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## COVID PRESENTING OPPORTUNITIES FOR TECH?

**HEALTHCARE:**  
Are UV  
Sterilisers  
Effective In  
Combating  
Covid-19

**INNOVATION:**  
Need For  
Touchless  
Technologies  
To Safeguard  
Against  
Viruses

**CLEAN ENERGY:**  
Plastic Waste  
To Renewable  
Energy—  
Implementing  
A Circular  
Economy

**POLICIES:**  
DRDO's  
Support To  
Manufacture  
Defence  
Equipment



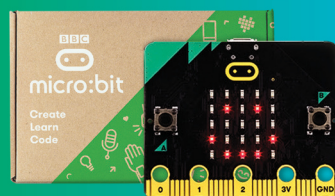
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Vol. 1 No. 2  
Pages: 72 | UK £2.5; US \$5

## Introducing the new BBC micro:bit

### What's new?

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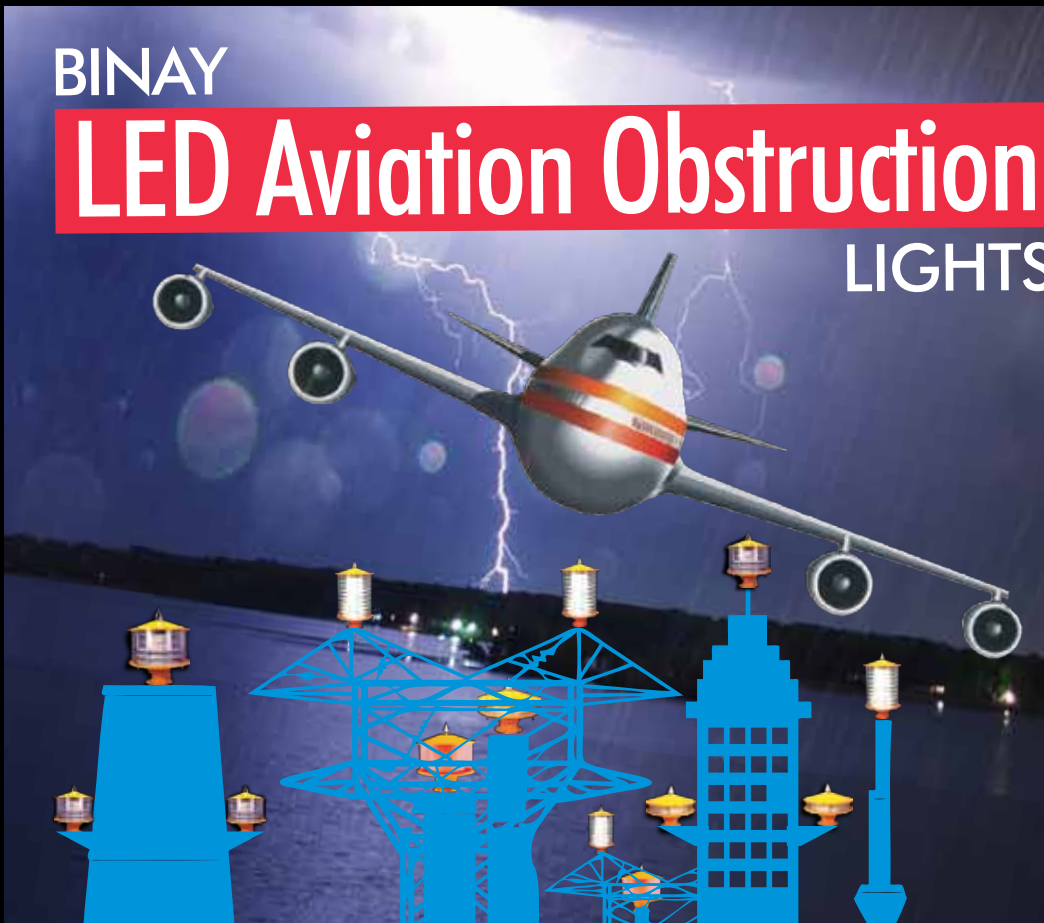
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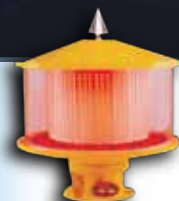
# LED Aviation Obstruction LIGHTS



High Intensity  
200,000 candela  
(Flashing White LEDs)



Medium Intensity  
20,000 candela  
(Flashing White LEDs)



Medium Intensity  
2,000 candela  
(Flashing Red  
OR Fixed Red LEDs)

## BINAY LED-based HIGH, MEDIUM and LOW Intensity Aviation Obstruction Light Beacons

As per International Civil Aviation Organisation (ICAO) requirements Available in Low Intensity, Medium Intensity and High Intensity versions (as per International Civil Aviation Organization guidelines), BINAY's patented LED Aviation Lights come with 5-year/3-year warranties



### All BINAY Aviation Lights are based on Non-switching passive type circuitry (NO SMPS)

The circuitry incorporated inside the LED Aviation Obstruction Lights is passive electronic (solid-state) in nature, and does not use internal SMPS driver switching units to control the light unit. Internal LED current control is by non-switching electronic means only. No electrolytic capacitors are used inside the Aviation Obstruction Light unit.

The above is necessary to ensure reliability of the LED Aviation Obstruction Light. This system design effectively eliminates any active components and circuits inside the aviation light itself, and enhances the solid-state passive reliability of the LEDs (mounted in relatively inaccessible locations at the height of tall structures). This drastically reduces the possibility of component failure - and hence possibility of any maintenance requirement - in the LED Aviation Obstruction Lights themselves (which are mounted at extreme heights in the system).

The BINAY LED Aviation Obstruction Light offers the following advantages:

- Fit-and-forget maintenance-free operation
- A long life of 100,000 hours (20 years at 12 hours daily burning)
- Pays for itself within a short period of operation in the form of reduced installation, maintenance and servicing costs
- Quick Installation; Reliable operation 365 days per year
- Shock-proof and vibration-resistant
- Over-Designed Intensity to allow for natural LED intensity degradation over its operating lifetime

LED Obstruction Lighting for:

- Industrial chimneys and smokestacks
- Transmission, microwave and cellular towers
- Radio, TV and similar structural towers
- High-rise buildings and structures
- Airports and airfields

THE BINAY LED OBSTRUCTION LIGHT IS UNDER ACCEPTED PATENT, AND AS SUCH IS A PROPRIETARY PRODUCT



**Binay Opto Electronics Pvt. Ltd.**

27, Panditia Terrace, Calcutta 700 029, India



**Industrial Lighting**



**High Mast & Street Lights**



**Common Area Lighting**



**Underground Lighting**



**Hospital Lighting**



**Retail Lighting**



**Commercial Lighting**

*LED Driver Failures getting you down?*

# LED LIGHTS THAT DON'T FAIL

**NO MORE LED DRIVER FAILURE**

Introducing Driver-Less LED Lights.  
 Backed by 5-year 'Touch-Free' Warranty on LED lights!

We've resolved the problem of LED driver failure by eliminating the LED driver with our revolutionary Driver-Less Nanogrid Technology



### TRIED AND TESTED TECHNOLOGY

Successful operational installations (over the last 10 years) in industrial plants, nuclear facilities, hospitals, 5-star hotels and several other applications

With so many advantages to the BINAY Driver-Less solution, it is costly to NOT implement this technology!



Lower Lifetime Cost of Ownership



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5 Years warranty



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Solar Power compatibility



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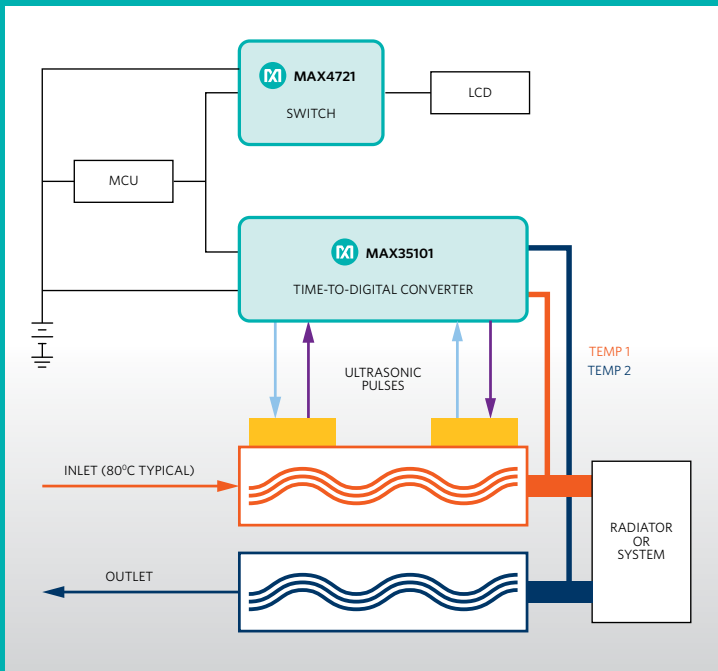
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### AI COMPANION ROBOT

'An Autonomous AI Companion Robot' article published in June issue (also available on an EFY website at <https://www.electronicsforu.com/market-verticals/consumer/autonomous-ai-companion-robot>) is very interesting and useful for everyone

Sreeja Vidiyala

...

### IOT BIOSENSORS

'Contact-Free IoT Biosensors For Patient Monitoring' article published in June issue (also available on an EFY website at <https://www.electronicsforu.com/market-verticals/medical/contact-free-iot-biosensors-for-patient-monitoring>) is the next good thing for medical application.

Rana

...

### GRAPHICAL TRENDING USING MATLAB

The 'Monitor Process And Graphical Trending Using MATLAB' DIY project published in March issue was a good one. I learnt new things from this project.

Indu

...

### LIQUID VENDING MACHINE

Excellent work! I have tried 'Arduino Based Liquid Vending Machine' DIY project published in May issue (also available at <https://www.electronicsforu.com/electronics-projects/arduino-based-liquid-vending-machine>). It worked well, so I want to thank the authors for the lucid explanation and guidance!

Kumar Vimal

□ The 'Arduino Based Liquid Vending Machine' project is an innovative solution for rural and urban India.

Balraj

...

### MORE ARTICLES WANTED

EFY is India's one and only prime electronics magazine. So please include articles on the Internet, Configuration of Switches, Routers and Optical Line Terminals (OLT). Also include more circuits and DIY articles on LED TV repairing.

Bljoo Leelamma

EFY. Thanks to the readers for their feedback! We will try to cover some more of the articles in demand in coming issues.

...

### LIQUID LEVEL MONITORING

This is regarding the 'MATLAB GUI Based Ultrasonic Liquid Level Monitoring System' DIY article published in October issue (also available at <https://www.electronicsforu.com/electronics-projects/ultrasonic-liquid-level-monitoring-system-using-matlab>). How do we upload the program in Arduino and which software do we need?

Arvind

EFY. You can use any recently released Arduino software, which can be downloaded from the link <https://www.arduino.cc/en/software>. Install the software in your system. Download the source program from [source.efymag.com](https://source.efymag.com). Run Arduino IDE, open the Arduino code. ino source code, compile/verify it and upload it to Arduino board.

...

### AUTOMATIC HAND-WASH TIMER

I have a doubt concerning the 'Automatic Hand-Wash Timer' DIY article published in July issue (also available at <https://www.electronicsforu.com/electronics-projects/automatic-hand-wash-timer>). How does this circuit automatically detect someone and turns on the LED without pressing any button?

Rene

EFY. There is an IR sensor in the circuit. When you put your hands near the sensor, the sensor automatically detects your hand, and the LED turns on. So, no physical switch or button is required in the circuit. The working of the circuit is simple. Please go through the complete article for more details on its working, construction and installation.

...

### GPS ANALOGUE CLOCK

I am interested in 'Try Making This TFT-Based GPS Analogue Clock Using Arduino' DIY project published in April issue (also available at <https://www.electronicsforu.com/electronics-projects/tft-gps-analogue-clock-using-arduino>). Where can I find the code for this project?

Dave

EFY. Please download the source code from [source.efymag.com](https://source.efymag.com)

...

### NOISE DETECTOR

This is regarding 'Make This Noise Detector For A Noise-Free Zone' DIY article published in March issue (also available at <https://www.electronicsforu.com/electronics-projects/noise-detector-for-noise-free-zone>). I cannot open the application in my computer. Do we need a software to open it?

Tariq

EFY. You cannot open the app directly in your computer. There are two files included in the source code folder of this project, namely, `silence_Zone.aia` and `silence_Zone.apk`. To open `silence_Zone.aia` file, you need MIT App Inventor, an open source software, installed in your computer. You can directly access MIT App Inventor from <https://appinventor.mit.edu>. The `silence_Zone.apk` file should be installed in your Android device.



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### Q1. Do PWM-based AC control circuits using MOSFETs require ZCD circuits? A. Samiuddhin

**A1.** There are two common types of zero-crossing detection (ZCD) circuits: operational amplifiers and passive circuits comprising resistors, capacitors, etc. ZCD circuits are used for detection of zero voltage reference point in an AC signal or in a sinewave signal. A typical zero-crossing detection of the AC signal is shown in Fig. 1.

Many PWM-based AC control circuits such as inverters use MOSFETs and ZCD circuits. MOSFET devices such as CS1501, AOZ5311NQi, AOZ5237Qi and CS1601H have dedicated pins for ZCD and related functions. ZCD circuit is used to initiate the MOSFET switching cycle for monitoring and controlling actions such as synchronisation of the signals.

The ZCD circuit is used in many applications including controlled voltage rectifiers, resonant power supplies, AC motor speed controllers, AC power controllers, among others.

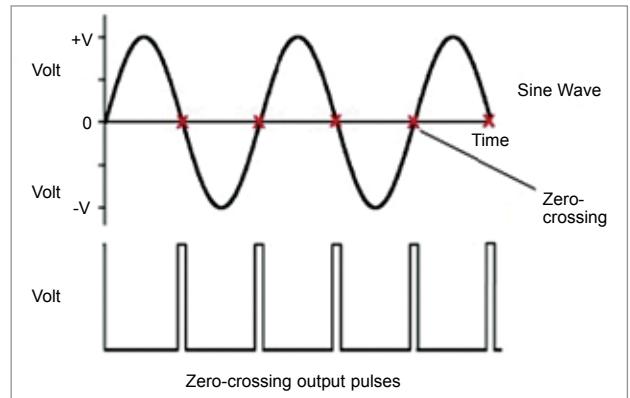


Fig. 1: A typical zero-crossing detection output

### Q2. What are real-time clock (RTC) chips? Which are some recent RTC chips launched in the market? Pamarthi Kanakaraja

**A2.** An RTC is an electronic device, generally an integrated circuit (IC), which keeps track of the current time and maintains accurate time in electronic systems. It is basically like a timepiece that runs on a battery and maintains current time, even when the main power supply goes off.

One of the best examples of its use is in a computer motherboard. Because of this RTC device, we get correct time on our computer/laptop, even after it is shut down and turned on again. RTCs are present in almost all infotainment systems, automotive systems, house metering, consumer electronics, and industrial electronic devices that require clock functionality.

Companies are focusing on miniaturisation of electronic devices for various applications. Therefore small and compact RTC modules are gaining widespread application in a wide range of products. This trend has huge significance for medical monitors and portable terminals.

For the development of ultra-low-power devices, many research efforts are going on to thoroughly understand the dynamics of size and connectivity requirements in RTC devices. Such devices have revolutionised the Internet of Things (IoT) and wearables sector. For instance, recently Seiko Epson Corporation launched two new small RTC modules (RX8111CE and RX4111CE) having low current consumption. RV-8803-C7 RTC chip developed by Micro Crystal is a high-accuracy, ultra-low power device with embedded 32.768kHz crystal.

Next-generation RTC chips with power management and

power switching functions are also available in the market. CBC921xx series chips from Cymbet Corporation are an example of such RTC devices.

Standalone RTC ICs are designed to have backup capabilities by analysing different parameters such as minimum and maximum current consumption in the power supplies. For instance, M41T62 from STMicroelectronics is a standalone RTC with backup that keeps the time with a supply voltage as low as 1.0V and can tolerate voltages of up to 4.5V.

With technological advancements, manufacturers are continuously introducing new features such as embedded memory, timestamp, and watchdog timers. DS3231M and DS3232M RTC chips by Maxim Integrated Products come with such features. DS3231M has temperature-compensated RTC with an internal MEMS resonator and DS3232M has additional memory in the small package. DS3231M RTC chip is shown in Fig. 2.

Key players operating in the global RTC chip market include Maxim Integrated Products, Inc, Seiko Epson Corp, STMicroelectronics, Microchip Technology Inc, NXP Semiconductors, Diodes Incorporated, Texas Instruments Incorporated, Renesas Electronics, Ricoh Semiconductor, ROHM, Micro Crystal, Cymbet and Cypress Semiconductor Corporation.



Fig. 2: An RTC chip (Credit: mouser.com)

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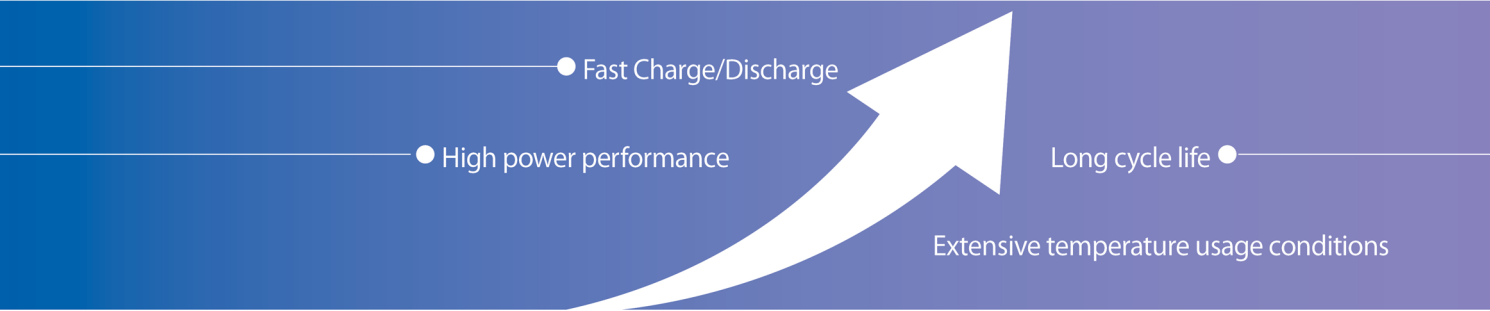


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## System developed to translate ancient 'dead' languages



In developing a system to help decipher lost languages, MIT researchers studied the language of Ugaritic, which is related to Hebrew and has previously been analysed and deciphered by linguists (Credit: S.R.K. Branavan)

A system developed at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) is able to automatically decipher a lost language, without needing advanced knowledge of its relation to other languages.

The system relies on several principles grounded in insights from historical linguistics, such as the fact that languages generally only evolve in certain predictable ways. For instance, while a given language rarely adds or deletes an entire sound, certain sound substitutions are likely to occur.

The system's algorithm learns to embed language sounds into a multidimensional space where differences in pronunciation are reflected in the distance between corresponding vectors. This design enables them to capture pertinent patterns of language change and express them as computational constraints. The resulting model can segment words in an ancient language and map them to counterparts in a related language.

## Hawk-inspired robot with movable wings is an agile long-distance flyer

A robot with wings has been developed that can fly more stably and nimbly than other flying robots—and it uses less power, extending flight time. The goal was to develop a drone that could fly long distances across cities, but manoeuvre around buildings and objects that it is likely to encounter, as multicopter drones can't fly long distances.

With wings and tail spread fully, the robot gains height. When it reaches top speed, the feather-like plates can be tucked in to become more aerodynamic, just like a bird.

The tail also moves up and down and side to side, enabling the robot to change its altitude quickly. Each wing can also retract or expand independently, as needed, to increase or reduce drag. By tucking in its wings and tail when travelling at its optimal speed of 9.6 metres per second, the drone uses 55.4 per cent less power than would be required to travel at that speed with its wings and tail fully open.



This hawk-like drone is an agile and efficient flyer (Credit: 2020 EPFL/Alain Herzog)

## Cellulose could play an important role in future green electronics

Researchers from Uppsala University, Sweden and Ulsan National Institute of Science and Technology, Korea have explored the feasibility of cellulose in energy storage devices composed of conducting composites and thin layers of electroactive materials, as well as cellulose-based current collectors and functional separators.

Cellulose has been found to be an excellent material in the fabrication of electrodes as well as battery separators through a straightforward approach that deposits a thin layer of a conductive material on the surface of a cellulose sheet, thus converting the insulating paper into a flexible, conductive current collector. Further, cellulose is an attractive substrate for printed energy storage devices due to its superior mechanical

flexibility, thermal stability, and recyclability.

Cellulose derived from wood conducts differently compared to cellulose from algae or cotton, which requires further investigations for proper selection of the types of cellulose to be employed. A too low or a too high porosity would decrease the battery performance. The water content of the cellulose is another important parameter.

Thus, research on cellulose-based supercapacitors and batteries is very promising. Considering the properties of cellulose and the possibilities to employ existing large-scale manufacturing methods, cellulose-based energy storage systems will enable novel devices that will serve as complements to conventional technology.



# Integral Avionic, Space and Defense Solutions

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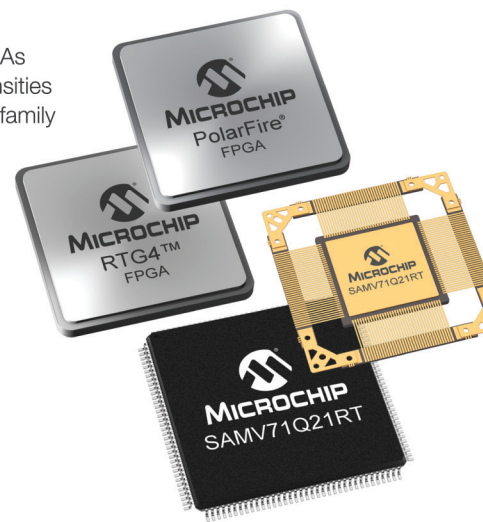
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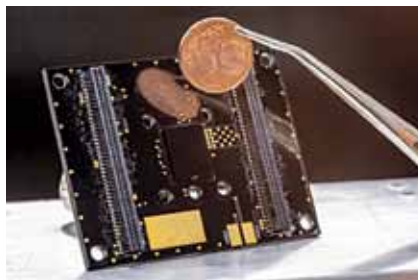
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## Sensor for air quality monitoring can fit in phones and wearables

A particle sensor developed by TU Graz, ams and Silicon Austria Labs is slightly smaller than two one-cent coins stacked on top of each other. Compact and energy-efficient, the  $12 \times 9 \times 3$ mm innovation requires no maintenance and can be integrated into mobile devices such as smartphones, smartwatches, or fitness wristbands for measuring air quality in real-time and create an alert in the event of increased fine dust levels.

Besides wearables, the sensor can be integrated with local applications—both in the home and outdoors—and thus provide an unprecedented variety of measured values.



Prototype of the particle sensor (black square in the middle of the board) developed at TU Graz compared in size with a one-cent coin (Credit: Lunghammer - TU Graz)

## Methanol fuel gives this tiny beetle bot the freedom to roam

A new robot beetle has been developed that can go a long-range distance on its own thanks to a methanol-fueled micro muscle (that can pack in 10x energy as tiny batteries). This can possibly lead to swarms of robotic insects that could assist



Look ma, no wires! A robotic beetle, which weighs about as much as three grains of rice, crawls, carries and climbs without being tethered to a power source (Credit: X. Yang, L. Chang, N.O. Pérez-Arancibia/Sci. Robotics 2020)

search-and-rescue operations - even through tight spaces that are out of reach.

To turn methanol into motion, the researchers coated a nickel-titanium alloy wire with platinum. The alloy contracts like a muscle when heated and extends once cool. The platinum generates heat by combusting any methanol vapour that comes in contact with it. By varying the exposure to fuel in a periodic pattern, the temperature varies and the micromuscle accords. That motion causes the bot's forelegs to rear up. When the legs move back again, the body drags forward.

The beetle bot weighs about as much as three grains of rice, on par with live insects, and crawls on flat surfaces while carrying up to 2.6 times its weight.

## A smartwatch app alerts hard of hearing to nearby sounds

A new smartwatch app alerts users who are deaf or hard of hearing of nearby sounds such as microwave beeps or car horns. It can also be used for hearing urgent noises like fire alarm, door knock, or alarm clock.

Although sound awareness apps for smartphones exist, people who are deaf or hard of hearing generally prefer to wear such a device on the wrist rather than keep it inside a pocket or bag. The SoundWatch app pairs with an Android smartwatch and phone.

The watch records ambient noises and sends that data to the phone for processing. Up to twenty sounds can be identified with 81 to 97 per cent accuracy.



The new smartwatch app, SoundWatch, alerts people who are deaf and hard of hearing to bird songs, sirens and other noises (Credit: Jain et al./ASSETS 2020)

## Cameras can now capture colours invisible to the human eye

Now a breakthrough research allows cameras to recognise colours that the human eye and even ordinary cameras are unable to perceive.

The technology makes it possible to visualise gases and substances such as hydrogen, carbon, and sodium—each of which has a unique colour in the infrared spectrum—as well as biological compounds that are found in nature but are invisible to the naked eye or ordinary cameras. It has groundbreaking

applications in a variety of fields from computer gaming and photography to the disciplines of security, medicine, and astronomy.

Researchers were able to develop cheap and efficient technology that could be used with a standard camera for the conversion of photons of light from the entire mid-infrared region to the visible region, at frequencies that the human eye and the standard camera can pick up.

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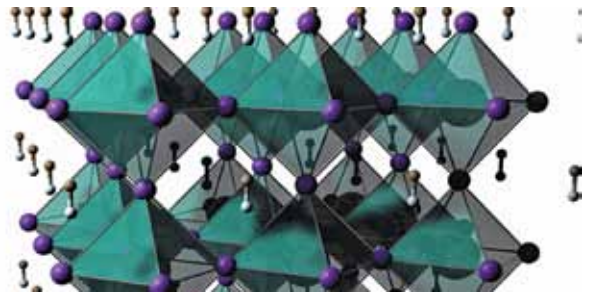
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## Key advance for printing circuitry on wearable fabrics

Much effort has gone into integrating sensors, displays, power sources, and logic circuits into various fabrics for the creation of wearable electronic textiles. Fabricating rigid devices on cloth, which has a surface that's both porous and non-uniform, is tedious and expensive, requiring a lot of heat and energy. It also limits the flexibility and wearability of the fabric.

Now, a stable, printable ink, based on binary metal iodide salts, thermally transforms into a dense compound of cesium, tin, and iodine. The resulting film of  $\text{Cs}_2\text{SnI}_6$  has a crystal structure that makes it a perovskite.

Thanks to the perovskite film, negative-temperature-coefficient thermistors can be directly woven onto polyester at temperatures as low as 120 degrees Celsius—just 20 degrees higher than the boiling point of water. For the future of wear-



Perovskite crystal structure (Credit: <https://today.oregonstate.edu>)

able e-textiles, the ink and the thermistor performance are all promising.

## EV batteries can now be charged up to 90% in just 6 minutes

A POSTECH research team has developed a faster charging and longer lasting battery material for electric vehicles (EV). For fast charging and discharging of Li-ion batteries, methods that reduce the particle size of electrode materials were used. However, a reduced particle size decreases the volumetric energy density of the batteries.

To this, the research team confirmed that if an intermediate phase in the phase transition is formed during the charging and discharging, high power can be generated without losing

high energy density or reducing the particle size through rapid charging and discharging, enabling the development of long-lasting Li-ion batteries.

This in turn proved that the intermediate phase formation can dramatically increase the charging and discharging speed of the cell by creating a homogenous electrochemical reaction in the electrode. As a result, the synthesised Li-ion battery electrodes charge up to 90% in six minutes and discharge 54% in 18 seconds, a promising sign for developing high-power Li-ion batteries.

## Robot remotely checks Covid-19 patients' vital signs

During the current coronavirus pandemic, one of the riskiest parts of a healthcare worker's job is assessing people who have symptoms of Covid-19. Researchers from MIT, Brigham, and



Researchers from MIT and Brigham and Women's Hospital hope to reduce the risk to healthcare workers posed by Covid-19 by using robots to remotely measure patients' vital signs (Credit: Spot image courtesy of the researchers, edited by MIT News)

Women's Hospital hope to reduce that risk by using robots to remotely check patients' vital signs. Controlled by a handheld device, these can also carry a tablet PC that allows doctors to ask patients about their symptoms without being in the same room.

Using four cameras—an infrared camera plus three monochrome cameras—that filter different wavelengths of light mounted on a dog-like robot developed by Boston Dynamics, the researchers have shown that they can measure skin temperature, breathing rate, pulse rate, and blood oxygen saturation.

For body temperature, the camera measures skin temperature on the face, and the algorithm correlates that temperature with core body temperature. As the patient breathes in and out, wearing a mask, their breath changes the temperature of the mask. Measuring this temperature change allows the researchers to calculate how rapidly the patient is breathing.

The three monochrome cameras allow the researchers to measure the slight colour changes that result when hemoglobin in blood cells binds to oxygen and flows through blood vessels. An algorithm uses these measurements to calculate both pulse rate and blood oxygen saturation.



## AI In Customer Service Industry: What's The Big Deal?

This article discusses various artificial intelligence (AI) technologies that are helping the customer service team improve their performances and businesses. The customer service team is required to keep customers happy and delightful



Representation of AI-robot in customer service (Credit: chatbotsmagazine.com)

Sani Theo

**Y**ou must have come across the joke, “If the customer is always right, then why isn’t everything free?” Well, everything cannot be free in business, but one thing is for sure that every business setup needs to listen to customers carefully, including their requirements and problems. ‘Customer is King’ is an age-old proverb and philosophy but still relevant to every business in the modern world.

The customer service team is required to keep customers happy and delightful. This team is an integral part of all businesses. By automating different customer service activi-

ties with artificial intelligence (AI) tools, companies can provide faster and better responses to customers’ queries and smart customer experiences.

Let us look into various AI technologies that are helping the customer service teams improve their performances and businesses. But before delving into the AI technology, let’s find out why customer service is important in every business.

### Why customer service?

As per the definition on Wikipedia, customer service is the provision of service to customers before, during, and after a purchase. Quality customer service is about making sure that your customers are valued, treated fairly, and appreciated. Prioritising customer service support helps attract as

well as retain loyal customers. This will have a big impact on the growth and success of your company. So, customer service plays an important role in every business and industry. The advantages include preventing business failures, retaining customers, helping your brand, and providing an element of trust and value to your business.

**Prevents business failure.** When a business does not have good customer service associates, customers can become frustrated over small problems that are not addressed properly. There is a high chance that customers may stop doing business with your brand and go for your competitors or brands offering similar solutions. To prevent such problems, the customer service team can follow up and promptly address the issues. Customer service is the backbone of your business, and without a backbone, your business could collapse.

**Retains customers.** The customer service team can retain customers. In most cases, satisfied customers become devoted buyers when you provide good customer services along with your trustworthy business records. When you're offering the same products as your competitors, one of the things that you can do to differentiate yourself from your competitors is to build a good customer service team.

**Promotes your brand.** Aligning your brand and customer service is a good way forward to survive in the market. When a brand focuses on customer service and support, it has great growth potential.

As per the report from Customer Experience Impact, 82 per cent of consumers in the US said that they've stopped doing business with a company due to poor customer service experience. Of these, 73 per cent cited rude staff as the primary reason, and 55 per cent was due to the company's failure to resolve their problems in a timely manner. Another report says that 66 per cent of B2B and 52 per cent of B2C customers stopped buying from a brand after a bad customer service interaction.

**Provides element of trust.** When your business has good customer service in place, customers trust you more. Trust could make all the difference in the world of business. When customers trust you more, they are

likely to remain loyal to your brand and product.

**Provides value.** The customer service team provides value to your business by treating customers well, answering questions, and building strong relationships. Customers understand that they are the source of revenue for your business, and they want to feel appreciated.

### Is AI a big deal for customer service?

AI is revolutionising the future of customer service in many ways. It is not just limited to chatbot or auto-answering; it is much beyond, as described in the next section. AI supports and works alongside humans, enables a business to grow in a cost-effective way, and promotes the best possible customer experience. By assigning simple and repetitive tasks to AI machines and allowing humans to focus on customers that require complex issues or assistance, companies are able to improve customer services leading to improved customer experiences, enhanced brand reputation, and well-informed actions.

Some of the advantages of AI include auto-answering, 24-hour service, faster decisions, handling voluminous data, and boosting efficiency.

**Auto-answering.** Auto-attendant is a common feature in office telephone systems. It is an important part of your business. It is typically the first point of contact with your customers. Similarly, AI-based voice bots and chatbots are used in modern communication devices.

**24-hour service.** One of the key benefits of an AI chatbot is that it never sleeps. It is there to help customers resolve their issues at any time. This is important for companies operating globally and looking to provide better customer service and support. Humans can get tired and demotivated after answering the same repetitive questions. AI is perfectly suited for repetitive and menial tasks like tagging tickets. Most of the time, the bot is able to resolve the query, but in situations where it cannot, it is passed on to the humans.

**Handling data.** Companies are collecting more data than ever about their customers. But it's difficult for

humans to accurately analyse the vast amount of unstructured data. AI and machine learning can derive quantitative data and respond to customers much faster than humans.

**Faster decisions.** When customer service is available round the clock with a vast amount of data, AI platforms can find answers quickly and respond to queries faster.

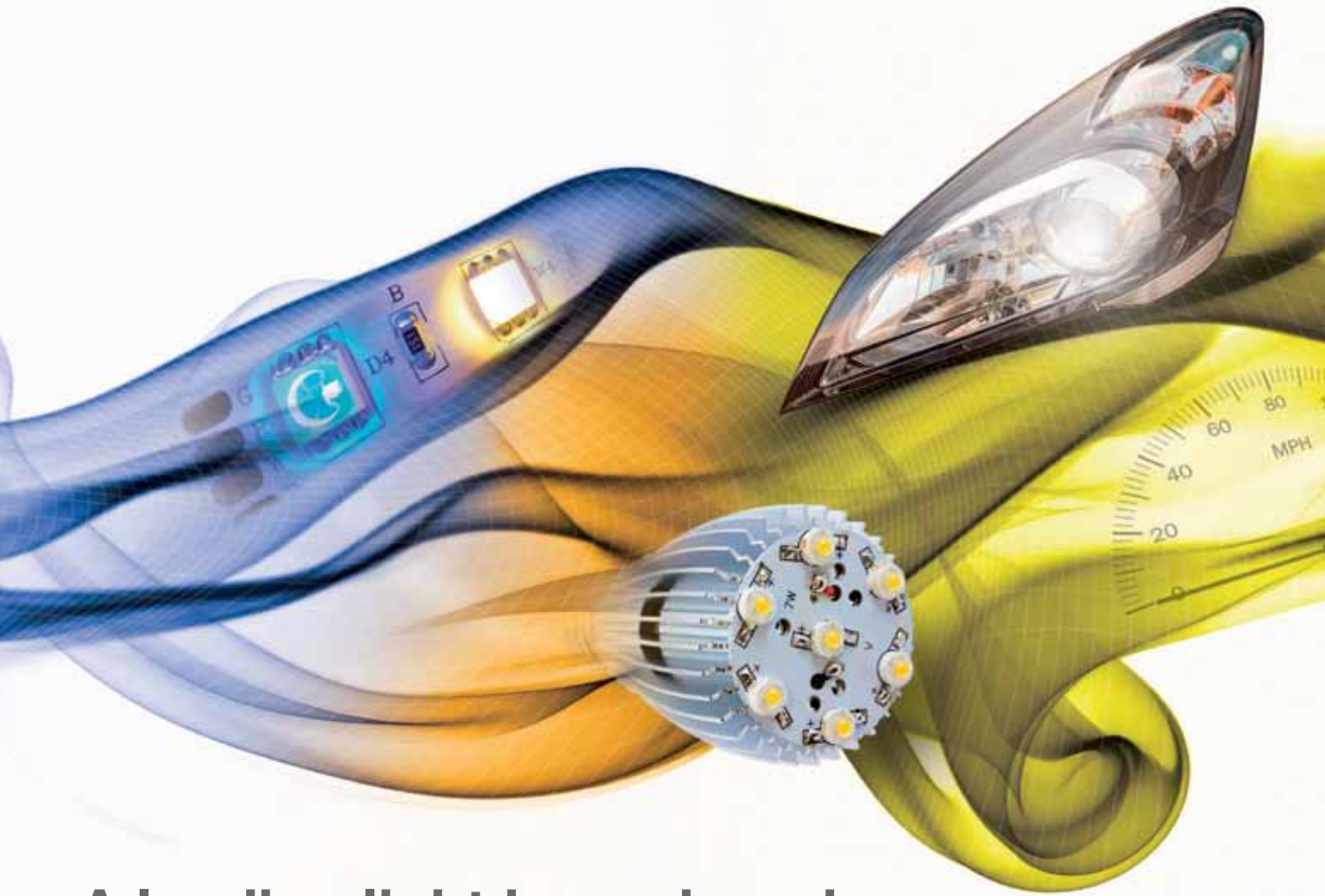
**Boosting efficiency.** Even if your brand has an experienced customer service team, AI can still lend a hand behind the scenes. Using natural language processing, AI can read a ticket and direct it to the right team much faster than a human triage system can.

### Some use cases of AI in customer service

**Voicebot.** It is based on AI and is a more advanced version of an auto-attendant system. It is great for handling automated tasks that involve numbers and simple yes/no answers. Voicebot with natural language understanding (NLU)-based voice channel for communication works by converting audio to text format. For example, Dialogflow CX, recently launched by Google, is used for building text and voice-based AI agents for mobile apps, websites, and Google Assistant actions. A user can speak to the virtual agent naturally, and it will process the information and respond appropriately. Another example is the AI-powered voice bot 'TIA' launched by Tata Capital on WhatsApp.

**AI chatbot.** The AI-based human-like bot that pops up on the website to start an online chat is becoming a common feature on most business websites. The chatbot can be integrated on websites, messaging applications, mobile apps, and kiosks. These bots play a vital role in the simplification of human interactions with the computers and customer interactions with the business, providing engaged self-service.

As per some reports, sixty per cent of online customers do not like to wait for more than sixty seconds for a response to their query. The use of chatbots drastically reduces customers' waiting time and provides a quicker solution to their queries, thus improving customer experiences. Chatbots with Natural Language Pro-



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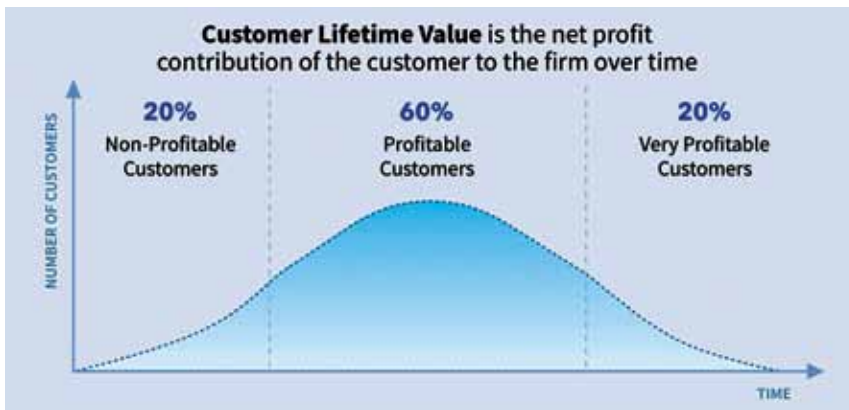


Fig. 1: CLV graph (Credit: www.retently.com)

cessing or NLP capabilities are used to handle customer complaints through faster responses, thus elevating customer satisfaction.

For example, the AI-based COTA (customer obsessed ticket assistant) system built by Uber helps customer support representatives improve their speed and accuracy, resulting in improved customer experience. It is found that with the AI system, ticket routing efficiency is increased by ten percent.

Big companies like Google, Microsoft, Facebook, and others are all actively engaged in the race to build chatbots that can respond to customer queries.

**Customer identifications.** These include biometrics and face and voice recognition. Biometrics refers to body measurements, authentication, identification, and access control. Facial recognition identifies and verifies an individual by comparing facial features from a digital image or video to a database.

Voice recognition biometrics digitises words and encodes them with data such as pitch, cadence, and tone, and then forms a unique voiceprint related to an individual.

AI-based biometrics help customer service agents to recognise customers and greet them in a personal manner. The customer support team can use biometrics to quickly authenticate customers while minimising the risk of fraud.

For example, tools like ScopeAI work with customer support teams to analyse the voice of customer (VOC) data across multiple channels.

**Predictive personalisation.** Most

companies now have access to huge amounts of data about their customers. When a customer clicks, views and purchases a product from a website, these data are translated into predictions that deliver value-added personalisation and recommendations to targeted consumers. That is, AI-based predictive technology can identify patterns that indicate a customer's intent based on web activity or text and route the call or chat to the appropriate agent.

AI has been used in the e-commerce industry to improve product recommendations based on personal customer needs, buying behaviour, and user profile. For example, Netflix's AI-powered customer service algorithm uses data such as demographics, viewing history, and personal preferences to predict what the user would like to watch next.

**Predictive maintenance.** This technology is used to predict technical and maintenance issues before major problems occur. AI predictive maintenance is in use at United Parcel Service and Cisco. It is reported that United Parcel Service has saved millions of dollars by implementing an AI predictive maintenance solution that reduces delivery truck breakdowns. At Cisco, AI predictive maintenance is used to optimise network performance and troubleshoot issues faster.

**Motivation and productivity.** Research shows that disengaged employees in the US cost billions of dollars a year. With advanced AI technologies, customer service agents can work faster and more efficiently. AI tools used in customer service include:

- Call prioritisation
- Customer identification
- Recommendation engines
- Smart agent monitoring and training

AI-powered tools and solutions help extend the abilities of customer support teams, enabling them to master complex processes. It is an effective way to improve job satisfaction and reduce attrition. When employees are empowered with top-notch solutions, they are motivated to work better. You can get many AI-based tools from different vendors such as Zendesk, HappyFox, Freshdesk, and Accenture.

**CLV optimisation.** In marketing, customer lifetime value (CLV) is a metric that tracks how valuable a customer is to a company throughout the relationship. It is a prediction of the net profit attributed to the entire future relationship with a customer. Studies have shown that the likelihood of selling to a first-time customer is five to twenty per cent as opposed to an existing customer with the probability of sixty to seventy per cent.

There are many customer service software tools for companies to continuously improve or pinpoint areas of excellence. Using AI-driven data analysis to track customer lifecycles and target customers with loyalty promotions help optimise CLV. Apart from using AI to calculate and improve CLV, marketers are using it as a primary key performance indicator (KPI) metric.

As per the Pareto principle, better known as the 80/20 rule, eighty per cent of the profits come from twenty per cent of your customers. The actual customer distribution may vary depending on the industry and other factors. However, at the most basic level, the distribution might look like the CLV graph, as shown in Fig. 1. The goal of CLV is to identify the segments that are practical and help you make better marketing decisions. Some key parameters while calculating CLV include average order value (AOV), purchase frequency (F), gross margin (GM), and churn rate (CR).

AI-based CLV optimisation tools are available from different vendors such as XLSTAT, Pega, Qualtrics, Optimize, and others. **EFY**

*It's not the survival of the fittest...  
...It's the survival of the fastest.*

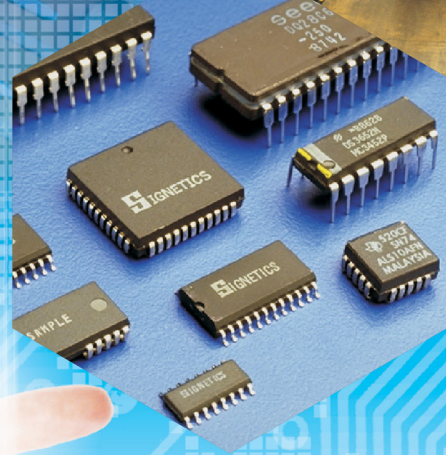
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# Fruit Classification And Quality Detection Using Deep Convolutional Neural Network

Soon we can make a portable application that takes pictures of fruits and labels them accordingly



**Saksham Aggarwal** is Bachelor of Engineering in Computer Science with specialisation in Information Security from VIT Vellore. He is an AI enthusiast and competitive coder

**F**ruit classification using a deep convolutional neural network (CNN) is one of the most promising applications in personal computer vision. Profound learning-based characterisations are making it possible to recognise fruits from pictures. However, fruit recognition is still a problem for the stacked fruits on a weighing scale because of the complexity and similarity.

In this article, a fruit recognition framework utilising CNN is proposed. The proposed strategy utilises profound learning methods for the grouping. The work uses the fruit shape and shading to recognise each picture.

We have used the Fruits-360 dataset for the evaluation purpose. An exact and dependable picture-based fruit recognition framework is crucial for supporting more significant rural assignments like yield mapping and automated reaping.

## Introduction

These days, the process of mechanisation is playing a vital role in numerous businesses. Several programmed techniques are created for delivering and checking forms. The subject of computerised picture handling has found numerous applications in the field of mechanisation.

In personal computer vision and example acknowledgment, shape coordination is a significant issue, which is characterised as the foundation of shapes and its utilisation for shape examination. Fruit recognition and classification systems can be utilised by numerous genuine applications.

For example, a general store check-out framework may be used as an instructive device instead of manual

scanner tags to upgrade learning, particularly for kids and Down's syndrome disorder patients. It can help plant researchers to do an advanced examination on a variety of fruit shapes and assist in understanding the hereditary and sub-atomic instruments of the organic products.

Recognising various types of fruits is a rehashed task in grocery stores, where the clerk needs to characterise everything to decide the cost. A well-known answer for this trouble is to provide codes to every fruit item.

Along these lines, the main objective of this work is to program the perceived fruit picture by grouping it as indicated by its highlights utilising AI methods. An image recognition model is proposed, which contains three stages: pre-preparing, include extraction, and arrangement stages.

In include extraction stage, scale invariant feature transform (SIFT) and shape and shading calculations are used to extricate a component vector for each picture. The classification phase uses two algorithms: K-nearest neighbourhood (K-NN) and bolster vector machine (SVM). Assessing the recognition model is finished by completing a progression of trials. The after-effects of completing these examinations exhibit that the proposed approach can naturally arrange the fruit name with a high level of exactness.

## Related work

**TensorFlow.** TensorFlow is an open source programming library for machine learning (ML) applications such as neural networks. It was developed by the Google Brain group for Google's exploration and product advancement. It was released under the Apache license 2.0 on November 9, 2015. TensorFlow can run on several CPUs and GPUs in work area conditions. It is used in numerous fields

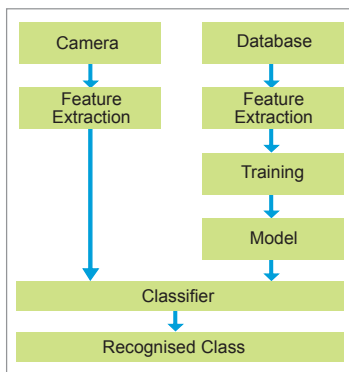
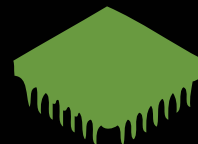


Fig. 1: Block diagram of fruit recognition system

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such as voice acknowledgment, personal computer vision, mechanical technology, data recovery, and characteristic language handling.

**CNN.** Convolution neural network (CNN) is a class of deep learning that has accomplished creative outcomes in different fields such as natural language processing and image recognition. The layers of a CNN consist of an input layer, an output layer, and a hidden layer. The hidden layer includes multiple convolutional layers, pooling layers, fully-connected layers, and normalisation layers.

**Inception-v3 model.** The Inception-v3 model is a state-of-art image recognition model created by Google. It is the third edition of Google's Incep-

tion Convolutional Neural Network, originally introduced during the ImageNet Recognition Challenge 2012. The Inception-v3 model comprises two sections: Highlight extraction part with a convolutional neural system and classification part with fully-connected and softmax layers.

**Fruits-360 data set.** In this article, we have used the Fruits-360 dataset to identify fruits from pictures. For this, fruits were planted in the pole of a low-speed engine (3rpm), and a short film of 20 seconds was recorded. Behind the organic products, we set a white piece of paper as a background. Due to the variations in lighting conditions, the background was not uniform, and we composed a devoted

calculation that separated fruits from the background.

This algorithm is flood-fill type: we start from each edge of the picture and mark all pixels there. At that point we mark all pixels found in the area of effectively checked pixels for which separation between hues is not exactly an endorsed esteem. We rehash the past advance until no more pixels can be checked. All checked pixels are considered as being background (which is then filled with white), and the remaining pixels are considered as belonging to the object.

The maximum value for the distance between two neighbouring pixels is a parameter of the calculation and is set (by experimentation) for every film. Fruits were scaled to fit a  $100 \times 100$  pixel picture.

## Proposed methodology

The framework takes a picture of the fruit with a camera, and the initial step runs a little neural system in TensorFlow to recognise whether the picture is a natural product (Fig. 1). The picture is then passed to the TensorFlow CNN neural system learning on a Linux server for additional grouping.

The TensorFlow code is an Incep-

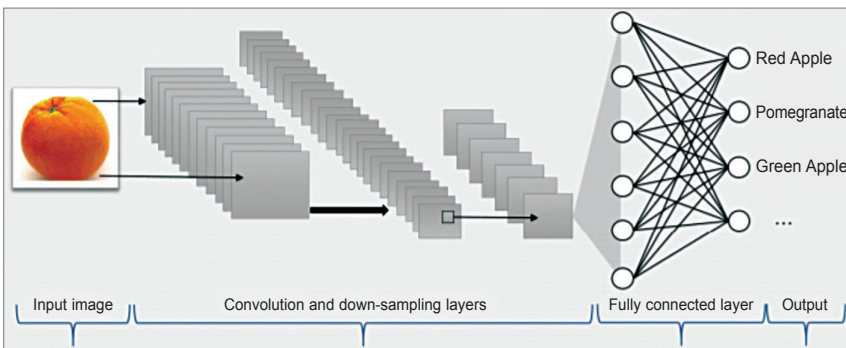


Fig. 2: Layers in CNN

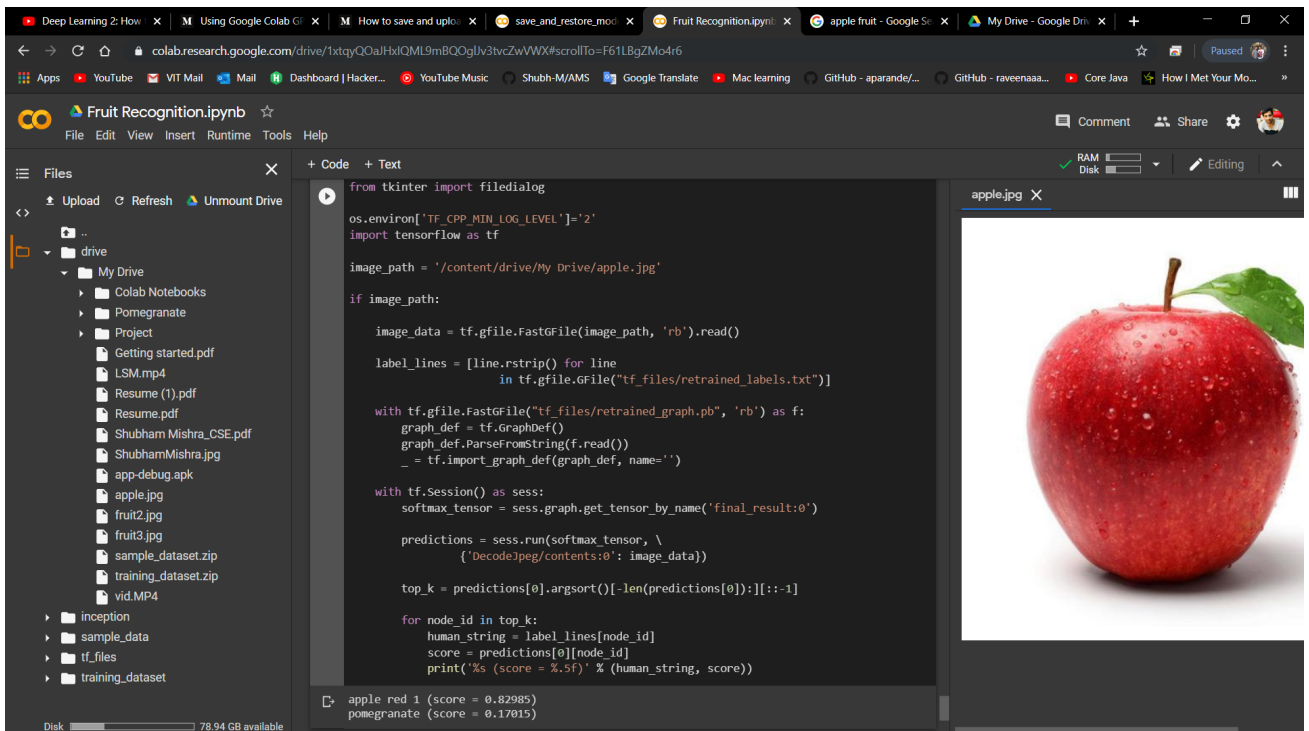


Fig. 3 (a): Experimental analysis of red apple

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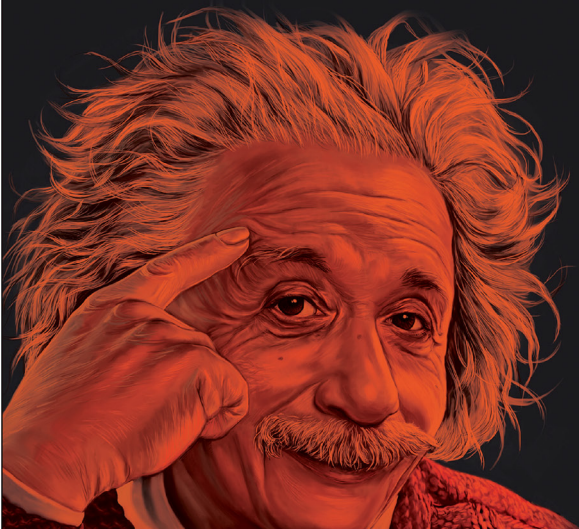
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tion-v3 model code given by Google that alters the union, pooling, and arrange configuration to coordinate the number of classes and classes of pixels in the picture with minor alterations to the last layer. CNN places

a convolutional layer and a pooling layer in the concealed layer between the info and yield layers (Fig. 2).

In these two layers, the way of bringing down or testing the goals of the picture is reshaped. The convolu-

tion layer applies a weighted channel to a piece of the information picture that might be useful for grouping, making an element map. The pooling layer decreases the element map by sub-testing the most significant piece

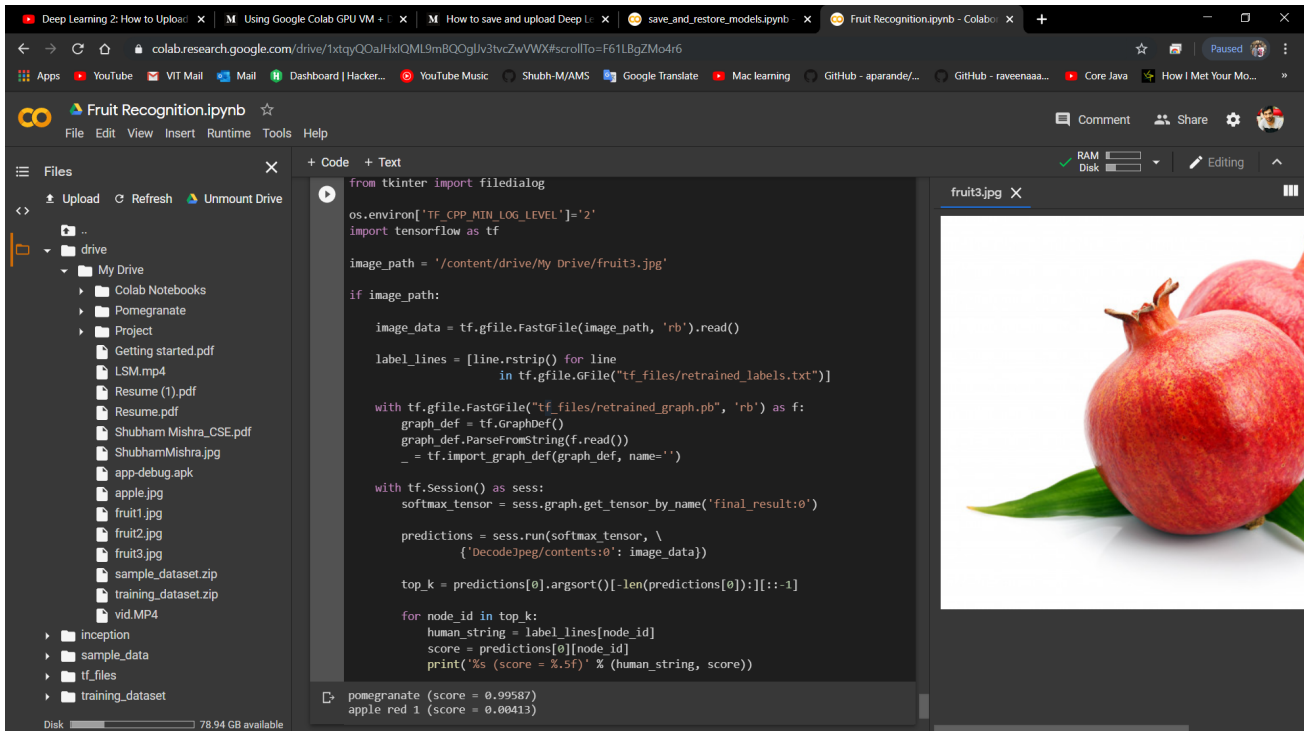


Fig. 3 (b): Experimental analysis of pomegranate

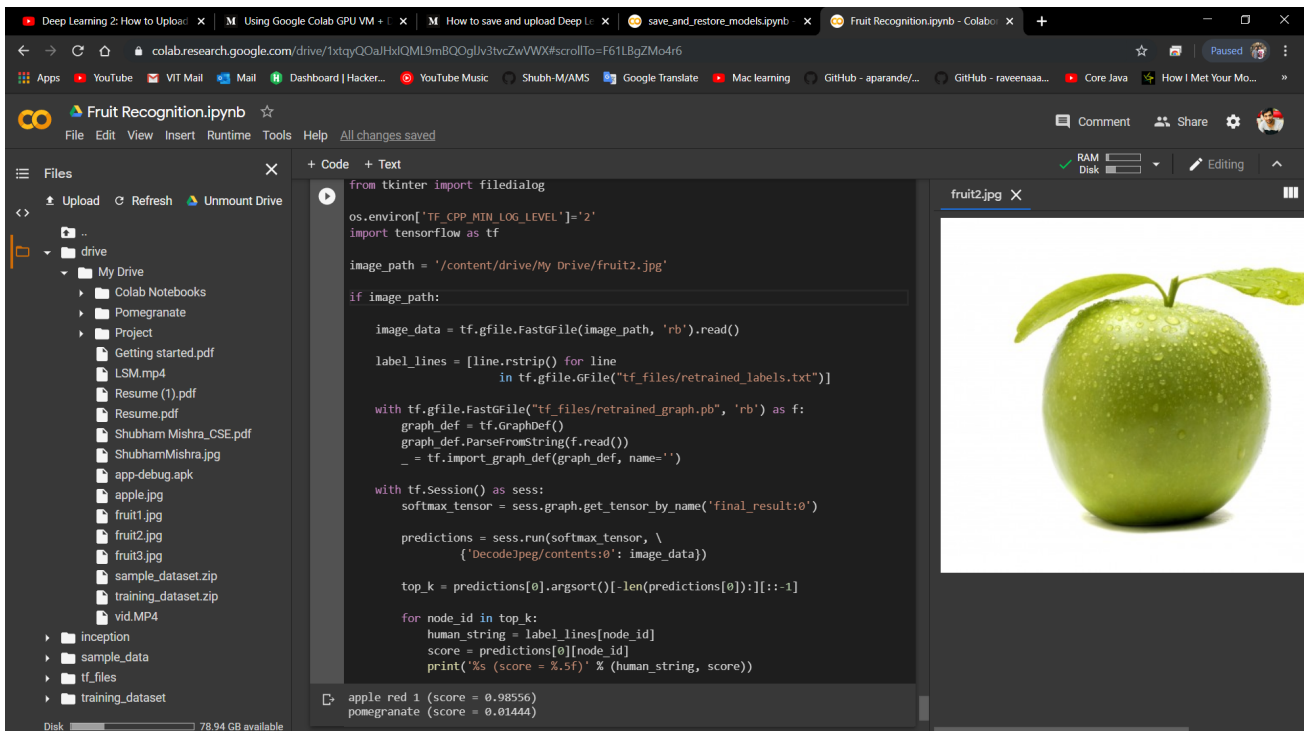


Fig. 3 (c): Experimental analysis of green apple

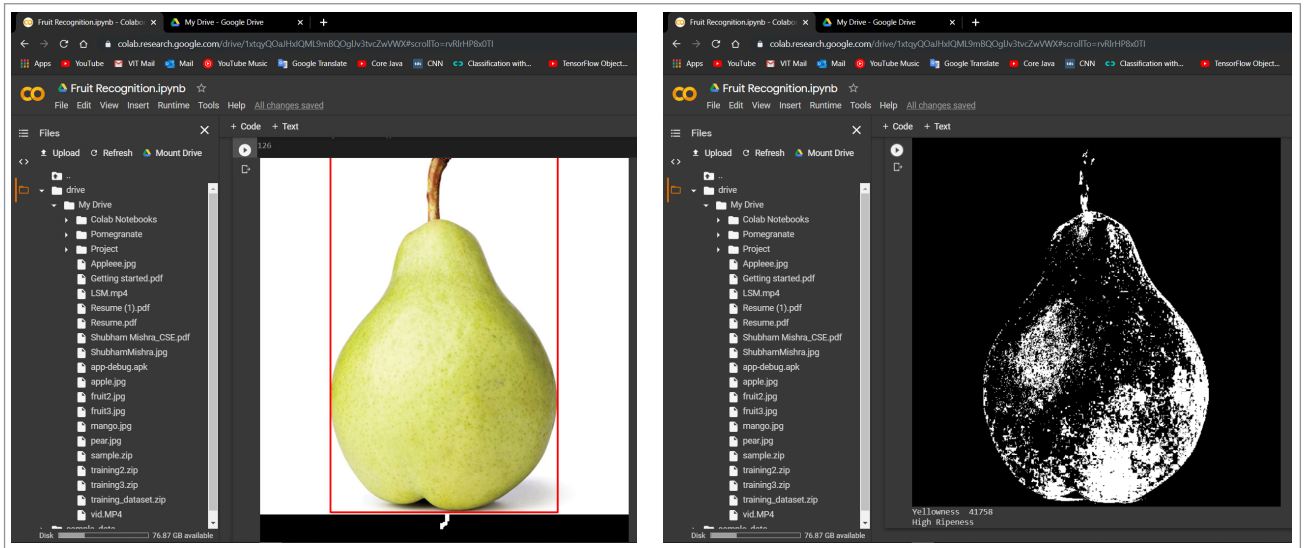


Fig. 4: Fruit freshness detection

of the component map received from the convolutional layer.

It reduces the size of the information while keeping up the attributes, subsequently forestalling the difference in the information because of the area change and improving the exhibition of the neural system by diminishing the information size. In light of these removed highlights, the grouping is performed.

### Experimental analysis

To order the picture information, first, the folders are created with different names and the image data is stored corresponding to the folder name.

Second, each picture information gathered is changed by the code of characterising fruits by the Google Inception-v3 model. Picture learning is completed. At last, in view of the finished retraining Inception-v3 model, the test continues.

### Result

We did tests based on the Inception-v3 model, which was fixed. Test image information was gathered using red apple, pomegranate, and green apple.

Because of the test, it was seen that red apple was grouped into 0.87959 per cent. Because of rehashed tests, it was affirmed that the more the quantity of preparing steps and picture information as per personal computer particulars, the higher the grouping precision. Later on, it will be important to develop a reason for high characterisation exactness by expanding the particulars of the explora-

tory personal computer and gathering more picture information.

### Conclusion

This undertaking attempts to start an area that is less explored at present. During this project, we had the option to investigate some portion of the profound learning algorithms and find qualities and shortcomings. We picked up information on deep learning, and we got a product that can perceive fruits from pictures.

We trust that the outcomes and strategies introduced in this article can be additionally extended to a greater task. From our perspective, one of the principal goals is to improve the precision of the neural system. This includes further exploring different avenues regarding the structure of the system.

Another alternative is to supplant all layers with convolutional layers. This appears to give some improvement over the systems that have completely associated layers in their structure.

A result of supplanting all layers with convolutional ones is that there will be an expansion in the number of parameters for the system. Another chance is to replace the corrected straight units with exponential direct units. We might want to evaluate these practices and attempt to discover new arrangements that give fascinating outcomes. Soon we can make a portable application that takes pictures of fruits and labels them accordingly. **EFY**

Categories of Fruits			Table 1	
Label	Number of training images	Number of test images	Accuracy on training set	Accuracy on test set
Red apple	872	219	93.22%	87.98%
Pomegranate	584	154	94.40%	88.16%
Green apple	621	160	99.15%	98.3%

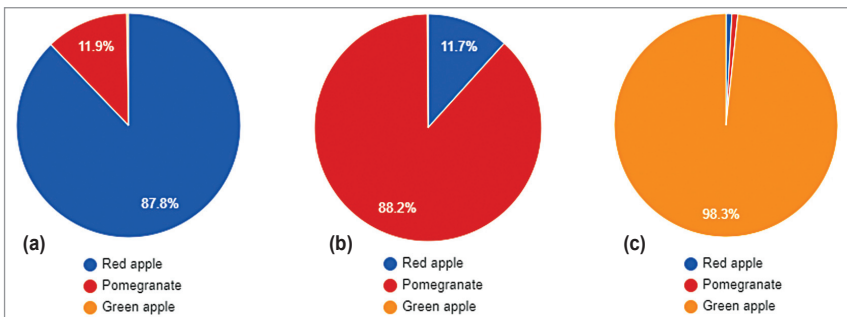


Fig. 5: (a) Red apple test, (b) Pomegranate test, (c) Green apple test



# Need For Touchless Technologies To Safeguard Against Viruses



**Rathan Natarajan**  
is assistant professor at  
Hindustan Institute of  
Technology

We have intelligent devices like smartphones, smart TVs, computers, and robots in use that need not be touched for operation. In fact, many more things need to be operated without touching through voice control and gestures, etc, such as ATM machines and check-in counters at airports

**S**cientists believe that as the hole in the ozone layer in Earth's stratosphere collapses, the sun's rays will strike the earth directly and cause new deadly diseases. Many diseases have developed and disappeared in the past, but Covid-19 infection remains a challenge for us at

present. The disease is unlikely to go away soon; some medical professionals believe that it may not go away at all and could continue to stay with us for long. This means we have to get used to living with this infection.



No one is certain, in spite of popular theories, where the infection originated



(Credit: <https://geomarketing.com/wp-content>)




### Look

Check for the Contactless Indicator  on your card and Contactless Symbol  on the store's checkout terminal.



### Tap

When prompted, bring your card within a few centimetres of the Contactless Symbol. 



### Go

Get the ok—a 'beep,' checkmark or green light—and go!

*How to use your contactless card (Credit: www.creditcardinsider.com/wp-content)*

from. Somehow the sores appeared and have spread all over the world. Unfortunately, many more viruses can attack us in the future and spread. So we need to prepare ourselves to fight against all these viruses and win, just like fishermen fight against waves in the deep sea and overcome them.

Symptoms such as runny nose, sneezing, sore throat, cough, and fever may indicate coronavirus infection. In some cases there is even vomiting and diarrhea, while in many cases the virus is present without any symptom. In this situation, anyone of us could be having the virus within us.

We all know the virus spreads through droplets released in the air by an infected person when he or she coughs, sneezes, or even speaks loudly. These droplets eventually settle down on surfaces which, if touched, can spread the disease. The problem is that we tend to touch so many things in our daily routine.

So how can we minimise touching things? Can technology help us in this situation?

Computers, robots, smart phones, smart TVs, etc in common use can now be activated without touching. Voice assistants, hand gestures, facial expressions, and retina scans, etc are all helping us in doing so to overcome the problem. But we still have to touch to execute many actions. New technologies are now needed to execute those actions without touching.

At an overcrowded airport, for instance, the boarding pass can be obtained by using hand gestures and voice assist devices in future. In the aircraft, a sensor could automatically initiate overhead luggage compartment's closure when it is full, or is not used for, say, five minutes. To open it, a new gesture-based technology could be developed.

Similarly, we could get a ticket with the help of a voice assistant at

the railway station. Toilets within all trains could be locked and unlocked with, say, gesture control. Likewise, all public toilets could also make use of some touchless technology.

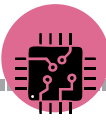
At the supermarket, we usually pick up the household items we need and pay the bill at a counter before leaving. Here, again, we can use automation and touchless technology to generate a virtual bill for the items being put in the shopping cart (trolley). We need not generate a physical bill at the counter as the payment can be made automatically from our bank account when we leave with the items. Some countries are already trying this system. It can be introduced in every country to avoid unwanted crowds at bill counters.

We can pay with a contactless wave credit card, which is already in use in India, whenever we buy an item. While using a wave credit card there is no need to hand over the card to the other person to put it in the POS machine, instead we can just place it over the machine ourselves. But there is a limit on the amount that can be paid thus due to security concerns. It would be better if this limit (usually ₹ 2,000) could be set higher after making the system more secure.

At present, we have to use an ATM's keyboard to withdraw money. There is a need to find a new touchless technology for the ATMs also. The fact is that, if we have intelligent devices everywhere that need not be touched for operation, not only Covid-19, no infectious germs will ever get transmitted by touching the devices in public domain in the future. **EFY**



*Kuri—A friendly home-assistant and security guard robot*



# Latest DC-DC Converters For Automotive And Industrial Applications

Some latest DC-DC converters are introduced here, along with the basic and new features, so that designers can select the best devices for their applications

Sani Theo

**D**C-DC converters are important parts of modern automobiles and industrial applications. This is because direct current (DC) power supplies are used in almost all the electrical devices in automobiles and other industrial applications.

A DC-to-DC converter is basically a DC electric power converter required in some devices because the standard DC sources (mostly batteries like 1.5V, 6V, 12V) available are either too high or too low in voltage to drive a particular circuit or gadget. Therefore some form of power conversion, either step-up or step-down, is required from a standard DC source.

For example, most mobile devices have 3.7V batteries. To charge them from a 12V car battery would require a DC-DC converter circuit because 12V is too high to charge a 3.7V battery. Again, most of the embedded system circuits in automobiles and industrial applications require either 3.3V or 5V DC sources, so you need power converters to drive them from a 12V battery. DC-DC converters are also used in many consumer electronics and domestic electrical systems.



Fig. 1: R05CT05S DC-DC converter (Credit: <https://recom-power.com>)

Power levels of DC-DC converters vary from very low (in small batteries) to very high (for high-voltage power transmission). Most of these converters are available as integrated circuits (ICs) and do not need many external components. These are available as complete hybrid circuit modules or as plug-in modules ready to use in an electronic assembly. Most power converter ICs include an integrated power MOSFET and are classified as regulators because they regulate the output voltage.

This article covers different types of DC-DC converters newly released/announced by different manufacturers for automotive and industrial applications. To better understand the features of these converters, let us first have a look at some major types of DC-DC converters available in the market.

## Types of DC-DC converters

The major DC-DC converter types are linear, switched mode, non-isolated, and isolated.

**Linear.** It uses resistive voltage drop to create and regulate a given output voltage. A linear converter can generate a voltage that is lower than the input voltage.

**Switched mode.** It converts DC voltage level by storing the input energy temporarily and then releasing that energy to the output at a different voltage. Energy storage can be done in either a magnetic field component like an inductor or a transformer, or in an electric field component such as a capaci-



Fig. 2: UWE-Q12 series DC-DC converter (Credit: www.murata-ps.com)



Fig. 3: AP61100Q chip (Credit: www.eepower.com)

tor. Transformer-based converters provide isolation between the input and the output.

**Non-isolated.** This converter is used when change in the voltage is small. It does not give protection from high electrical voltages and noise. The converters in this group include step-down (buck), step-up (boost), and buck-boost converters.

**Isolated.** It has a separation between input and output terminals. It has high isolation voltage properties and can block noise and interference. It also has cleaner DC output. This group includes flyback converter and forward converter.

### Common parameters/specifications

It is important that a DC-DC converter operates within the range of required DC parameters for a particular application. After understanding the different parameters of the converters, system designers can choose proper DC-DC converters for their applications. The most basic DC parameters are the input voltage range, the output voltage range,

and the maximum required output current.

DC input is an important parameter in DC-DC converters. Input voltages include 12V, 24V, 48V, 110V, 280V, and 360V. DC output is another important parameter to consider in DC-DC converters. Common output voltages are 3.3V, 5V, 12V, 15V, 24V, and 48V.

Other parameters include output power, line regulation, load regulation, minimum load, operating temperature, PCB footprint area, and topology. The most common DC-DC converter topologies are buck, boost, and buck-boost (flyback). Common features for DC-DC converters include constant current, over-voltage protection, over-current protection, and short-circuit protection.

Constant current provides constant output current, irrespective of the changes in load impedance. Over-voltage protection limits or shuts down the voltage output when over-voltage condition occurs. Over-current protection limits or shuts down the current output when over-current condition occurs. Short-circuit protection protects the converter in the event of a short circuit at load end.

### Some new features in DC-DC converters

There are many new features being added in some latest DC-DC converters. Apart from the wide range of input and output voltages, new features may include noise optimisation, higher efficiency, digital interface, power management, multi-channel input and output, remote control, ensuring compliance and compatibility, safety

standards, among others. Table 1 lists different DC-DC converters released/announced recently by some manufacturers.

Noise becomes an important parameter to consider for better performance and accuracy in DC-DC converters. Optimising a DC-DC converter for noise and electromagnetic interference (EMI) would enhance the performance of the power supplies in automotive and industrial applications. Electromagnetic compatibility (EMC) standards ensure proper operation of the equipment and control of EMI, so that unwanted effects are prevented.

For example, Flex’s BMR683 DC-DC converter has EMC specification according to EN55022/EN55032, CISPR 22/CISPR 32, and FCC part 15J regulations. Flex’s PUB-2M series has conducted EMI tests according to EN55032, CISPR 32, and FCC Part 15J. Traco Power’s TMR 4 series has EMC specifications as per EN55032, and FCC Part 15, both Class A and B.

Digital interface is becoming more popular in modern converters. Traditional way of controlling DC-DC converters using analogue techniques was simple to implement. However, over the past several years, with innovation in electronic devices—such as high speed, low power consumption, better efficiency, and inexpensive semiconductors—digital control is found much more advantageous over analogue techniques. DC-DC converters with digital interfaces are digitally controlled power sources that provide accurate and adjustable levels of voltage, current, and power. Digital control may include a processor, voltage/current programming circuits, software, current shunt, and voltage/current read-back circuits.

For example, Flex’s BMR683 DC-DC converter has a PMBus digital interface that enables the user to configure many aspects of the device operation through software control. It can be used with any standard two-wire I2C or SMBus host device. Rohm’s BD71850MWV DC-DC converter has digital I2C interface with clock frequency up to 1MHz. Diode’s AP61100Q converter has programma-

## Different DC-DC Converters Recently Released/Announced by Different Manufacturers

**Table 1**

Model	Make	Application	Input voltage DC range	Output voltage DC range	Output current	Output power	Soft start	Digital interface	Efficiency	RoHS compliant	Safety/quality standards
BMR683	Flex	Industrial	36V to 60V	18V to 32V	17.9A at 500W	500W	Yes	Yes	95.50%	Yes	IEC/EN/UL 62368-1
PUB-2M series	Flex	Industrial	5V to 24V	5V to 12V	0.167 to 0.4A	2W	NA	No	86.50%	Yes	IEC/EN/UL 62368-1
BD9P1X5EFV-C	Rohm	Automotive	3.5V to 40V	0.8V to 8.5V	1A	NA	Yes	NA	NA	NA	FS supportive/ AEC-Q100
BD9P2x5EFV-C Series	Rohm	Automotive	3.5V to 40V	0.8V to 8.5V	2A	NA	Yes	NA	NA	NA	FS supportive/ AEC-Q100
BD71850MWV	Rohm	Industrial	2.7V to 5.5V	0.7V to 3.3V	1.5A to 3A	NA	Yes	Yes	83% to 95%	NA	NA
UWE-Q12 Series	Murata	Industrial	9V to 36V	5V to 24V	5A to 24A	120W	Yes	NA	90% to 92%	Yes	IEC/EN/UL/CSA
AP61100Q	Diodes Inc	Automotive	2.3V to 5.5V	0.6V to 3.6V	1A	NA	Yes	Yes	89.00%	Yes	AEC-Q100
R05CT05S	Recom	Industrial	4.5V to 5.5V	3.3V or 5V	100mA	500mW	NA	NA	60.00%	NA	NA
URD48xxxD-30WR3	Mornsun	Industrial	18V to 75V	5V to 24V	0.6A to 4A	30W	NA	NA	84.00%	Yes	CISPR32/EN55032/ IEC61000-4-4/ EC61000-4-5/ EN62368
ORQB-50Y05x	Bel	Industrial	24V to 110V	5V	10A	50W	NA	NA	86 to 88%	Yes	IEC/EN/CSA/ UL 62368-1
TMR 4 series	Traco Power	Industrial	9V to 75V	5V to 24V	166mA to 800mA	4W	NA	NA	82% to 87%	Yes	IEC/EN/UL 62368-1

NA indicates the parameters are not clearly mentioned in datasheet

ble operation mode through digital input that turns the converter on or off.

Power management feature is included in some newer DC-DC converters. For example, Flex’s BMR683 DC-DC converter has power management feature that can be configured using its digital interface. Its software suite can be used to configure and monitor this product via the PMBus interface. It incorporates a wide range of configurable power management features that are simple to implement with a minimum of external components. Rohm’s BD71850MWV DC-DC converter is a programmable power management device for powering single-core, dual-core, and quad-core SoCs such as NXP-i.MX 8M Nano.

Efficiency is an important design parameter of DC-DC converters. Along with innovation and introduction of CMOS devices, digital control can improve the efficiency of a previously analogue design. With careful design, modern switching regulators/converters can achieve 90 percent efficiency and even more. For example, BMR683 can have high efficiency, typically 95.5 percent at

full load. BD71850MWV has its efficiency target between 83 percent and 95 per cent. Murata’s UWE-Q12 series DC-DC converters have efficiency up to 92 per cent.

Multi-input multi-output (MIMO) feature in newer DC-DC converters allows users to integrate multiple input sources and multiple output loads simultaneously. That is, this type of converter allows input sources to be added or removed seamlessly without cross-regulation problem. It is easy to achieve high extension capability for arbitrary inputs and outputs. For example, BD71850MWV integrates six buck regulators and six low-dropout (LDO) regulators to provide all the power rails required by the SoC and the commonly used peripherals.

The soft-start function in DC-DC converter is used to prevent large inrush current and output voltage overshoot. The function could be with an internally fixed soft-start time, or externally adjustable soft-start time, setting pin and externally adjustable oscillator duty cycle. Soft-start function is included in many DC-DC converters including BMR683, BD9P1X5EFV-C, BD9P2x-

5EFV-C, BD71850MWV, UWE-Q12 series, and AP61100Q.

Some DC-DC converters are integrated with remote control function, offering a convenient way to control your application. The control could be through a wire or wireless using infrared (IR) or some other wireless technology. For example, UWE-Q12 series has a remote sense circuit through which the product can be controlled using IR technology. TMR 4 series converter has dedicated pin for remote control function.

Ensuring safety is paramount to product users and industry. Adequate safety measures include fail-safe design against physical injury, damage to property, failure, or malfunction of a product. There are many industry safety standards that require restriction of hazardous substances or RoHS compliance, such as IEC/EN/UL safety requirements, Automotive Electronics Council (AEC) quality standards, etc. For example, BMR683, PUB-2M series, UWE-Q12 series, ORQB-50Y05x and TMR 4 series meet safety requirements according to IEC/EN/UL62368-1, while BD9P1X5EFV-C, BD9P2x5EFV-C, and AP61100Q are AEC-Q100 qualified. **EFY**

A dramatic mountain landscape with two hikers walking through large white letters spelling 'WHAT IF'. The hikers are carrying backpacks and are walking on a rocky path. The background features jagged, snow-capped mountain peaks under a cloudy sky.

# WHAT IF

## **WHAT IF ANYWHERE WAS ALWAYS CONNECTED TO EVERYWHERE?**

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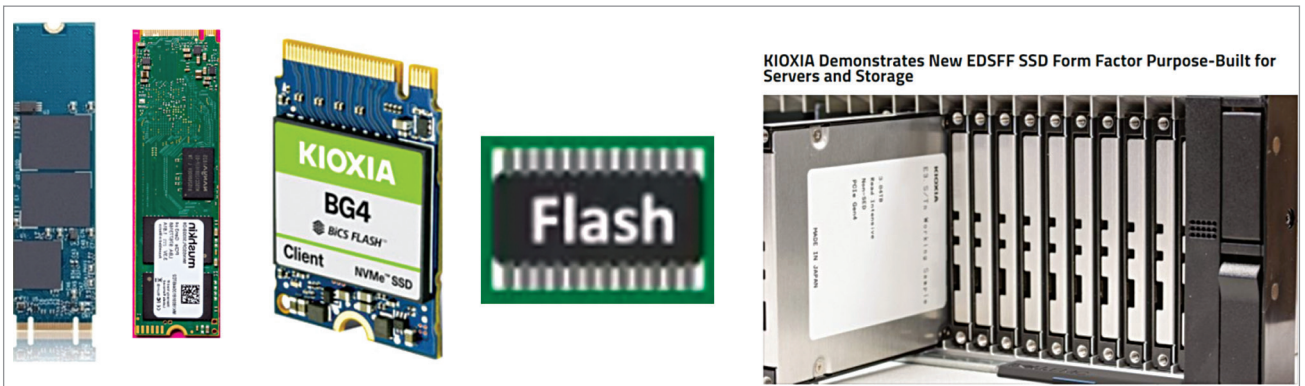


AHEAD OF WHAT'S POSSIBLE™



# Solid-State Drive: Ubiquitous Device In Making

With the tsunami of data in every application, a highly efficient data storage drive is going to be the de facto choice for all future gadgets starting from mobiles, laptops, and mini/microservers to high-performance computing systems



KIOXIA Demonstrates New EDSFF SSD Form Factor Purpose-Built for Servers and Storage

The various form factors of SSD drives



**Dr Sankar Reddy** has served as a faculty member at the Indian Institute of Science for fifteen years. He has built teams from scratch, nurtured, and grew them to world-class delivery teams in a multi-gigabit data rate. He founded Terminus Circuits ten years back

**N**on-volatile memory express (NVMe)-based solid-state drive (SSD) is a feature-rich device that can be exploited for future scaling needs via a peripheral component interconnect express (PCIe) bus for maximum throughput and lower latency. The recent trend of a further reduction in latency for hyperconvergence of servers in high-performance computing (HPC) systems increases its potential to be the ubiquitous candidate of the future.

## SSD and its inherent advantages

Before going into the details of what factors are in favour of SSD devices to be the most probable candidate of the future, we should first take a look at the importance of SSD as a storage device.

An SSD's faster boot speeds and orders of magnitude increase in the read/write speeds benefit an individual or an enterprise in saving time and improving productivity. The newer applications like streaming 4K/8K videos and the use case of 5G/6G communications will find SSD

a better match to address the bottlenecks as a storage partner in the essential chain of computer + network + storage. A data-centre-ready/cloud-ready infrastructure can help transform the economics for maintaining such a converged infrastructure. The following are three major components in revolutionising the future server farms:

**Computing server farms.** Over the years, we have experienced the explosion of data that may be further fuelled by technological revolutions such as the Internet of Things (IoT), artificial intelligence (AI), blockchain, autonomous driving, 4K/8K video streaming, 5G networks, etc. This has led to significant advancements in computing. To further reduce the latency in the cluster of computing cores, PCIe controller, network-on-chip (NOC), and the new standards like Compute Express Link (CXL) are being used. With the data-intensive advanced applications like AI and camera interface with HD videos, the load on the Internet has been increasing.

Of late, edge computing has become a prominent accelerator for AI processing

and ML by reducing the amount of data transfer on the net. This has been possible by in-memory computing or analysing the data through in-built analysers attached to the storage devices and computational storage drives (CSD).

**Networking.** The demand for the network bandwidth continues to grow exponentially with emerging applications like AI, high-bandwidth 5G use cases, ML, IoT, and edge computing applications. Huge demand for throughput with low latency is being addressed with various Physical Media Architectures of SerDes (Serialiser and Deserialiser), which is a cornerstone block for high-speed serial links.

The data can be transferred over optical/electrical cables or short PCB tracks. Various standard bodies are working on these SerDes specifications to support the ever-increasing demand for higher bandwidth and lower latency of the data centres, cloud and edge computing, 5G, AI, and ML applications.

**Storage.** The evolution of storage devices over the past seven decades witnessed continued miniaturisation of the storage drives, from a wardrobe sized drive that contains a few megabytes of data to a single-chip device that contains a few terabytes of data. The advancements in technology have helped to move from magnetic tapes to hard disk drives to NVMe-based SSDs. The storage elements have moved from magnetic devices/ferroelectrics to semiconductor elements, and the new one being flash memory devices with multi-level memory devices.

### Advantages of NVMe

NVMe is the prominent interface to the high-speed storage. PCIe interface that supports NVMe has become the default choice for building the SSD storage. This module consisting of PCIe bus, NVMe controller, and flash storage memories has distinguished advantages over many of the other storage systems.

The latency challenges are being optimised at various stages of HPC systems through emerging standards like CXL that include on the chip, chip to chip, boards to boards, and rack to rack within and across data centres.

## The Essentials of Hyperconvergence Systems/Infrastructure

Table 1

Computing	Networking	Storage
Many cores	Networking intra-chip	High throughput
Core to core communication	Inter-chip (NOC)	Low latency
Native PCIe	NIC (blade to blade or server to server)	Fast read/write cycles
Memory controller	CXL interface for low latency NIC (Financial trading)	Low power, no moving parts
DRAM controller	MIPI, USB	Security hardware/software
CXL	Read only or write only option through controller	Data processing closer to storage
—	—	No encryption needed as it is close proximity device in case of transferjet

To increase the throughput, the most prominent across the interfaces of many applications is PCIe, which is coming up with higher data rates for a given channel, and the latest upcoming specification will target 64Gbps per lane. This will help increase the throughput at the host site and the communication between the host and chip with a native controller on the chip. The PCIe, which supports as a bridge between the CPU and memory through the NVMe controller, has been the natural choice for building the future converged systems with integrated storage solutions.

Having said about the main features and the storage solutions that are emerging, we can address the demands of large storage systems comprising the SSD storage device.

The emerging systems and the complex applications draw the attention of specific features of the SSD-based storage solutions for further reducing the latency in applications like ML, addressing the security at hardware and software levels, reducing the throughput requirements between CPU and storage, distributed storage over the fabric, semi-processed data near storage, etc.

In other words, moving the data away from computation helps in saving the bandwidth, power, processing the metadata, security, and reducing latency.

**Having a camera interface.** Interfacing camera controllers to the storage device and transferring/analysing the data through a PCIe bus that seamlessly connects within the accelerators for graphics/images enhances the

system performance by reducing the workload at the main processors and eases the data transfer between storage and computing.

Also, the recent emergence of U.2, M.2, and EDSFF form factors further enhance the potential usage of NVMe-based SSD devices for all applications.

The table above gives the different elements and options that can form the enterprise computing systems of the future.

A careful look at the constituents of the future high-performance computing (HPC) systems infers that the thin line between the compute to networking, networking to storage, and computing to storage is diminishing.

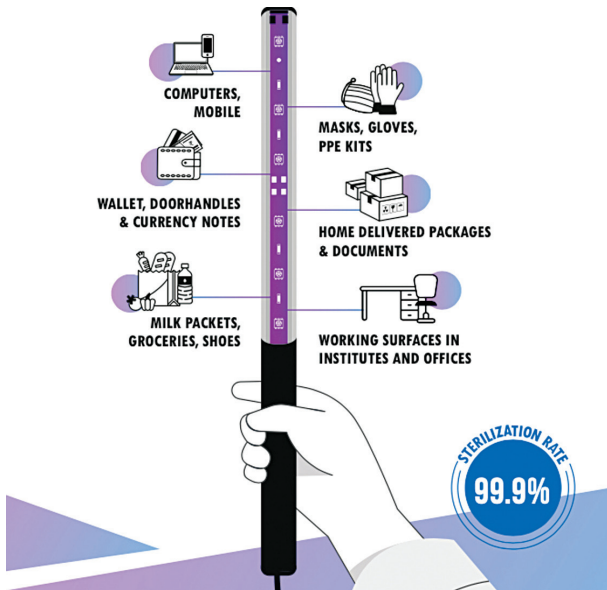
In reducing the latency across the ingredients of the hyperconverged systems, the NVMe-based flash storage systems play a critical role and emerge as the choice for all the storage solutions. The inherent advantages of the PCIe interface have become the de facto choice in the hyperconverged system.

To add to this, the NVMe controller has the adaptability to SSD architecture with the latest interface, memory controllers, advances in flash cells, and native controllers in CPUs. On top of all these, the controller is critical for customising for the umpteen number of applications that can be envisaged.

With the tsunami of data in every application, a highly efficient data storage drive is going to be the de facto choice for all the future gadgets and technologies like mobiles, laptops, HPC systems, edge computing, AI, ML, single board computing, car infotainment, and so on. **EFY**



# Are UV Sterilisers Effective In Combating Covid-19



Germiscan



IFITech Handheld

Potshangbam July

One can claim that the worst will be over only when a reliable vaccine is available. Until then there is not much one can do beyond maintaining physical distance from others, wearing a face mask, and washing hands frequently. The World Health Organization (WHO) and medical experts have been urging people to adopt the health guidelines religiously in a bid to ward off the virus. In the current scenario, strict hygiene practice is very important, considering the increase in the number of Covid-19 cases. However, even after following strict hygiene practices and sanitising surfaces in your home, the efforts can go in vain by just touching your phone, doorknobs, and other daily essential items. Therefore using ultraviolet (UV) light sanitising devices is helping considerably in disinfecting all your items with ease and efficiency.

## How UV light is helping

UV light has been recognised for its effectiveness in sterilisation and disinfection. It has the capability to kill germs or inactive the virus. A study conducted by researchers at the Columbia University Irving Medical Centre shows that far-ultraviolet C (UVC), when exposed to a particular wavelength that is safe to use around humans, can kill 99.9 per cent of coronaviruses that are present in airborne droplets. According to the researchers, continuous exposure to far-UVC light can kill ninety per cent airborne viruses in about eight minutes, 95 per cent in eleven minutes, 99 per cent in about sixteen minutes, and 99.9 per cent in 25 minutes.

UV light can be used with special bulbs that emit the right amount of UVC light, which is required to kill the virus. Traditionally, UVC lights have been utilised to



The House of Sensation 3-in-1 Portable



Life of Riley UV phone box



ULVIO UV Disinfection Lamp

disinfect drinking water, air, and pharmaceutical tools. UVC light is safe to use for disinfecting vegetables, fruits, utensils, mobiles, toys, surfaces, etc. These are effective in reducing the level of airborne virus in indoor environments.

### Pros of UV sterilisation

UV sterilisation devices can disinfect more efficiently than traditional cleaning methods. The most important benefit of UV sterilisation is that no chemicals are required, and no chemical residue is left behind, and hence it's safe to use. Besides, UV light is environment friendly. One should note that UV light disinfection is a physical process and not a chemical method.

Excessive or direct exposure to UV light is harmful to human beings as it can badly affect their skin and eyes. This is why UV sterilisation is used with UVC lamps having a protective shield. But the key thing to understand is that UV light is safe, if used correctly, and does not cause harm, unlike the harsh chemicals in cleaning products.

UV disinfection is a dry method that effectively prevents the growth of fungi in the future. In other disinfection methods, a damp environment may be created where fungi can thrive with dire consequences.

### Cons of UV sterilisation

UV sterilisation can kill a wide array of microorganisms, including drug-resistant bacterias. But it also has drawbacks. UV only works in its light path and can become ineffective when blocked by objects.

Therefore one must ensure that the

object to be sterilised is placed directly under the light. If the object is a bit off or not in line with the UV light, it will not be sanitised. One method to minimise the problem is to incorporate several UV bulbs to generate UV radiation from different angles.

UV light devices are not recommended for sterilising hands and using on skin. These can have harmful effects on our eyes and skin. These devices may even lead to chronic eye damage, which is not curable.

Here are some of the best UV sanitisers that are helpful during the Covid-19 pandemic.

**Germiscan.** The product is India's first UVC LED-based handheld steriliser. The company claims that the device can kill up to 99.9 per cent of germs within six seconds. It is equipped with an inbuilt sensor and a safety switch to avoid direct skin contact. Since it is a portable product, it can be easily carried to the market or workplace. The device can be charged like a phone and has a battery life of three hours on a single charge. Besides, it can be customised for use on escalators, large surfaces, travel baggage, and trolleys. The company plans to come up with a more affordable mobile version.

**IFITech Handheld UVC light wand steriliser.** The portable steriliser comes handy for products that can't be cleaned with soap or sanitisers such as mobiles, face masks, electronic gadgets, currency, packages delivered to homes, car dashboards, clothing, among others. This wand steriliser is just 30.4cm in length and fits easily in bags or purses. Hence, it

is easy to carry to job or grocery stores.

**The House of Sensation 3-in-1 Portable UV steriliser.** It is a multi-functional double UV steriliser with auto aromatherapy function. It comes with sixty-degree UV sterilisation, no dead zone, and kills bacteria in three minutes. It features a progress bar display that helps you know the sterilisation process clearly. It can be used to sterilise items of daily needs and personal healthcare products like masks, goggles, watches, etc. It uses eco-friendly material, nano-coating, and is resistant to high temperatures.

**Life of Riley UV phone box.** The gadget disinfects smartphones, watches, jewellery, glasses, keys, pacifiers, tableware, and other small items. It claims to destroy up to 99.9 per cent of bacteria in 3 minutes. The box comes in a compact size and is lightweight. It is available with a USB charging cable. It is easy to carry and can be used at home, office, car or even while travelling. The ultraviolet rays of the product are produced by UVC-LED, which is safe and environmentally friendly. Besides, it has a wired mobile charging option.

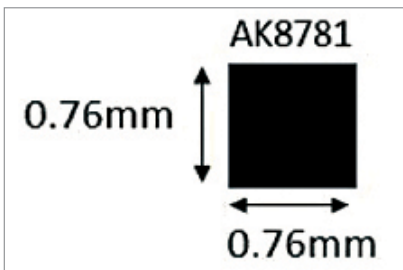
**ULVIO UV Disinfection Lamp.** It has 99 to 99.9 per cent sterilisation rate to kill bacteria, viruses, fungus, and spores. It is smoke-free as well as pollution-free, unlike traditional methods like fogging and chemical spray. The lamp is based on dual sterilisation, such as ozone and UVC. It features a motion sensor that automatically turns off on detecting motion around. The portable device can be placed anywhere and is ideal to use in home, office, clinic, hospital, etc. **EFY**

# Truly Innovative **TECH**

Amongst hundreds of press releases of new products received by us, these are the ones we found worthy of the title *Truly Innovative Tech*

## Smallest latch-type Hall IC

The AK8781 features fast response time and high-temperature operation from -40 degrees Celsius to +125 degrees Celsius in a small package of 0.76mm × 0.76mm as against 1.1mm × 1.4mm for the previous IC. It can detect high-



speed rotation as fast as 95,000r/min, for example, of 4 rotor poles and phase delay within five degrees of the electric angle. So, designers can create much smaller BLDC motors for small-size drones and thus replace coreless motors. It can also be used for robotic joints of consumer products and industrial equipment.

Asahi Kasei Microdevices (AKM)  
[www.akm.com](http://www.akm.com)

## Infrared LED for iris recognition

The NIR-C19M series of IR LEDs has a wavelength of 810nm, allowing a clear contrast effect to read the pattern of the



iris. It uses an advanced ISP image processor, together with a CMOS sensor, to receive infrared reflection from a human eye for authentication, which leads to strong security and quick recognition. It is specially designed to recognise the iris of humans for devising new methods of biometric authentication and iris-recognition for eye-tracking keyboard, smartphones, etc. Its advanced security features eliminate the need for costly ID authentication devices.

Everlight Electronics  
[www.everlight.com](http://www.everlight.com)

## Integrated networking solution

The BCM8850 scalable series processes up to 14.4Tb/s of line card traffic, supporting up to 18 400GbE ports, 72 100GbE ports, or a mix of front panel ports from 10GbE to 400GbE, operating



at Layer 2 through Layer 4. It enables system vendors to build a scalable product line based on a unified architecture for: (a) multi-terabit core and edge routers for data centre, packet transport, or carrier network applications; (b) large-scale spine and leaf switches for data centres with integrated deep buffering and hierarchical quality-of-service (HQoS); (c) multiple interconnected modular systems to create a scalable core platform for switching and routing capacity multiplication. It is claimed to be the world's first device that can achieve such high speed, and it fulfils

the need for mission-critical applications that require high-capacity switches  
Broadcom Inc  
[www.broadcom.com](http://www.broadcom.com)

## High-speed gaming DRAM

Crucial Ballistix MAX 5100 gaming DRAM offers the highest speeds for an optimal gaming memory. It incorporates custom



tuning at die level, resulting in high performance. It is purpose-built, allowing the new 5100MT/s modules to deliver blazing fast speeds to hardcore gamers and maximised results for overclocking enthusiasts. It is compatible with latest AMD and Intel platforms and offers low latency for extreme overclocking.

Crucial  
[www.crucial.in](http://www.crucial.in)

## Blue-green chip LEDs

The 1608-size high-accuracy blue-green chip LEDs have special wavelengths, which allow implementation of Color Universal Design in a wide range of



applications such as fire alarm system indicator lights, industrial equipment warning lamps, and public transportation information displays. The LEDs' ability to emit different colours allows

people suffering from P-type and D-type colour blindness to distinguish between red and green, so that correct information is accurately interpreted by them.

ROHM Semiconductor  
www.rohm.com

## Secure Bluetooth solutions

These Bluetooth Low Energy SoCs and modules are ultra-compact, low-cost and have long battery life as well as security

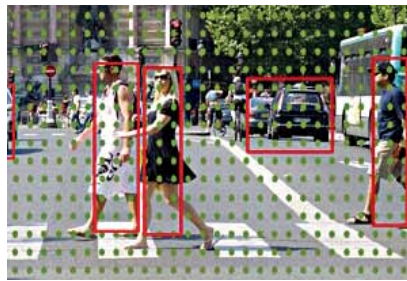


features that include Secure Boot with Root of Trust and Secure Loader, which, along with high-performance and security, are ideal for IoT device makers. Due to small size, the SiP modules add turnkey Bluetooth connectivity to extremely small products. These also support multiprotocol connectivity for the most demanding applications ranging from gateways, hubs, and smart lighting to wireless sensors, actuators, and portable medical equipment. Their small size and fully certified bluetooth SiP allows designing devices with Bluetooth capability without worrying about space generally scarce in wearables and earphones. With a small SiP, more free space is available to accommodate batteries and other sensors.

Silicon Labs  
www.silabs.com

## 4D imaging radar on a chip

This all-weather radar can detect cars from 500 metres and pedestrians from 200 metres, with an angular resolution greater than one degree. It uses a powerfully focused beam based on proprietary Phased Array radar technology, which is used in cutting-edge military systems including the F-35 fighter jet and air-defence systems. The focused beam created by dozens of transmitters rapidly



scans the field of view. The receivers ensure a much-improved radar image, a better signal-to-noise ratio, and a wide detection range (nearly 6x compared to existing radars) of obstacles such as cars and pedestrians. Using advanced military-grade technology used in commercial automotive applications, it ensures robust and reliable safety of both pedestrians and passengers.

RFSee  
www.rfisee.com

## TMR digital magnetic sensor

RedRock RR122-1A22-511/512 wafer-based TMR (Tunneling Magnetoresistance) digital omnipolar sensor has operating frequency of 10Hz, a voltage



supply range of +1.7V to +5.5V. With a low current drain (75nA) for an active magnetic sensor, the RR122-1A22 series is suited for performing the 'wake up' or 'turn on' function for battery operation. It is optimal for power-sensitive applications, and offers extremely strong magnetic sensitivity (9G or 0.9mT).

Coto Technology  
www.cotorelay.com

## Thin optical sensor

The MAXM86146, a dual-photodetector optical sensor, includes built-in algorithms for heart-rate and oxygen-saturation (SpO2) monitoring, as well as advanced activity classification. Its small size and ease of design allows innovative biosensing features in less space and supports rapid development

of accurate, continuous health-monitoring devices. Additionally, the module comes with biosensing algorithms that



are verified by strict medical standards for measuring vital signs. It allows wearable product designers to achieve a 45% thinner optical design and provides ease of access for health monitoring.

Maxim Integrated  
www.maximintegrated.com

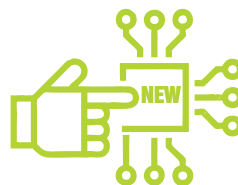
## Chip that requires no battery

An ultra-low-power MCU called the ONiO.zero, which can harvest energy from its surroundings and utilise it, requires no external batteries or capacitors. Despite the small size, it is quite powerful and can operate with the help



of a wide range of energy sources such as multi-frequency RF bands including GSM and ISM. Built on the RISC-V 16/32 bit architecture (RV32EMC), it has a mask ROM of 1kB, RAM of 2kB, and ULP Flash of 8/16/32kB. Operating frequency is up to 24MHz, while it can safely work under temperatures ranging from -40 to 85 degrees Celsius. An internal RF rectifier of multi-frequency bands (800/900/1800/1900/2400 MHz) provides support for harnessing power from GSM or ISM. It can achieve high energy efficiency of 85 to 90%. No batteries means less number of components required, which leads to more space.

ONiO  
www.onio.com



## COMPONENTS

### Low-power MCUs

STM32WB35 and STM32WB30 Value Line are the new dual-core multi-protocol MCUs from STMicroelectronics for large-scale IoT applications such as fleet and resource management, as well as asset monitoring and tracking. The



extremely low-power MCUs integrate a 2.4GHz radio managed by a dedicated Arm Cortex-M0+ core, with a 64MHz Arm Cortex-M4 for the main application for permitting uninterrupted real-time performance. They support Bluetooth Low Energy 5.0, Zigbee 3.0, OpenThread (IEEE 802.15.4) protocols and concurrent modes, with built-in security features. The devices include up to 512kB integrated Flash memory and up to 96kB SRAM, with a Quad-SPI interface for connecting to external high-speed memory. They also feature secure firmware installation, hardware encryption for the application and radio stacks, hardware public-key authority, hardware accelerators for state-of-the-art cryptographic algorithms, and support for secure OTA firmware updates.

STMicroelectronics  
[www.st.com](http://www.st.com)

### Motor controller

The LX7720 radiation-hardened mixed-signal motor controller from Microchip aims to reduce weight and board space. By reducing the number of components on a system, developers can inspect and test fewer parts, while also minimizing the physical points of potential failure due to a smaller number of connections and solder joints. Some of the integrations into this device are: four half-bridge N-channel MOSFET



drivers, four floating differential current sensors, pulse modulated resolver transformer driver, three differential resolver sense inputs, six bi-level logic inputs, power drivers via external FETs, loop control electronics for voltage or current control, and position read-back. It serves as a mixed-signal companion IC to the selected digital IC used in the application and is ideal for enabling various motor control applications in space robotics and human-rated space missions.

Microchip Technology  
[www.microchip.com](http://www.microchip.com)

### Diode array

SP1250 discrete unidirectional TVS diode array from Littelfuse provides high electrostatic discharge (ESD) protection for consumer electronic equipment by safely absorbing repetitive ESD strikes of  $\pm 30\text{kV}$  (contact and air discharge) without any performance degradation. Each device can dissipate up to 50A, 8/20 $\mu\text{s}$  surge event. Typical applications for the SP1250-01ETG include desktops, servers, notebooks, computer peripherals, medical equipment, POS terminals, test equipment, and portable battery.



Littelfuse  
[www.littelfuse.com](http://www.littelfuse.com)

### Buck boost DC-DC converters

The ISL9122A, a flexible buck-boost switching regulator with bypass mode from Renesas, provides ultra-low quiescent current ( $I_Q$ )  $< 1.3\mu\text{A}$  for powering sensors, MCUs, wireless devices, and other system components. It features low shutdown mode current of



7nA to extend battery life, high efficiency at light load (84% at 10 $\mu\text{A}$ ) and 97% peak efficiency to reduce power drain and heat buildup, automatic and selectable forced bypass power-saving mode to reduce  $I_Q$ , output current up to 500mA ( $V_{out} = 3.3\text{V}$ ,  $V_{in} = 3.6\text{V}$ ), ultra-small footprint with  $1.8 \times 1.0\text{mm}$  WLCSP package or  $3 \times 2\text{mm}$  DFN package, requires only three external components (inductor, input and output capacitors), full protection against over-current, short-circuit and overheating. Operating off 1.8V to 5.5V, it extends the battery life of smart IoT devices. Target applications include wireless earbuds, fitness bands, smartwatches, water and gas meters, portable medical devices and battery-operated smart IoT devices.

Renesas Electronics Corporation  
[www.renesas.com](http://www.renesas.com)

### DC-DC converter in SOIC package

R05CT05S, a high-isolation, high power density, 0.5W DC-DC converter from RECOM provides a fully regulated, low-noise output. It has a nominal 5V input (4.5 – 5.5V) and is settable by a resistor to 3.3V or 5V DC for direct connection to the load, or 3.7V/5.4V DC to power a downstream LDO for ultra-low noise applications. Protection and control features include short-circuit immunity, over-temperature shutdown, and under-voltage lockout. It is suitable for medical applications up to 5000m altitude and applications with high common-mode, switched voltages such as high-side gate driver power supplies.



RECOM  
[www.recom-power.com](http://www.recom-power.com)

### Graphic controller ICs

To facilitate larger displays at greater resolution, graphic controller ICs BT817 and BT818 have been introduced by

Bridgetek. These are meant for use in retail, digital signage and office management systems, as well as public information units, vending machines, domestic appliances, store/mall direction find-



ing systems, training/educational equipment, and interac-

tive exhibits. Each has 1MB embedded graphics RAM, which can be supplemented by attaching an external NOR flash memory through the QSPI interface. BT818 is optimised for use with 4-wire resistive touchscreens, while BT817 for capacitive touchscreens (with detection of up to 5 different touch-points).

*Bridgetek*  
[www.brtechip.com](http://www.brtechip.com)

## DC-DC converter

For use in convection-cooled equipment and applications, including microcontrollers, data-com, telecom, remote sensor systems, and portable elec-



tronics, a DC-DC converter series has been introduced by CUI. Its features include 2:1 and 4:1 input voltage range, 3W power, single regulated output, 1,500V DC isolation, 125 to 600mA output current, -40 to +85 degrees Celsius operating temperature, low profile, and protection against over-voltage, over-current, and short-circuit.

*CUI Inc.*  
[www.cui.com](http://www.cui.com)

## GNSS receiver

The new u-blox M10 is a highly integrated global navigation satellite system (GNSS) designed for ultra-low power, high-performance positioning applica-



tions such as sports watches or asset and livestock trackers. It can track up to four GNSS constellations at once to deliver positioning data even in challenging environments. The receiver's Super-S technology helps distinguish positioning signals from background noise to capture positioning data even when satellite signals are

weak. The device consumes 12mW in continuous tracking mode, making it ideal for battery-powered applications.

*u-blox*  
[www.u-blox.com](http://www.u-blox.com)

## SENSORS

### Digital magnetic sensor

Coto Technology has released RedRock RR122-1E73-511/512 wafer-based tunneling magnetoresistance (TMR) digital omnipolar sensor, featuring an operating frequency of 2,500Hz, a voltage supply range of 1.7V to 5.5V, and an extremely high magnetic sensitivity (15G or 1.5mT) in an ultra-miniature package at a competitive price. The sensor can be used in products ranging from small battery-powered electronics to industrial machinery. Specific applications could include proximity detection, rotary sensing, utility meters, portable rechargeable medical devices, motor controllers, and consumer electronics.

*Coto Technology*  
[www.cotorelay.com](http://www.cotorelay.com)



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### Health sensors

The Health Sensor Platform 3.0 (HSP 3.0) from Maxim monitors blood oxygen saturation (SpO2), electrocardiogram (ECG), heart rate (HR), body temperature, and motion. Included algorithms provide HR, heart-rate variability (HRV), respiration rate (RR), SpO2, body temperature, sleep quality and stress level information at clinical-grade levels. It includes:



**MAX86176.** For synchronous acquisition of PPG and ECG measurements, providing pulse transit time for cardiac health.

**MAX20360.** Having integrated power and battery management power management IC optimised for advanced body-worn health sensing devices.

**MAX32666.** Bluetooth (BLE)-enabled, ultra-low-power microcontroller with two Arm Cortex-M4F cores and an additional SmartDMA, which permits running the BLE stack independently.

**MAX32670.** Ultra-low-power micro-controller for PPG algorithms of pulse rate, SpO2, HRV, RR, sleep quality and stress monitoring.

**MAX32028.** Reads the temperature and can be mounted on a flex cable or PCB, making it easier to incorporate into wearables.

*Maxim Integrated*  
[www.maximintegrated.com](http://www.maximintegrated.com)

### CMOS image sensor

The new XGS family of image sensors from ON Semiconductor include the XGS 45000, XGS 30000, XGS 20000, and XGS 5000. These provide 12-bit image quality at a high frame rate, detailed imaging with up to 45-megapixel resolution, and up to 60fps in 8K video mode. These are meant for challenging IoT applications such as machine vision and intelligent transportation systems. A global shutter ensures that moving objects can be captured without any motion artefacts.



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*ON Semiconductor*  
[www.onsemi.com](http://www.onsemi.com)

## ENTERPRISE-CLASS PRODUCTS

### High-performance computer

For high-performance connectivity, the DA-820C series fanless 48.3cm (19-inch) 3U rackmount computer from Moxa features a powerful 7th generation Intel Xeon or Core i7/i5/



i3 processor and multiple expansion interfaces to include IRIG-B, serial, and Gigabit Ethernet fibre SFP connectivity for smart grid applications. By using only one high-performance computer to run multiple operating systems on virtual machines, instead of installing multiple computers to run each OS separately, saves space and costs. To handle high-speed, low-latency communications for exchanging large amounts of data, while withstanding high EMI/EMC interference, the DA-820C features SFP interface for gigabit Ethernet fibre-optic communications.

*Moxa*  
[www.moxa.com](http://www.moxa.com)

## Surveillance system

The security camera by Prama Hikvision incorporates AcuSense technology that precisely captures any unwanted intrusion. It reduces false alarm triggering, does more efficient and effective file searching (based on human and vehicle classification), and combines siren with flashing light. With high accuracy, the system disregards alarms triggered by other objects such as rain or leaves and delivers alarms that are associated with human or vehicle detection.

*Prama Hikvision*  
[www.hikvision.com](http://www.hikvision.com)



## Component epoxy

The Vitralit UD 1405 from Panacol-Elosol GmbH is a transparent, solvent-free, one-component epoxy that has low viscosity and good wetting properties. It allows the reinforced windings to be



cured within seconds through irradiation with UV (365nm) or visible (405nm) light. Fibres or filaments can first be pulled through an adhesive bath, then wound onto the rotor or respective cylinder and cured with UV or visible light. A secondary thermal cure ensures that the layers of coated windings below the surface become fully cured. After curing, Vitralit UD 1405 is electrically insulating, shows minimal shrinkage, and remains resistant at temperatures from -40 degrees to 180 degrees Celsius.

*Panacol-Elosol GmbH*  
[www.panacol.com](http://www.panacol.com)

## MANUFACTURING EQUIPMENT

### 3D printer

The Ultimaker 2+ Connect 3D printer from Ultimaker allows users to send print jobs via Wi-Fi or Ethernet. Cloud 3D printing enables remote file transfer with added security from anywhere globally. The printer also offers a 6cm colour touchscreen,



an ergonomic feeder lever, and a stiffer build platform for ease of use and reliability.

*Ultimaker*  
[www.ultimaker.com](http://www.ultimaker.com)

### Microwave amplifier

The R&S SAM100 microwave amplifier from Rohde & Schwarz features ease of operation, robust design, and



super-compact footprint within its 2 to 20GHz range with up to 20W output power. It targets manufacturers

of passive and active microwave components, and microwave devices for mobile radio (UMTS, LTE, 4G, 5G), IoT (WLAN, Bluetooth), satellite, and radar applications. Its high gain with low noise at superior linearity makes the unit highly suited to AM, FM, PM, and OFDM applications.

*Rohde & Schwarz*  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## MODULES & BOARDS

### IoT modules

Silicon Labs has launched wireless modules with full-stack support for commercial and consumer IoT application development with flexible package options



and highly integrated device security. The new modules include xGM210PB that supports Bluetooth, Zigbee, OpenThread, and Wi-Fi; BGM220—ideal for a broad range of Bluetooth 5.2 LE applications including appliances, asset tags, beacons, portable medical, fitness and Bluetooth mesh low-power nodes; MGM220 - ideal for Zigbee Green Power and energy harvesting applications; BGX220 Xpress that includes an onboard Bluetooth stack, Xpress command interface, and pre-programmed cable replacement firmware to deliver a serial-to-Bluetooth LE solution needing no firmware development.

*Silicon Labs*  
[www.silabs.com](http://www.silabs.com)

### Haptic control board

There is a growing demand for vibrational feedback, which allows more intuitive control. The HAPTIC Reactor Heavy Type developed by Alps Alpine produces an excitation force of 15G (at 100g) at a low frequency (130Hz), despite compact dimensions of 33 × 23 × 13mm (W × D × H), while retaining the typical HAPTIC Reactor characteristics of horizontal resonance, which is easier to perceive with fingertips and has an outstanding response speed. A small input voltage of 7V eliminates the need for a booster circuit.



*Alps Alpine*  
[www.alpsalpine.com](http://www.alpsalpine.com)

### SoM

PolarBerry, a production- and deployment-ready SoM by Sundance



Multiprocessor comes with a hardened 64-bit, multicore real-time, Linux-capable RISC-V MPU subsystem and PolarFire SoC field-programmable gate array (FPGA). Its compute engine delivers up to 50% lower power than alternative FPGAs, 250k logic elements (LEs), and features four high-speed, low-power transceivers from 250Mbps to 12.7Gbps. It is suited to the development of embedded computing and real-time applications based on RISC-V processors as an alternative to ARM. Typical applications will be found in the defence/mil-aero, AI/ML, communications, automotive, industrial automation, and imaging markets as well as the Internet of Things.

*Sundance Microprocessor Technology*  
[www.sundance.com](http://www.sundance.com)

### Single board computer

To be in line with the fast-growing semiconductor tech for various IoT applications, the open-source low-cost RuggedBOARD SBC with phyCORE-A5D2x SoM based on ARM Cortex-A5 SoC @500 MHz, provides a good plat-



form for rapid prototyping. It is also suitable for immediate use in Industrial IoT and other verticals. The SoM has 64MB DDR RAM and 32MB NOR flash, Ethernet, and PMIC onboard. Multiple interfaces for industrial field devices are supported such as Ethernet, RS232, CAN, and RS485. The board contains standard MikroBUS header for add-on sensors, actuators, and multiple wireless modules such as ZigBee, LoRa, Bluetooth. For cloud connectivity, 3G, 4G, NB-IoT, WiFi are provided. It has variants with WiFi or eMMC.

*RuggedBoard*  
www.ruggedboard.com

## T&M SOLUTIONS

### Vector network analyser

VNAs with more frequency range, port power and dynamic range, faster, and with varied functionalities are required for data flow, communications, food, healthcare, defence, civil infrastructure, robotics, and automation. With this in mind, the PicoVNA 108 by Pico Technology can see out further to 8.5GHz and see down deeper to -124dB. It allows RF mixer and RF/IF system characterisations, and is capable of delivering all four s-parameters in as little as 190µs, with high dynamic range and accuracy.



*Pico Technology*  
www.picotech.com

### Multi-featured oscilloscope

Infiniium EXR-Series, which is an 8-channel oscilloscope from Keysight Technologies, extends the power of Infiniium MXR oscilloscopes. The MXR-Series and EXR-Series feature multiple instruments and applications such as oscilloscope, digital voltmeter (DVM), waveform generator, Bode plotter, counter, protocol analyser, and logic analyser integrated into a single platform. Both platforms offer advanced software applications and features that simplify debugging, power measure-



ments, and remote collaboration. The EXR-Series offers up to 8 analogue channels that operate simultaneously at 2.5GHz with 16 independent digital channels.

*Keysight Technologies*  
www.keysight.com

### Evaluation kit

Evaluation kit based on an OPTIGA Trust M security solution for Raspberry Pi from Infineon simplifies design and implementation of secured smart home devices. Using this kit, device manufacturers can experience strong security in combination with the new Connected Home over IP standards that are being developed by the Zigbee Alliance. Features include common Criteria Certified EAL6+ (high) hardware security controller, true zero touch provisioning, secured data storage, support (for AES, ECC, NIST and Brainpool P256/384/512, RSA, TLS), TRNG/DRNG random number generators, I2C interface with shielded connection (AES encrypted and authenticated communication), hibernating mode for zero power consumption.

*Infineon Technologies AG*  
www.infineon.com

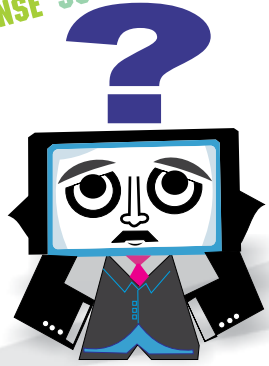
### Pyrometry Platform

Advanced Energy has released the Impac Series 600 for non-contact temperature measurement of non-metallic or coated metallic surfaces in industrial manufacturing applications. Featuring a modular, field-configurable multichannel plug-and-play design, this pyrometry platform has a multi-sensor head design, which interfaces with a central hub, enabling cost-effective temperature measurement, and power control and optimisation of industrial heating applications. It is user-friendly and provides the flexibility to support applications in a wide variety of target markets, including automotive, laminating, injection moulding, PET bottle production, packaging, and more.

*Advanced Energy*  
www.advancedenergy.com



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## Are You In Suspense?

**Are you wondering what happened to your order or payment, even after a fortnight? But did you mention your name and address clearly while sending payment, and what the payment was for?**

We get several payments every month without adequate instructions or even identity of the person sending the payment. As a result we are unable to take appropriate action on these, till we get a complaint - if at all.

At EFY, we want you to be our satisfied customer. So please do let us know in case your payment or instructions are not even acknowledged within a fortnight. We are not that lazy!

**Email:** support@efy.in  
**Ph:** +91-98111-55335

EFYGROUP

YOURS SINCE 1969

# A Simple Timer Based On Arduino Uno

P. Balasubramanian

Presented here is a simple timer built around an Arduino Uno board. It can be used to measure the time delay duration of devices like timer relays, circuit breakers, and other sequential logic circuits. This timer will be a low-cost solution for

laboratory/industrial requirements. The author's prototype is shown in Fig. 1.

## Circuit and working

The schematic diagram of the kit, shown in Fig. 2, has few components besides the Arduino Uno board (Board1). It has external input contacts to start and stop the timing measurement. Both the contacts can be either normally open (N/O) or normally closed (N/C). The change-over operation of start contacts initiates timing measurement, and of the stop contacts stops the measurement.

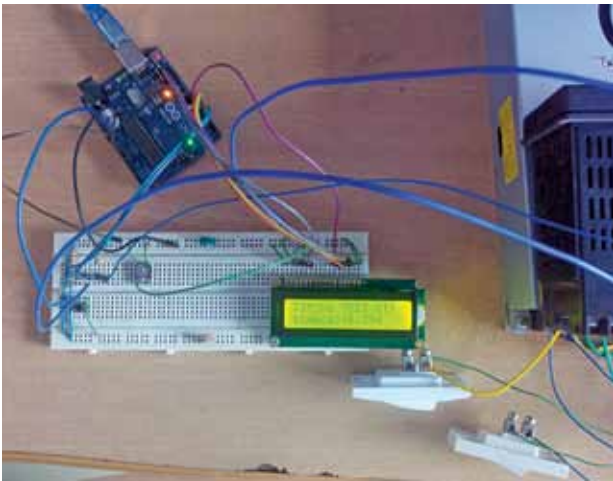


Fig. 1: Author's prototype of the timer kit

The measured time is displayed in seconds on LCD1. Measurement in the range of milliseconds to several minutes is possible. It is tested with known values set in a mini programmable logic controller (PLC.) A reset button (connected across CON3) is provided to reset the display to zero and start a fresh timing measurement.

The software (timing\_kit.ino) is written in Arduino programming language using Arduino IDE version 1.8.5. The sketch/program uses the interrupt and millis ( ) functions of the Arduino. Ensure that you select the correct board from the Tools menu in Arduino IDE before uploading the timing\_kit.ino sketch file to the board.

## Construction and testing

Assemble the circuit on a breadboard or PCB. An actual-size PCB layout for the timer kit is shown in Fig. 3 and its components layout in Fig. 4.

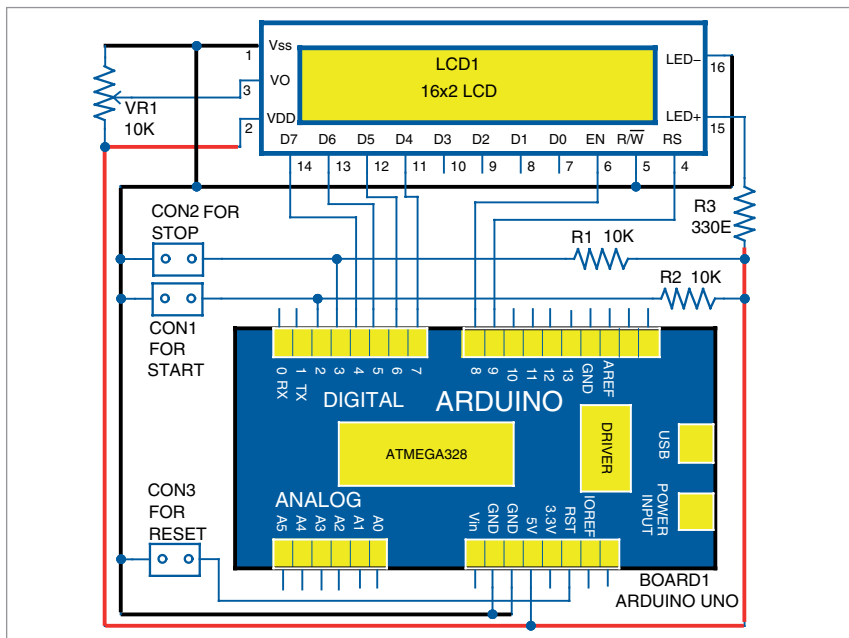


Fig. 2: Schematic diagram of the timer kit

## PARTS LIST

### Semiconductors:

- Board1 - Arduino Uno
- Resistors (all 1/4-watt, ±5% carbon):
- R1, R2 - 10-kilo-ohm
- R3 - 330-ohm
- VR1 - 10-kilo-ohm potmeter

### Miscellaneous:

- LCD1 - 16x2 LCD
- CON1-CON3 - 2-pin connector
- Push-to-on reset switch
- On/off switch (2 numbers for testing)
- USB cable

## EFY Note

The source code of this project is available for free download at [source.efymag.com](http://source.efymag.com)

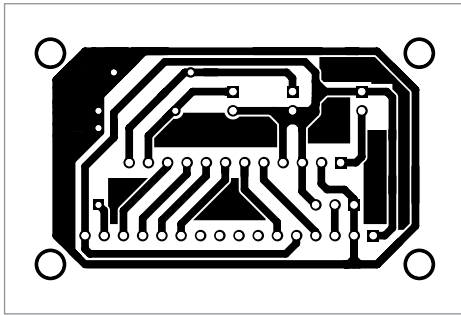


Fig. 3: Actual-size PCB layout for the timer kit

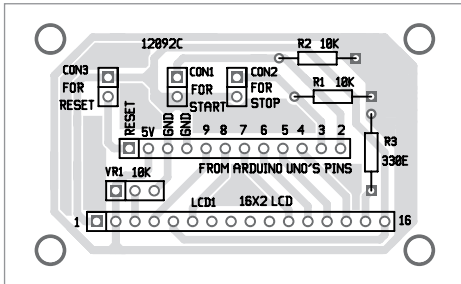


Fig. 4: Components layout of the PCB

Connect the Arduino Uno board and LCD1 as shown in the schematic diagram. Make sure that you first upload

the source code (timing\_kit.ino) to the Arduino Uno board via a USB cable attached to the laptop/desktop.

Connect start contacts to CON1, stop contacts to CON2, and reset push button to CON3. Power on the Arduino Uno board through USB/adaptor power supply. Adjust LCD1 contrast using potmeter VR1 to get a clear display.


Press the reset push button before carrying out time measurement. You will get the 'Timing test kit' message on the first line and 'Time(s): 0.000' on the second line of LCD1. The circuit is basically an up-counter/timer.

Now close the start contacts to start the count. The counted reading will be displayed on LCD1. Depending on your requirement, you can stop the count anytime by closing the stop contacts after a delay. The counting time is displayed in seconds on the left side and in fraction of seconds (in milliseconds) on the right side of LCD1,

which is the time duration between the start and stop of the timing test kit.

After assembling the circuit, enclose it in a suitable box with LCD1 display and reset button on the front panel. Start and stop connectors can be provided on the rear side of the panel for manual control or PLC connections. Now the kit is ready to use for measuring the timings of timer relays, circuit breakers, and similar devices.

**Note.** Only potential-free external N/O or N/C contacts shall be used as the start and stop contacts with a common ground. **EFY**



P. Balasubramanian is a retired scientific officer from Nuclear Power Corporation of India Ltd (NPCIL). He has 32 years of experience in the field of electrical maintenance at Madras Atomic Power Station, Kalpakkam and Koodankulam Nuclear Power Project, Koodankulam. His area of interest includes microcontrollers and power electronics

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# Smart 230V AC Bulb Holder

T.K. Hareendran

The smart 230V AC bulb holder introduced here is an ultra-simple device with an automatic electric bulb controller switch and a standard electric bulb holder realised with the help of a few inexpensive and easily available components.

The electric bulb plugged into the integrated bulb holder of this fit-and-forget device wakes up at nightfall and ticks over just after the first light of day. The device can be used to drive an ordinary incandescent bulb, a light ballast (for fluorescent and discharge lamps), or a solid-state lighting fixture (CFL and LED bulbs) operating on a current less than or equal to 5A at 230V, 50Hz. The author's prototype is shown in Fig. 1.

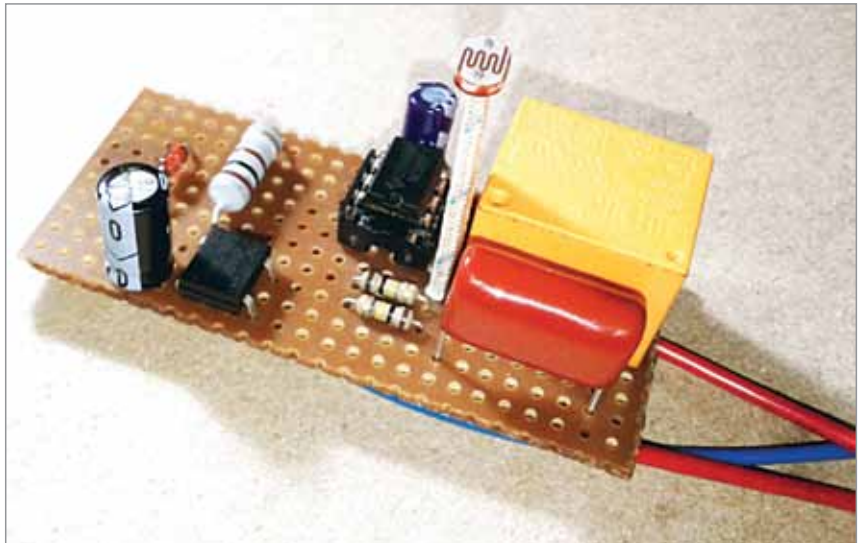


Fig. 1: Author's prototype

## Circuit and working

The circuit diagram of the smart bulb holder is shown in Fig. 2. It is built around a bridge rectifier (BR1), timer NE555 (IC2), optocoupler PC817(1), 12V Zener diode (ZD1), rectifier diode 1N4007(D1), 12V single-changeover relay (RL1), and a few other components.

As you can see in the schematic diagram, the day/night sensor is a GL5528 light-dependent resistor (LDR), which forms a simple potential divider with an ordinary 100-kilo-ohm resistor (R2). The variable output voltage from this potential divider is used to control one G5L series (12V/400Ω) electromagnetic relay (RL1) through an NE555 timer (IC2). Note that when the input (pins 2 and 6) of IC2 is above 8V, the output (pin 3) goes low, and when the input is below 4V, the output goes high.

For controlling the bulb, common pole (P) and normally-open (NO) contacts of RL1 are used as a single-pole on/off switch to route AC input supply to the integrated bulb holder. Under normal conditions, RL1 is energised

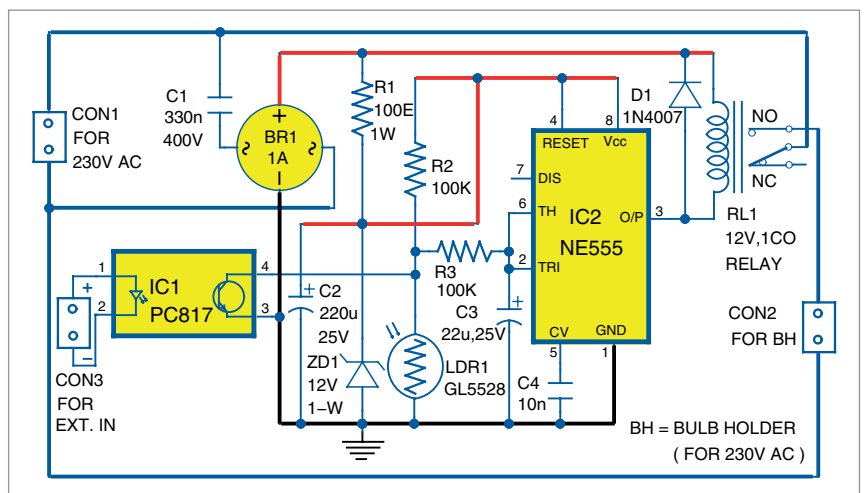


Fig. 2: Circuit diagram of the smart 230V AC bulb holder

through IC1 when ambient light is less than ten lux. When light is greater than forty lux, it will de-energise the relay. You can alter the threshold level of LDR1 by changing the value of the resistor (R2).

The capacitive power supply is used here as the power source. It is configured to cater to a typical output

current of 24mA. IC2 runs on about 12V DC supply available across the 220µF buffer capacitor (C2), while RL1 will get a DC supply of around 14.4V. This 'elevated' 14.4V ensures that RL1 will work smoothly even at the current level that is comparatively much lower than what is actually called for.

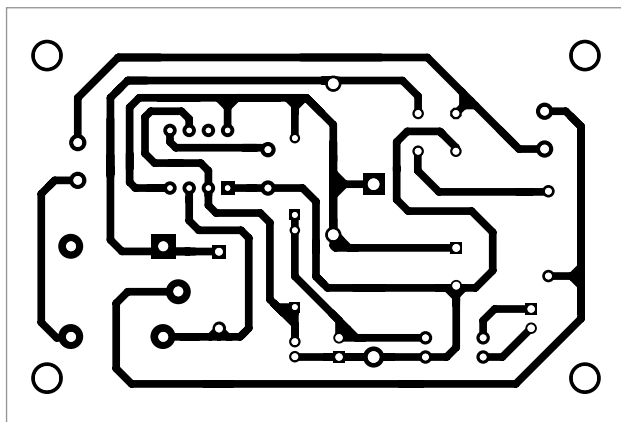


Fig. 3: Actual-size PCB layout for the smart bulb holder

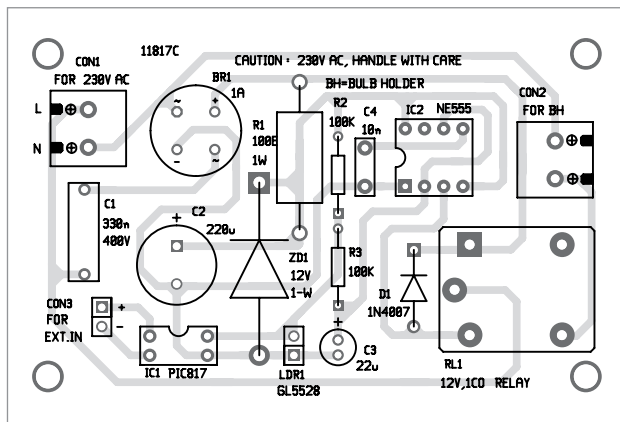


Fig. 4: Components layout of the PCB

### PARTS LIST

**Semiconductors:**

- IC1 - PC817 opto-coupler
- IC2 - NE555 timer
- BR1 - 1A bridge rectifier
- D1 - 1N4007 rectifier diode
- ZD1 - 12V, 1-watt Zener diode

Resistors (all 1/4-watt, ±5% carbon), unless stated otherwise:

- R1 - 100-ohm, 1-watt
- R2, R3 - 100-kilo-ohm

**Capacitors:**

- C1 - 330nF, 400V ceramic disk
- C2 - 220µF, 25V electrolytic
- C3 - 22µF, 25V electrolytic
- C4 - 10nF ceramic disk

**Miscellaneous:**

- CON1, CON2 - 2-pin terminal connector
- CON3 - 2-pin connector
- LDR1 - GL5528 LDR
- RL1 - 12V, single changeover relay
- Bulb holder

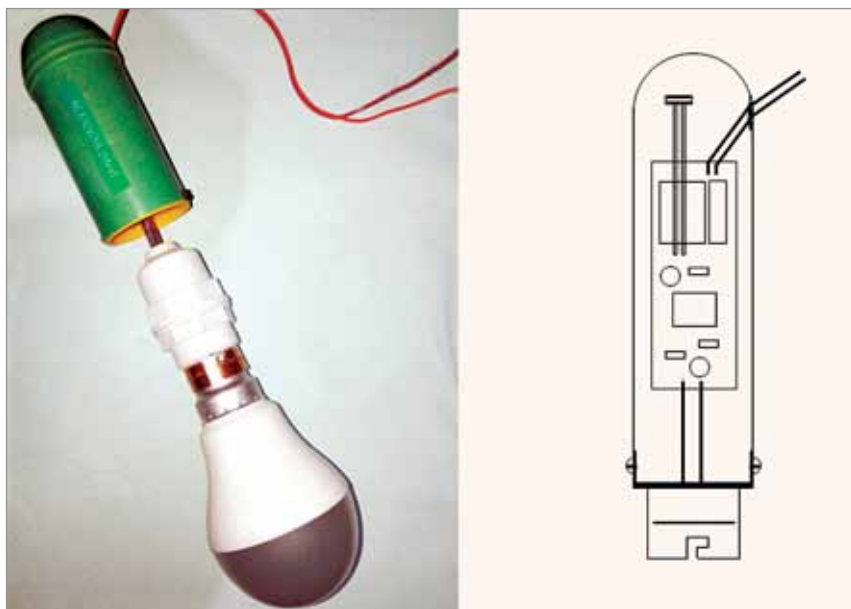


Fig. 5: A sample enclosure layout

As you might notice in the diagram, there's also a galvanically-isolated switch/sensor input in the device built around a common photocoupler PC817 (IC1). The option allows you to remove LDR1 and control the smart bulb holder from an external IoT (or similar) gadget if you desire to have a simple home automation project. It is to be noted here that if the photocoupler is in active state, the bulb will switch off. Needless to say, the photocoupler requires a current-limiter resistor at its input to set the typical forward current close to 20mA at 1.2V typical forward voltage.

### Construction and testing

The entire circuit can be assembled on a rectangular piece of perforated or general-purpose PCB (refer author's prototype). An actual-size PCB layout

for the smart bulb holder is, however, shown in Fig. 3 and its components layout in Fig. 4. After assembling the circuit on the PCB, connect the 230V AC mains across CON1.

A small (waterproof) translucent enclosure is a must for this project. Prototype enclosures come in many shapes and sizes. It would be better to make your own enclosure if you've access to a 3D printer as it'll give your model a polished look. A sample enclosure layout is also depicted here in Fig. 5 for your quick reference.

**Author's note.** At first, the dimmable daylight LED bulb enclosed prototype was used for performance evaluation. Later, it was mounted on a garden lamp pole, and the real-world results (till now) are very promising.

This smart bulb holder not only works as an energy-saving outdoor light bulb but also serves as a security light bulb or home occupancy indicator to deter prowlers even when you're on a vacation.

**Caution.** This circuit involves the direct use of 230V AC mains voltage, which is dangerous, and the chances of getting an electric shock are high if not handled properly. If you are not used to handling such voltages, please get the help of a qualified person. **EFY**



T.K. Hareendran is an electronics designer, hardware beta tester, technical author, and product reviewer. He is founder and promoter of TechNode

# Gesture-Controlled Contactless Switch For Smart Home

Ashwini Kumar Sinha

To avoid the risk of contracting Covid-19, it is important not to touch surfaces including switches, doorknobs, and keys that have been frequently used by other people. This project is for a contactless switch that works with hand gestures.

The smart switch includes a sensor that can detect hand movements and translate them into commands for controlling lights, fans, and various other home appliances. The author's prototype for this switch, with its OLED display installed on the wall switchboard, is shown in Fig. 1. The list of components required for designing the gesture-controlled switch is given in Table 1.

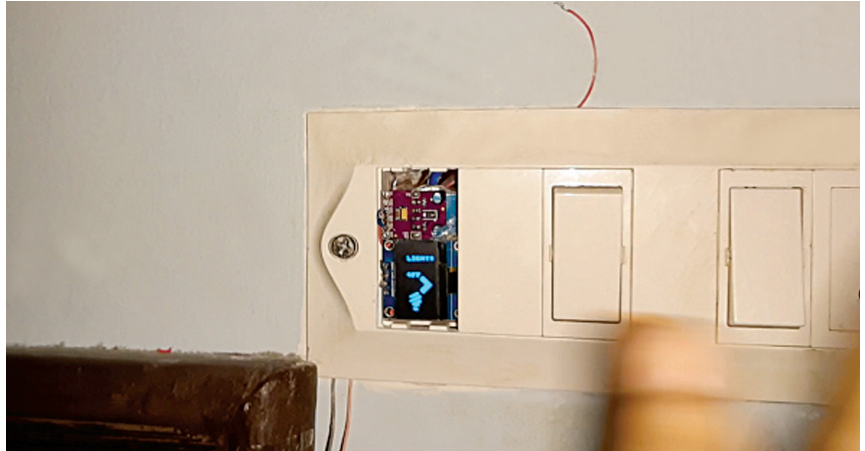


Fig. 1: Prototype of gesture-controlled contactless switch with OLED display

## Coding

First, install the required libraries in the Arduino IDE. Go to Select → Library Manager → Search APDS9960 and U8g2lib as shown in Fig. 2. Then add each library to Arduino code as shown in Fig. 3. Define Arduino pin numbers for controlling the light and fan. Next, create a setup function where you can initialise the sensor and set the pin mode output for light and fan control as shown in Fig. 4.

Create a loop function to update the sensor readings and use your hand gestures as inputs to control Arduino output pins. Also create a switch condition in the code, as shown in Fig. 5, for specifying the commands based on the type of hand gestures (up, down, left, and right). The icons (arrow symbols) below indicate the gestures and commands to be displayed on the OLED:

- Up: Light on
- Down: Light off
- Left: Fan on
- Right: Fan off

After coding is done, compile it in Arduino IDE and upload the code to Arduino board.

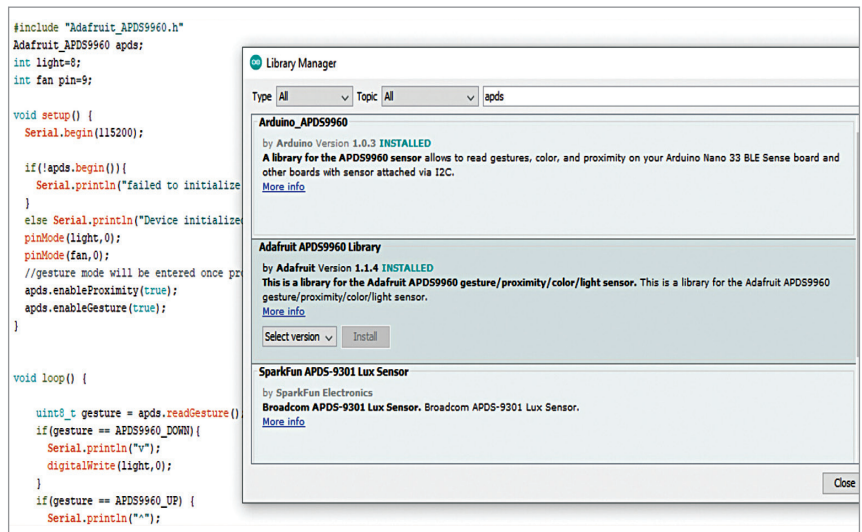


Fig. 2: Library Manager window

## Components for Smart Switch

Table 1

Components	Numbers	Description
Arduino Mini Pro	1	For programming
SSD1306 OLED	1	OLED display
2-Channel relay	1	5V DPDT relay module
5V adaptor	1	For Arduino, relay and APDS
APDS-9960	1	Gesture sensor module
Bulb	1	Any light bulb operated through 230 AC mains
Fan	1	Ceiling fan

```
#include <Arduino_APDS9960.h>

#include <U8g2lib.h>
#include <Wire.h>
int light=8;
int fan=9;

U8G2_SSD1306_128X64_NONAME_F_HW_I2C u8g2(U8G2_R0, /* reset=*/ U8XB_PIN_NONE);
```

Fig. 3: Arduino code with libraries and pin numbers for light and fan

```
void setup() {
  Serial.begin(9600);

  u8g2.begin();
  u8g2.setFont(u8g2_font_pxplusibmvga9_tf);

  if (!APDS.begin()) {
    Serial.println("Error initializing APDS9960 sensor!");
  }

  //APDS.setGestureSensitivity(80);

  Serial.println("Detecting gestures ...");
  pinMode(light,1);
  pinMode(fan,1);
}
```

Fig. 4: Setup function with pinMode functions

```
void loop() {
  if (APDS.gestureAvailable()) {
    // a gesture was detected, read and print to serial monitor
    u8g2.clearBuffer();
    int gesture = APDS.readGesture();

    switch (gesture) {
      case GESTURE_UP:

        digitalWrite(light,1);
        Serial.println("Detected UP gesture");
        u8g2.setFontDirection(1);
        u8g2.setFont(u8g2_font_pxplusibmvga9_tf);

        u8g2.setCursor(110, 10);
        u8g2.println("Lights");

        u8g2.setCursor(95, 30);
        u8g2.println("on");

        u8g2.setFont(u8g2_font_open_ionic_all_4x_t);
        u8g2.drawGlyph(60,40, 118);

        u8g2.drawGlyph(20,30, 196);
```

Fig. 5: Arduino code with switch conditions

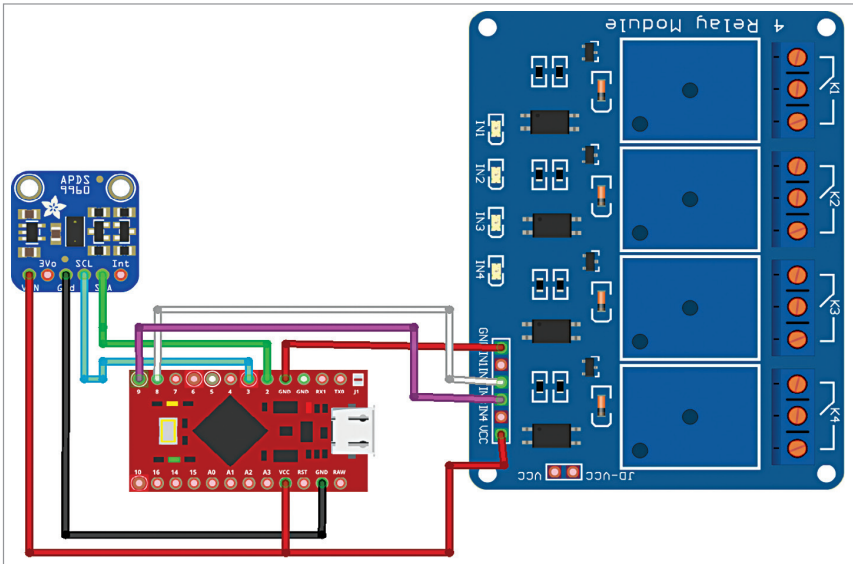


Fig. 6: Connection diagram

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**EFY Note**  
 The source code of this project is available for free download at [source.efymag.com](http://source.efymag.com)

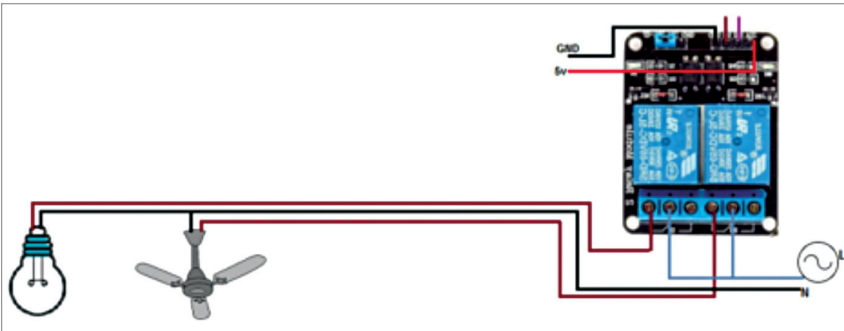


Fig. 7: Relay connections with bulb and fan

**Arduino Connections with OLED and APDS Gesture Sensor** Table 2

Arduino Pro Micro	OLED and APDS 9960
SDA (Pin 2)	SDA
SCL (Pin 3)	SCL
GND	GND
VCC	VCC

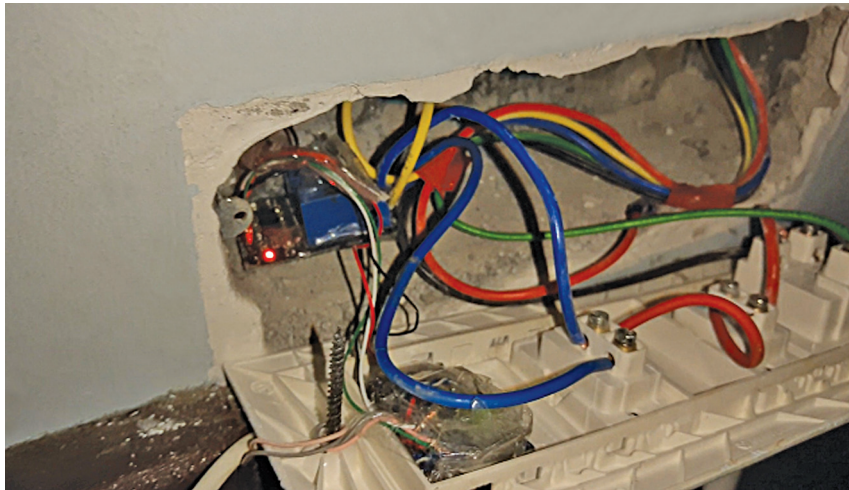


Fig. 8: Installation of gesture-controlled switch on wall switchboard

**Connections and testing**

Connect the components as shown in Fig. 6, following Table 2. Then connect the 230V AC mains with the common pin of the relay module to control the light and fan as shown in Fig. 7.

Install the automatic contactless switch on the wall switchboard as shown in Fig. 8. Switch on 5V adaptor to power the device and relay module.

When you move your hand from down to up direction in front of the sensor, as shown in Fig. 9, light will switch on and at the same time an up arrow will be displayed on the OLED. If you move your hand from up to down position, the light will switch off and a down arrow will be displayed on the OLED.

Similarly, when you move your hand from left to right in front of the sensor, the fan will switch on and a left arrow symbol will be displayed on the OLED. If you move your hand from right to left, the fan will switch off and a right arrow will be displayed on the OLED. **EFY**



Fig. 9: Moving hand up in front of the contactless switch switches on light bulb

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

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# THE DASHBOARD



## PCs in India Set a New Record

Company	Q3 2020 shipments ('000 of units)	Q3 2020 market share	Q3 2019 shipments ('000 of units)	Q3 2019 market share	Year-over-year unit change (Q3 2020 vs Q3 2019)
HP Inc.	965	28.2%	828	26.4%	16.6%
Lenovo	744	21.7%	895	28.5%	-16.9%
Dell Technologies	731	21.3%	619	19.7%	18.2%
Acer Group	327	9.5%	373	11.9%	-12.4%
Asus	257	7.5%	165	5.3%	55.4%
Others	403	11.8%	259	8.2%	55.4%
<b>Total</b>	<b>3427</b>	<b>100.0%</b>	<b>3139</b>	<b>100.0%</b>	<b>9.2%</b>

The Indian traditional PC market (desktops, notebooks, and workstations) delivered a strong quarter with 9.2% year-over-year (YoY) growth in Q3 2020 (July-September 2020), according to IDC. Demand for e-learning and remote working resulted in Q3 2020 emerging as the biggest quarter in the last seven years in India.

Source: IDC Worldwide Quarterly Personal Computing Device Tracker, November 2020

## India's Handset Market Grows by 5 per cent

Company	Q3 2019	Q3 2020
Samsung	21%	22%
Xiaomi	17%	14%
Vivo	11%	11%
Realme	11%	10%
Itel	6%	8%
Others	34%	35%
<b>Total</b>	<b>100%</b>	<b>100%</b>

The Indian mobile handset market grew eight per cent YoY in Q3 2020 due to stronger consumer demand in the smartphone segment and stronger sales of feature phones. The feature phone market registered a five per cent YoY growth in Q3 2020 with Itel being the number one brand followed by Samsung and Lava.

Source: Counterpoint Research Market Monitor, Q3 2020

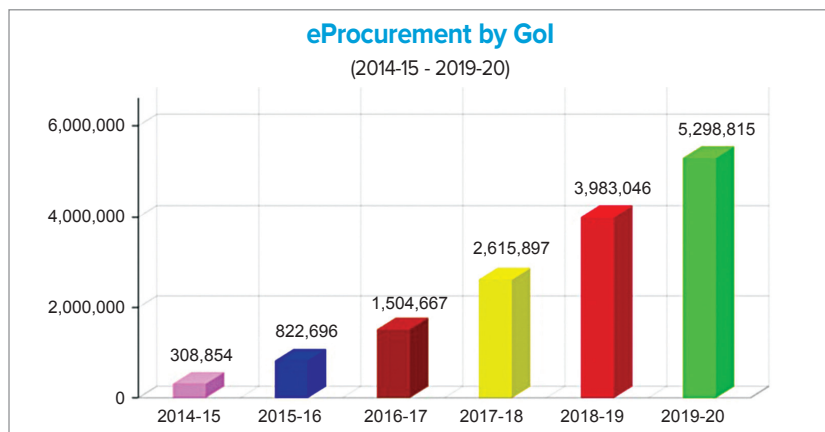
## India's Smartphone Market Records Highest-ever Shipments

Company	Q3 2019	Q3 2020
Samsung	20%	24%
Xiaomi	26%	23%
Vivo	17%	16%
Realme	16%	15%
Oppo	8%	10%
Others	13%	12%
<b>Total</b>	<b>100%</b>	<b>100%</b>

India's smartphone shipments grew nine per cent year-over-year (YoY) to reach over 53 million units in Q3 2020, according to the latest research from Counterpoint's Market Monitor service. This is the highest-ever shipment in a quarter for the Indian smartphone market.

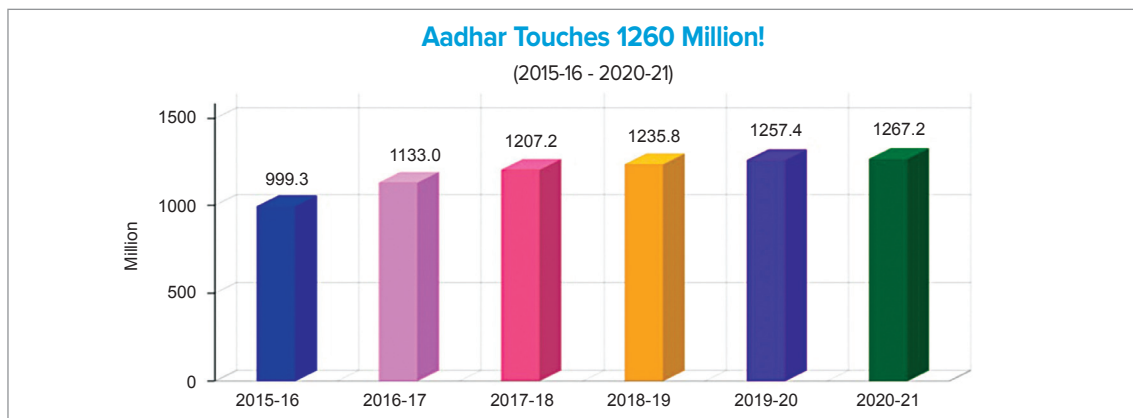
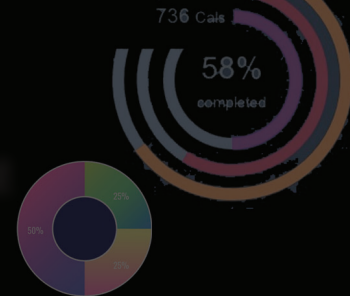
Note: Xiaomi's share includes Poco brand

Source: Counterpoint Research Market Monitor, Q3 2020

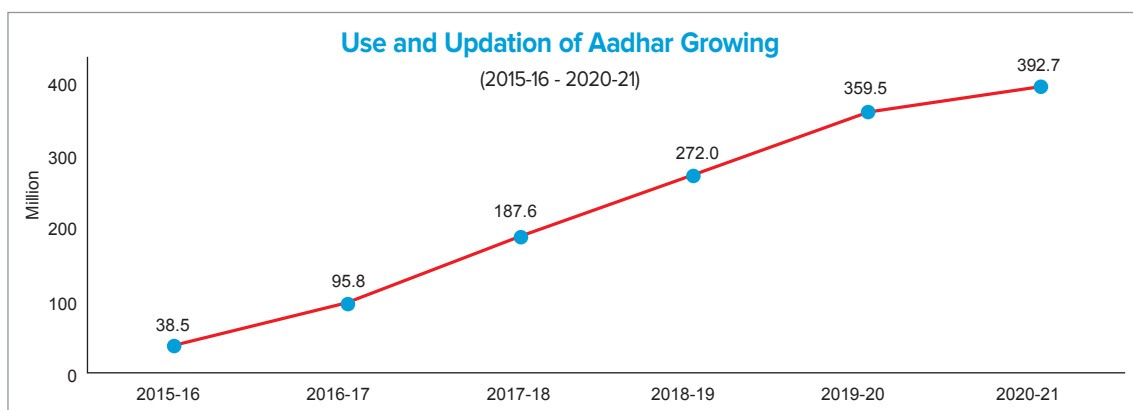


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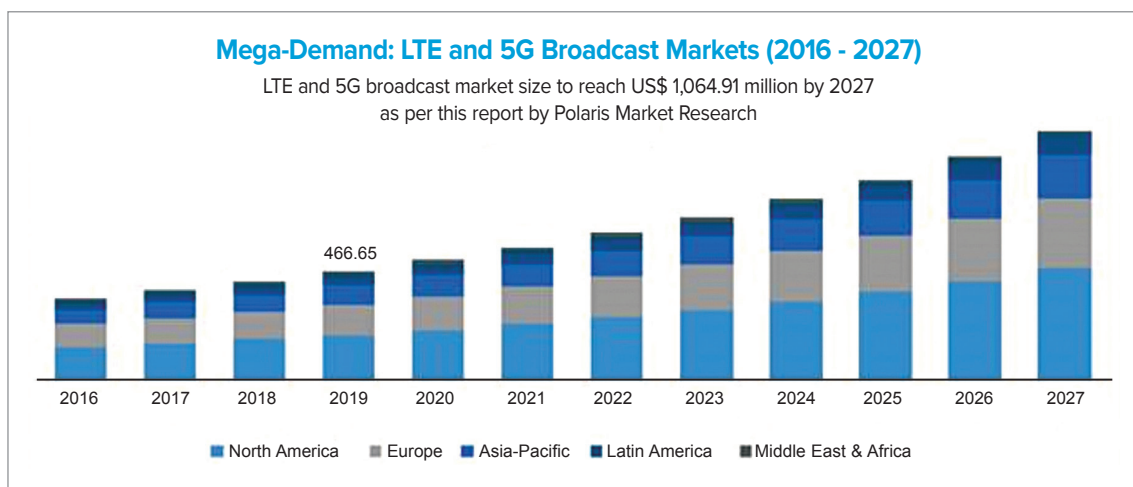
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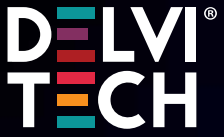


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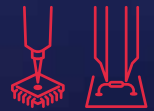
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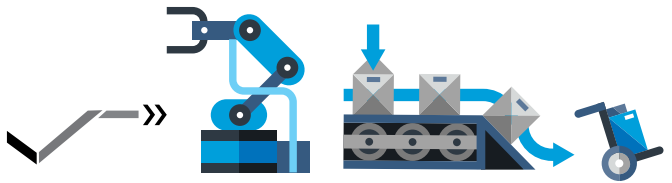
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## Industry Updates

### Battery, telecom, automobile, PV included in new PLI scheme

The union cabinet chaired by Prime Minister Narendra Modi has approved the introduction of Production-Linked Incentive (PLI) Scheme in ten key sectors to enhance India's manufacturing capabilities and exports for an Atmanirbhar Bharat. A total of ₹1,459.8 billion has been approved for a financial outlay spread over five years. The new PLI scheme mentions a semiconductor as well as a display fab.

"The PLI scheme across these 10 key specific sectors will make Indian manufacturers globally competitive, attract investment in the areas of core competency and cutting-edge technology; ensure efficiencies; create economies of scale; enhance exports and make India an integral part of the global supply chain," read an official press note released by the govern-

ment of India. It continued, "India is expected to have a USD 1 trillion digital economy by 2025. Additionally, the Government's push for data localisation, Internet of Things market in India, projects such as Smart City and Digital India are expected to increase the demand for electronic products. The PLI scheme will boost the production of electronic products in India."

₹50 billion for the electronic/technology products vertical, ₹181 billion for the advanced chemistry cell battery, ₹570.42 billion for the automobile and auto components PLI scheme, ₹121.95 billion for the telecom equipment, ₹45 billion for the solar PVs, and ₹62.38 billion for the white goods have been earmarked in the new PLI scheme.

### Construction drone market to reach \$11.96 billion by 2027

The global construction drone industry garnered \$4.80 billion in 2019. As per Allied Market Research, it is projected to reach \$11.96 billion by 2027 at a CAGR of 15.4 per cent. The infrastructure inspection segment is expected to witness the highest CAGR of 17.1 per cent, owing to features of drones such as cost effectiveness, high range, accuracy, and excellent endurance.

By type, the rotary-wing drones segment accounted for more than four-fifths of the total share of the global construction drone market in 2019, and is estimated to continue its lead

position throughout the forecast period. Based on application, the land surveying segment held the highest market share, accounting for nearly half of the global construction drone market in 2019, and is estimated to continue its dominance throughout the forecast period.

Indo-Pacific, followed by North America, accounted for the highest market share in 2019. This region is expected to witness the largest CAGR of 17.8 per cent during the forecast period due to the rise in urbanisation and surge in construction activities in countries including China and India.

### ON THE move



#### Panasonic appoints veteran Yuki Kusumi as CEO

Japan's Panasonic Corp has appointed its head of automotive business Yuki Kusumi as next CEO, replacing Kazuhiro Tsuga, who was the architect of a partnership with Tesla Inc. He will take over on April 1, 2021, after a three-decade career at the company, which saw Kusumi lead the automotive component business and the TV operations. Kusumi also oversaw the launch of a joint battery venture with Toyota Motor Corp in April. Panasonic has shifted its focus away from low-margin consumer electronics to batteries, factory machines, and components.

#### PVG Menon appointed as CEO of ESSCI

Electronics Skill Sector Council of India (ESSCI) has appointed PVG Menon as its CEO. Menon started his career as a multimedia specialist with CMC limited in 1988. He moved to Siemens Information Systems in 1993. Menon also worked with Analog Devices as a product line manager for over five years. Prior to founding VANN Consulting, he was serving as a senior business development manager with NXP Semiconductors. Menon has served as the president of the India Electronics and Semiconductor Association from August 2011 to March 2014.

#### Sanjeev Keskar starts a consulting firm

Sanjeev Keskar has quit Arrow Electronics India to start a consulting firm named Arvind Consultancy. Named after his late father, the consulting firm is focusing on developing a high-value-added ecosystem for electronics in the country. The consultancy will support startups in IP creation and manufacturing companies on value addition. Sanjeev has experience in different aspects of the electronics industry spanning from design to pricing a product, circuit design ecology, kits and chipsets pricing, and the semiconductor industry.

#### Acharya to lead EESL subsidiary

Energy Efficiency Services Limited (EESL) has appointed Mahua Acharya to lead a new 100% owned subsidiary of EESL – Convergence Energy Services Limited. It focuses on energy solutions that lie at the confluence of renewable energy, electric mobility, and climate change. Acharya has almost two decades of international experience in green finance, renewables, and carbon markets. She was the assistant director-general of Global Green Growth Institute, an intergovernmental organisation headquartered in Seoul.

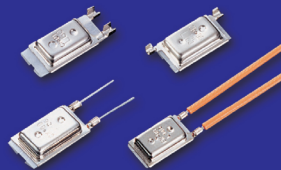
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ST-12



CK-01 & CK-99

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ST-22 & Bracket

New ST-30 15x6x3mm



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HB-2 and HB-21



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- Dish Washer
- Boiler, Refrigerator
- Microwave Oven
- -20°C~180°C
- Auto & Manual Reset



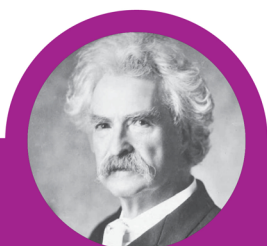
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“  
 Many a small thing has  
 been made large by the  
 right kind of advertising.  
 ”



-Mark Twain



## India has huge opportunity to manufacture tablets and laptops

India has the potential to scale up its cumulative laptop and tablet manufacturing capacity to \$100 billion by 2025 through policy interventions, as per industry body ICEA. It believes that scaling up laptop and tablet PC manufacturing can take share of India in the global market to 26 per cent from mere one per cent now.

The report said that this could generate 500,000 new jobs and lead to a cumulative inflow of foreign exchange to the tune of \$75 billion and investment of over \$1 billion by 2025. It added that the domestic market will account for around \$170 billion by 2025. There is a need to look at export markets for the rest of \$230 billion to meet the target of NPE 2019.

As per ICEA, the laptop and tablet market in India is very small and most of the manufacturing can be done for exporting them to markets in the US, Europe, among others. Manufacturers in India suffer from issues like high cost of power, tax, and ease of doing business, which makes India 10 to 20% less competitive than Vietnam and China, respectively.

### Initiatives like smart meters driving market growth in Indo-Pacific countries

In February 2020, Energy Efficiency Services Limited (EESL), under the Smart Meter National Programme of the government of India, finished installing one million smart meters in the country, and it further aims to install more than 250 million in the near future. Due to government initiatives such as this, the global smart meters market is projected to witness a 4.9 per cent CAGR between 2020 and 2030, to grow from \$13.1 billion in 2019 to \$20.0 billion in 2030, according to P&S Intelligence.

In the immediate future, the higher CAGR in the smart meters market of 8.2 percent would be experienced by the AMI bifurcation, under segmentation by technology. The smart meters market currently generates the highest revenue from Indo-Pacific, which would also be the fastest-advancing region in the immediate future. Mass



Representational image

smart meter installation projects have already kicked-off in numerous nations, such as China where a five-year program to upgrade its grid infrastructure is underway.

### Second-life automotive lithium-ion battery growing fast

The global second-life automotive lithium-ion battery market will reach \$7,392 million by 2030 from \$430 million in 2019, according to P&S Intelligence. It will grow at a CAGR of 23.1 per cent until 2030. Used vehicle batteries retain up to 80 per cent of their efficiency, which is why these are being reused for storing energy in the industrial, renewable energy, and telecom sectors.

The largest contribution to the second-life automotive lithium-ion battery market is made by Indo-Pacific countries. China registers the most EV sales, owing to the strong government support, which creates a large stock of partially depleted vehicle batteries.

Europe is projected to witness the fastest advance in the second-life automotive lithium-ion battery market in the years to come. It is also seeing the execution of a strategic action plan for a sustainable battery value chain. Under this, raw material extraction, battery material sourcing and processing, and cell and battery system production, reuse, and recycling are being focused upon.

### E-waste management market to reach \$13.3 billion by 2026

The global e-waste management market is expected to reach \$13.3 bil-

lion by 2026, as per a report by Facts and Factors. The valuation stood at \$3.6 billion in 2019.

Indo Pacific was the largest market of e-waste management during 2019. This is due to the rise in spending power in developed and emerging economies coupled with the rising use of electronic devices.

In addition, due to the illegal processing of e-waste from developed nations, along with increasing government regulations for comprehensive collection and recycling of technological scrap in the region, the Middle East and Africa are expected to deliver the highest CAGR over the forecast period.

### Most chipsets will be AI-equipped by 2025

The AI chipset marketplace is poised to transform the entire embedded system ecosystem with a multitude of AI capabilities such as deep machine learning, image detection, and many others. With 83 per cent of all chipsets globally shipping AI-equipped, over 57 per cent of all electronics will have some form of embedded intelligence by 2025. This will also be transformational for existing critical business functions such as identity management, authentication, and cybersecurity.

“Consumers will realise benefits indirectly through improved product and service performance such as device and cloud-based gaming. Enterprise and industrial users will benefit through general improvements in automated decision-making,

## Samsung to manufacture smartphone displays in India

Samsung will invest nearly ₹5,000 crore in a smartphone display manufacturing facility in Noida, Uttar Pradesh. The export-oriented unit (EOU) is expected to be ready by January-February 2021. It will attain commercial production by April 2021. Once the unit is operational, India would become the third country in the world having Samsung's smartphone display manufacturing facility. The project is expected to create nearly 1,500 jobs.

## L&T Tech to support Alexa integration in devices

L&T Technology will be implementing and providing end-to-end engineering expertise from product ideation to launch for Amazon Alexa in connected products and services. Seema Ghanekar, global head, industrial & consumer products, L&T Technology Services said, "With expertise in industrial market, product development, device testing and certification, LTTTS is well-equipped to become a provider of choice for software integration for Amazon Alexa products. Our work with Amazon for AVS is a step in this direction as together we look towards driving new-age customer experience engineering benchmarks."

## Intel sells power management chip business to MediaTek

Taiwan-based chip manufacturer MediaTek has acquired Intel's power management chip business, Enpirion. The deal, estimated to be worth \$85 million, was done through MediaTek's subsidiary company Richtek. Famous for chips used in smartphones, MediaTek might be eyeing an expansion to its integrated power solutions used in FPGA, CPU, SoC, and ASIC.

## SyrmaTech to merge with SGS Teknics

Syrma Technology has announced that it is merging with SGS Teknics in a cash and stock deal. Both are in the electronics design and manufacturing domain. Once created formally, Syrma SGS Technology Pvt Ltd will be looking at a possible combined turnover of over ten billion rupees. These figures include tentative 55% revenue from exports majorly coming from the USA and Europe.

## VVDN inaugurates SMT facility at its Manesar plant

VVDN Technologies has opened a new SMT facility and Mechanical Tooling Park-II in Manesar, Haryana. The new SMT facility and

Mechanical Tooling centre were inaugurated by the Minister of State for Labour and Employment (independent charge) in the government of India, Santosh Gangwar. VVDN was recently chosen by STL as the engineering and ODM partner for the development of a few indigenous 5G products and solutions.

## Tremendous increase in Apple's profit from India

Apple has reported revenue figures of ₹137.56 billion for FY 2020. These figures, during FY 2019, stood at ₹106.74 billion. This 29 per cent year-on-year jump in revenue also represents a jump of nearly 267 per cent in the profits Apple made in India during this period. The company, last year, had announced an investment of \$13 million (approx ₹10 billion) for India. Apple, through the investments, is planning to start an online retail platform and launch physical stores in the country.

## ITI likely to provide 4G and 5G network gear

Government-run ITI is in active talks with Indian companies to provide them with end-to-end 4G and 5G network gear. It is also exploring the possibility of manufacturing equipment for band E and V, both of which are critical for 4G and 5G technologies. ITI has quite recently signed MoU with Tech Mahindra and TCS for collaboratively working on the development of 4G and 5G technologies. The companies are collaborating to create a 'Make in India' stack as part of this MoU for the upcoming 4G & 5G opportunities in India.

## Ather Energy raises funding led by Sachin Bansal

Ather Energy said that it has raised an investment of \$35 million in its latest round of Series D funding. This funding was led by Sachin Bansal's \$23 million. Hero MotoCorp also invested \$12 million as a part of the Series D round in Ather Energy. Bansal said that Ather Energy has set a new benchmark for intelligent electric bikes in the Indian automobile industry. Its new product line and expansion plans across the country will make EVs a part of the Indian landscape.

## India-headquartered EV charging startup raises funding

Charge+Zone, an electric vehicle (EV) charging startup, has raised \$3 million in a pre-series A round of funding. The startup was founded by Kartikey Hariyani and Pavan Bakeri in 2018. It is into providing services including info on availability of charging points and pre-booking them using a mobile app. Charge+Zone, as it informed, caters to more than 500 cars on a daily basis and has a network of more than 100 charging points across seven cities.

especially in the areas of robotic process automation, decision support systems, and overall data management," read a latest report from Research and Markets. It continued, "AI chipsets will be particularly useful for business edge equipment for real-time data analytics and store versus processing decisions."

Major drivers for the market are increasingly large and complex datasets driving the need for AI, the adoption of AI for improving consumer services and reducing operational costs, the growing number of AI applications, the improving computing

power, and growing adoption of deep learning and neural networks.

## Telangana unveils ten-year EV policy

The Telangana state government has launched the 'Telangana Electric Vehicle & Energy Storage Policy.' It aims to attract private investments worth \$4 billion in the EV sector and create employment for 120,000 people by 2030 through shared mobility, charging infrastructure development, and manufacturing activities.

The policy incentivises EV and ESS sectors as per the subsidies and incen-

tives available under the Electronics Policy 2016. Telangana ministers K.T. Rama Rao and Ajay Kumar were present at the launch of the policy. It will be effective for ten years from the date of notification and will be reviewed by the Steering Committee, as notified in the policy.

Rama Rao said after unveiling the policy that Telangana has come out with an extremely comprehensive policy. The government has ensured that the energy storage policy is clubbed with the EV policy because these two are tight-knit ideas that need to work cohesively.



# Plastic Waste To Renewable Energy—Implementing A Circular Economy

NGOs, investors, waste management practitioners and environmental conservation groups should recognise waste plastics as a resource for a clean renewable energy, and join hands with the plastic-to-fuel innovators to develop more pioneering technologies that produce ultra-clean emissions and replace fossil fuels



**Dr Krishna Naga** works as a Physics teacher. She has over twenty years of experience in this field. Her hobbies include reading and writing

*“Nowadays people know the price of everything and the value of nothing.”*

—Oscar Wilde

The archaeological timeline of human evolution shows how we have organised ourselves through the Stone Age, Bronze Age, Iron Age, and Polymer Age. These ages have proved that we can blend and amend natural resources and turn them into desirable materials. In this Polymer Age, we are showcasing that apart from blending and amending, we can manipulate the structure of chemicals and create artificial products. The versatility of plastics finds tremendous application in all household and consumer products, thus playing a major role in domestic and industrial areas.

The growth in use of plastics in products ends up with wastes that are

non-biodegradable, thus becoming an environmental hazard. Plastics with polystyrene and polypropylene become a major problem because these cannot be recycled. Even when means to recycle them are found, their saleable value being very little, recyclers throw these plastics into landfills. As plastics never decompose, the landfills become a major environmental concern.

Plastic debris is also polluting the oceans and has become a major detrimental factor to vulnerable aquatic lives. Ellen MacArthur Foundation, in partnership with the World Economic Forum, has estimated that by 2050 oceans will have more plastics than fish. We, as global citizens, need not become extremists and call for an absolute close to plastic production. Let us understand that plastic is not the problem but its way of disposal is the main concern. Actually, we desperately need a paradigm shift in perceiving things. **Let us be aware that plastics are a solid form of oil. So let us keep the plastics in the supply chain and work together to break the misperception of plastic wastes, which can be a valuable sustainable fuel.**

## Why is WTE unsuccessful in India?

Waste-to-energy (WTE) plants installed in the USA and European cities have now made them the most sustainable and eco-friendly cities. The solid wastes used in these plants are materials that cannot be recycled, but the plants recover the energy from these wastes either in the form of heat or electricity. When these cities have proved a proportional relationship between WTE plants and sustain-

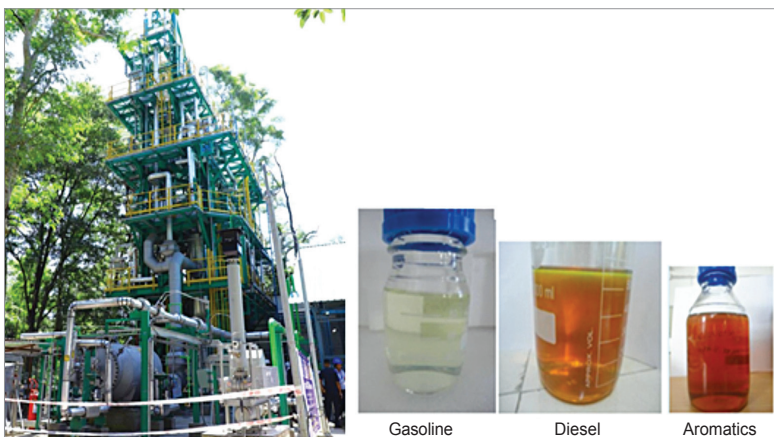


Fig. 1: IIP's products from waste plastics (Credit: CSIR-IIP)

ability, unfortunately, in India, many WTE plants are being shut down due to environmental violations.

Some reasons behind this failure on our part are:

1. Our WTE plants do not segregate the solid wastes, so wet wastes get mixed with dry wastes and reduce the calorific value of the wastes.

2. The high organic content in the wastes is another factor that decreases their calorific value.

3. Some wastes are highly inert, and the high moisture content in the wastes decreases the quality of it. Hence, incineration plants are unable to burn the wastes completely. In fact, most of the wastes are unfit for incineration.

4. Unsegregated wastes require an excessive amount of fuel to burn. So, the cost of energy per unit from our WTE plants is high. Like the USA and European landfills, Indian landfills should learn to accept only non-recyclable and non-biodegradable wastes, and incineration should be done by grate combustion technology.

### Successful Indian companies that turn end-of-life plastics to fuels

When WTE plants have shown their downsides, waste plastics have come as the light at the end of the tunnel, enabling us to move forward and transform end-of-life plastics to renewable fuels by adopting simple and cost-effective ways. The growing interest in creating something different from plastic wastes has led to many methods that turn plastics to fuel(s). **Plastics are considered to be toxic, but by following proper waste management techniques, these can be vapourised rather than burnt and oxidised.** A brief account of some com-

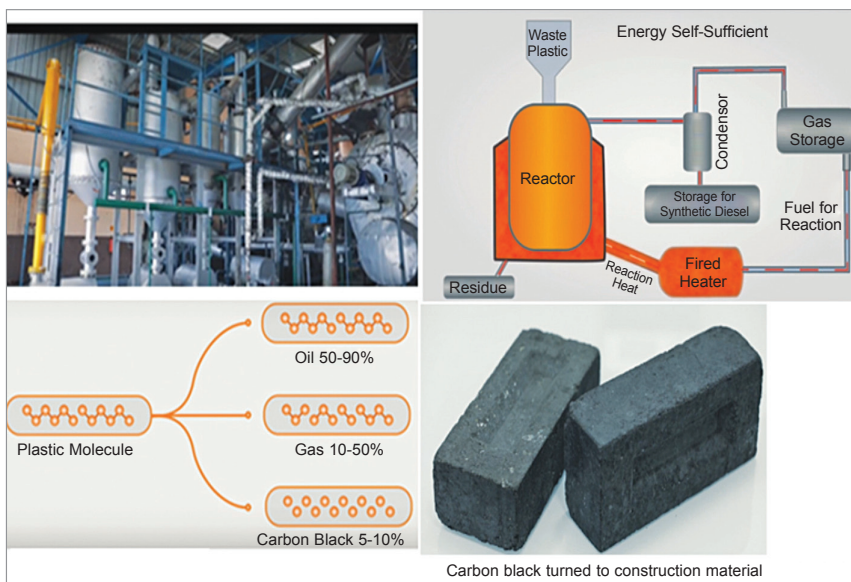


Fig. 2: APChemi plant for recycling via pyrolysis

panies that are successfully turning waste plastics to sustainable fuel(s) is given below.

Indian Institute of Petroleum (IIP), Dehradun, under the umbrella of Council of Scientific & Industrial Research (CSIR), has set up a plant that is the first by a government research institute in India. It converts waste plastics into useful hydrocarbons like petroleum or diesel using pyrolysis method. In this method, the segregated plastic wastes are not burnt but heated in the absence of air, so that the complex hydrocarbons are broken to small molecules. A right combination of catalysts is added to these small molecules, which are then converted to valuable hydrocarbons in vapour form. This vapour is then condensed to get the final products such as gasoline, diesel, or aromatics, in liquid form.

The IIP plant is capable of converting one tonne of plastic wastes to 850

litres of diesel, or 700 litres of petrol, or 500 litres of aromatic products. The obtained fuels are free from toxic substances and are thus completely environment friendly. The final IIP products are welcome by Indian Railways because these have zero sulphur and therefore meet the Euro-III standards. The aromatics are rich in BTX.

Agile Process Chemicals (APChemi) is a leading solution provider in following the technology of chemical recycling via pyrolysis. The company is one among the eleven winners of the Asia-Pacific End Plastic Waste Innovation Platform, which supports the innovations of the startups in ending waste plastics, conducted by Alliance to End Plastic Waste & Plug and Play.

At APChemi, the plastics from the municipal solid wastes are thoroughly washed, dried, shredded and then fed into a gas-powered reactor where the plastic, which contains complex hydrocarbons, is broken down using heat to its molecular level. It yields oil and gas that are clean and efficient hydrocarbons, which serve as fuels and petrochemicals, thus reducing the dependence on crude oil and paving the way to an ecological circular economy.

The only waste product in the pyrolysis process is the carbon black. However, APChemi has successfully converted this pyrolysis waste to solid sustainable construction material. APChemi's plant successfully converts 75,000kg of end-of-life plastics per day,



Fig. 3: Plant of 500kg capacity at Rudra Environmental Solutions



Fig. 4: PolyCycl plant that claims to achieve 95% efficiency

and more than eighty percent of the polymer hydrocarbons become sustainable energy products. The output hydrocarbon oil is further fractionated into petrol, diesel, and jet fuel that can run petrol and diesel engines. This oil also finds many industrial applications such as the generation of steam, hot water, hot air, or for heating thermic fluid. The oil and the gas can be used in internal combustion engines to produce electricity.

Rudra Environmental Solutions has bagged the Dynamic Asia Global Award for its outstanding contribution to the recycling industry. Rudra uses the process called Thermo Catalytic Depolymerisation (TCD) in which shredded plastics are heated at 380°C to 430°C in absence of oxygen. A catalyst is used to crack the polymer chain, thus producing hydrocarbon vapours, which are condensed. The condensed vapours produce a fuel called polyfuel, and synthetic gases called syngas. The polyfuel undergoes filtration before collection, and the syngas is also cleaned before using in a reactor.

At Rudra, each tonne of plastics produces 600 to 650 litres of polyfuel, which is used in boilers, furnaces. etc. Efficiency of syngas, which is used for heating the reactor at Rudra, is 20%

to 25%. In this process, no harmful gases or effluents are generated. The end product yields a residual char, which is a non-hazardous waste that can be used as a road filler along with bitumen.

The advantage of the method followed at Rudra is that plastic wastes need not be presorted, cleaned or dried before processing. This reduces the overall cost of operation, the process is eco-friendly, and the final output yield is not only energy-efficient but also has a negative carbon footprint.

PolyCycl Private Limited has won the Indian Innovation Initiative award from the Confederation of Indian Industry (CII) for making an impact towards sustainable circular economy by converting waste plastics to high-value petroleum fuels. PolyCycl has also been chosen as one among the eleven winners of the Asia-Pacific End Plastic Waste Innovation Platform, from Alliance to End Plastic Waste & Plug and Play, for innovative ideas from startups in efficiently making use of the plastic wastes.

Amit Tandon, founder of PolyCycl, strongly believes that producing high-value fuel and adopting low-cost extraction technology are the two main factors to increase the

plastic-to-fuel conversion. The plant at PolyCycl adopts Contiflo Cracker extraction technology that uses a patented continuous process to generate distillate fuels, which can be used in industrial boilers and furnaces. In the process of converting waste plastics to liquid fuels and gas, PolyCycl achieves an efficiency of 95%. For every tonne of waste plastics, PolyCycl plant produces 5.8 to 6.4 barrels of liquid fuels. In short, for every ton of plastic wastes the yield is 850 litres of lighter distillate fuels.

According to PolyCycl, extracting fuel from waste plastics using a batch-based approach is not only tedious but gives an output that is of low-value; whereas the fuels generated from PolyCycl's process are lighter, less viscous and high in GCV (global value chain?), thus making them highly effective and valuable. These fuels require no further distillation and are ready to be sold as a substitute for industrial diesel.

Paterson Energy provides a wholesome solution to plastic wastes through a sustainable and eco-friendly mechanism. Paterson uses continuous Thermo Chemical Depolymerisation (TCD) in its recycling plant to break the large plastic molecules, which yields a fuel named by them as 'verte-x' that is free from sulphur-like toxic elements. Verte in French means 'green,' and as the fuel finds many industrial applications, the company has added an 'x' to it.

Paterson produces 600 litres of verte-x from one tonne of plastic wastes. The carbon black residue is used as a replacement of coal. Verte-x can be used as a fuel in generators to produce electricity, in marine engines, in casting furnace, or any other plant that requires heat or electricity.

MK Aromatics, a manufacturer of various aromatic hydrocarbon solvents, also provides a technical solution to synthesise waste plastics or multi-layered plastics like sachets. The company uses a completely automated method where there is no need to segregate or wash or dry the plastics. The plant converts seven to ten tonnes of collected waste plastics per day.

At MK Aromatics, the collected waste plastics are loaded

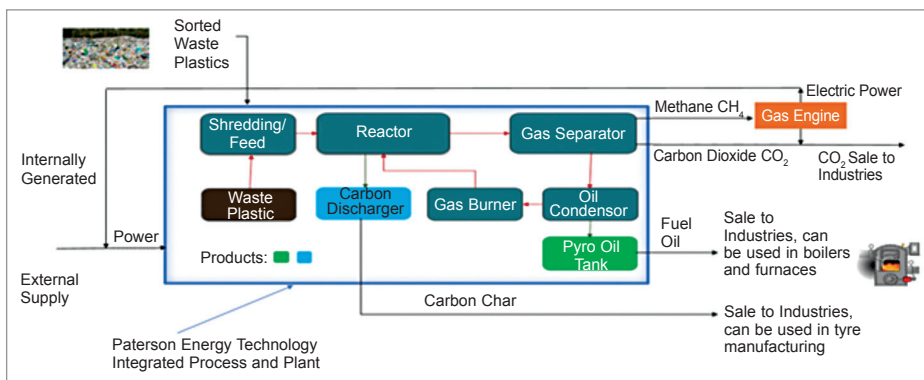


Fig. 5: Plastic waste menace converted to usable products (Credit: Paterson Energy)



Fig. 6: MK Aromatics does not need to segregate, wash or dry the plastics

on a conveyor belt that leads to a rotary drummer, where the dust and dirt get settled at the bottom and diverted to a compost pit. The dust-free plastics are collected, bailed and then fed into the loading press. The hydraulic cylinder in the press pushes the plastic into the reactor, which operates between 350°C and 450°C, where the plastic is melted and vaporised. The resulting vapour from the reactor is then condensed to get crude oil, which can be further distilled to get various derivatives of hydrocarbons. The non-condensable gases like methane, butane and propane are recycled back to the reactor and used as fuel for the reactor.

This method is eco-friendly and

energy-efficient as fuels are produced without any emissions and effluents. The fuels produced by MK Aromatics are used by well-known companies like Unilever and Britannia to energise their plants.

### Conclusion

Companies mentioned above and some other companies, or individual innovators who are not mentioned, are creating a long-term promise by changing end-of-life plastics to valuable renewable fuels in a sustainable and environment-friendly way. The huge amount of money we have spent as half-measures on WTE plants is in a black hole now. The investments

and the efforts made by these plastic wastes-to-energy companies will substantiate the principle 'in for a penny in for a pound.'

Reliance Industries plans to become one of the world's leading new energy companies by creating value from plastic wastes that yields a clean, affordable energy and makes carbon-dioxide a recyclable resource. State governments, NGOs, investors, waste management practitioners and environmental conservation groups should recognise waste plastics as a resource for a clean renewable energy, and join hands with the plastic-to-fuel innovators to develop more pioneering technologies that produce ultra-clean emissions and replace fossil fuels.

With the support of the government, we expect that the conversion of waste plastics to energy in all states of India will show a sharp rise in the following years and thus promote our country's economy. By doing so, we are not only moving towards the circular economy but also bringing more benefits to the environment to create a win-win for all. **EFY**

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## DRDO's Support To Manufacture Defence Equipment

EFY Bureau

**D**RDO, over years, has substantially enhanced the technological capabilities of Indian industry through various policy initiatives, sustained engagements and intense technology transfers. DRDO is taking these efforts to next level to transform India into a hub of advanced defence technologies developing state-of-the-art defence equipment and systems. Government policies, especially with respect to 'Make in India,' 'Start-up India,' 'Stand up India,' 'Skill India' and 'Atmanirbhar Bharat' have provided new opportunities. These are being leveraged to develop defence R&D and manufacturing eco-system in the country.

This document brings out various policy initiatives taken by DRDO.

### **DRDO Policies in Support of Industries.**

The existing Policies/SOPs/Guidelines of DRDO to support industries are listed below:

**1. Transfer of Technology.** DRDO provides the relevant 'know-how' in the form of Technology Transfer Documents (TTD) and handholding support to Indian industry. Technology is transferred to Development cum Production Partner (DcPP)/Development Partner (DP)/Production Agency (PA) without any ToT Fee and to other industries with a one-time ToT Fee @5% of total project sanction cost. Royalty is not charged on net sales to Indian Armed Forces and other government departments. Only 2% royalty is applicable for sales in Indian commercial market and exports. Details are available at website <https://drdo.gov.in/transfer-technologies>

**2. Technology Development Fund (TDF).** In TDF, a corpus fund of a billion rupees has been created to enable Indian industries, specially MSMEs, for indigenisation of the defence products, sub systems and components. The fund may also be utilised for developing new technologies as required by DRDO, Services and DPSUs. The cost of each project under TDF can be up to one hundred million rupees. The industry can get funding up to 90% of the project cost. Details are available at website <https://tdf.drdo.gov.in>

**3. DRDO Patents for Indian Industry.** All patents and relevant intellectual publications are available on DRDO website. These can be used by Indian industry free of cost. For any

further support, DRDO may be approached for working out the modalities. Details are available at website <https://drdo.gov.in/ipr>

### **4. Development and Production Partner.**

DRDO engages industry as Development Cum Production Partner (DcPP)/Development Partners (DP)/Production Agency (PA) during the execution of its projects and programmes. The selection of industries is carried out based on procurement rules and procedures. Industry may approach through website <https://drdo.gov.in/headquarter-directorates/finance-and-materials-management>

**5. Testing Support.** DRDO supports Indian industry during their technology and products development by extending Test Facilities (<https://www.drdo.gov.in/test-facilities>) and Proof & Field Firing Ranges (<http://www.makeinindiadefence.gov.in>). This assures development of high-quality defence products.

### **6. Evaluation and Certification Support.**

The following certification services are provided by DRDO to industry:

(i) CEMILAC provides the certification support to industry for military airworthiness. CEMILAC may be contacted at <https://drdo.gov.in/labs-and-establishments/centre-military-airworthiness-certification-cemilac>

(ii) SAG, Delhi provides testing and certification support for IT and crypto products developed by industries on request of Services. SAG may be contacted at <https://drdo.gov.in/labs-and-establishments/scientific-analysis-group-sag>

**7. Export Support.** A Standard Operating Procedure (SOP) is promulgated to assist Indian Industry to export products developed with DRDO support. An export compendium, comprising DRDO products having potential of export, has also been prepared along with details of manufacturing industries. Industry may approach through website <https://drdo.gov.in/transfer-technologies>

### **8. Technological and Scientific Support.**

Technological and scientific support will be provided to industry by DRDO on need basis. The interested industry may contact DRDO at <https://drdo.gov.in/headquarter-directorates/contact-us/industry-interface-technology-management> **EFY**

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## CTECH ENERGY LITHIUM ION BATTERY

### Product

StoraX 50- Lithium Battery storage solution 240V



### Application

Solar Power Plant and UPS



### Product

3.7v 2.2Ah/4.4Ah



### Application

Emergency LED Bulb LED Batten



**CTECH ENERGY PRIVATE LIMITED**

Plot No.152, Sector -7, IMT Manesar, Gurugram, Haryana, -122050, India  
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# Wanda

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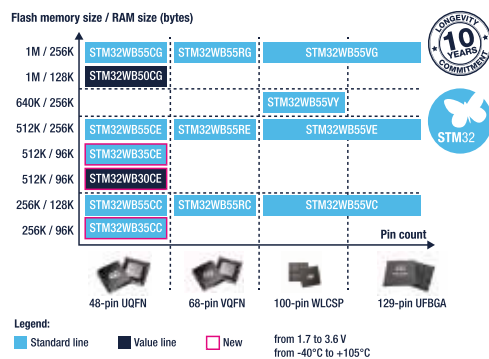
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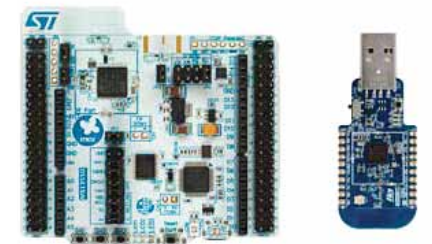
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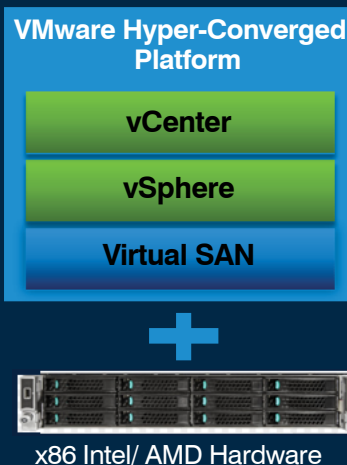


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