in from multiple sources. AI platform Ella by IC Real-time, for instance, makes the data instantly searchable. Users can even narrow down their results by filters like time range and location as well as give their feedback by rating their relevance.

When it comes to surveillance, AI can utilise machine-based vision and be trained to observe every detail in the livestream, or record and notify the operator in case of even the slightest deviation from activity (incidents, behaviour, or actions) that is usual in the ideal scenario that it has been fed, ensuring proactive real-time security. Data fed into the algorithms can include geographic location, biometric data, social media feeds, history of arrest, among others. Deep learning has heavily engineered neural networks

that can detect objects in real-time. Popular methods include faster Region-CNN (RCNN), You Only Look Once (YOLO), and the Single Shot Detector (SSD) networks. The choice of algorithm depends on parameters like speed, accuracy, size, and so on.

For training the surveillance system, training the model is done after data preparation. For the last step—inference, if the processing is done on the edge, onboard GPUs need to be used, or models with lower accuracy need to be used since microcontrollers are not as powerful as GPUs.

Facial recognition uses both video footage and still images for not only a person's identification via database matching but for even more in-depth purposes like expression analysis through crowd scanning and analysis of other similar trends. Evolv Technology, for example, offers a security system that consists of a screening machine and facial recognition application. The screening device detects metallic and non-metallic explosives and other dangerous weapons, while the facial recognition algorithms match the faces on the cameras with the watchlist in the database.

Where can it be used?

When it comes to national security, AI-enabled solutions can detect unattended objects like bags in airports and other places like metros and railway stations, easing the work for security personnel. Also, passengers can be verified through facial recognition along with biometric travel documents. If they do not get cleared, manual screening can be done to meet the requirements. This is even suitable for border control systems.

With mobile surveillance bots like micro drones, large areas of land can be covered. Startup Shield AI, for instance, offers Hivemind Nova drone and machine learning applications that the team says helps military or security personnel in surveillance of even GPS absent high threat environments.

Amongst the main aspect of smart cities is better security by predicting, preventing, addressing, and reducing crimes and other emerging threats to make them safe cities. Smart cities

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typically use an array of sensors, tracking devices, and surveillance technology to gather information in real-time from interconnected devices. The information relevant to city operations is then centrally processed and analysed. AI-based surveillance can monitor crowds in retail stores and identify those who have potential chances of engaging in activities like shoplifting.

As systems become smart and everything is connected, they also become vulnerable to cyber-attacks. Facial recognition technology has also been incorporated in many smartphones for protecting user data from outside attacks and hacks. AI and deep learning can detect such threats quickly and are being leveraged in most cybersecurity software and products in the market these days.

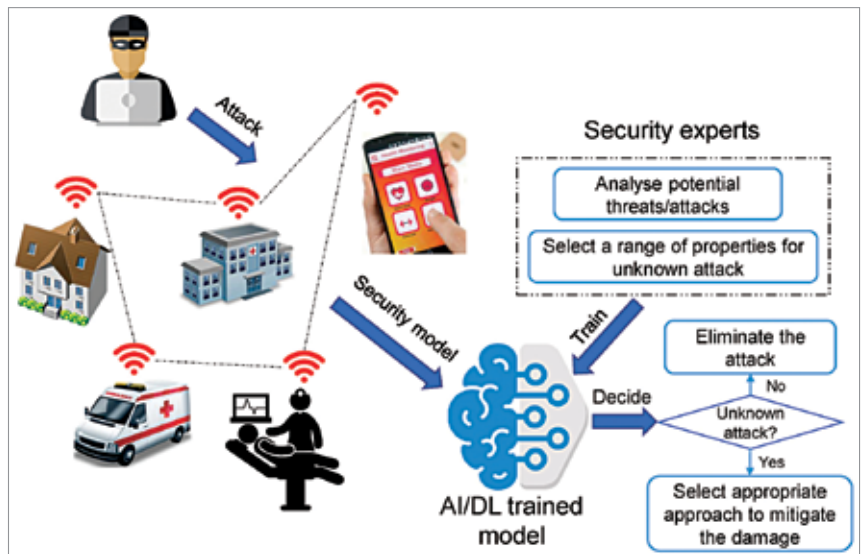
Impact of Covid-19 pandemic

Amidst the need for social distancing during Covid-19 lockdown across different countries, AI-based technological solutions that enable contactless functioning are at their peak. Startup Landing AI has created an AI-enabled social distancing detection tool that represents each individual in the video as a dot and turns bright red when the computed distance between two people is less than 1.8 metres (six feet).

In India, Vehant Technologies, a physical security and surveillance solutions manufacturer, recently launched Covid Analytics - an AI and computer vision-based intelligent image analytics solution. It detects violations through face mask detection, social distance detection, and vehicle movement detection through automatic number plate recognition (ANPR). It can be deployed both indoors and outdoors.

Enabling technologies

AI does not work in isolation to achieve its goal. Technologies like the Internet of Things (IoT) and cloud computing play a key role in the success of AI implementation in security systems. This is what makes devices like smart speakers, automotive built-in cameras and remote keyless entry locks behave as efficient tools for AI-powered surveillance. As an increas-



Use of AI in cybersecurity (Credit: www.mdpi.com)

ing number of devices get connected to each other in IoT systems, huge amounts of data need to be shared for processing. Giants like Microsoft, Alibaba, Amazon, IBM have cloud computing data centres, a more secure method of data storage and communication than traditional on-site infrastructure, for facilitating AI tasks. The data stored in cloud servers is usually accessible through the Internet. After connecting hardware to the cloud via 4G/5G networks, specialised software works to interpret this Big data collected from different locations and allows users to observe necessary measures to protect both people and assets.

Future scope

Although AI helps in spotting crimes and accidents easily, it also raises serious concerns about the future of privacy and risks to the current social structure. If companies and governments fail to take adequate steps to monitor and control the privacy violations in this field, it can have disastrous consequences. The opacity regarding the usage of data obtained in the process of surveillance varies in different nations.

Processing large amounts of information is necessary to obtain that one useful data, which implies heavy computing with multiple algorithms that require hundreds of servers. This wastage of resources leads to over-the-top expenditure on hardware. This limits its expansion in a country

like India where hardware is usually imported from other countries. When quality is often lowered to maximise storage, deep learning algorithms need to be able to evaluate these low-quality images. Also, the Internet connection needs to be faster for limited latency in processing data.

In addition, it is not always accurate or even fair, as seen from the soaring use of deep-fake videos. Take face recognition systems, for example, when the weather is poor or the images are distorted, false positives are high. Other reasons for the high false-match rates are consistent biases related to minorities and genders in AI training datasets and prejudice due to predictive policing tools. Such inconsistency is highly risky when it comes to situations of national/international importance.

In spite of the challenges, the spread of AI is undoubtedly proliferating. Innovative solutions are coming up and everyone from widely recognised security vendors to startups are contributing to these surveillance and security operations. Huawei, IBM, NEC Corporation, Hikvision, Cisco, ZTE are among the prominent companies that cater to AI surveillance necessities of most countries. There is a crucial need to not just blindly leverage the benefits of AI in surveillance but to establish a balance between AI technology, government surveillance, and the privacy rights of citizens. **EFY**



Drone Based Measurement And Drones' Certification

The deployment of drones/unmanned aerial vehicles (UAVs) has made the job easier, faster, and safer for surveyors. Some drones are specifically designed for data acquisition and surveying professionals, and are equipped with a high-resolution digital camera

Deepshikha Shukla

In the era of the Internet of Things (IoT), one of the prevalent concerns is the deployment of unmanned aerial vehicles (UAVs) to automate different commercial applications, ranging from simple deliveries to more sophisticated aerial taxi. This creates a requirement for different measurements conducted with drones, which serve as the basis for further evaluation of potential UAV applications.

Surveying with drones makes the job easier, faster, and safer for surveyors. It captures and measures image data with a substantially increased spatial and temporal resolution as compared to many classical methods. Some drones are specifically designed for data acquisition and surveying professionals, who need accuracy and efficiency. These drones are equipped with a high-resolution digital camera that has been geometrically calibrated to perform measurements.

Drone mapping is the process of sur-

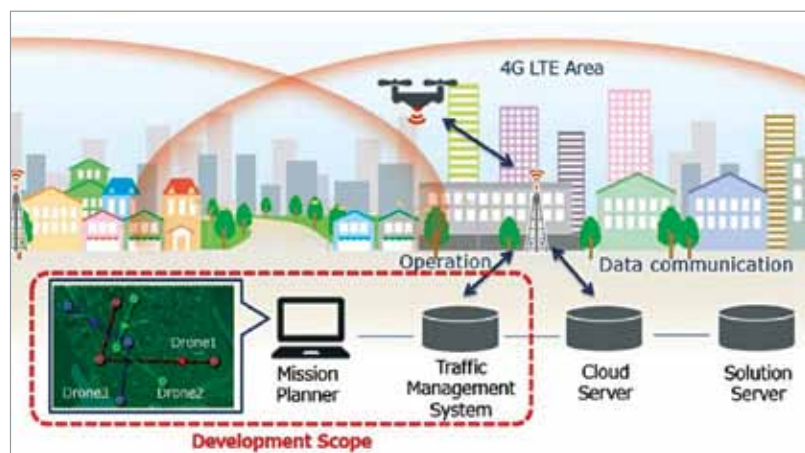
veying an area of land with a UAV, taking hundreds of pictures as it moves. Then with the help of computer software, it stitches and layers the images to analyse different results. Some of the most significant applications of drone mapping include construction sites, oil and gas, infrastructure, archaeological sites, mining, land surveying, property surveying, and landfill surveying.

Communication network testing

To ensure safety, unmanned traffic management (UTM) systems are being developed to connect and operate multiple drones simultaneously. It is imperative to ensure that the quality of the UTM's communication network is reliable to have seamless control of the UAVs in the designated areas. This makes it critical to test the network quality at high altitudes before any UTM is successfully deployed or UAV flies in that area.

Testing the quality of service (QoS) and quality of experience (QoE) of LTE networks at flight altitude can help to identify the problem in the UAVs' path and altitudes such as a lack of data throughput, insufficient network coverage, and high latency, which can pose a problem in UTM's communication with the UAVs.

RF scanners and QualiPoc Android handsets mounted on a UAV can be used for testing network QoS and QoE. The coverage of a UAV's flight path at different altitudes can be determined by measuring and plotting network coverage parameters such as reference signal received power (RSRP) and signal to interference plus noise ratio.



4G LTE control system for drones (Credit: www.terra-drone.net)

Rohde & Schwarz has partnered with UTM vendors for conducting flight tests in different parts of the world to collect information regarding LTE network at varying heights of UAV flight paths. They conducted latency and data throughput tests to identify the potential problems at different altitudes. Looking ahead, 5G will help to improve the UTM needs further, in particular, the latency by using ultra-reliable low-latency communications.

Performance testing

A complete diagnosis of the remotely piloted aircraft is required for reducing damages, accidents, and losses. An accurate and complete analysis indicates weak points, malfunctions, and offers the opportunity to improve the devices' performance.

This requires a hi-tech mechanism for monitoring and measuring electrical-energy parameters through sophisticated sensors. The main measures are absorbed power, figure of merit (FoM) parameter, power consumption per kg of thrust, weight, and thrust of the drone, energy used, real battery capacity, and centre of gravity position.

The DPM Elettronica's Drones Laboratory offers a system of integrated services defined as the DronesBench Index (IDB) for the diagnosis, testing, setting, measuring, and certification of professional drones. It allows the compliance of the relative parameters compared to those existing at the time of the homologation of the drone. It can also be used to calculate the power/absorption ratio of the motors with the respective propellers.

DronesBench instruments were developed to monitor energy parameters. They have a sophisticated sensor system to ensure accurate measurements on remotely piloted aircraft (up to 15kg payload). Further, the DronesBench devices allow performing global tests of the specific



A drone sniffs for methane leaks (Credit: <https://news.stanford.edu>)

functions of the aircraft like tracking the spread of a wildfire, searching for a missing person, and detecting toxic fumes before sending in rescue workers.

To ensure the capability, a new standard has been published recently based on more than twenty aerial test methods developed by the NIST (National Institute of Standards and Technology). These are all being standardised through the ASTM International Standards Committee, which includes tests for searching and mapping wide areas, navigating hallways within buildings, and avoiding situations that may interfere with radio communications.

Measurements through drones

Drones are the latest technology deployed for arsenal leak detection, providing real-time identification of leaks and accurate quantification of emissions. Drone-based methane monitoring programs have the potential to help the entire industry reduce emissions by detecting and quantifying methane emission rates coming from individual oil and gas production sites. This technology

advancement quantifies emissions and allows you to direct more efficient and effective maintenance activities in the future.

The drone system is outfitted with onboard gas analysers and meteorological sensors, which provide data to the operator while being flown around well sites. By executing a flight pattern that creates a virtual plane downwind of equipment, the technology identifies the total amount of methane being emitted from the site. The system does this by detecting methane passing through the virtual plane and capturing wind vectors in real-time. These variables are then fed into sophisticated algorithms to quantify methane volumes.

Since drones are much smaller than aircraft, they fly at much lower altitudes and can more precisely pinpoint the location of leaks by pairing the data collected with visual information from the on-board video feed.

Nondestructive testing (NDT) measurements require collecting data from locations that are either inaccessible or difficult to obtain due to access issues, safety considerations, or other limitations. The drone-based NDT measurement systems use computer-controlled heavy-lift multirotor drones outfitted with various sensors. It allows flight control to accomplish the precise flying and maneuvers required close to the structure. Thus, a software-controlled flight is crucial for an easier, safer, and faster NDT measurement process.

The aerial robotics platform is an innovative application that utilises existing NDT devices and available drone technologies equipped with a system of complex integrations, custom sensor arrays, PCBs, and software. The system has the potential to improve testing, inspection, and data collection aspects of assets, allowing a better application of science. **EFY**

India's **TECH ECOSYSTEM** Encompassing IoT Deployment Is At **CURIOUS CROSSROADS**

Eric Zhou

executive vice president, UNISOC



UNISOC is a fabless semiconductor company committed to R&D of core chipsets in mobile communications and AIoT. Its products cover mobile chipset platforms supporting 2G/3G/4G/5G communication standards and various chipset solutions in the field of IoT, RFFE, wireless connection, TV, etc. Eric Zhou, executive vice president, UNISOC, throws light on the ways India based IoT firms can scale-up deployment and results

Q. Which are the top three technologies that are shaping the future of IoT? How are these influencing the future of IoT?

A. The growth trajectory of the global IoT ecosystem is being shaped by several interconnected, interdependent technologies.

Take, for instance, artificial intelligence (AI) and related technologies such as machine learning and data analytics. Not only are these technologies providing the framework on which IoT solutions are built but are also helping in ensuring better service delivery, higher personalisation, and more interconnectivity to the benefit of the end-consumer.

The mass deployment of many advanced IoT solutions is hindered by bandwidth-related challenges. The introduction of 5G will address these issues and allow for high-speed connectivity needed to power the IoT ecosystem, leading to the development and deployment of the next wave of platform architectures and devices.

The biggest driver for IoT, however, will be NB-IoT. This technology, which leverages DSS modulation, is being hailed as a faster and potentially less expensive IoT connectivity option despite its higher upfront costs. This is because, unlike other wireless connectivity options, NB-IoT allows sensor data to be directly communicated to the primary server.

Q. Between the cellular and NB-IOT/LPWA families of wireless technologies, which one are you betting upon? Why?

A. We have a broad range of good products in NB-IoT/CAT1/GPRS. All of these directions have good conditions in industrial ecology, and we will be

focussing on these. UNISOC is one of the few companies in the industry that can provide the most comprehensive low-power wide-area (LPWA) technology portfolio.

Q. How ready is India's tech eco-system to develop and deploy IoT solutions?

A. When it comes to IoT deployment, India's tech ecosystem is at curious-crossroads. On the one hand, we have telecommunication companies that exist in the IoT workflow across almost all solution development stages because of their advantages in network ownership. On the other hand, however, telecommunication players in the nascent IoT ecosystem still have to deal with several critical challenges such as standardisation, interoperability, and data security.

This is further complicated by the fact that low-power, low-cost channels such as NB technology are yet to find traction in India. So, while the ecosystem shows promise, there are many measures that need to be taken to ensure that the proper rules, processes, procedures, audits, accountability, and coherence are in place.

Q. Do you foresee India's tech industry developing its own IP and branded products/solutions in the IoT arena?

A. There is definitely a huge scope for Indian companies to develop their own IPs and branded solutions/products in the IoT space. This is because of the scope of disruption that is available to them—primarily in the IoT products space, which currently is not as versatile as the consumer segment.

Partnering with leading chipset manufacturers to localise these value propositions for the Indian market will

help indigenous companies generate unique IPs and brand differentiation.

Q. Do you see the open source phenomenon playing an important role in the IoT arena?

A. Any technology moves through four cycles of market acceptance, and open source development plays a vital role in helping it gain market traction. Why? Because open source applications help in exploring new use-cases for technologies to make them more viable for end-consumers, business processes, and industries. The IoT space is no exception to this paradigm.

That said, it will be vital to introduce certain regulations that monitor the adoption of open-source IoT products and solutions in large-scale applications. IoT manufacturers also need to explore stronger linkages across the supply chain—especially with systems integrators, connectivity solutions providers, and chipset manufacturers—with a security-first perspective. These measures will help in addressing the various security vulnerabilities and challenges that currently restrict the domain.

Q. What are the key technologies missing, which when made available will accelerate the adoption of IoT across the globe?

A. 5G's big connection is now happening. 5G's low-latency application may be a key technology in IoT. We predict that ultra-reliable low latency communication (URLLC) will be truly deployed in many places within three years; at the same time, various types of sensors are also IoT outbreaks. **EFY**

“CONVERSATIONAL AI Can Help COMMUNICATIONS Scale Up Tremendously”

Chaitanya Chokkareddy

chief innovation officer, Ozonetel



There is a growing use of cloud communication due to the ease of remote working, besides high efficiency and reduced complexity through the integration of real-time capabilities in communication. Chaitanya Chokkareddy, chief innovation officer, Ozonetel discusses how cloud communication and artificial intelligence (AI) can revolutionise traditional approach in businesses, in an exclusive interaction with Ayushee Sharma

Q. What are the challenges in traditional communication methods that the cloud can solve?

A. The first challenge that traditional communication methods face is setup and maintenance. There is a need to buy and install hardware, phone lines and create teams to maintain these. In comparison, cloud communications require zero hardware or software. The onus of maintenance and upgrades falls on the solution provider rather than the business.

The second challenge that traditional communications face is agility. Today, new tools are continually being developed or upgraded. New communication channels are continuously opening up. Businesses with legacy systems struggle to integrate these new channels and technologies, whereas cloud communication users integrate with a few clicks. Moreover, today's climate has made it clear that disruptions don't just come in the form of new technologies. A world-wide pandemic and national lockdowns has caused huge disruption in legacy call centres. Meanwhile, cloud call centres moved their operations to work-from-home, for thousands of agents, in a few hours.

This brings us to the third challenge, which is location. Legacy systems are limited by location whereas the cloud's omnipresence ensures easy remote working across dispersed offices, with a shared repository of data.

The final challenge is scale. Scaling up your legacy communication requires an investment of time and money. Whereas adding (or removing) any number of agents to a cloud communication platform can be done in minutes.

Q. What are the features of cloud communication?

A. Cloud communication is agile and continuously upgrading. This enables seamless integrations with the latest technologies or communication channels. It also allows businesses the flexibility to scale up or scale down as per their capacity needs and growth. We have had call centres scale up from five to five hundred agents on the same platform.

Cloud communications are omnipresent, that is, they are not limited by geography. Your call centre can exist wherever the Internet is available. Also, there are no hardware setup costs in a cloud communication solution. And since cloud communications are essentially pay-as-you-go subscription models, there are no software and maintenance costs involved.

Q. Which businesses can benefit the most from it?

A. Any business can benefit from cloud communications. Since it involves zero setup costs, it is the go-to communication method for most start-ups and small businesses. Because of its advanced technologies, it is equally attractive to enterprises.

Q. What is the impact of conversational AI on cloud communication?

A. Conversational AI can help communications scale up tremendously. This means that cloud communications will have more automation and self-service options built into it. Conversational AI logic is also used to sift through data for more insights via tools such as speech analytics. This will help to effectively tap into the vast reservoirs of data collected via cloud communication.

Q. What are the basic necessities for building a chatbot?

A. The most basic necessity is data. A good dataset can go a long way in building a good chatbot. With the advancements in natural language processing using deep neural networks, building the base for a chatbot becomes easy if you have a good dataset.

Start by identifying what conversations can be moved to bot. Identify previous conversations that can help in training. From these conversations identify the intents and entities applicable to your bot. Once you have these, a good flow designer can help you build bot flows. If you have to support multiple languages, then a translation engine is also needed to support your chatbot.

Q. How can developers choose the right cloud communication platform for their needs?

A. For developers, the most important thing is flexibility. They have to check the spread of application programming interfaces (APIs) provided by the communication platform - whether the APIs only cover voice or other channels like WhatsApp, email and chat, too; are they defined in such a way that they are extendable and can support new channels as and when they come.

Other questions include whether the documentation is good enough, can developers configure alerts, does API support webhooks, whether the API has libraries in multiple programming languages, and so on.

Q. What are the hurdles faced by companies in this field?

A. Getting access to good data is the biggest problem. Since each domain is different in itself, we have to collect data from scratch for each domain. **EFY**



Smart Water Meter To Help Control Water Wastage

Ashwini Kumar Sinha

Increasing water consumption and wastage is leading to water scarcity. While a large population has no safe drinking water, some people use a lot of water on daily basis and waste it.

This project is of a smart water

meter that measures our daily water usage and feeds live data on our phone that is connected to a database, which can be accessed by the concerned authorities through a web browser.

Some components required for the project are:

- Water flow sensor (FS400A is recommended).
- Arduino Pro Mini
- Bluetooth HC-05
- Programmer (Arduino Uno/FTDI USB-UART adaptor)
- OLED SSD1306
- Water pipe (size as per flow meter inlet diameter)
- Water tap connector

To start the project, download the flow meter library from the link <https://github.com/sekdiy/FlowMeter>. Unzip the FlowMeter-master folder and paste it in the libraries folder of Arduino IDE. After that, open multi.ino file from FlowMeter-master folder and save it as water_meter.ino.

We need to include some additional features in this code by adding some libraries and modifying the code. To add libraries, click on Manage Libraries (refer Fig. 1) and search for OakOLED SSD 1306 library and install that library as shown in Fig. 2.

Now our Arduino IDE is ready. Let's start the coding part.

Coding

First, we need to include libraries in water_meter.ino code as shown in Fig. 3.

Next, create the interrupt han-

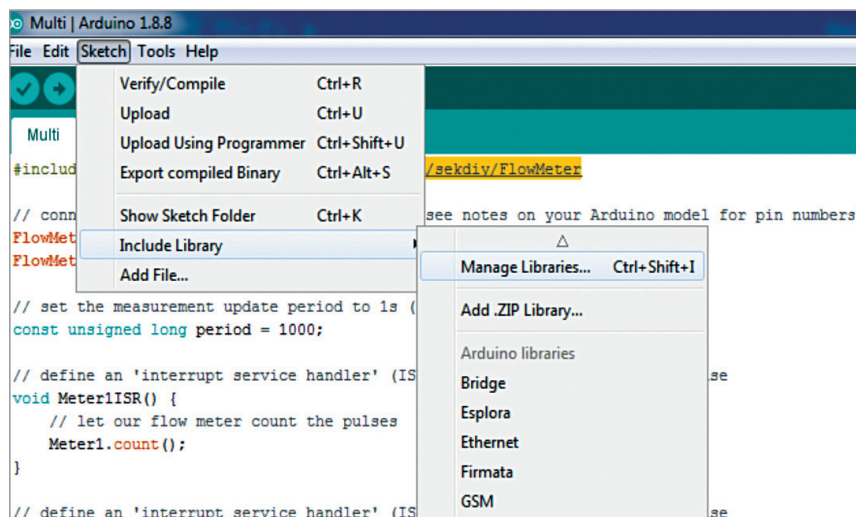


Fig. 1: Steps to add Arduino OLED library

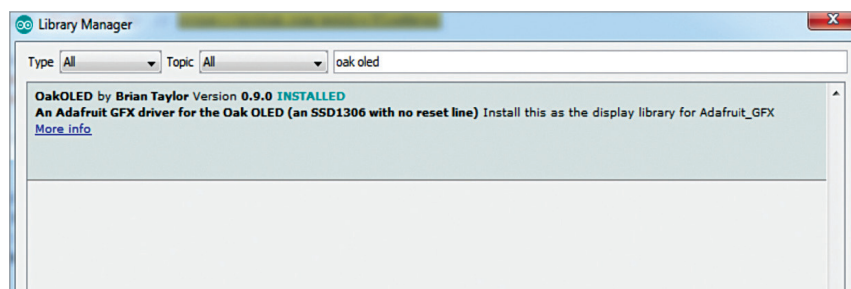


Fig. 2: Installing OLED library

```
#include <FlowMeter.h> // https://github.com/sekdiy/FlowMeter

#include "Wire.h"
#include "OakOLED.h"
OakOLED oled;
FlowMeter Meter1 = FlowMeter(2);
FlowMeter Meter2 = FlowMeter(3);
```

Fig. 3: Arduino code with libraries

```
void Meter1ISR() {

    Meter1.count();
}

void Meter2ISR() {

    Meter2.count();
}
```

Fig. 4: Arduino Interrupt handler

```
void setup() {
    oled.begin();

    Serial.begin(9600);

    attachInterrupt(INT0, Meter1ISR, RISING);
    attachInterrupt(INT1, Meter2ISR, RISING);

    Meter1.reset();
    Meter2.reset();
}
```

Fig. 5: Setting Bluetooth

```
Meter2.tick(3000);
Serial.print(String(Meter1.getCurrentFlowrate()));
Serial.print("l/m");
Serial.print(":");
Serial.print(String(Meter1.getTotalVolume()));
Serial.print("L total");
Serial.print(":");
Serial.print(String(Meter2.getCurrentFlowrate()));
Serial.print("l/m");
Serial.print(":");
Serial.print(String(Meter2.getTotalVolume()));
Serial.print("L total");
Serial.println(" ");

oled.clearDisplay();
oled.setTextSize(1);
oled.setTextColor(1);
oled.setCursor(0, 0);
oled.println("Flow rate");
oled.setTextSize(2);
oled.setCursor(10, 12);
oled.println(Meter2.getCurrentFlowrate());
oled.setTextSize(2);
oled.setCursor(80, 12);
oled.println("l/m");
```

Fig. 6: Printing data to OLED display and sending data to Bluetooth module

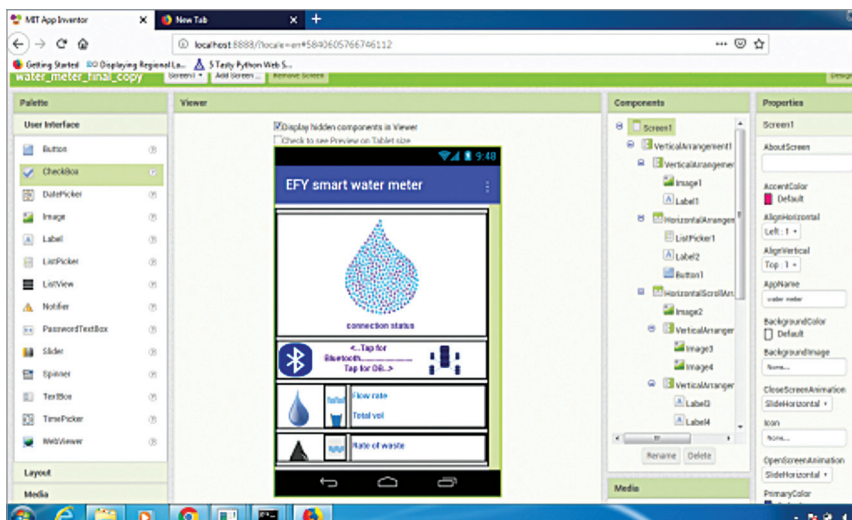


Fig. 7: Adding components in app layout

for the sensor as shown in Fig. 4.

Here, we set up the Bluetooth with baud rate at 9600. If this baud rate does not work, try default baud rate at 4800.

Now, set the data output that will be sent to Bluetooth with Serial.print (data to send) function as shown in Fig. 6.

And at last, set OLED display with oled.println (data to send) function.

We have finished the coding part; now let's start making an app using MIT App Inventor.

Android app development

Open MIT App Inventor, make a layout and add the components as shown in Fig. 7.

Main components added in the layout are:

- 1 x Button for database
- 5 x Text views for Bluetooth connection status, inlet water flow rate, the total volume of water consumed,

wastewater flow rate, and total volume of water waste.

- TinyWebDB
- List picker for Bluetooth
- Bluetooth client
- Timer clock

The final app layout is shown in Fig. 8.

Now, go to MIT Code block and set the code as shown in Fig. 9. Save this code as smart_meter.aia and generate its .apk file. This .apk file needs to be installed on your Android smartphone.

Next, we need to upload the Arduino code to Arduino Pro Mini.

Note. Arduino Pro Mini was used in the prototype to make the project small and easy; you can also use Arduino Uno for this project. Code and connections remain the same for both.

Uploading code to Arduino Pro Mini

First, remove ATmega328 microcontroller from Arduino Uno board as shown in Fig. 10.

Connect Arduino Pro Mini with Arduino Uno as per Table 1.

Now, go to Tools and select Board as Arduino Pro Mini and upload the code (water_meter.ino) to Arduino Pro Mini as shown in Fig. 11.

Next, we need to connect all the components to make the final smart water meter project.

The Arduino Pro Mini pin connec-

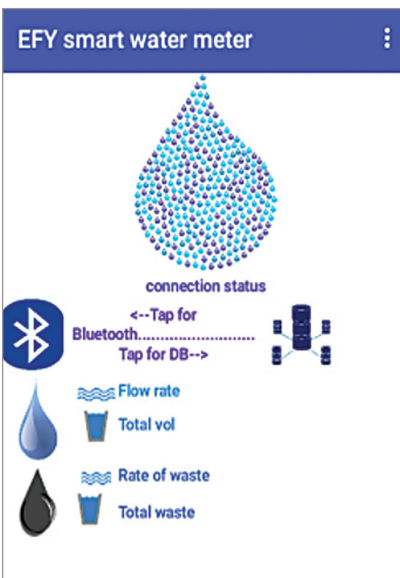


Fig. 8: App layout

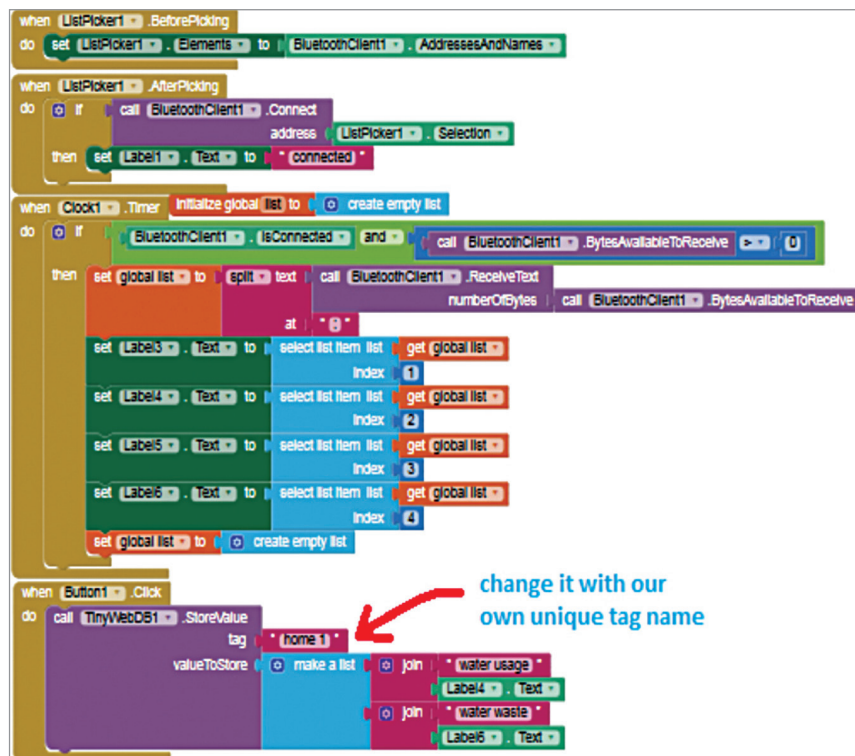


Fig. 9: MIT App code blocks coding

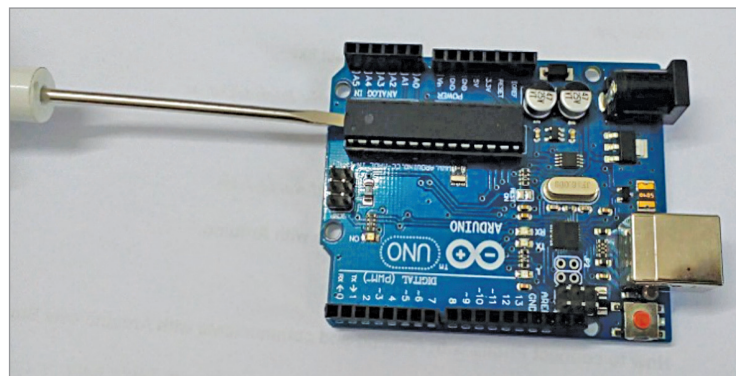


Fig. 10: Removing ATmega328 IC from the board

tions with the components are given in Table 2. The actual wiring diagram of the Arduino Pro Mini pins with the components is shown in Fig. 12.

Now, cross-check all the connections. If all the connections are correct, then power the Arduino with a 5V DC power supply.

Connect the water sensor pipe to the water tap or water inlet of your water tank. You can see the total volume of water and water flow rate on the OLED display. Next, install the smart_meter.apk file on your Android device. Then, open smart_meter app and press on the Bluetooth icon.

You will get a list of Bluetooth

devices available near your Android phone. Select HC-05 from the list to pair it. The default code for pairing is 1234 (or could be 0000 or 1111). After connecting/pairing it, you will get the water flow rate and water volume consumed in the app on your phone as shown in Fig. 13. If there is a display problem or the data is incorrect, disconnect Bluetooth and connect it again.

You can tap on the DB icon to upload your water usage data to the Web server so that it can be seen from anywhere through the Internet.

Connections Between Arduino Uno and Pro Mini Boards Table 1

Arduino Uno	Arduino Pro Mini
Rx	Rx1
Tx	Tx0
Gnd	Gnd
5V	Vcc
Reset	Reset

Arduino Pro Mini Pins Connections With Components Table 2

Arduino Pro Mini pins	Components pins
5V	Vcc of Bluetooth
GND	GND of Bluetooth
RX1	TX of Bluetooth
TX0	RX of Bluetooth
Vcc	OLED Vcc
GND	OLED Vcc
A4(SDA)	OLED SDA
A5(SCL)	OLED SCL
Pin 3	Output pin of water flow sensor

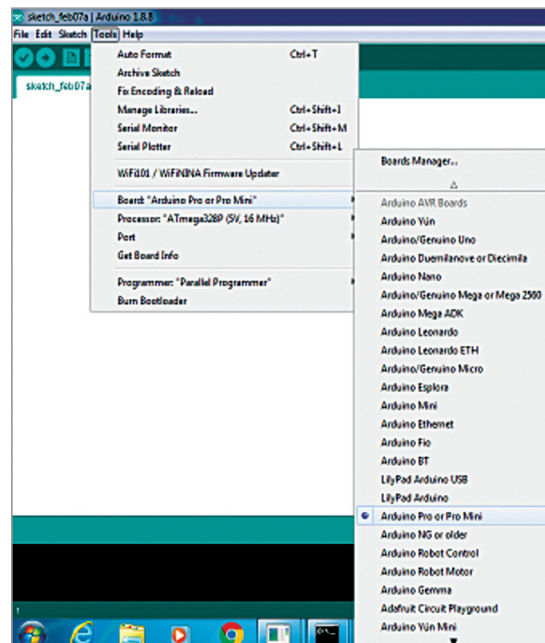


Fig. 11: Selecting the Board in Arduino IDE

Note. Internet Wi-Fi connection needs to be turned on in order to upload the data to the server.

Now, to fetch the data, click on the link <http://appinvtinywebdb.appspot.com/getvalue>. Then type your house tag name as home 1, which is already mentioned in the app. Click on Get

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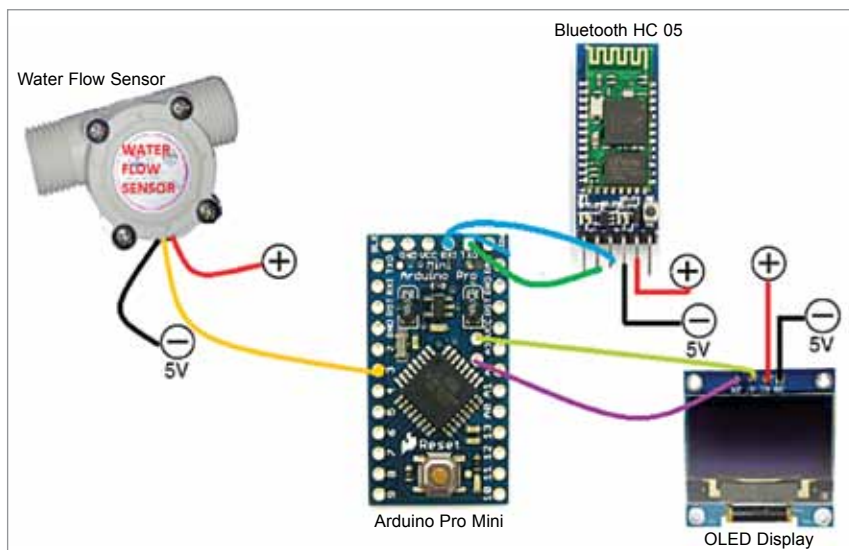


Fig. 12: Wiring diagram of smart water meter



Fig. 13: Working model of smart water meter

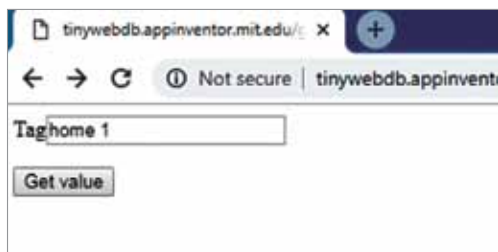


Fig. 14: Fetching data

Value button to get the details of water usage as shown in Fig. 14.

Cheers! We have made the wonderful solution that can help us control water wastage.

You can add an extra flow sensor to pin 2 of Arduino for water wastage data from the sewer pipe outlet. It will work with the same code and app.

So, use two sensors (one for water usage and another for waste water) and enjoy your project. **EFY**

EFY Note

The source code
of this project
is available
for free download
at source.efymag.com

Ashwini Kumar Sinha is an electronics
hobbyist and tech journalist at EFYi



S. Basilea Ruban

ATmega328 Analogue I/O Port Expander Using I2C Bus

This project explains the interfacing of PCF8591 converter (slave) with ATmega328 microcontroller (master) using I2C bus to get direct multiple analogue inputs and outputs. ATmega328 microcontroller (MCU) on the Arduino Uno board consists of only six analogue inputs, which are not enough for some projects that need more analogue inputs. This circuit provides twenty analogue inputs, five analogue outputs and an LCD for display.

Circuit and working

The circuit diagram of ATmega328 analogue I/O port expander using I2C bus is shown in Fig. 1. It is built

around five PCF8591 (IC1 through IC5), ATmega328 (IC6), and a few other components.

PCF8591 is basically an 8-bit analogue-to-digital conversion (ADC)

Slave Address Byte

Table 1

Bit	Slave address							0
	7	6	5	4	3	2	1	
	MSB							LSB
Slave address	1	0	0	1	A2	A1	A0	R/W

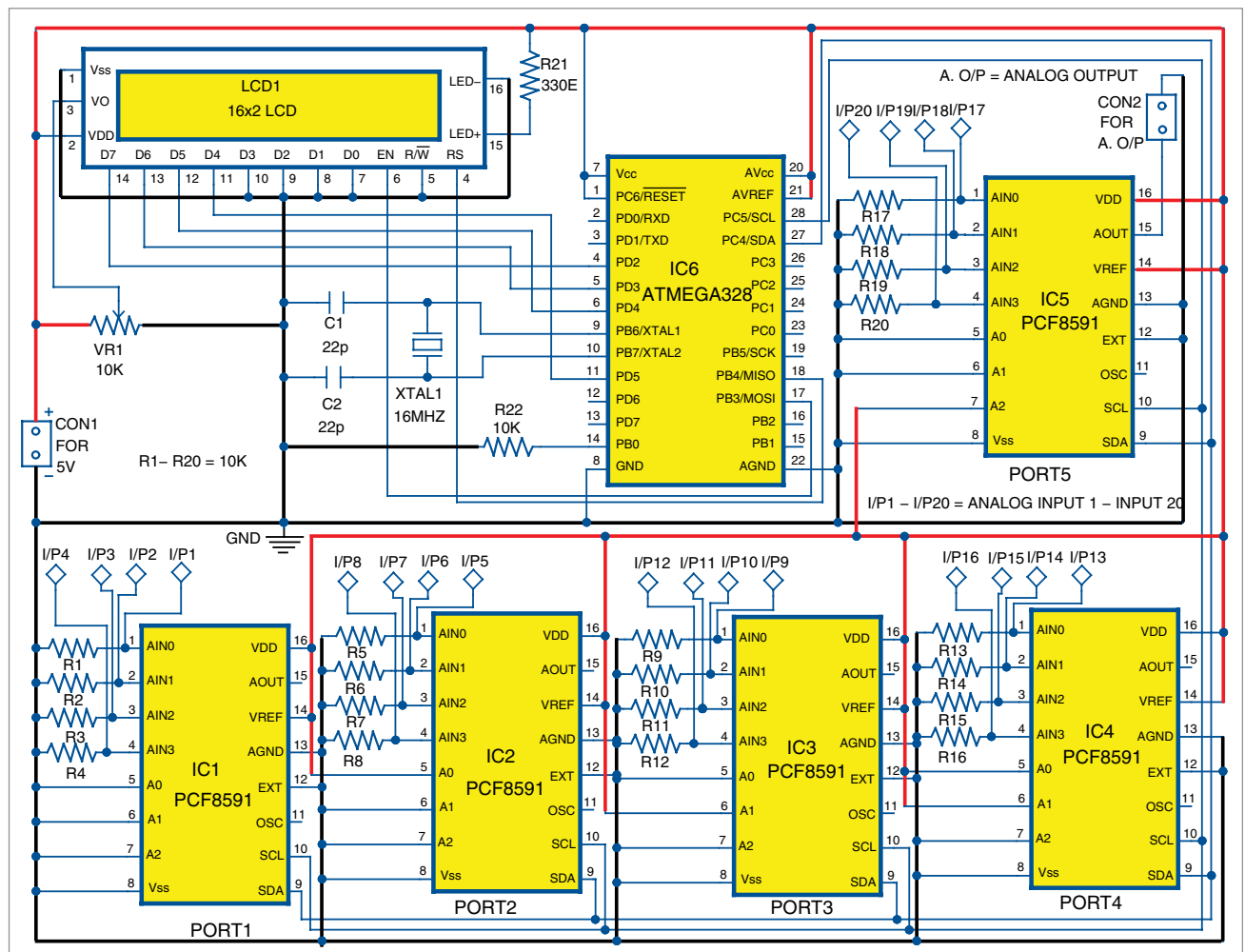


Fig. 1: Circuit diagram of ATmega328 I/O port expander

and an 8-bit digital-to-analogue conversion (DAC) chip. As shown in the circuit diagram, you may also replace ATmega328 with the Arduino Uno board directly by connecting SCL and

SDA pins of Arduino to PCF8591.

In this circuit, the I2C bus connections include pins 9 and 10 of PCF8591 and pins 27 and 28 of ATmega328, which are SDA and SCL pins, respectively.

In this I2C bus, we can connect eight slave ICs (PCF8591) with each slave having a unique address for data transmission and reception. However, only five slave ICs are used in this project.

Table 1 shows the slave PCF8591 addressing in detail. A2, A1, and A0 are slave address bits to configure I2C slave address selection for different inputs (refer Table 2). To enable each slave IC, the corresponding address bits must be either GND (logic 0) or connected with 5V supply (logic 1) as shown in Fig. 1.

To know more about the slave address bits selection, refer to the control byte of PCF8591 as shown

Slave Address for Different Inputs

Table 2

A2	A1	A0	Analogue input
0	0	0	IC1 (port1)
0	0	1	IC2 (port2)
0	1	0	IC3 (port)
0	1	1	IC4 (port4)
1	0	0	IC5 (port5)

PARTS LIST

Semiconductors:

- IC1-IC5 - PCF8591 8-bit ADC and DAC converter
- IC6 - ATmega328 MCU

Resistors (all 1/4-watt, $\pm 5\%$ carbon):

- R1-R20, R22 - 10-kilo-ohm
- R21 - 330-ohm
- VR1 - 10-kilo-ohm potentiometer

Capacitors:

- C2, C2 - 22pF ceramic disk

Miscellaneous:

- LCD1 - 16 $\times$ 2 LCD
- Xtal1 - 16MHz crystal
- CON1 - 2-pin terminal connector
- CON2 - 2-pin connector
- 20-pin male Bergstrip for I/P
- 5V DC regulated power supply
- 28-pin IC socket for IC6
- 16-pin IC socket for IC1 through IC5
- 16-pin female Bergstrip for LCD
- 20-pin male Bergstrip

(All these are available from kitsnspares.com)

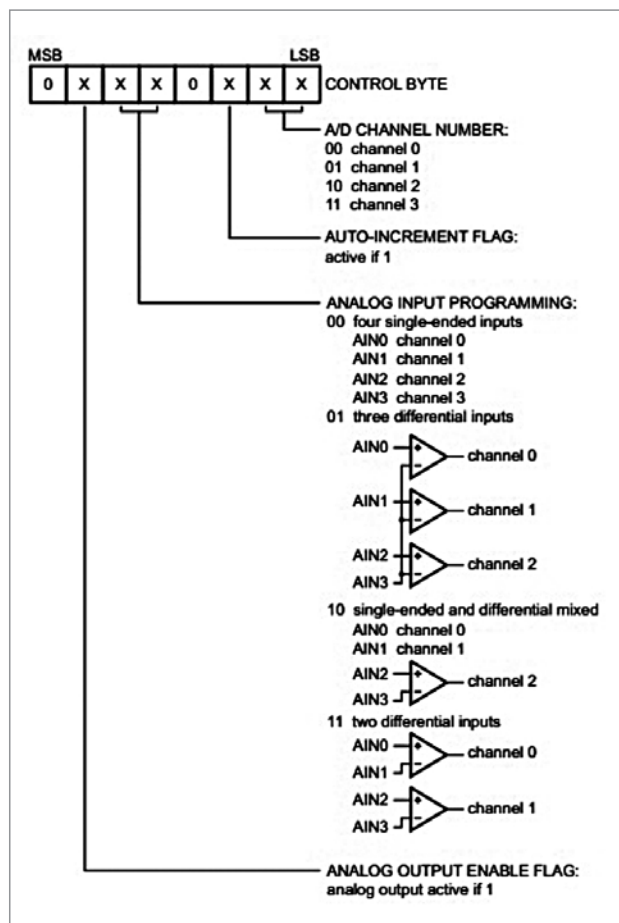


Fig. 2: PCF8591 I2C control byte

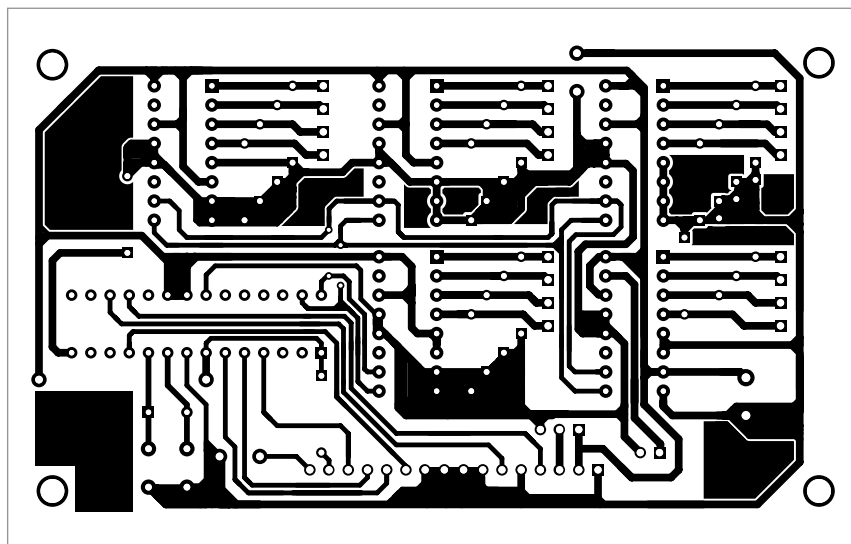


Fig. 3: Actual-size PCB layout for the port expander

in Fig. 2. By enabling the control bits we can configure the analogue inputs and outputs. Each slave IC has four analogue inputs (AIN0 through AIN3). In this project, there are five slave ICs, which means twenty analogue inputs (I/P1 through I/P20) of PCF8591 will be automatically scanned and the corresponding outputs can be displayed on 16 $\times$ 2 LCD display.

To get the outputs on the LCD, control byte and analogue output values are to be programmed in the coding. The system scans the addresses (A2, A1 and A0) of each slave port one by one, processes the inputs (AIN0 through AIN3) and displays them on the LCD. For better accuracy in the display, each analogue input pin is pulled down to ground using 10-kilo-ohm resistor.

Software

Arduino IDE is used for programming the code (Atmega328_expander.ino).

EFY Note

The source code of this project is available for free download at source.efymag.com

LCD library is used for display and Wire library is used for I2C communication. Before uploading the code to ATmega328, do not forget to include the related files (Atmega328_expander_library_files.zip) in the Arduino Library.

For uploading the code to ATmega328, use an Arduino Uno board with bootloader. After uploading the code, remove ATmega328 chip from Arduino Uno board and insert it into the circuit or PCB.

Construction and testing

An actual-size PCB layout for the ATmega328 analogue I/O port expander is shown in Fig. 3 and its components layout in Fig. 4. After assembling the circuit on PCB, con-

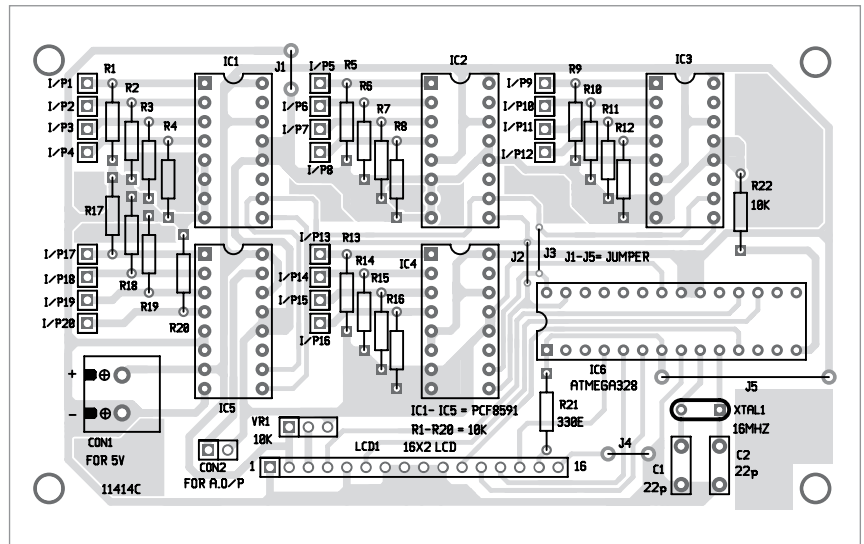


Fig. 4: Components layout of the PCB

nect 5V across CON1.

To test the working of the circuit, just connect a variable resistor or preset between ground and 5V power source with its wiper (middle pin) connected to any of the analogue pins of IC5. Vary the preset and check the output voltage on LCD. You can also

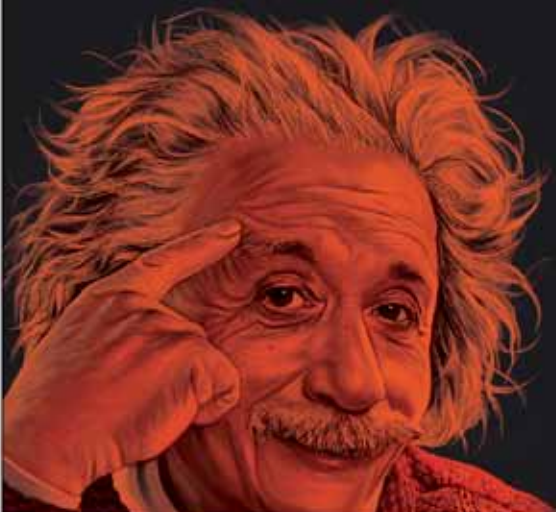
check the output voltage at connector CON2 on a digital voltmeter. **EFY**



S. Basilea Ruban is an electronics and communication engineer, circuit designer, and embedded programmer

Once you stop learning, you start dying.

—Albert Einstein



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Basic Installation Of Access Control System

S. Aravind

This article describes the basic installation of an RFID and password-based access control system. Access control systems allow only the authorised persons to enter or exit the premises. An access control system may include locks, turnstiles, biometric readers, face recognition readers, RFID readers, boom barriers, etc.

The materials required for this project include:

- Magnetic lock with a mounting bracket (fail-safe type lock)
- DC power supply adaptor or switched-mode power supply (SMPS) (12V, 3A)
- Access control reader
- Exit push button
- Connecting wires (Cat 6 or copper wires, as required)

Circuit and working

The block diagram of the access control system is shown in Fig. 1. It is built around a magnetic lock with mounting brackets, 12V SMPS/adaptor for power supply, access control device, exit push button, RFID tags and cables. It includes 3- and 6-pin connectors along with 3- and 6-wire cables to connect the access control device. The complete wiring diagram for the project is shown in Fig. 2.

Relay connections. Let us go through the relay concept before the actual installation. The relay (refer Fig. 3) has three contacts: NO, NC and COM, which are usually referred to as normally open, normally close, and common terminal, respectively. COM usually remains connected to NC terminal. When the relay is activated, the COM terminal gets connected to NO terminal, breaking away from NC terminal. Most of the access control readers, push buttons and locks have an inbuilt relay circuit for the desired connections.

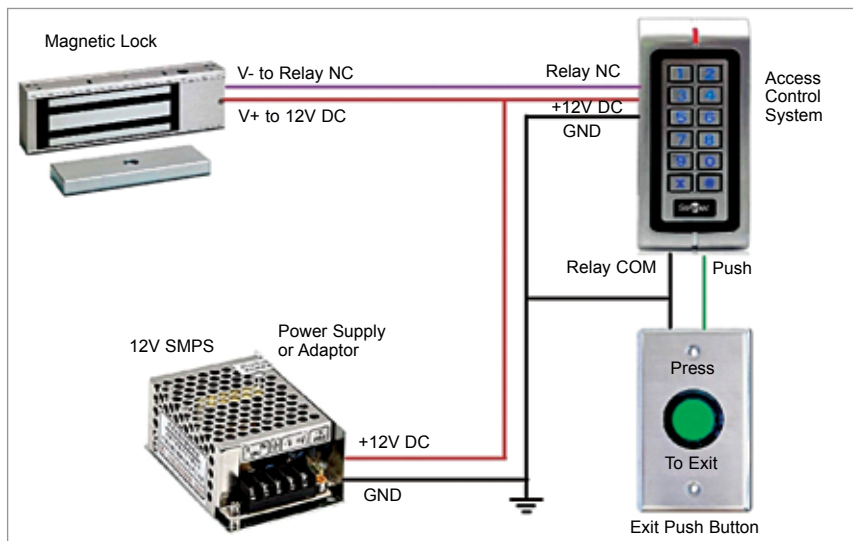


Fig. 1: Block diagram of author's prototype

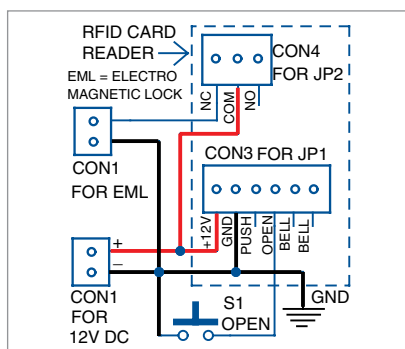


Fig. 2: Wiring diagram of access control system

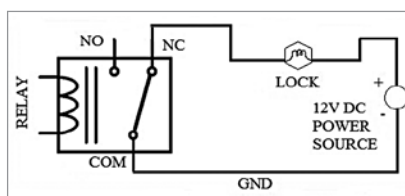


Fig. 3: Relay connections

Access control device. Access control device and magnetic lock are the main components required for the installation. The standalone access control device (model number SA32-

E) used in this project is shown in Fig. 4. It is a contactless RFID smart card reader and password verification device. It enables three verification modes (RFID card only, PIN only, and card & PIN) to ensure maximum safety and flexibility. With one relay output (optional) and a push-button (low) output, one door button port, and one doorbell port, the device is simple but effective for use in residential housing, offices, and other public facilities.

When the magnetic lock is directly connected with a +12V supply and ground (GND) across the terminals, the lock functions normally (that is, the door remains locked). Note that there are two main types of magnetic locking devices: fail-safe and fail-secure. A fail-secure locking device gets locked when power is off. Fail-safe locking devices are locked when power is on and gets unlocked when power goes off. This project uses a fail-safe locking device.

The locking device must be configured in such a way that if a person uses the RFID tag (or biometric) to



Fig. 4: RFID based access control device



Fig. 5: Electromagnetic lock installation on a glass door

open the door, the lock should open and then close automatically after a few seconds to avoid tailgating. For this, we need the relay circuit.

Most of the biometric devices or access control readers are pre-equipped with a relay circuit on board. The circuit is designed in such a way that the GND rail from the power supply/adaptor connects through the NC and COM terminals of the reader and exit push button. The +12V DC from the adaptor or SMPS is connected directly to the electromagnetic lock as shown in the block diagram (refer Fig. 1). Most of the magnetic locks and access control readers are pre-equipped with timer for locking and unlocking time delays. Generally,

presets are found on the PCB board, which can be adjusted for locking or unlocking time delays.

Working of access control system

When a pre-registered user or authorised person tries to open the door using an RFID tag (card) or password or biometrics, the relay circuit gets activated and the COM terminal gets disconnected from the NC terminal for a while. That is, the COM terminal gets connected to NO terminal. Hence, the 12V DC power supply is disconnected from the magnetic lock for a few seconds (depending on the preset time delay). So the magnetic lock gets unlocked when the power goes off. This action allows the door to open.

Again, when the user presses the exit push button, the relay gets activated and is forced to connect COM with NO terminal. The supply gets disconnected from the magnetic lock and it gets unlocked, the door gets opened again.

Basically, the access control device is to be installed near the door outside the room and exit button is to be installed near the door but inside the room. The electromagnetic lock installed on the glass door is shown in Fig. 5.

Some exit push buttons will have inbuilt relay circuitry, which must be given external power supply. In that case, it is preferred to use a 12V, 3A power supply.

RFID card. Some details on the RFID card/tag are given here. Every RFID card/tag has a unique number. When the tag is swiped across the RFID reader, the access control system prompts you to enter a password. The default password is 123456. To change the password, press #123456#0987654#987654# on the access control keypad. If you hear a long beep, it means the password is successfully registered. To add a new RFID card, press #987654#1 on the input keypad. Swipe the tag/card near the reader followed by pressing the # key.

EFY note. For more details on configuration and settings, refer RFID manual of this product at source.efymag.com. **EFY**



S. Aravind is B.Tech and currently working as extra-low voltage systems engineer in Oman



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Make This Automatic LED Staircase Light

Nikhil Shah

Going up or down a staircase can be a challenging task at night, especially for kids and elderly people. This circuit lights up two LEDs, one at each end of the staircase, for a couple of minutes. The LEDs switch off automatically thereafter. The lights can be switched on from either end.

Circuit and working

The circuit diagram of staircase light is shown in Fig. 1. It is built around transistors BC547 (T1) and BC557 (T2), two 5mm white LEDs (LED1 and LED2), and few other components.

When switch S1 or S2 is pressed, capacitor C1 charges through resistor R1. This raises voltage at the base of

transistor T1, which enters into saturation. Meanwhile, capacitor C1 starts discharging through resistors R2 and R3 and the base-emitter terminals of T1. Now, since T1 is conducting, the base of transistor T2 gets grounded, and hence it also starts conducting. This causes current to flow through transistor T2 and LED1 and LED2 turn on.

Since the capacitor is constantly discharging, once its voltage goes below the cut-in voltage of transistor T1, the transistor turns off, and hence T2 also turns off. This makes LED1 and LED2 switch off. The values of capacitor C1 and resistor R3 determine the discharge time of capacitor C1. So, if you want to keep the lights (LED1 and LED2) on for a longer period of time, increase the values of C1 and R3.

The switches S1 and S2 should be installed at either end of the staircase so that the lights can be switched on from either end.

This circuit works on a 9V battery/power adaptor. It can also be designed to work on 5V or 12V.

Construction and testing

You can assemble the circuit on a breadboard and experiment with different capaci-

tor (C1) and resistor (R3) values for proper delay time as per your requirement. Once done, solder everything onto a PCB and place the PCB inside a suitable enclosure. Extend wires of the LEDs (LED1 and LED2) and switches S1 and S2 from the PCB to appropriate locations for installation in the staircase.

An actual-size PCB layout for the staircase light is shown in Fig. 2 and its components layout in Fig. 3. After assembling the circuit on PCB, connect a 9V DC supply across CON1.

After installation of the switches, press S1 or S2, LED1 and LED2 will glow to light up the staircase. The light turns off automatically after the preset period.

The light-on duration can be extended up to 7.5 minutes by increasing the value of capacitor C1 to 2200µF. To use a higher wattage LED/LED strip-like arrangement, use transistor T2 with a higher collector current or use a power transistor. **EFY**

PARTS LIST

Semiconductors:

- T1 - BC547 npn transistor
- T2 - BC557 pnp transistor
- LED1, LED2 - 5mm white LED

Resistors (all 1/4-watt, ±5% carbon):

- R1, R4 - 100-ohm
- R2 - 470-ohm
- R3 - 1-mega-ohm
- R5 - 47-kilo-ohm
- R6 - 150-ohm

Capacitors:

- C1 - 220µF, 25V electrolytic

Miscellaneous:

- CON1 - 2-pin terminal connector
- S1, S2 - Push-to-on switch
- 9V regulated power supply

(All these are available from kitsnspares.com)

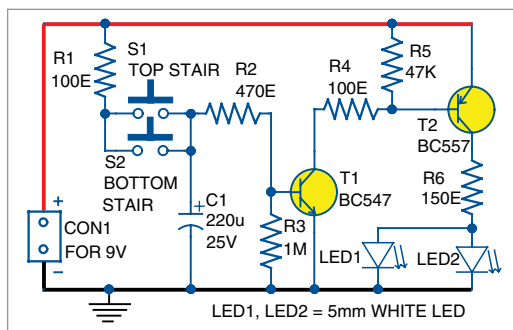


Fig. 1: Circuit diagram of automatic staircase light

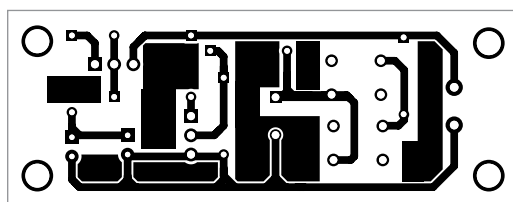


Fig. 2: Actual-size PCB layout for the staircase light

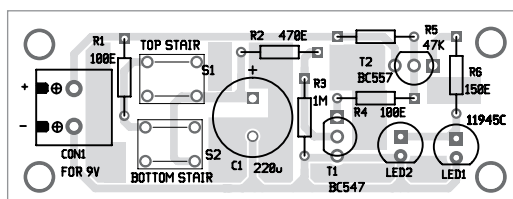


Fig. 3: Components layout of the PCB



Fig. 4: Author's prototype



Nikhil Shah is an electronics and telecommunication engineer with a keen interest in experimenting with electronics circuits



Surround Yourself With Sound From Three-Channel Audio Amplifier

Petre Tzv.
Petrov

This article presents a simple, low-cost audio amplifier with three channels built around two

TEA2025 ICs. The amplifier works from an AC or a DC power supply in the range of 3V to 12V (max. 15V).

This audio amplifier has a left channel, a right channel and one additional channel for the sum of the signals from both channels or for subwoofer or other audio effects.

Approximate Voltage Gains in TEA2025

Table 1

Mode of operation	Gain, dB	Gain, V/V
Gain without external resistor for IC1	43 to 47	140...224
Minimal gain with external resistor for IC1	36	63
Gain in bridge mode	49 to 53	282...447

Description of the circuit

Circuit diagram of the 3-channel audio amplifier is shown in Fig. 1. It is built around two TEA2025 ICs (IC1 and IC2). Each IC has two internal

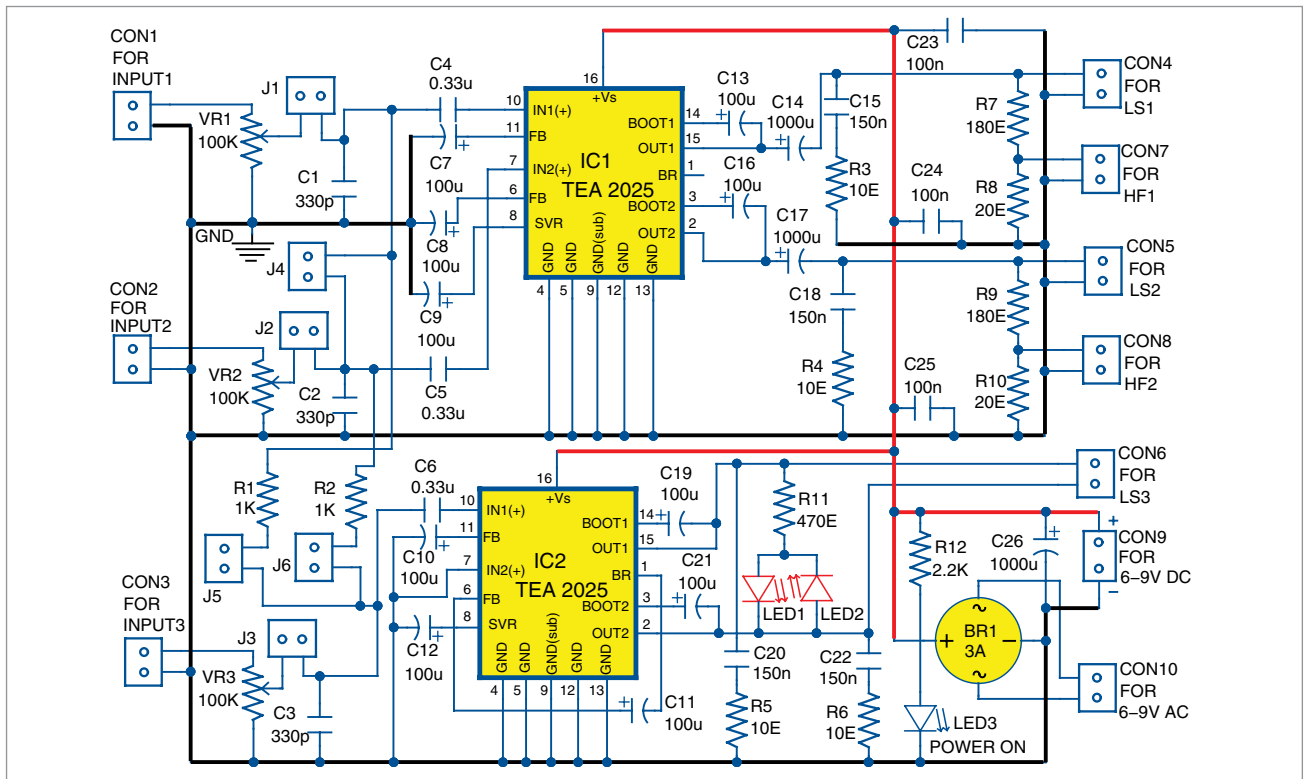


Fig. 1: Circuit diagram of audio amplifier with three channels

Different Configurations and Modes of Operations of The Amplifier

Table 2

Mode	J1	J2	J3	J4	J5	J6
Three separate channels	On	On	On	Off	Off	Off
Stereo and the third channel with the sum of first and second channels	On	On	Off	Off	On	On
First and third channels together, the second channel is alone	On	On	Off	Off	On	Off
Second and third channels together, the first channel is alone	On	On	Off	Off	Off	On
First and second channels together, the third channel is alone	On	Off	On	On	Off	Off

Approximate Output Power of The TEA2025 Amplifiers

Table 3

Configuration	+Vee	RLoad	Pmin	Ptyp	Pmax
Single amplifier	9V	4-ohm	1.7W	2.3W	-
Single amplifier	9V	8-ohm	0.7W	1.3W	-
Single amplifier	6V	4-ohm	0.7W	1.0W	-
Single amplifier	6V	8-ohm	0.7W	0.6W	-
Bridge amplifier	9V	8-ohm	0.45W	4.7W	-
Bridge amplifier	6V	4-ohm	-	2.8W	-

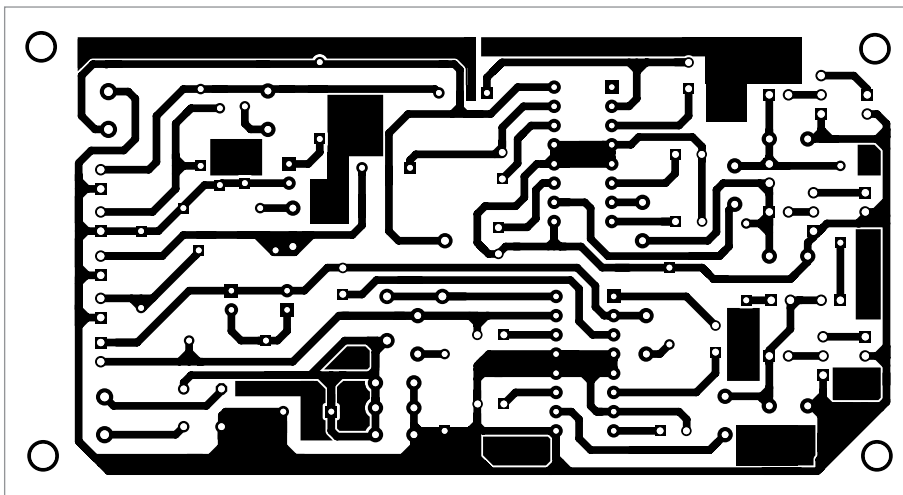


Fig. 2: Actual-size PCB layout for audio amplifier with three channels

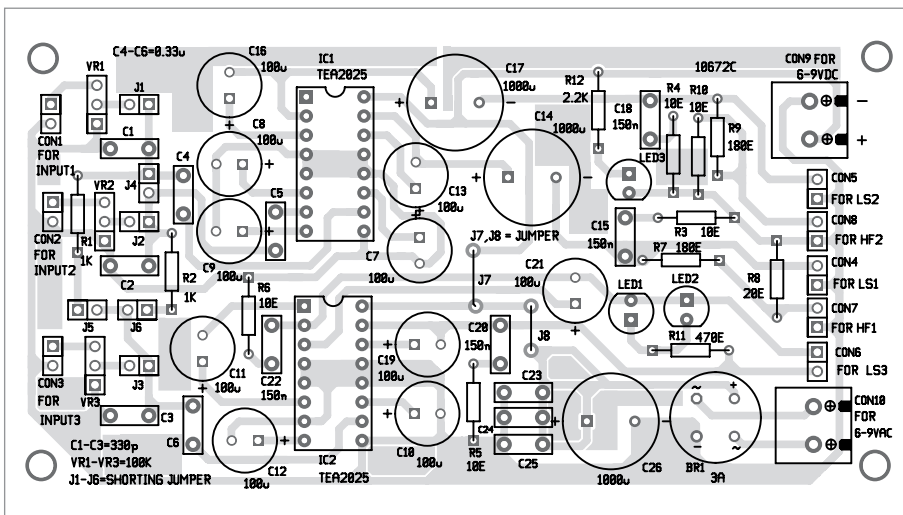


Fig. 3: Components layout of the PCB

audio amplifiers.

The input audio signal is applied to connectors CON1, CON2 and CON3. IC1 works as two separate audio amplifiers, each of them with output power more than 2W. The suggested loads across IC1 are loudspeakers LS1 and LS2 (connected to CON4 and CON5) with a power of 4W or more.

Also, you may use appropriate headphones (HF1 and HF2) with an impedance of 8-ohm or more, connected to CON7 and CON8.

IC2 works as a single bridge amplifier with output power more than 4W. It is suggested to use loudspeaker LS3 (connected to CON6) with a power of 6W or more.

A 6-9V DC voltage can be applied to connector CON9 and 6-9V AC voltage to connector CON10. You can use a 50/60Hz 230V AC primary to 9V rms, 3A secondary transformer X1 for AC supply at CON10. A 3A bridge rectifier BR1 is used across CON10. Alternatively, you can use four 1N540X or similar diodes with at least 3A and 50V ratings in place of BR1.

Amplifier voltage gain

TEA2025 has relatively high voltage gain, which can reach 220dB or 47dB. Approximate voltage gains in the TEA2025 amplifier in different modes of operations are listed in Table 1.

Use external resistors to reduce the gain down to around 36dB. But reducing the gain to less than 36dB will make the amplifier unstable. External resistors can be connected between pins 11 and 6 of IC1 and the cor-

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PARTS LIST*Semiconductors:*

- IC1, IC2 - TEA2025 audio amplifier
- LED1-LED3 - 5mm LED
- BR1 - 3A, bridge rectifier

Resistors (all 1/4-watt, $\pm 5\%$ carbon):

- R1, R2 - 1-kilo-ohm
- R3-R6 - 10-ohm
- R7, R9 - 180-ohm
- R8, R10 - 20-ohm
- R11 - 470-ohm
- R12 - 2.2-kilo-ohm
- VR1-VR3 - 100-kilo-ohm potentiometer

Capacitors:

- C1-C3 - 330pF ceramic disk
- C4-C6 - 0.33 μ F ceramic disk
- C7-C13, C16, C19, C21 - 100 μ F, 25V electrolytic
- C14, C17, C26 - 1000 μ F, 25V electrolytic
- C15, C18, C20, C22 - 150nF ceramic disk
- C23-C25 - 100nF ceramic disk

Miscellaneous:

- LS1, LS2 - 4-ohm, 4W loudspeaker
- LS3 - 4-ohm, 6W loudspeaker
- HP1, HP2 - 8-ohm headphone
- CON1-CON8 - 2-pin connector
- CON9-CON10 - 2-pin terminal connector
- J1-J6 - Shorting jumper
- J7, J8 - Jumper wire
- 6-9V AC or 6-9V DC power supply
- 16-pin IC base for IC1 and IC2

(All these are available from kitsnspares.com)

responding capacitors C7 and C8 to stabilise.

The amplifier has six shorting jumpers J1 through J6 to have different modes of operation. Some of the configurations are given in Table 2.

Output power

The output power of the amplifier depends on the power supply and the load resistance (loudspeaker). Table 3 gives information about the approximate output powers (minimum, typical and maximum) of TEA2025 for different configurations and load resistances (Rload). IC1 works as two simple amplifiers and IC2 works as a single bridged amplifier with higher output power.

The input impedance of the IC TEA2025 is typically 30-kilo-ohm. Here we use three external potentiometers (VR1 through VR3), each of 100-kilo-ohm, to adjust the volume of the corresponding channel inputs.

The circuit has three LEDs. LED1 and LED2 are used as simple level indicators. These produce light pro-

portional to the level of the output signal of the third channel, which is the most powerful channel that works in bridged mode. LED3 is the power on/off indicator.

Construction and testing

An actual-size PCB layout for the amplifier is shown in Fig. 2 and its components layout in Fig. 3.

The circuit can be tested with DC input voltage (6V-9V) applied to connector CON9 or AC input voltage (6 to 9Vrms) applied to connector CON10. The test input signals (about 10mV rms, depending on the power supply) are applied to CON1, CON2 and CON3. **EFY**

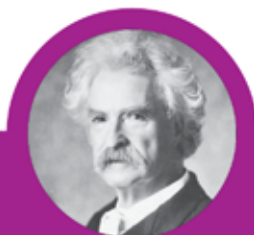


Petre Tzv Petrov was a researcher and assistant professor at the technical University of Sofia, Bulgaria, and expert-lecturer in OFPPT (Casablanca), Kingdom of Morocco. Now he is working as an electronics engineer in the private sector in Bulgaria

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-Mark Twain



Configure Arduino Uno As Square Wave Generator

Shibendu Mahata
and Souvik Kumar Das

In this project, the Arduino Uno is configured as a square wave generator with user-selectable control of the frequency and duty cycle. The operating range of the system is up to 10kHz. The desired frequency and duty cycle of the generated square wave can be produced using a matrix

keyboard that is interfaced with digital pins of the Arduino. The authors' prototype of the generator is shown in Fig. 1.

Circuit and working

The circuit diagram of square wave generator built around Arduino Uno board, a matrix keyboard and few other components is shown in Fig. 2.

The 4 × 3 matrix keyboard is used as input device. The four rows (RW1 through RW4) of the keyboard are connected to digital pins 10, 11, 12, and 13 of the Arduino Uno board. The three columns (CL1 through CL3) of the keyboard are connected to the Arduino analogue input pins (A0 through A2). Each column is connected to 5V supply through 1-kilo-ohm resistor (R1 through R3).

Arduino Uno is an AVR ATmega328P microcontroller (MCU) based development board with six analogue input pins and 14 digital I/O pins. The MCU has 32kB ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides serial communication via UART, SPI and I2C. The MCU can operate at a clock frequency of 16MHz. Here,

the digital I/O pins 13, 12, 11, 10 and 9 of the Arduino are configured as output pins. Pins A0, A1, and A2 serve as analogue input pins.

Software

The source code is written in Arduino programming language. The MCU is programmed using Arduino IDE software.

Select the Arduino Uno board

PARTS LIST	
Semiconductors:	
Board1	- Arduino Uno
Resistors (all 1/4-watt, ±5% carbon):	
R1-R3	- 1-kilo-ohm
Miscellaneous:	
CON1	- 2-pin connector
	- 4×3 matrix keyboard
	- USB cable for Arduino
(All these are available from kitsnspares.com)	

from Tools→Board menu in Arduino IDE and upload the *wavegenerator.ino* code through the standard USB port on your computer. The *Serial.begin(9600)* function initialises the serial port with a baud rate of 9600. In this project, the serial monitor of Arduino IDE also displays the entered value of frequency and duty cycle for the square wave.

Note. The Arduino must be reset every time a new frequency and duty cycle is required.

The working of the circuit is simple. After uploading the code to Arduino, connect the keyboard as shown in the circuit. Switch on the power and enter the desired value of frequency through the keyboard. Next, press the Duty Cycle button S11 (see Fig. 2) and enter the desired value of the duty cycle by pressing the number keys (S0 through S9). Finally, press the Enter key (S12). The output square waveform is available across CON1, which is connected to digital pin 9 of Arduino Uno. **EFY**

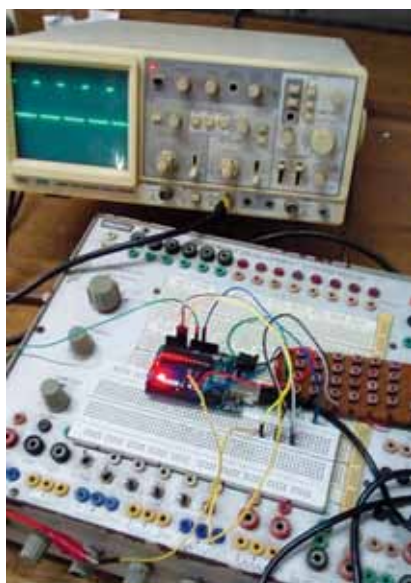


Fig. 1: Author's prototype

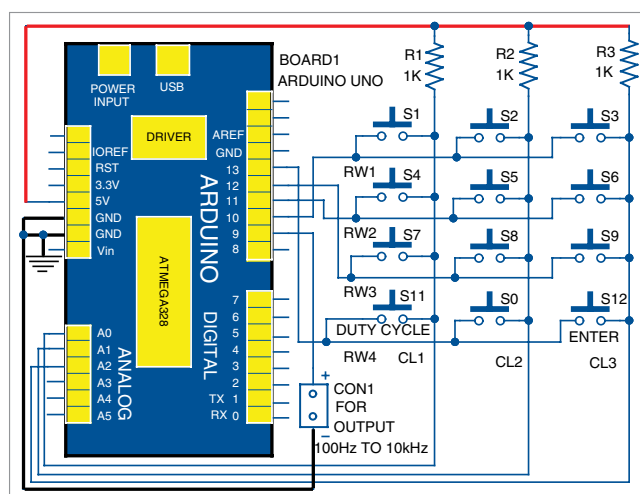
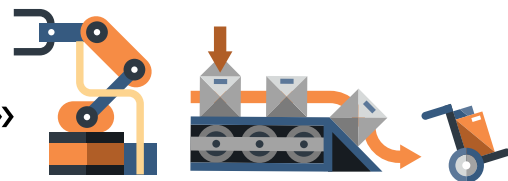


Fig. 2: Circuit diagram of Arduino based square wave generator

Shibendu Mahata is MTech (gold medallist) in instrumentation and electronics engineering from Jadavpur University. He has several publications in the domain of signal processing in reputed international journals and conferences

Souvik Kumar Das is passionate about electronics and MCU-based system design



MSMEs hit by Covid-19 pandemic to get additional assistance

The Union Cabinet has approved additional funding of up to ₹ 3,000 billion through the Guaranteed Emergency Credit Line (GECL) for the MSME sector hit hard by the Covid-19 pandemic. For this purpose, a corpus of ₹ 416 billion will be provided by the central government spread over the current and the next three financial years to provide a guarantee against loan losses. Interest rates under the scheme are capped at 9.25 per cent for banks and financial institutions and fourteen per cent for non-banking financial companies (NBFCs).

The National Credit Guarantee

Trustee Company (NCGTC) will provide 100 per cent guarantee against losses on loans advanced to eligible micro, small, and medium enterprise (MSME) and MUDRA borrowers under the scheme which is open till October 31.

All MSME borrower accounts with outstanding credit of up to ₹ 0.25 billion as on February 29, which were less than or equal to sixty days past due as on that date, and with an annual turnover of up to ₹ 1 billion, would be eligible for GECL funding. They can get up to twenty per cent fresh loans of their entire outstanding credit.

Fingerprint-on-display sensors to reach 400 million units in 2020

Global shipments of fingerprint-on-display (FoD) sensors expanded by nearly a factor of eight in 2019 as these devices replaced conventional silicon-based capacitive chips in smartphones. A total of 228.3 million FoD sensors were shipped in 2019, according to Omdia.

“With FoD sensors having reached the sweet spot for market pricing, FoD shipments are expected to continue rising at a tremendous rate in 2020, expanding to more than 400 million

units,” reads Omdia’s official statement.

Besides Apple, most smartphone brands have adopted FoD as an advanced bio-metric identification technology to replace capacitive fingerprint chips. More than seventy smartphone models integrated FoD in 2019. FoD can offer the same type of user experience of fingerprint recognition experience as capacitive chips, without requiring any learning. The invisibility of FoD also gives smart-

Battery technology market to reach \$194 billion by 2027

The battery technology market is estimated to reach 194 billion dollars by 2027, as per a report by Acumen Research and Consulting. Further, the market is expected to grow at a CAGR of eleven per cent. The report says that Asia-Pacific is driving market demand. It has several developing economies

with substantial natural and human capital. It also says that India and China are projected to be major investment hubs for battery technology companies during the forecast period.

“Asia Pacific is expected to be the leading player in the battery technology market due to rapid urbanisation

ON THE move



Silicon Labs appoints Karuna Annavajjala as CIO

Silicon Labs has announced the appointment of Karuna Annavajjala as chief information officer. As CIO, Annavajjala will oversee information technology (IT) services for Silicon Labs’ global business operations including strategic planning, infrastructure services, business application platforms, cyber security and data privacy, and IT service delivery. Prior to joining Silicon Labs, Annavajjala served as CIO of corporate functions at AIG. She has also worked as the executive director of technology delivery at TIAA where she developed IT transformation strategies, managed multiple global technology and professional services teams, and established offshore capabilities.

MSME Ministry appoints Arvind Kumar as new secretary

Ministry of Micro, Small and Medium Enterprises (MSME) has appointed Arvind Kumar as the new secretary. Prior to this appointment, Sharma was serving as additional secretary in Prime Minister’s Office (PMO). He is 1988 batch IAS officer of Gujarat cadre. He has also worked for the Gujarat government at various positions including field and policy level and has extensive experience of handling the portfolios of regulatory and developmental administration.

phone makers the freedom to offer a handset design without any notches.

The FoD technologies are mature and affordable, so the average selling price of a fingerprint module ASP can be as low as three to four dollars, which is more cost-effective than alternative 3D facial recognition technologies.

and consumption spending in countries such as India and China, which are projected to increase demand for advanced technology, due to the current opportunities to grow the market during the forecast period,” the report mentions.

The major factors that will drive the market growth include growing demand for electric and hybrid-electric cars, strong demand for clean energy storage technology. It

Calendar of Forthcoming Electronics Fairs/Exhibitions/Seminars/Events

Event, Date and Venue	Topics	Contact address for details
IndiaTechnologyWeek@Home June 17-19, 2020	Virtual exhibition and conferences covering electronics and IoT solutions	EFY Enterprises Pvt Ltd Website: www.indiatechnologyweek.com
electronica China productronica China Laser World July 3-5, 2020 National Exhibition and Convention Center Shanghai, China	electronica China and productronica China will continue to involve the vertical industry and related technologies in addition to displaying more diversified products	Messe München GmbH Website: www.messe-muenchen.de
IFA Berlin September 3-5, 2020 Exhibition Grounds Berlin Expo Center City, Messedamm 22, Berlin, Germany	Main meeting place for key retailers, buyers, and experts from the industry and the media	IFA Berlin Website: https://b2b.ifa-berlin.com
CE China Summit September 24-26, 2020 Guangzhou, China	Consumer electronics and home appliances solutions	CE China 2020 Website: www.en.cechina-ifa.com
GITEX Technology Week September 27-October 1, 2020 Dubai World Trade Centre	World-class technology event. Technology leaders, enterprises and startups from around the world come together to show the future of every business and every industry	GITEX Website: www.gitex.com
OSI Days October 8-9, 2020 Nimhans Convention Centre, Bengaluru	Mega technology show with multiple events including expositions, conference and seminars	EFY Enterprises Pvt Ltd Website: www.opensourceindia.in
Engineering Design Show October 14-15, 2020 The Ricoh Arena, Coventry	UK's only event entirely dedicated to engineering, electronics and embedded design	Engineering Design Show Website: www.engineeringdesignshows.co.uk
3rd Automotive World October 21-23, 2020 Portmesse Nagoya, Japan	Exhibition and conference for advanced automotive technologies	Reed Exhibitions Japan Ltd Website: www.automotiveworld-nagoya.jp/en-gb.html
Light + LED Expo India 2020 December 3-5, 2020 Pragati Maidan, New Delhi	Will have Future Zone for innovative products, Solar Zone, and Launch Zone for new products	Messe Frankfurt Trade Fairs India Private Limited Website: www.in.messefrankfurt.com Email: deepak.bohara@india.messefrankfurt.com
CES 2021 January 6-9, 2021 Las Vegas, Nevada	Global consumer electronics show	Consumer Technology Association Website: www.ces.tech
NEPCON JAPAN January 20-22, 2021 Tokyo International Exhibition Center, Tokyo	Asia's leading electronics tech show about R&D and manufacturing, including packaging, with seven concurrent specialised shows	Reed Exhibitions Japan Ltd Website: www.nepconjapan.jp/en
India Electronics Week February 3-5, 2021 Karnataka Trade Promotion Organisation, Bengaluru	Mega electronics and technology show with multiple co-located events including expositions, conference and seminars	EFY Enterprises Pvt Ltd Website: www.indiaelectronicsweek.com

Since this information is subject to change, especially due to coronavirus breakout, all those interested are advised to ascertain the details from the organisers before making any commitment.

also includes rising demand for factory automation and storage-operated material handling equipment and high demand from the energy utility sector.

EV market to reach 40.6 million units by 2026

The global electric vehicles (EVs) market size is projected to reach 40.6 million units by the end of 2026 as per a report by Fortune Business Insights. According to the report titled, 'Electric Vehicle Market Size, Share & Industry Analysis, By Type, By Vehicle Type and Regional Forecast, 2019-2026,' the market was worth 8.6 million units in 2018 and it will grow at a CAGR of 21.1 per cent during the forecast period.

The report says that electric vehicles make use of a high voltage battery that can store a huge volume of

energy. Using advanced concepts in the development of this battery will help in the adoption of electric vehicles over normal vehicles. These also come with benefits like low pollution and lesser operational and maintenance cost that leads to wider adoption globally.

As per the report, "The high investment in the development of the product, coupled with the emphasis on technological intervention, will have a positive impact on the growth of the market. The increasing awareness regarding environmental pollution among the government, as well as private organisations, will have a huge impact on the growth of the electric vehicle market. The efforts taken to maximise the production of electric cars and the presence of several large

scale manufacturers will emerge in favour of market growth."

The strict government regulations regarding greenhouse emissions will lead to better adoption of these over conventional vehicles.

India's clean air programs fuelling environmental sensors market

The environmental sensors market was valued at 1.28 billion dollars in 2018 and is expected to register a CAGR of over 9.25 per cent during the 2019 to 2024 period. The same, as per a MarketWatch Report, is poised to reach a value of 1.99 billion dollars by 2024.

"With the increase in pollution year on year through air, automobiles, etc environmental sensors market is seeing huge opportunities in forecast future. This is supplemented by the growth of Industry 4.0 because that is creating a market for environmental sensors," reads the report.

The environmental sensor market is fuelled by the growing number of government initiatives for curbing environmental pollution. For instance, the government has announced 6.37 billion rupees worth 'National Clean Air Programme' to improve the air quality in India.

The market, as per the report, is also witnessing a shift from the standalone sensors to integrated sensors that are widely used to measure temperature, humidity, dust intensity, UV radiation, and other environmental parameters.

PEDA announces tender for 19,000 LED solar streetlights

The Punjab Energy Development Agency (PEDA) has issued a tender for 19,000 solar streetlights in the state. This is under the Ministry of New and Renewable Energy's (MNRE) off-grid and decentralised solar photovoltaic (PV) program.

The scope of the work will include supply, installation, and commissioning of solar streetlights with five years of repair and maintenance. The interested bidders are expected to make an earnest money deposit (EMD) of three million rupees. The techno-commercial bids will be opened on May 29, 2020.

The tender states that the tentative quantity is 19,000 solar lights. But this may be increased or decreased by

Lava to shift operations from China to India

Lava International, citing the government of India's production linked incentive (PLI) scheme, has decided to shift its operations from China to India. The company plans to completely shift its mobile R&D, design, and manufacturing operations to the country in the next six months. As part of the long-term plan, the India-headquartered mobile handset company will invest a total of ₹ 8 billion in the next five years. It is to be noted here that Lava exports over 33 per cent of its phones to markets such as Mexico, Africa, Southeast Asia, and West Asia.

STMicroelectronics joins Zhaga Consortium

STMicroelectronics has become an Associate member of Zhaga Consortium. It aims to advance the deployment of Near Field Communication (NFC) technology in the industrial lighting market. Sylvain Fidelis, head of marketing and application for NFC Tags and Readers, STMicroelectronics says, "With the Zhaga Consortium, the lighting industry is paving the way towards harmonised and interoperable us-

age of NFC technology, driving new opportunities to enhance lighting-equipment connectivity."

Mouser signs global deal with Fortebit

Mouser Electronics has announced signing of a global distribution agreement with Fortebit. The latter is a designer and manufacturer of solutions for embedding voice recognition, speech playback capabilities, and location services. Through the agreement, the Fortebit product line available from Mouser includes the EasyVR 3 Plus speech recognition devices and Polaris vehicle IoT platform.

Volkswagen partners with Northvolt AB for EV battery

Volkswagen has announced that its battery joint venture with Swedish battery producer Northvolt is moving forward and it will start production of lithium-ion cells in Salzgitter in early 2024. Construction of this manufacturing plant is scheduled to commence in Salzgitter in 2020 and production is planned for the beginning of 2024. This facility will come with an annual production capacity of around 16GWh.

PEDA. To be eligible, the bidder should be involved in the business for the minimum last three years in either LED street-lighting projects, solar power projects, or as any SL EPC contractor. The annual turnover of the bidder should have been at least 71 million rupees in each financial year during the last three financial years. The bidder should also be profitable in the last two financial years (2017-18 and 2018-19).

NTPC and ONGC collaborate for renewable energy business

NTPC Ltd, the PSU under Ministry of Power and Oil, and Natural Gas Corporation Limited (ONGC), the PSU under Ministry of Petroleum & Natural Gas, have signed a Memorandum of Understanding (MoU) to set up a joint venture company for renewable energy business. The MoU, as the duo informed, will enable both companies to accelerate their footprint in renewable energy.

The MoU was signed by A.K. Gupta, director (Commercial) NTPC and Subhash Kumar, director (Finance) and in-charge business development and joint venture, ONGC. As per the MoU, NTPC and ONGC will explore the setting up of offshore wind and other renewable energy projects in India and overseas. They shall also explore opportunities in the fields of sustainability, storage, E-mobility and ESG (environmental, social and governance) compliant projects.

NTPC presently has 920MW of installed renewable power projects in its portfolio and about 2300MW of RE projects under construction. With this tie-up, NTPC would accelerate its RE capacity addition programme and

also expand its footprint in offshore wind and overseas renewable energy projects. This will help India's largest power generator achieve its ambitious target of 32GW of renewable energy projects by 2032.

Medical semiconductor segment growing faster

The worldwide semiconductor market, as per a new report by Omdia, is expected to decline by five per cent in 2020, excluding memory ICs. With memory included, global revenue for the overall market will total 439.3 billion dollars in 2020, up 2.5 per cent from 428.5 billion dollars in 2019. This is a significant reduction from the previous Omdia forecast of 5.5 per cent growth for this year.

The medical electronics semiconductor market, as per the report, will total 6 billion dollars in 2020, up from 5.6 billion dollars in 2019. In revenue terms, the ventilator market this year will be worth 4.6 billion dollars, a hefty increase of 71 per cent from 2.7 billion dollars in 2019.

A major growth driver for medical semiconductors will be ventilator equipment used to treat Covid-19 patients. Worldwide, ventilator shipments are projected to reach a total of 691,840 units for the year, up 60 per cent from 430,843 units in 2019.

The medical semiconductor segment will continue to grow faster than the overall industrial semiconductor market in 2021 and beyond, driven by long-term trends such as the aging population, the increasing use of telehealth, the move to portable and wearable devices, and the rise of artificial intelligence (AI).

Apple could shift 20 per cent production to India

Apple is examining a proposal to shift nearly 20 per cent of its production capacity from China to India and boost up its local manufacturing capabilities through its contract manufacturers, as per a report published in The Economic Times. The report also says that it aims to achieve 40 billion dollars' worth of production over the next five years.

The report further adds that sources close to the company's plans said that there are few reservations on the government's production incentive (PLI) scheme. It was recently announced to incentivise local handset manufacturing and exports.

In March this year, the government approved PLI scheme for large scale electronics manufacturing. The scheme includes incentives for players manufacturing mobile phones in India. It also encompasses specified electronic components including assembly, testing, marking and packaging (ATMP) units.

As per the report, officials in the government said that they will look into all the concerns as the centre is focussed on bringing hi-tech manufacturing to India. Prime Minister Narendra Modi met top executives of Apple, Samsung, and Lava on December 28 last year to start the process.

A report by International Data Corporation said that in 2018-19, Apple held a 38 per cent market share of global handset exports. Samsung took second place with a 22 per cent share. A company has to manufacture at least 10 billion dollars' worth mobile phones in a phased manner between 2020 and 2025 to avail of the benefits of the PLI scheme. The applicant has to meet the targets on a yearly basis.



Startup Zone

- 1 An Autonomous AI Companion Robot
- 2 Intelligent Logistics
- 3 3D Bioprinting For Organ Transplantation
- 4 Contact-Free IoT Biosensors For Patient Monitoring
- 5 A Solution To Fight The Mosquito Menace

1 AN AUTONOMOUS AI COMPANION ROBOT

Robots, though initially used for purposes like manufacturing in factories, are slowly finding their way more often in workplaces and homes for day-to-day work. After realising how troublesome it can be for older people to perform basic tasks with their own hands, Yossi Wolf, co-founder of Roboteam, designed the autonomous personal artificial intelligence (AI) assistant robot Temi that offers high performance with minimal power consumption.

Weighing 12kg, the robot (100cm × 35cm × 45cm) has a 25.65cm HD LCD screen with fingerprint-resistant coating and autonomous face tracking screen tilt (15° ~ + 55°). It uses Robox autonomous navigation system for 3D mapping, user detection and tracking, obstacle avoidance, path planning, and so on. This enables mobility and stability over any kind of surfaces such as hard floors, rugs, tiles, and room transitions; its adaptive motor control allows adjustment of torque accordingly. A system of sensors (like 360 degrees LIDAR, depth cameras, RGB camera, proximity sensors) is present to sense an obstacle and move around it as well as algorithms to stop if it cannot be avoided, such as a staircase. The system supports both Bluetooth and Wi-Fi connectivity.

The built-in AI feature lets users utilise Amazon's 'Alexa' or 'Hey temi' as a voice assistant within their applications. It has auto speech recognition (ASR) and far-field voice technology, natural language processing (NLP), speech-to-text, and text-to-speech (TTS) engines to respond to the user.

Multiple cameras (13MP high-resolution camera, 13MP wide camera for remote navigation, and a time-of-flight (TOF) depth camera) are available for capturing images.

Other features include four omnidirectional digital mics with acoustic echo cancellation and environment noise reduction; lithium-ion battery with up to eight hours of operation per charge and a docking station for recharging; 20W audio with one subwoofer, two midrange speakers, two tweeters, passive radiators, and high fidelity equaliser; custom tires with a zero-turn radius and a speed up to one metre per second, among others.

The temi app (available for free on iOS and Android) enables users to control the bot from anywhere in the world and virtually move through their homes to make sure everything is fine in their absence. The app supports English, Japanese, Korean, simplified Chinese, along with the inclusion of Thai and traditional Chinese in the latest version. The software gets updated over-the-air whenever needed. The app allows users to interact and share photos and videos instantly with people who do not have the assistant.

The bot can identify and follow when asked, save preset locations, and navigate around autonomously while simultaneously controlling all smart home devices and connecting users to other people through its dynamic audio and video feature and web services. User data is fully encrypted with the latest standards when sent over the Internet or saved



in the cloud storage platform.

Besides being a personal robot for home use, it serves as an engagement solution for retail, hospitality, enterprise, education, healthcare, entertainment, and so on. Recently, the US-based startup announced a global partnership with Connected Living community in response to the Covid-19 pandemic.

—Ayushee Sharma

2 INTELLIGENT LOGISTICS

With the coronavirus pandemic causing a lockdown, our reliance on doorstep delivery has surged and, naturally, companies that are delivering essential items are now facing major stress on their supply chain. Technology can be a great enabler to navigate through these tough times. It ensures that deliveries reach us, while we work safely from our homes.

The customer can choose to get the expected time of arrival (ETA) alerts. This will ensure that the customer is prepared to collect the parcel with the already existing tracking link. Sharing driver information, digital transactions instead of cash-on-delivery, and one-time password (OTP) verification at the time of delivery, adds an additional layer of security to our packages.

Businesses should be ready to deal with uncertainties now, more than ever. Think of the worst case, best case and conservative case scenarios and arrive at the possible impact on your logistics for each use case—fleet required, number of drivers to be deployed, impact on fuel cost, warehousing needs, inventory management, etc.

Locus is the advanced supply chain decision-making engine that reduces costs, achieves order prioritisation, and enhances customer experience. Its geocoding engine converts the most ambiguous addresses into precise geographical coordinates with

location tagging and geospatial-heat maps. Addresses are mapped correctly irrespective of the quality of address, leaving no room for error, thus avoiding misroute. It automatically directs your fleet/driver to use alternative and safer routes.

Locus helps to keep track on-ground resources and get instant alerts in case of any deviation from the planned route, exceeding break times, undesigned halts, dynamic alerts for maximum and minimum temperature, etc. Smart alerts allow the rider to mark any order completion to ensure optimal utilisation of resources, and thus reduce costs. It improves customer experience by informing them beforehand about potential delays with predictive alerts.

Live tracking provides delivery details and allows the dashboard admin to take a service level agreement (SLA) to breach corrective measures with transparency. It provides details like the current latitude and longitude, estimated time of arrival, contact details of customer care and the driver, resulting in enhanced customer experience.

Enroute Analytics allow comparing planned vs executed delivery routes. This helps to observe the driver's riding behaviour and analyse



this compliance with the given plan. It lets you understand the rider's deviations from the plan to eradicate frauds.

Locus Dispatcher is an advanced and powerful route optimisation software. It does artificial intelligence (AI) backed route planning that has a negligible dependency on human intelligence. It supports on-demand dispatch planning and optimal handling of orders along with scheduled routing on the go. It provides automated recommendations on the best-suited vehicles based on traffic, volume, shipment, vehicle type, delivery times, stop durations, and more.

Locus software has a detailed, easy-to-use UI that is available for both iOS and Android mobile users. It provides electronic proof of delivery such as customer signature, product image, or QR code at the point of sale to authenticate your deliveries. It enables easy rescheduling, cancelling of orders, or a part of the order for enhanced customer experience and reduced logistics costs.

—Deepshikha Shukla

3 3D BIOPRINTING FOR ORGAN TRANSPLANTATION

The medical world has been able to find remedies for most issues that were once life-threatening for mankind in the past century and some of it, if not all, could be truly possible due to rapid advancements in technology. Since the first-ever successful organ transplant, great improvements have been made to increase the success rate of trans-

plants. But the problem is that organ supply is not enough to suffice the demand, causing deaths from vital organ failure. 3D printing is being seen as the solution to this issue by researchers across the globe.

Next Big Innovation Labs, a Bengaluru startup founded in 2016, is working to develop innovative products and services for research

and development and clinical applications in this field. The team was awarded the Idea2POC grant as well as the Biotech Ignition grant under the BIRAC scheme in 2017. The founders initially began making maxillofacial 3D models for doctors with the help of patient-specific scans.

After realising the need for customisable implants, the team started



(Credit: www.sigmaaldrich.com)

out with a long-term aim to eliminate the demand-availability gap through 3D bioprinting. In this type of additive manufacturing, biomaterials like cells and other biocompatible materials are combined to form bioinks. After testing the suitability of bioinks, these are then printed to generate bodily structures such as tissues and organs that imitate natural ones.

The company launched its first product, the bioprinter Trivima, meaning three-dimensional in Sanskrit, at

Bengaluru Tech Summit in 2018. The design of most machine components was done using Autocad Fusion 360. The precise, customisable and lightweight 3D bioprinter specifically caters to the research requirements of individuals in the field of 3D bioprinting. Some examples include the development of tissue disease models

and 3D printed scaffolds, stem cell research, and the like. The possibility of varying print speed, temperatures, nozzle diameters, and parameters in various mechanisms helps researchers in better investigation of their topic of interest, which is not present in many other bioprinters in the market.

The startup has already expanded its business by setting up offices in Germany in 2018 and it looks forward to more such opportunities. It has also developed Innoskin human epidermis

(HE) using its patented 3D bioprinting technology, which is the first in the series of Innoskin products. Innoskin FT, which is the other variant, consists of dermal and epidermal components of the skin.

The challenge was to use the right materials that could combine to form human skin. The product can replace animal testing for cosmetic, chemical, agrochemical, and pharmaceutical sectors working on skin-related applications, which is the current standard method in most places. The company plans to offer it later on for clinical applications where 3D bioprinted tissue can be used as a skin graft to treat skin injuries, burn victims and other skin related damages.

Fully functional bioprinted organs will need to clear the necessary guidelines before being used as a transplant. But once this becomes successful, it will have a huge impact on the lives of common people by increasing availability and affordability.

—Deepshikha Shukla

4 CONTACT-FREE IoT BIOSENSORS FOR PATIENT MONITORING

It is often seen that late diagnosis of many diseases leads to loss of patients' lives. In most cases, monitoring key parameters like respiration and heart rates, and hence early prevention as a response to warning signs can lead to better patient care, reduced hospital stays, and lower costs.

This led to the establishment of Vitaletter in Israel in 2016 with an aim to enable continuous preventive monitoring of vital signs for predicting future health risks for every person. In order to achieve this, the company designed a comprehensive Internet of Things (IoT) patient monitoring platform with the same name. The integrated platform uses small, lightweight, contact-free IoT biosensors along with artificial intelligence (AI) software to ensure accuracy.

The mobile biosensor continuously monitors heart rate, respiration rate, and body

motion. It can be easily attached under the patient's bed or wheelchair without any discomfort as compared to already available pressure mats in the market. The biosensor is wirelessly connected to the integrated care management system. Data including reports and graphical data analysis is sent via Wi-Fi to the cloud based

machine-learning platform. It also alerts medical staff when a patient requires assistance. The alerts can be prioritised by the doctors so that the most important cases are not neglected while avoiding alarm fatigue. This ensures close monitoring without the need for one-to-one nursing care all the time.

The advanced cloud based alerting system provides real-time actionable information from anywhere and a customisable monitoring dashboard identifies the risk of falling signals to avoid falls before they happen, and tracks bed-time and turn movements for ulcer prevention. Monitoring is also done to send irregular breathing alerts and heart incident alerts, improve sleep quality, and predict epileptic seizures, among others.

The device is waterproof with no physical wear, and connects via Bluetooth or Wi-Fi



to standard or existing network infrastructure. The benefit is that the system is low-maintenance with no IT integration needed and the sensors are powered by mains or long-life batteries with wireless charging option, which makes it easy to reposition them. Security is ensured by encrypting all the stored data in secure Microsoft data centres. The modular nature of the system enables easy addition and reconfiguration of new sensors,

functions, and algorithms to adapt to several needs of the users.

Besides leveraging available hospital infrastructure, the mobile app allows users to access the Vitalerter platform and is available on both Android and iOS for free. The target is to serve long-term care facilities, hospitals, and telecare providers, and improve safety, productivity, and efficiency with personalised care.

No special training is needed for

the medical staff to start using the platform for advanced analytics. The startup claims an overall 42 per cent reduction in resident falls and 68 per cent reduction in a pressure ulcer. The system has been used in over ten thousand beds in Israel. Its adoption in other countries is also widely growing since it can be used for better management by integrating and not entirely replacing human assistance with AI.

—Deepshikha Shukla

5 A SOLUTION TO FIGHT THE MOSQUITO MENACE

When we think about the deadliest animals and insects in the world, snakes, sharks, crocodiles, spiders top our list of answers. Contrary to these beliefs, mosquitoes are the vectors for diseases like malaria, Zika, dengue, chikungunya, and yellow fever that are responsible for the largest number of human deaths every year. WHO reported 438,000 deaths caused by malaria alone in 2015. On World Mosquito Day 2018, Bill Gates mentioned that mosquitoes kill more people in a day than sharks do in a century.

Out of thousands of mosquito species, the disease-causing ones were primarily confined to the tropics earlier but global warming is causing them to move into more temperate zones. Dengue, which existed in only nine countries in the 1970s, is now endemic in 128 countries and affects around 96 million people each year, according to global data collated by WHO. From employing drones to vaccines, different techniques are being used to deal with the challenge.

Understanding the seriousness of the issue, an IIT-Madras incubated startup MGH Labs developed its first simple, non-toxic, sustainable innovation, Bogorchid with the aim of shrinking mosquito population to eradicate diseases by leveraging science and technology. Weighing nearly



one kg, one Bogorchid machine effectively covers up to 186 sq. metres area (approximately 2000 sq. feet) which is sufficient to get rid of mosquitoes in a home. It has a cord length of 3.2 metres and can be powered by a 230V source.

The extract in the machine uses several artificially generated non-toxic elements such as human odour, generally used by mosquitoes to identify their food, to attract and trap these insects in a suffocation chamber, killing them naturally. The user can see and count the number of mosquitoes that get caught and killed on a daily basis.

Existing solutions like repellants and electrical traps have some drawbacks. Repellants come in many forms

but work in a similar way. Mosquito mats, papers, coils, etc burn toxic chemicals to create the smell. In other cases, the liquid evaporated from a bottle creates deadly fumes to deal with the mosquitoes, which affect human health too. Electric traps use ultraviolet light to lure the mosquitoes and kill every insect that comes near the electric rod. The rod gets covered with insects after a period of time and starts emitting a foul odour. Mosquito bats and nets have their limitations, too.

Unlike these products, Bogorchid provides safety from mosquito-borne diseases with eighty per cent

efficiency, while ensuring that the surrounding air is free from germs and bacteria. It is designed in India keeping in mind the country's weather conditions. The chemical emits no smell, contains no harmful contents, and has no side effects. This makes it suitable for homes with children, elders, asthma, and sinus patients.

The original model was introduced in two colours at a price of ₹ 1887 per unit. The outdoor device comes with a fine mesh catch bag and can cover a maximum range of thirty metres. Separately, the refill bottles containing synthetic pheromone to mimic odour were priced at ₹ 150 per unit. Currently, the model is being revamped and not available for purchase. **EFY**

—Ayushee Sharma



“Entrepreneurs Should Never Give Up, But Take Calculated Risks And Be Open Minded”

Sheer determination and ambition kept him going even through challenging times. Vick Aggarwala, president and CEO of Supreme Components International (SCI), talks to Baishakhi Dutta about his career path that has taken him across the globe



Vick Aggarwala

president and CEO, Supreme Components International (SCI)

I was born and raised in Delhi, where I also completed my education. I have two brothers and three sisters. I am the fifth sibling. My father was a senior officer in the electronics directorate at DGTD, Udyog Bhawan, Delhi, government of India and my mother was a home maker.

I had initially planned on studying medicine and even qualified to go into pre-medical college in Hansraj College in Delhi. But then I got selected in Regional Engineering College, Kurukshetra, where I did electronics and communication engi-

neering in 1975. At that time, electronics was a relatively new subject, so I thought it would be better for me to enter this upcoming career line. Ours was the second batch of electronics and communication engineers in India with only about 400 passing out. I also earned a merit scholarship that covered the four years of my engineering degree.

My family

My wife Priti has been a professional Kathak dancer and has performed all over in India,

including at the Rashtrapati Bhawan. She's also a doctorate in homoeopathy from the British Institute of Pharmacy and has a master's in English Literature. Currently, she helps with the finance and operations of our company.

Our son Piyush is helping in growing our business for the LED lighting division. He is an electrical and computer engineer from the Rochester Institute of Technology, New York, USA. He lived in the US for 13 years before he returned to join our business six years back. My daughter is in Singapore. She graduated from Singapore University and is a director of one of the top marketing and advertising companies in the world. She is married with two beautiful daughters. We are all Indian-born, Canadian citizens as well as Singapore PRs (permanent residents).

The stepping stones in my career

After completing my education, I started out as an R&D engineer in the semiconductor company called Continental Device India Limited (CDIL) at Naraina, New Delhi. I very quickly moved into bigger roles, and was one of the few engineers chosen to bring in the colour TV technology into India, on behalf of CDIL. I got trained at various colour TV factories for months together in Germany before we introduced that technology into India.

After CDIL, I worked in Delhi on new projects in electronics, launching colour TV components and assemblies, and setting up colour TV accessory plants in India. I later became the CEO for the United Group, setting up the firm's colour TV plants in Bhopal. Once this was completed, I shifted to Canada in 1986, where I worked at Future Electronics for six years. After my 14 year stint at Future, I worked in Alcatel for just under two years, running its microelectronics division for the Asia-Pacific region and setting up all the sales and marketing offices in Asia, before the division got sold to STMicroelectronics and AMI.

I then decided to move back to

component distribution at NU Horizons (now Arrow Electronics) Asia-Pacific in 2002. After that, I acquired Supreme Components International and have been heading the company ever since.

The turning point in my life

Sheer determination and ambition have helped me evolve as a professional over the years. I think moving from India to Canada was a big eye-opener for me. I realised I was missing out on so many things while I was in India, where I had seen less than 1 per cent of what I encountered in the Canadian electronics industry—the systems, the processes, the procedures and so many other things. I also realised that being an Indian and a person of colour in a country dominated by Caucasians, I needed to work much harder to do better than the locals.

At that time I decided I would work even four times harder than the Caucasians in order to be at par or to get promoted. Those were challenging days, but I did it and eventually even employed the local people. There was a time when I had Americans, Canadians, Germans, Japanese, Thais, Filipinos and others working for me. After that, I moved back to Asia, opening up 40 offices in 13 countries with three distribution centres in Asia-Pacific.

The milestones

My key contribution to the industry is in bringing the North American distributors to the Asia Pacific region. Future Electronics was the first one to come to Asia and set up operations in Singapore, followed by offices in Hong Kong, Taiwan, Korea, India and, finally, Japan. In 1993, Arrow Electronics entered Hong Kong by acquiring local firms in the city. So it bought Component Agent Limited in Hong Kong, which was the National Semiconductor distributor at that time. Avnet also came to the region in 1994 by acquiring Texny (Texas Instruments' distributor) in Hong Kong. I am happy that I got a chance to play a big part in this revolution.

When I moved to Canada, I was told to change my name, since people found it difficult to pronounce it—at my workplace as well as among North American customers. I was in need of a job as I had to look after my family back in India, and going back was not an option for me. However, I didn't want to lose my Indian identity. So I thought a lot about this and came up with an idea. I did not want to give up the alphabets that comprised my Indian name.

Also, I was working in the component industry which was very close to my heart. Hence, combining the two, I decided my new name was going to be 'Vick'. The alphabets 'V' and 'K' were in my original name and 'IC' represented the industry that I worked in. That's how Vick Aggarwala was born—a name that now has strong brand equity of its own in the electronic components industry internationally.

I believe in leading by example. I firmly believe that persistence and perseverance are important traits, and so is integrity. Also, people with the hunger for success are driven by a high level of energy and a positive attitude.

A few years down the line, on the professional front, I would like to make sure that Supreme Components International is among the top 50 global distributors in the world.

From the personal point of view, it will be important to ensure that I continue to be healthy and fit. That's one of my goals so that I can continue to serve the industry and continue to give back to society.

Advice to entrepreneurs

There is a lot to be done in the components industry. One should find out the possibilities of addressing existing challenges to create a much stronger ecosystem. Also, entrepreneurs should never give up. My advice to them would be, "Take calculated risks and be open minded. You don't know what you can get away with until you try. Give it a shot." **EFY**

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Drones Market Still Nascent But Rapid Growth Likely

Drones/unmanned aerial vehicles are now being used in several commercial applications such as news coverage, delivery of goods and environmental monitoring. Amidst the outbreak of the Covid-19 pandemic, the use of drone technology has increased in government organisations such as defence and police force, but their demand can increase exponentially for e-commerce and logistics

Nijhum Rudra and
Deepshikha Shukla

With the massive popularity and development of unmanned aerial vehicle (UAV) technology over the past few years, the Directorate General of Civil Aviation (DGCA) has taken several initiatives to introduce drones in the commercial air space. With this step, the deliveries by drones have gained momentum over the past couple of years. Solutions by drones are now applied in various sectors,

for commercial purposes, and also by the government in their defence space. Currently, the DGCA has approved the manufacturing of drones by only a handful of companies. Hence, the number of logistic firms using drones is still less.

Drones are at present being tried across numerous commercial applications such as news coverage, emergency services, delivery of goods, Wi-Fi access,

and environmental monitoring. Hence, scores of global companies are now experimenting with drone technology to provide state-of-the-art services, and various steps are being taken to make it more popular in the coming years. In the past few years, technologies such as machine learning, artificial intelligence (AI), GPS, and other new technologies have massively improved the functioning and efficiency of drones in the logistics industry. E-commerce and logistics companies are constantly trying to introduce more innovations among drones.

Scope for drone manufacturing industry in India

Currently, with the outbreak of Covid-19 pandemic, homeland security department has understood the requirement of blending security framework with this cutting-edge technology. The department's interest in drones has escalated massively for an impeccable security-proofing and surveillance.

In the past, there was a massive lack of regulation that posed a major impediment. It is now being slowly tackled with the introduction of civil aviation requirements. Moreover, the difficulty in obtaining drones for public sector firms will now decrease with the introduction of drones as a separate category in Government e-Marketplace (GeM).

Several drones are being used during Covid-19 pandemic, which will push its growth rate all over the world, especially in India. According to market experts, government organisa-

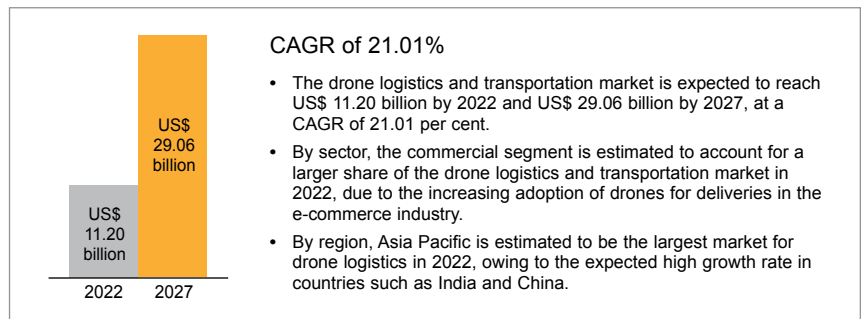


Fig. 1: Opportunities in drone logistics and transportation market (Credit: www.marketsandmarkets.com)

tions such as police force and defence would start buying drones in huge numbers. Therefore the DGCA drones in the surveillance sectors could witness rapid growth soon.

Amit Thokal, marketing manager at IdeaForge, states, "We are creating high-performance, safe, and autonomous unmanned aerial systems that enhance productivity and safety. Our aim is to increase the adoption of drones in India for public safety, security and surveillance, and emergency response and create an ecosystem that enhances the quality of life. We are India's one of the largest manufacturers of drones for defence, homeland security, and industrial applications. IdeaForge has over 90 per cent share in India in the security and surveillance market of homegrown drones. We are also a major player in surveying and mapping, precision agriculture, asset inspection, and disaster management."

Glenford V D'Souza, senior general manager - LYNX: Lawrence & Mayo, says, "With the prevailing Covid-19 situation, we are certain that the use of this versatile technology would be

better seen and experienced by the health authorities and the police. Our drones are extensively helping the law authorities in several parts of the city for providing surveillance and security in areas that were hard to reach."

Potential market areas of drone

The benefits of using a drone are varied and large. It reduces manpower and helps speed up operations, especially in the defence sector. Also, drones assist police in monitoring large crowds, tracking vehicles, and ensuring social distancing during Covid-19. Drones fitted with radio-active cameras/radiometric thermal imaging sensors can even be used to measure the temperature of individuals by flying at lower heights.

Drones, which are capable of flying distances ranging from two to four kilometres, are able to capture still images and videos to gather information about specific targets such as individuals, groups or environments. Their surveillance abilities enable surreptitiously gathering information about a target as captured from a distance or altitude.

The drone logistics and transportation market is segmented by solution—warehousing, infrastructure, shipping, or software; sector—military, or commercial; drone type—passenger drones, freight drones, or ambulance drones; and geography. Over time drones will become part and parcel of households and industries. Additionally, there are several other applications that are currently being explored to make these even more dynamic. For now, drones are being used mostly in the following sectors:

- Aerial photography for journalism and film making



Fig. 2: Drone logistics and transportation market growth rate by region during 2020-2025 (Credit: Mordor Intelligence)

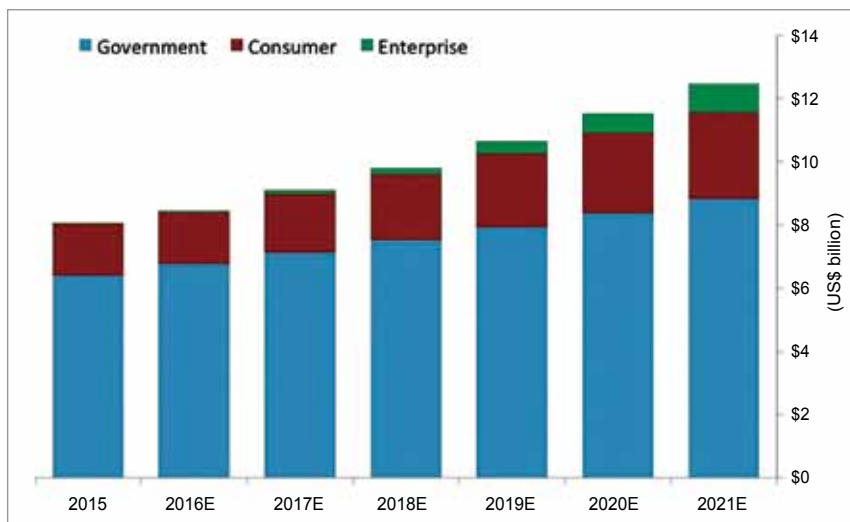


Fig. 3: Estimated global investment in drone hardware (Credit: BI Intelligence)

- Gathering information or supplying essentials for disaster management

- Thermal sensor drones for search and rescue operations

- Geographic mapping of inaccessible terrain and locations

- Precision crop monitoring

- Law enforcement and border control surveillance, and building safety inspections

- Storm tracking and forecasting hurricanes and tornadoes

- Surveillance by defence, police, large public sectors, security departments, and railways.

- Mapping large areas in land survey, surveying and mapping by Survey of India, mining industry, land records, etc

D'Souza adds, "Drones use significantly less manpower, thereby reducing long-term costs. Indian Railways is using UAVs for inspection and 3D mapping to bring to life their vision of a dedicated freight corridor. Heavy-duty drones offer much smoother management of inventory and have the ability to move the inventory easily from one warehouse to another. The upcoming biggest jump of technology will be the usage of drones in logistics. Nowadays, the biggest commercial usage of drones is the last-mile delivery with the usage of drones."

Global drone market forecasts

According to a study by Market-sandmarkets, the drone logistics and transportation market is expected to

reach 11.20 billion dollars by 2022 and 29.06 billion dollars by 2027, at a compound annual growth rate (CAGR) of 21.01 per cent during the period. McKinsey predicts that AVs, including the delivery drones, will make up to 80 per cent of deliveries in the future, while NASA estimates that 2.6 million commercial drones will be in the air in 2020 itself.

According to a recent report by Goldman Sachs, the global drone market is projected to be a 100 billion dollars opportunity by 2020. Key market spending will include: military—70 billion dollars, consumer—17 billion dollars, and commercial/civil—13 billion dollars, with the last offering the fastest growth opportunity.

According to Mordor Intelligence, the drone logistics and transportation market would register a CAGR of over 20 per cent during the period 2020-2025.

A recent study from IDC's Customer Insights & Analysis mentions that, worldwide drone spending was 9.3 billion dollars in 2018 and is expected to grow at a faster rate than the overall market with a five-year CAGR of 32.1 per cent. Throughout this period, enterprise drone solutions are expected to incur more than half of all the drone spending as more interests and demand appear from consumer drone solutions. Category wise, the largest demand of drones during this period will be from precision agriculture/crop scouting (86.1

per cent CAGR), emergency service (86.4 per cent CAGR), and dispensing pesticides and fertilizers (109.4 per cent CAGR).

According to BI Intelligence, the commercial and civilian drone market has been growing at a CAGR of 19 per cent between 2015 and 2020. That dwarfs the CAGR of 5 per cent for military drones, which is just a fraction of the overall drone market.

The Federal Aviation Administration (FAA) forecasts that sales of commercial drones will reach 2.7 million by 2020 end, while the total number of UAVs seen in the sky will be around seven million during the same period. Currently, the largest application of commercial drones is in the field of video and still photography. But, a report from Global Market Insights highlights that the global commercial drone market will reach 17 billion dollars by 2024.

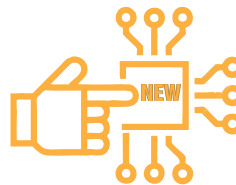
Growth of drones in Indian market

Currently, both the market and drone industry in India are at a very nascent stage. But, according to experts, their potential for growth in India is colossal. In India, between 2017-2023, the expected growth rate of the drone market would be eighteen per cent annum, claims 6Wresearch.

D'Souza says, "In India, the commercial use of drones has been limited by policy paralysis. But now, the Ministry of Civil Aviation has come up with a policy around drones and their commercial use."

According to a study by Unearth-Insight, there are about 100 drone startups in India, 681 in the United States and 129 in China. The drone market is still nascent world over, but rapidly growing with game-changing innovations yet to come.

In terms of creating new jobs, drones offer huge potential for engineers, UAV operators, pilots, and data analysis and processing experts. The potential for a job could be both full-time and contract-based, also opening the doors of internships for many. In this regard, FICCI and EY clearly mention that the UAV market will touch 885.7 million dollars in India by 2021 while the global market size will be 21.47 billion dollars. **EFY**



COMPONENTS

5G chip

MediaTek has announced Dimensity 820 system-on-chip (SoC) that delivers ultra-fast 5G speed and is feature-packed with



the latest multimedia, artificial intelligence (AI), and imaging innovations, offering enhanced user experience. It is equipped with high-

performance Arm Mali G57 GPU graphics and HyperEngine 2.0 enhancements that offer an extraordinary gaming experience on mobile phones.

The Dimensity 820 integrates a 5G NR (sub-6GHz) modem into this single-chip solution with MediaTek's 5G UltraSave technologies, including exclusive 5G UltraSave network environment detection and 5G UltraSave OTA content awareness that altogether provides best-in-class energy efficiency. The 5G modem design also uses dynamic bandwidth part (BWP) adaptation and connected mode discontinuous reception (C-DRX) power-saving technologies.

It supports dual SIM, dual standby (DSDS) 5G technology, and voice over new radio (VoNR) services on both SIMs. It has been designed for global sub-6GHz 5G networks in Asia, North America, and Europe.

MediaTek

www.mediatek.com

DC-DC converter

Xilinx has launched a 20-nanometer (nm) space-grade FPGA, the Kintex-UltraScale XQRKU060 that delivers full radiation tolerance, ultra-high



throughput, and bandwidth performance for satellite and space applications. It also provides true unlimited

on-orbit reconfiguration, which is ideal for payload applications and full radiation tolerance across all orbits.

The launch of XQRKU060 for space

applications delivers a significant reduction in size, weight, and power. It is engineered with robust radiation-tolerant features. The XQRKU060 provides customers with a space-resilient device equipped to handle both short and long duration missions in harsh space environments.

It is equipped with 2,760 UltraScale DSP processors and provides up to 1.6 TeraMACs of signal processing computing as well as dramatic efficiency gains for floating-point computations. The increased compute capability in space is paired with massive I/O bandwidth from 32 high-speed transceivers (SerDes) that can run up to 12.5Gbps to deliver 400Gbps aggregate bandwidth.

Xilinx

www.xilinx.com

IoT eSim

Cellular connectivity allows easy deployment and management of Internet of Things (IoT) devices by businesses due to its progressive infrastructure. To enable even better connectivity, OPTIGA



Connect eSIM has been launched by Infineon for cellular-connected IoT devices. Its small size aims to provide flexibility to device makers and manufacturers.

It enables hundred times faster data transmission and 1000 times greater data capacity coupled with heavy data encryption and mutual authentication of devices and networks at the same time. It is available in two forms - OPTIGA Connect Consumer and OPTIGA Connect IoT. Launched in March this year, the OPTIGA Connect Consumer allows consumer devices to connect to mobile network operators. It is 5G ready and provides security according to GSMA requirements.

The newest member in the OPTIGA Connect solution, OPTIGA Connect

IoT is based on leading-edge security hardware and comes pre-loaded with worldwide bootstrap connectivity.

Infineon

www.infineon.com

MCU with Bluetooth 5.0

Renesas Electronics has launched the first RA microcontroller (MCU) with an integrated Bluetooth 5.0 low energy

radio. The single-chip RA4W1 MCU includes a 48 MHz, 32-bit Arm Cortex-M4 core, and Bluetooth 5.0 core delivered in a 56-pin QFN package. Together, the RA4W1 MCU and easy-to-use flexible software package (FSP) enable engineers to immediately begin development with Arm ecosystem software and hardware building blocks that work out-of-the-box with RA MCUs.



The RA4W1 MCU makes it easy for embedded designers to develop safe and secure IoT endpoint devices for Industry 4.0, building automation, metering, healthcare, consumer wearable, and home appliance applications. The MCU is also ideal for developing IoT edge devices for wireless sensor networks, IoT hubs, and an add-on to gateways.

The RA4W1 MCU features field upgradeable 512kB flash memory, 96 kB SRAM, and connectivity such as USB, CAN, and HMI capacitive touch technology.

It includes full Bluetooth 5.0 functions such as 2Mbps data throughput, all advertising extension functions with maximum advertising length (1650 byte), periodic advertisements, and channel selection algorithm #2 for applications requiring large traffic.

Renesas

www.renesas.com

Motion sensor

TDK Corporation has launched a high-performance motion sensor, the InvenSense ICM-42688-P. It is a 6-axis MEMS

motion tracking device that comprises a 3-axis gyroscope and a 3-axis accelerometer. The device enables high-precision motion sensing for applications such as robotics, wearable devices, drones, and many other IoT devices.



Compared to traditional consumer-grade IMUs, the ICM-42688-P provides a forty per cent lower noise-figure and improves temperature stability by 2x. This ensures that any motion event is measured with the highest accuracy and is independent of temperature changes.

The ICM-42688-P also includes a 100 per cent accurate clock and high-resolution analogue-to-digital converter. The converter facilitates an 8x increase in gyroscope resolution and a 4x increase in accelerometer resolution.

It is specifically designed with a focus on their tier-1 and channel customers, who care about high-precision and best-in-class sensors performance.

TDK

www.tdk.com

Notebook processor

AMD has announced the global availability of 7nm commercial notebook processors, the AMD Ryzen PRO 4000 Series Mobile family that delivers the most cores



and threads in an ultrathin business notebook. These new processors are fully optimised for remote work capabilities and designed to take business computing to the next level with multi-threading performance for modern productivity.

The AMD Ryzen PRO 4000 Series mobile processors are designed to deliver advanced computing and security. AMD Ryzen 7 PRO 4750U is the fastest business processor for ultra-thin business notebooks, with up to eight cores and sixteen threads and up to 33 per cent better multi-threaded performance compared to the competition. It delivers a responsive and power-efficient solution, with up to 37 per cent better overall performance in Microsoft Office applications over the previous generation.

Built with untethered productivity in mind, along with the advanced 7nm

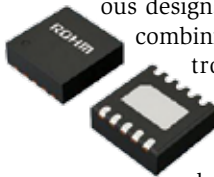
process and Zen 2 core architecture, the AMD Ryzen 7 PRO 4750U delivers up to 2x performance per watt over the previous generation.

AMD

www.amd.com

LED driver IC

Automotive lamps are increasingly adopting LEDs due to their longer life and high-density mounting. Conventional onboard LEDs support various designs and functions by combining numerous electronic components



on a modular substrate. Also, socket-type LED lamps have been attracting attention by offering superior maintainability. However, it is difficult to decrease the socket size for better design flexibility.

In response, ROHM has developed a new, compact, and high output linear LED driver IC, BD18336NUF-M. It enables mounting in ultra-compact socket-type LED lamp circuits while ensuring stable lighting even during a drop in battery voltage. It is ideal for a broad range of socket-type LED lamps used in vehicle systems, from DRLs (Daytime Running Lamps) and position lighting to rear lamps.

The BD18336NUF-M has a current bypass function that prevents LED turn off. A smooth switching of the LED lighting path occurs through which current flows from three lamps to two without flickering when the supply voltage from the vehicle battery drops to 9V and maintains thirty per cent brightness at all times. This function can be configured using three external resistors (for the operating start voltage and operating interval), providing greater flexibility for a wide range of applications.

for the operating start voltage and operating interval), providing greater flexibility for a wide range of applications.

ROHM

www.rohm.com

POWER SUPPLIES

Power management ICs

Silicon Labs has announced a new line of energy-friendly power management ICs (PMICs) for EFR32 wireless devices and EFM32 microcontrollers (MCUs). The EFP01 PMIC family provides a

flexible and system-level power management solution enhancing the energy efficiency of battery-powered applications including IoT sensors, asset



tags, smart meters, and health and wellness products. These feature-rich PMICs enable developers to choose the optimal battery

type and chemistries for their applications while controlling a product's power supply over multiple output rails and voltages.

Silicon Labs' PMIC solution addresses the power management needs of IoT developers by extending the energy efficiency of its wireless and MCU products while simplifying product design with best-in-class tools and support.

EFP01 PMICs simplify the power system design and reduce power consumption through enhanced control. The PMICs include low-voltage DC-DC converters and regulators, along with a flexible mechanism to manage the power rails in system design.

Silicon Labs

www.silabs.com

Wi-Fi SoC

Dialog Semiconductor, a leading provider of battery management, has announced the availability of



the DA16200, a highly-integrated and ultra-low-power Wi-Fi networking SoC to deliver a breakthrough in battery life for Wi-Fi connected battery-powered IoT devices.

Unlike other Wi-Fi SoCs, the DA16200 is specifically optimised to support such battery-powered IoT devices. DA16200's VirtualZero technology enables a low level of power consumption that makes it achieve three to five years of battery life. The SoC utilises an algorithm-driven design to provide the lowest power solution for facilitating an extended battery life, while also maintaining a continuous Wi-Fi connection.

To achieve extended range without compromising battery life, the DA16200 also features an integrated power amplifier (PA) and low-noise amplifier (LNA),

offering users industry-leading output power and receiver sensitivity.

Dialog Semiconductor
www.dialog-semiconductor.com

Battery protector

Littelfuse has announced the launch of ITV series, a three-terminal, surface-mountable li-ion battery protector, designed to guard against the damage caused by both overcurrent and overcharging. The innovative design provides fast response and reliable performance to interrupt the charging or discharging circuit before the battery pack becomes overcharged or overheated.

The ITV series helps to solve customer applications requiring current ratings from 12A to 45A. An embedded fuse element cuts off the circuit when overcurrent issues occur. A heater element, directly embedded under the fuse element, generates enough heat to blow the fuse once overcharging is detected by IC or FET.

The ITV series battery protectors are now available in five compact and surface-mount packages in current ratings of 12A, 15A, 30A and 45A.

Littlefuse
www.littelfuse.com

TEST & MEASUREMENT

Oscilloscope

Keysight Technologies has launched a new and enhanced family of oscilloscopes that has up to 6GHz of bandwidth and 16GSa/s across eight channels.



The MXR-series is an upgrade from previous versions in terms of ADC resolution. It also includes eight powerful instruments into one: real-time spectrum analyser (RTSA), oscilloscope, digital voltmeter (DVM), waveform generator, Bode plotter, counter, protocol analyser, and logic analyser.

The MXR series is equipped with fault hunter software, which automatically detects and captures signal issues with just two clicks, comparing them over time. This results in rapid problem

resolution for troubleshooting irregular, random, or spurious signals. The Pathwave Infiniium offline software allows remote access to the oscilloscope, enabling engineers to do extensive analysis and data manipulation of measurements from anywhere.

The series is offered in six models ranging from 500MHz to 6GHz with both 4 and 8 channels. It helps engineers to demodulate, analyse, and perform advanced analysis on complex signals for reliable measurements.

Keysight
www.keysight.com

Phase noise analyser

To help engineers and scientists make accurate measurements of frequency signals generated for 5G networks, data centres, commercial and military aircraft systems, space vehicles, communication satellites, and metrology applications, Microchip Technology has announced the new 53100A phase noise analyser.



This phase noise test instrument is capable of measuring radio frequency (RF) signals up to 200MHz. It is also capable of rapidly acquiring frequency signals and characterising the phase noise, jitter, Allan deviation (ADEV), and time deviation (TDEV) precisely within minutes.

The 53100A phase noise analyser enables a variety of configurations by allowing up to three separate devices to be tested simultaneously using a single reference, thus enabling higher capacity for stability measurements. It provides backward compatibility with Microchip's 51xxA test sets' command and data stream, which eliminates the need to redesign existing automated test equipment (ATE) infrastructure.

Microchip Technology
www.microchip.com

Pulse system source meter

Tektronix has announced the new 2601B-PULSE system source meter 10µs pulser/SMU instrument that integrates a high-speed current pulse with DC source and measurement functionalities in a single instrument. The

new system incorporates pulse meter technology for sourcing current pulses from 10µsec to 500µsec at 10A and 10V without manually tuning the output to match device impedance up to 3µH. This ensures that the current pulse has no overshoot or ringing, thus reducing device self-heating, which can result in erroneous measurements and potential damage to the test equipment. This results in fast rise time, accurate pulse output, and high fidelity.



The 2601B-PULSE system source meter simplifies the complications of testing vertical-cavity surface-emitting lasers (VCSELs), which are mission-critical for automotive light detection and ranging (LIDAR) applications. The instrument is ideal for testing VCSELs and LEDs, semiconductor device characterisation, fault power management testing, surge protection testing, and more.

Tektronix
www.in.tek.com

Signal generator

Keeping up with the excellent offering of test and measurement equipment, Siglent presents the new SSG5000X series of RF signal generators, an upgrade of the previous SSG3000X series in terms of the higher output frequency range.



They have a frequency range from 9kHz up to 4GHz or 6GHz, and feature industry-leading performance in phase noise, spectral purity, bandwidth, EVM, and output power. The internal IQ modulation generator and waveform playback generator cover the most important RF band for digital wireless communications and include standard waveform files. The series is available in four variants: SSG5040X, SSG5060X, SSG5040X-V, and SSG5060X-V.

With its powerful functions and wide frequency range, SSG5000X has abundant application fields, such as receiver tests, amplifier tests, IP3 measurement, and radar and digital modulation tests, spur and harmonics measurement, ACPR tests, and cable loss compensation.

Siglent
www.siglent.com



Do's and Don'ts Regarding Operation Of Drones

Unmanned Aircraft System (UAS)/Remotely Piloted Aircraft System (RPAS), commonly known as drone/UAV, is a new addition to the aviation sector. This technology has a promising effect on the economic growth of India; both manufacturing and service industries. As more people enter the commercial and recreational hobby drone scenes, the prospects for drone accidents/incidents also multiply. This applies not just to newcomers/amateurs but even to professionals. As per the regulation, there are five categories of RPAS categorised by weight, namely, nano, micro, small, medium, and large. Here are some operational safety tips to ensure that you have better and safer flying experience, not just for yourself but for the people around you

Do's	Don'ts
• Ensure your drone (except Nano in uncontrolled airspace up to 15 metres) is Digital Sky 'No Permission - No Take Off' (NPNT) Compliant • Obtain Unique Identification Number (UIN) from Directorate General of Civil Aviation (DGCA) for operating in controlled airspace and affix it on your drone • Obtain Unmanned Aircraft Operator Permit (UAOP), if applicable from DGCA for commercial operations and keep it handy • Obtain Permission before each flight through Digital Sky Platform • Ensure the drone is in good condition (not damaged) and fit for flying safely • Keep an eye on interference: Interference can be from mobile devices or blockage of signals, do watch out when flying your drone • Fly only during daylight (after sunrise to before sunset) • Fly in good weather: Good weather lets you not only fly your drone better but also keep track of it in the air • Fly in visual line of sight (VLOS): Always be within visual range of your drone • Follow flying guidelines • Do your homework before spending considerable money on a drone. Make sure you clearly understand all operational and regulatory aspects • Be aware of Airspace Restrictions/No Drone Zones • Do stay away from airports and heliports • Respect the privacy of people • Keep local police informed about your drone flying activity. If you are ever approached by police provide all requisite information. • Do log your flights and intimate concerned authorities (like DGCA, local police, etc) of any incidents/accidents	• Don't fly a nano drone above 15m (50ft) from the ground level • Don't fly a micro drone above 60m (200ft) from the ground level • Don't fly drones more than 120m (400ft) from the ground level • Don't fly a drone near other aircraft (manned or unmanned) • Don't fly a drone near airports and heliports • Don't fly a drone over groups of people, public events, or stadiums full of people without permission • Don't fly a drone over government facilities/military bases or over/ near any no-drone zones • Don't fly a drone over private property unless permission is given • Don't fly a drone in controlled airspace near airports without filing flight plan or AAI/ADC permission (at least 24 hours before actual operation) • Don't drop or carry hazardous material • Don't fly a drone under the influence of drugs or alcohol • Don't fly a drone from a moving vehicle, ship or aircraft

Source: <https://dgca.gov.in/digigov-portal>



Guidelines For Manufacturing Remotely Piloted Aircraft Systems In India

Although Manufacturers/OEMs of remotely piloted aircraft system(s) (RPAS) are not regulated through the Civil Aviation Requirements (CAR) Section 3, Series X, Part I, being a responsible entity, a manufacturer is expected to follow the procedure specified hereunder.

1. Apart from the indigenous manufacturers, the entity importing parts and assembling remotely piloted aircraft (RPA) in India (assembler) will also be considered as a manufacturer.

2. Manufacturers should ensure that their RPAs meet the minimum standards specified in the CAR.

3. Manufacturers should carry out necessary tests, as many as required. They may use the test sites specified in the CAR for carrying out such tests.

4. OEMs/manufacturers may alternatively utilise unused airstrips or government educational institution's campus, provided adequate safety precautions are in place. However, they need to ensure that no manned or unmanned aircraft is flying during such operations in the intended test area.

5. The manufacturers/OEMs of Nano RPA should prominently engrave/display the manufacturer's serial number. Also, they should appropriately geo-fence their nano RPA for 15 metres (50 feet) above ground level (AGL) ceiling.

6. The manufacturer/assembler of micro and above should comply with the NPNT (No Permission-No Takeoff) specifications.

7. If the RPA developed is in the nano or micro category, the minimum standards set by manufacturer/OEM will be considered. However, for the micro category, the manufacturer should certify compliance of the NPNT, equipment, and other standards specified in the CAR.

8. If the model developed is in the small or above category, the OEM/manufacture should use the checklist for the manufacture of small and above categories of RPAS (both Indian and foreign) and get it certified by certifying agency

by showing compliance to applicable standards. In addition, the manufacturer should submit a certificate of compliance.

9. Post-certification (by self or certifying agency), all models will be listed on the Digital Sky Platform with all requisite details. This will ensure that the user/operator/remote pilot picks the correct model from the list.

10. The manufacturer/OEM may obtain Equipment Type Approval (ETA) from Wireless Planning and Coordination Wing (WPC), DOT to facilitate the end-user, as the ETA is given for a particular type/model or lot in case of import.

11. The manufacturer should develop the following manuals: (a) RPA Flight Manual/Manufacturer's Operating Manual specifying operating conditions/limitations. (b) Maintenance manual/guidelines/procedure. (c) Maintenance inspection schedule/overhaul interval. (d) Self-explanatory information booklet for end-users.

12. The manufacturer should provide the self-explanatory information booklet to end-users in the RPAS package/box.

13. Maintenance and repair of RPAS should be carried out in accordance with manufacturers' approved procedures in authorised service centres of the manufacturer/OEM or remote pilot/operator. In the latter case, the OEM/manufacture should ensure that remote pilot/operator does not have unauthorised access to mandatory equipment/firmware (including NPNT).

14. Nano RPA Manufacturers/OEMs must ensure the traceability of the purchaser for every drone. Their agents/distributors must collect and safely store IDs at point of sale. Manufacturers should ensure that a record of serial numbers by distributor/agent is maintained and kept up to date. **EFY**

Source: <https://dgca.gov.in/digigov-portal>

Latest guidelines are now available at https://www.civilaviation.gov.in/sites/default/files/Draft_UAS_Rules_2020.pdf

Software For DRONES AND QUADCOPTERS

Free Daily Utility Tools

- + Office tools: Apache OpenOffice (www.openoffice.org)
- + Zipping software: WinZip (www.winzip.com)
- + Browser: Mozilla Firefox (www.mozilla.org)
- + PDF Reader: Adobe Acrobat Reader DC (get.adobe.com)
- + Media player: PotPlayer (potplayer.daum.net)

Ayushee Sharma

PX4

Visit: <https://px4.io/#>
Full version: Free

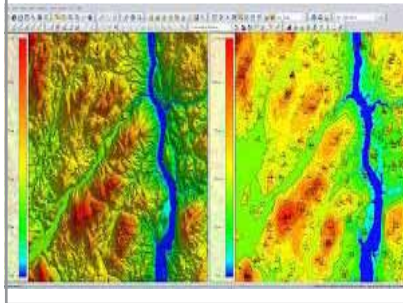
PX4 is a free, open-source software used for flight control while operating drones and other unmanned aerial vehicles (UAVs). The framework offers a set of optimised application programming interfaces (APIs) and software development kits (SDKs) that allows developers to create scalable and tailored solutions for various related applications. When integrated with embedded computer vision, it becomes easier to work on localisation and obstacle detection algorithms. Besides several tests that are performed regularly to ensure the codebase's safety and reliability, automated failsafe behaviour, support for different return modes, parachutes, and more are also included.



Global Mapper

Visit: <https://bluemarblegeo.com>
Full version: Paid

Global Mapper is a geographic information system (GIS) software package, consisting of a suite of data creation, editing, rendering, and analysis tools, especially useful for LiDAR enabled drones. It supports more than 300 geospatial data formats and provides access to common spatial databases. For terrain and 3D data processing, several functions including watershed delineation, view shed and line-of site modeling, volume measurement, and cut and fill optimisation, among others, are available. Options like geospatial PDF creation and direct Web publishing to MangoMap enable easy sharing of map data. The optional LiDAR module comes with a wide range of point cloud processing tools.



Propeller

Visit: www.propelleraero.com
Full version: Paid

Propeller is a cloud-based platform for accurate 3D site surveys via data visualisation and analytics. Data accuracy is ensured via options for filtering analysis, processing reports, and checkpoint verifications for datasets. Earthworks software simplifies design conformance checks, stockpile measurements, road-grade checks, and volumetrics. Other features include visual timeline slider for visual assessment of sites, terrain editing to remove inaccuracies in survey data, lidar support with easy point cloud upload, downloadable PDF, and CSV measurement reports for easy collaboration, among others.



Drone2Map For ArcGis

Visit: <https://www.esri.com/en-us/home>; **Full version:** Paid

Drone2Map's professional photogrammetry suite for image processing, powered by Pix4D, allows users to turn their drone-captured collections into high-quality 2D and 3D imagery products quickly for analysis and visualisation. It streamlines surveying and mapping techniques, which enables delivery and sharing of orthomosaics, 3D meshes, and more. Other features include calculation of volumes and elevation, capturing of high-accuracy points to simplify ground control workflow, and so on. Also, it is user-friendly, which makes it easy to share data among team members through ArcGIS Online or portal, necessary for accurate, data-driven decisions.



Open Drone Map



Visit: <https://www.opendronemap.org/>; **Full version:** Free

Open Drone Map (ODM) is a free and user-friendly drone mapping software that includes tools for processing, analysing and generating georeferenced maps, orthorectified imagery, point clouds, digital elevation models (DEMs) and textured 3D models from aerial data. For graphical user interface, WebODM comes with a 3D viewer, a map viewer, user logins, a plugin system, and the like. NodeODM API allows users to access ODM features over a computer network. The application can be run via a docker on macOS, Linux, or Windows (7 and above).



MOBILE APPS

For Drones and Quadcopters



Scan the QR codes to download the apps based on the operating system of your device

UAV Forecast

Updated: March 2020

OS: Android and iOS

Download: Full version (paid)

UAV Forecast allows drone pilots to check the suitable time for flying their drones through automatic colour-coded (green and red) analysis of the conditions. Hyper-local weather data provided by Dark Sky includes wind and gust speeds at ground level and at any altitude. Other features include fully configurable thresholds, details of no-fly zones and flight restrictions, tablet support, GPS satellite data, location search and favourite locations, hourly forecasts up to seven days, and so on. The app is compatible with DJI Spark, Inspire, Yuneec, Mavic, 3DR, Parrot Bebop, and many other UAVs and radio-controlled aircraft.



Android



iOS

Litchi

Updated: November 2019

OS: Android and iOS

Download: Full version (paid)

Litchi app allows users to work with drones like DJI Mavic 2 Zoom/Pro, Inspire 2, Spark, Mavic Air/Pro, Inspire 1 X3/Z3/Pro/RAW, and so on. Advanced waypoint editor enables setting up of classic missions as well as cable cams, selfies, panoramas, with real-time controls and unlimited distance. Other features include the ability to save and load waypoint missions and orbit flights, automatic sync for flight logs, dynamic homelink, auto record, virtual reality (VR) mode compatible with most mobile VR goggles (such as Cardboard and Freefly VR), among others.



Android



iOS

Drone Harmony Planner

Updated: May 2020

OS: Android

Download: Full version (paid)

Drone Harmony's Mission Planner allows users to create cinematographic and professional flight plans for DJI drones. Camera parameters can be adjusted according to light conditions and other requirements. Also, mission sync and planning features enable smooth flights for data capture (videos, scenic orbits, and the like). The plan can be reviewed in 2D as well as 3D and adjusted with simple tools for accurate results. Obstacle avoidance algorithms help in computing optimal flight paths. Drone Harmony plus version provides support for drones such as Mavic 2 Enterprise, P4P RTK SDK, m200, m210, m600, Inspire 1&2, too.



Android

B4UFLY

Updated: August 2019

OS: Android and iOS

Download: Full version (paid)

B4UFLY app allows drone operators to check airspace to ensure safety before taking flight. The app has a simple and user-friendly interface. By tapping on the map or searching for a location, the pilot knows whether flight is possible and also if there is a need to use caution while flying. Once the destination for flying is selected, operators receive the current status and stay informed of advisories and restrictions in detail for the chosen airspace.



Android



iOS

DroneBase Pilot App

Updated: December 2019

OS: Android and iOS

Download: Full version (free)

DroneBase Pilot App helps anyone involved in commercial flying to build their business and improve their flying skills through trainings, wherever required. The pilots can accept and schedule client missions on-the-go for applications in residential real estate, commercial real estate, insurance, construction, and more. Flying available missions is simple due to the availability of detailed instructions and integration with DJI's SDK. The app comes with full support for Inspire 1, Inspire 1 Pro & Inspire 1 RAW, Mavic Pro, Mavic 2 Pro, Mavic 2 Zoom, Pro Platinum, Air, and many other drone models.



Android



iOS

Versatile laptops

With improved graphics and speed

Microsoft has launched Surface Pro X, Surface Pro 7, and Surface Laptop 3 in India. The latest models are more versatile, adaptable and personal.

Surface Pro X comes with a 33cm (13-inch) PixelSense display and signature 3:2 ratio to help you maximise your workspace. The device also features a custom processor developed in partnership with Qualcomm that delivers best-in-class graphics performance and is coupled with full solid-state drive (SSD) size and speed and dual 4K video output via USB-C.

Surface Pro 7 comes with the latest quad-core, 10th generation Intel core processor, making it 2.3 times faster than previous generations. It is available in two colours—black and platinum. Surface Pro 7 offers high power, laptop-to-tablet versatility, and high-resolution



31.2cm (12.3-inch) display. Whether for work or leisure, it is a perfect companion for everyday life.

Surface Laptop 3 retains its iconic slim, sleek and lightweight design but is now twice as fast as previous generations, with faster multitasking and improved graphics. It is available in two sizes—34.3cm (13.5-inch) and 38.1cm (15-inch).

Smart speakers

With custom-engineered amplifier

Apple HomePod is now available for purchase in India. It uses the company's proprietary audio technology that comes with a high-excursion woofer, equipped with a custom-engineered amplifier. The device also comes with seven tweeters and six different microphones. It includes an A8 chip that enables smart features through Siri integration.

The HomePod also offers a touch panel that supports gesture controls. It is available in two colour options - white and space grey. Further, the speaker

has AirPlay 2 support to deliver a multi-room audio experience when using multiple HomePod units. Connectivity options on the HomePod include Wi-Fi 802.11ac with MIMO and Bluetooth v5.0.



Fitness band

With Covid-19 detection

GoQii has launched Vital 3.0 fitness band in India. With its sensors that detect body temperature, the fitness band could help in early Covid-19 detection and tracking. Just like any other fitness band, Vital 3.0 is equipped with heart rate sensors, can measure blood pressure, and detect the user's body temperature.

The fitness band comes with an in-built temperature display and thermal sensor. The continuous monitoring feature and on-demand features are for users who would like to check it at their convenience. The fitness band also features a waterproof coloured display, it shows notifications for messages and calls, has a built-in USB charger and can offer up to seven days battery life. The fitness band will be available in India in phases and on an immediate basis for the frontline workers, government, and private enterprises.



Streaming device

With HDR content

Xiaomi has launched Mi Box 4K streaming device in India. It is a standalone Android TV 9 Pie-powered device that plugs into your existing television through HDMI port. The device is Wi-Fi enabled for connectivity and gives users access to a variety of apps and services available on Android TV.

The streaming device is powered by a quad-core Amlogic processor and features 2GB RAM and 8GB internal storage for apps. It supports 4K streaming on supported content platforms, along with HDR10 format. Users will get additional connectivity through a USB port and 3.5mm digital out socket, as well as Bluetooth to connect headphones or wireless speakers for sound. There is also built-in Chromecast Ultra on the device, allowing users to cast content at 4K resolution.



Wireless earphones

With environmental noise cancellation

Xiaomi has launched Mi True wireless earphones 2 in India. This is the company's first pair of true wireless earphones in India. The earphones feature an AirPods-like earpiece design with an outer-ear fit and 14.2mm drivers. These support Bluetooth 5.0 and come with environmental noise cancellation on voice calls.

The earphones are powered by 30mAh batteries and an additional 250mAh battery in the charging case. These feature touch-sensitive controls for playback and accessing the voice assistant on your smartphone. Google Assistant, Alexa, and Siri are supported, and the headphones have optimisation for fast pairing and battery levels.



Smartphone

With curved display

Motorola Edge+ has been launched in India. It comes with a hole-punch display that has a curved design. Other features of the smartphone include 108MP primary shooter and Qualcomm Snapdragon 865 SoC. For selfies and video chat, it has a 25MP camera sensor at the front.



It is powered by a 5,000mAh battery that supports 18W TurboPower wired charging, 18W wireless charging, and 5W wireless reverse power-sharing. Connectivity options on the phone include 5G, 4G LTE, Wi-Fi 6, Bluetooth v5.1, GPS/A-GPS, USB Type-C, and a 3.5mm headphone jack. Onboard sensors include an accelerometer, gyroscope, ambient light, and a proximity sensor. Further, the phone has an in-display fingerprint sensor. It is available in smoky sangria and thunder grey colour options.

The prices, features and specifications are based on information provided to us, or as available on various websites and portals. EFY cannot vouch for their accuracy.

SOME USEFUL APPS IN THE TIMES OF **COVID-19**



Potshangbam July

The deadly Covid-19 pandemic has taken the world by surprise with the way it continues to spread like wildfire in every corner of the world. With no vaccine in sight, social distancing and stringent lockdown restrictions are the only reliable tools to battle the virus at the moment. These practices have helped to bring the virus under control to a great extent. But still, there is no surety if these can wipe out the coronavirus pandemic completely.

Weeks after lifting restric-

tions, South Korea and China have reported new cases of coronavirus infection. And Wuhan, where the virus first emerged in December, also reported new cases after the city re-opened after a 76-day lockdown. The fear of a second wave is still looming large. In India too. Both the central and state governments have been working aggressively to control the virus, from imposing a nationwide lockdown to leveraging technological support. Not only the government, private players, healthcare organisations, tech giants, etc have come with various technological solutions.

Among these several innovative and emerging technologies, mobile applications have also emerged as an effective medium to prevent the rapid spread of fast-moving coronavirus. These apps work more or less like the detective's

modus operandi—finding the infected people, their travel history, who they recently interacted with, etc.

The technique, known as contact tracing, is significantly helping to stem the coronavirus outbreak. Besides, apps help in reducing the complexity involved in the process, controlling the situation before it gets out of hand, and save considerable time. Moreover, these are useful tools for disseminating up-to-date news and verified information on the coronavirus pandemic, vaccine developments, containment zones, quarantine facilities, etc.

Mobile apps have also come forth as an effective medium to raise awareness campaigns for tackling misinformation concerning the Covid-19 crisis. This false information, ranging from the number of fatalities, medi-

cines, cure, and treatment methods to government policies, can put lives at risk. This proliferation of incorrect information from unreliable sources adds more fear, confusion, and anxiety among the people. At these desperate times, people are hungry for information; therefore, any misinformation can spiral into greater problems.

During a pandemic, clear and transparent information to the populace is critical to ensure that they are well informed and taking appropriate precautions. The development of mobile apps is helpful to educate and warn the masses by giving accurate information, which in turn can make a mammoth difference in the battle against the pandemic.

One should be aware that there are multiple apps available, however, it can be quite confusing for a user to decide the 'right app.' Here's a list of useful coronavirus-related apps that will help to fight against the coronavirus.

Aarogya Setu. This Covid-19 tracking app, developed by the Indian government, is one of the most downloaded apps globally. The app has crossed 100 million downloads since its launch on April 2, 2020. Notably, the app will witness a surge in the number of downloads in the coming days as the central government has made it mandatory for all the employees both in government and private sector, train travellers, and those stranded Indians flying back to their states.

The app uses a smartphone's GPS and Bluetooth features to track the coronavirus infection. It keeps track of the persons who are infected, who have come in contact with infected individuals and who are at high risk of being infected. The app collects data, which is broadly divided into four categories, such as demographic data, contact data, self-assessment data, and location data. This is collectively called response data. The app is available in eleven languages.

Corona Kavach. Launched by the Union Ministry of Electronics and Information Technology (MeitY) in association with the Ministry of Health and Family Welfare (MoHFW), the app is available on Google Play store. The highlight of the app is that it gives users a real-time location of coronavirus infected people. The app also keeps you updated about real-time informa-



Quarantine Watch



Simply Local

tion on infected cases, mortality rates, and cured cases. The users' location is mapped through GPS on the app to trace whether they are in high-risk locations or not. The app also provides other relevant official information and guidelines pertaining to novel coronavirus, issued by the government. Data experts express that the app is advantageous for a country like India as the vast majority of the population has access to cellphones.

Cova Punjab. Corona Virus Alert App (COVA) has been developed by the government of Punjab to keep citizens updated on the latest preventive care information and other government advisories. The app is very user friendly, providing a real-time dashboard for Punjab, India, and global stats. Users can have a quick self-screening, check their health status, and find out the distance between them and the nearest infected person.

Besides, the app provides information on travel instructions, corona hospitals in Punjab, and the list of people home quarantined and hospital quarantined. The app has the feature to connect with doctors and hospitals. It allows to generate curfew pass, request essentials, and report mass gatherings. Further, the users receive updates from government, advisories, and instructions from time to time via push notifications on the app.

Covid19 Feedback. Built by MeitY, the app has been created in public interest to gather information or feedback from individuals about treatment/test they have experienced. This helps the government to highlight the

efficiency of the process, and at the same time identify the problem areas to rectify.

Quarantine Watch. Developed by the Revenue Department of the government of Karnataka, the app is mandatory for individuals who are being quarantined at home. It helps the state authorities to keep a track of people under watch. They are asked to self-report while in quarantine by sending their details. To ensure that they are following the isolation norms, it has been made compulsory for home quarantined persons to take a selfie every hour except between 10pm and 7am. Every selfie is examined by the monitoring team. In cases where individuals are found defying the isolation norms, they are shifted to a mass quarantine facility.

Simply Local. The app helps to bridge the information gap in your locality or your community. It broadcasts important news and information on the current situation/happening in the locality and also shares security warnings and updates. It is beneficial for societies or localities under quarantine due to Covid-19 positive cases, and elderly people who are finding it difficult to get access to medical and essential facilities.

The app helps to connect communities digitally by sharing information and solutions, such as local issues, security issues, and to the extent of connecting with local vendors. It makes it easier to offer or get help from neighbours, and start discussions with them. The app enhances community engagement and togetherness to gain control over the spread of coronavirus. **EFY**

SOME AFFORDABLE DRONES AVAILABLE

Nijhum Rudra

The concept of drones/unmanned aerial vehicles (UAVs) has been constantly developing with technology getting more advanced these days. Earlier, this technology was utilised only for military purposes but for the past few decades, drones have become easily available to businesses across all sectors and to regular people, too. Technologists have been continuously contributing to the development of drone technology, and drone manufacturers are finding ways to make it more cost-effective.

According to market research firm Statista, their sales are escalating in various parts of the world. In the US, the sales are speculated to cross the one billion dollar mark. According to a report by FICCI and Ernst & Young, the Indian drone market is speculated to reach around 885.7 million dollars by 2021 with the international UAV market size reaching close to 21.47 billion dollars.

Drone is now being used in various verticals such as logistics and transportation, security, photography and filmmaking, and entertainment sectors. Various industries are now seeing this technology as an opportunity to reduce their costs.

Hence, we will showcase some of the latest and affordable drones available in the market. But before that, let's find out the qualities and requirements

one should look for before buying this product.

Register and know where to fly. Your drone needs to be registered, irrespective of whether you are using it for photography, videography, or just for fun. Also, if your product weighs less than 25kg, or if you are using it for commercial purposes, you need to take additional steps for registration. And before flying a drone, you must know some additional guidelines—flying within 8km of any airport is prohibited, flying below 122 metres (400 feet) is allowed, and most importantly, flying a drone over any government building is not allowed.

Budget. The most important thing to consider before buying any product is budget. You should be ready to pay a high price on industrial drones that come with heavy-duty motors. After you know the purpose of buying a drone, you can easily set your budget by checking out the various price ranges for the drones. A slightly expensive drone is better because it is lighter and comes with a flying training mode.

Drone types. Before you buy any tech product, it is advisable to check all the brands and features as it would help in selecting the product as per your requirements. That's the same with drones. There are four types of drones that you must know and then set your buying target.

The first one is Ready to Fly (RTF), but it is a bit expensive. You just need to charge the batteries and attach the propellers. The second one is Bind to fly (BTF), which doesn't come with a controller and it needs to be installed on your mobile device. The third is Almost ready to fly (ARF), which is basically a drone kit and does not include transmitters and receivers.

Most of them do not have motors, speed controllers, flight controllers, or batteries. Thus, you will have to make your entire drone, while additional items need to be purchased. The last is First-person video (FPV) that can capture footage and send the footage to your smartphone, VR headsets, or other compatible devices.

Weather conditions. Always keep in mind the weather conditions of your region when you are flying a drone. If there is wind in your area, your drone must have the potential to handle it because many of them can handle only 20mph (nearly 32kmph) wind speeds. Also, ensure that your drone is waterproof because there is a lot of moisture in windy areas.

Now, let us find out the latest and affordable drones available in the market.

DJI Mavic Air 2. This product is equipped with a camera sensor of 12MP and has a flying range of 10km, while it is powered by a 395mAh battery and weighs only 570gm. According to some reviewers, this is an



ideal option for beginners. It has the potential to shoot a top-notch 4K/60p video and is furnished with a vast number of shooting features and 34-minute constant flying time. It has a new 1.3cm (½-inch) sensor that assures enhanced ISO performance and supports slo-mo 1080p video up to 240fps.

Price: \$799

DJI Mavic 2 Pro. The Mavic 2 Pro has a state-of-the-art camera sensor of 20MP that weighs only 970gm. Along

with an available controller, the product is powered by a 3,950mAh battery whose flying range is 8km. This drone



comes under a premium category and is equipped with a slew of new cutting-edge features. As it is equipped with a large sensor, it has a better photo and video quality and is travel-friendly because of its portable and foldable design. It has the capability to shoot 4K video at 30fps, while the aperture is adjustable between f/2.8 and f/11, which means less need for ND filters. Additionally, it is quite easy to fly and control with its partner app. It has lots of new and sophisticated flight and shooting modes that help capture the best of cinematic shots.

Price: \$1,449

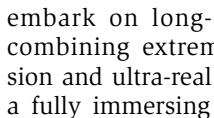
Syma X20 Mini Pocket. The Syma X20 is crafted with hyperboloid design and appears with high elastic amicable environment material and comes



with an automatic power-off option. The altitude hold mode enables Syma X20 mini drone to maintain a consistent altitude while allowing roll, pitch, and yaw to be controlled normally. Another USP is its headless mode that ensures the quadcopter will always follow controls from your perspective all the time, regardless of which way the quad is facing. Moreover, there is a 3D roll option; just press the button on the transmitter, and you get 360-degrees flip, continuous roll for perfect action, and wonderful performance.

Price: \$39.99

Parrot Bebop 2 FPV. Coupled with a unique Parrot sky controller 2 and Parrot cockpit glasses, Parrot Bebop 2 drone has lots of new features such as you can



embark on long-distance courses combining extreme piloting precision and ultra-real viewing. There is a fully immersing experience while

flying via FPV goggles. Users can experience a true HD image quality with the FreeFlight Pro app on smartphone. The broad, 90-degree field of vision offered by the Parrot cockpit glasses' lenses gives total immersion experience. It has been designed to fly both indoor and outdoor. According to the company, it is the first leisure drone weighing less than 500gm with 25-minute battery life.

Price: \$599.99

DJI Mavic 2 Zoom. Powered by a 12MP sensor with up to 4x zoom, including a 2x optical zoom (24-48mm), DJI Mavic 2 Zoom drone is all about dynamic perspectives. It has one minute flight time,



44mph max speed, 905G take-off weight, 3-axis gimbal for steady shots, 8GB internal storage, and SD card support up to 128GB. Apart from that, it has various functions that include active track 2.0, omnidirectional obstacle sensing, hyper-lapse, low-noise design, adjustable aperture, HDR photos, and dolly zoom. It has a remote controller that offers up to 135 minutes of battery life on a full charge. Users need to use the DJI GO 4 app on their smartphone.

Price: \$1,249

Autel Robotics Evo. This drone features an enhanced sensor on a 3-axis stabilised gimbal that records video at 4K resolution up to 60 frames per second and a recording speed



up to 100Mbps in an H.264 or the H.265 codec. Using real-glass optics, EVO captures stunning photos at 12MP with a wide dynamic range for more details and colour. It boasts flight times up to 30 minutes with a range of 7km. According to Autel's official website, EVO offers failsafe features, letting you know when the battery is low and it's time to return home. It also includes a remote controller that houses a 8.4cm OLED screen, providing you with critical flight information or a live 720p HD video feed and letting you see the camera view without the need for a mobile device.

Price: \$1,049 **EFY**

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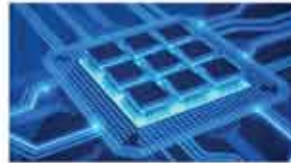
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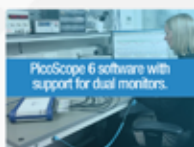
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May	Quantum Computing	AI for Manufacturing	High-Performance Computing - Quantum Computing	Top Quantum Computing Platforms for 2020	Edge and Cloud Computing
June	Drones and Quadcopters	AI and Hybrid Drones	AI in Surveillance and Security	Upcoming Drones for Industry Manufacturing	Drones in Delivery and Logistics
July	Strategic Electronics	AI for Military Operations	AI and ML to Enhance the Performance of Semiconductors and Electronics	Powerful Smartphones with Powerful Batteries and Processors	Signal Processing in Communication
August	Education and Skill Development	AI in Education Industry	Technologies in Education and Skill Development	Cutting-Edge Gadgets Making Schools and Classrooms Smarter	Electronics in Education and Skill Development
September	AI, Robotics and Cobots	AI in Humanoid Robots	Exoskeletons for Healthcare	Top AI-Powered Speakers Under ₹ 15k	Industrial Automation Through Robots and Cobots
October	Renewable Energy	AI in Fighting Global Climate Change	Electricity from Snow, Plastic and Any Other Raw Materials (Other Than Water and Solar)	Top Solar and Wind Power Panels	Transition from Conventional to Renewable Sources of Energy
November	Bots and Conversational Apps	AI in Customer Service Industry	Robotic Process Automation	Top Free Bots and Conversational Apps	Chatbots Prospects in Businesses
December	Blockchain	AI and Blockchain - A Perfect Match	Blockchain for Travel and Tourism	Top Antivirus Software for Malware	Database Management with Blockchain

In addition, there will be regular series every month on subjects such as:

- Smart World
- Test & Measurement
- Design/R&D
- Artificial Intelligence
- Do-It-Yourself
- Market Survey
- Startup Zone
- Interviews
- eStyle
- New Products
- Tech News
- Industry News

Plus, subjects such as the following will be covered more or less in each issue:

- Automation
- Healthcare
- The Internet of Things (IoT)
- Wireless/5G

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