2019-2020

DEPARTMENT OF

ELECTRICAL AND ELECTRONICAL ENGINEERING

Technical Magazine

HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HECT

MESSAGE FROM THE CHAIRMAN

It gives me immense pleasure to note that response to this magazine of our department has been overwhelming. The wide spectrum of articles in different sections gives me a sense of pride that our students and professors possess creative potential and original thinking in ample measures. Each article is entertaining, interesting and absorbing. I applaud the contributors for their stimulated thoughts and varied hues in articles contributed by them. My congratulations to the team who took the responsibility for the arduous task most effectively. I am hopeful that this small piece of technical work shall not only develop the taste for reading among students but also develop a sense belonging to the institution as well.

Mr.T.S.R. KHANNAIYAN

MESSAGE FROM
THE MANAGING TRUSTY

Good things remain good only because they are always scarce. I am glad to pen for this wonderful magazine as an appreciation of the commendable efforts put forth by the team for its grand beginning. The efforts taken to bring about innovative content is appreciable. Content on the various opportunities available in the corporate world and alerts on various student level competitions shall be included hence next. Wish you all a grand operation throughout the year.

- **Mrs. SARASWATHY**

MESSAGE FROM
THE EXECUTIVE SECRETARY

I am confident that this issue of Department Magazine will send a positive signal to the staff, students and the person who are interested in the Technical education and Technology based activities. A Magazine is like a mirror which reflects the clear picture of all sorts of activities undertaken by a Department and develops writing skills among students in particular and teaching faculty in general.

-K. PRIYA SATISH PRABU

MESSAGE FROM THE PRINCIPAL

"The mind is not a vessel to be filled, but a fire to be kindled." Said Plutarch. Our Technical College Magazine kindles the imagination of our learners. swaying from serious thinking to playful inventiveness, five thousand men and women students at Hindusthan College of engineering and technology are brimming with a zeal for life empowering themselves with skills and creativity.

Dr. T. KANNADHASAN

MESSAGE FROM THE HOD

I am gratified to know that the department of Electrical and Electronics Engineering is bringing out their technical magazine of this academic year. This is a productive technical material and subsidiary skill developing tool for the students. I wish this organization **"Electrical and Electronics Engineering Association"** a very big success in all their ventures. I also applaud the coordination and efforts.

- **Prof. N .P. ANANTHAMOORTHY**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Vision:

To manifest itself as a valuable global resource for industry and society with strong foundation. Abetting the students with innovative ethical and creative talents of endeavoring young professionals in Electrical and Electronics Engineering.

Mission Statement:

- Educate the students to acquire knowledge in recent advancement of Electrical and Electronics Engineering and prepare the students for professional career and higher studies
- Inculcate the students to develop innovation for the societal needs through research oriented teaching and creative skill enhancement training.
- Enunciate the students with better skills to meet the challenges of the technical world and intensify the skills towards the practical approach.

- **PEO 1**: Graduate will be able to execute the principles of basic science, mathematics and engineering fundamentals necessary to formulate, solve and analyze engineering problems.
- **PEO 2:** Graduate will be able to accrete the knowledge for pursuing advanced degrees in Engineering, Science, Management, Research and Development.
- **PEO 3:** Graduate will be able to effectuate professionalism, leadership qualities, self and continuous learning and concern for environment to meet the societal needs.
- **PSO1:** Graduates will acquire the knowledge of design, performance & testing of static & dynamic Electrical Machines, Electrical Drives, Power Electronics applicable in core and related fields.
- **PSO2**: Graduates will attain knowledge and acquire skills by applying modern software tools for design, simulation and analysis of Electrical Systems to successfully adapt in multi-disciplinary environments.

ARTICLES

ARTIFICIAL INTELLIGENCE & AUTOPILOT IN TESLA CAR:

We develop and deploy autonomy at scale in vehicles, robots and more. We believe that an approach based on advanced AI for vision and planning, supported by efficient use of inference hardware, is the only way to achieve a general solution for full self-driving and beyond.

Hardware:

Build silicon chips that power our full self-driving software from the ground up, taking every small architectural and micro-architectural improvement into account while pushing hard to squeeze maximum silicon performance-per-watt. Perform floor-planning, timing and power analyses on the design. Write robust, randomized tests and scoreboards to verify functionality and performance. Implement compilers and drivers to program and communicate with the chip, with a strong focus on performance optimization and power savings. Finally, validate the silicon chip and bring it to mass production.

Neural Networks:

Apply cutting-edge research to train deep neural networks on problems ranging from perception to control. Our per-camera networks analyze raw images to perform semantic segmentation, object detection and monocular depth estimation. Our birds-eye-view networks take video from all cameras to output the road layout, static infrastructure and 3D objects directly in the top-down view. Our networks learn from the most complicated and diverse scenarios in the world, iteratively sourced from our fleet of nearly 1M vehicles in real time. A full build of Autopilot neural networks involves 48

networks that take 70,000 GPU hours to train 🔥. Together, they output 1,000 distinct tensors (predictions) at each timestep.

Autonomy Algorithms:

Develop the core algorithms that drive the car by creating a high-fidelity representation of the world and planning trajectories in that space. In order to train the neural networks to predict such representations, algorithmically create accurate and large-scale ground truth data by combining information from the car's sensors across space and time. Use state-of-the-art techniques to build a robust planning and decision-making system that operates in complicated real-world situations under uncertainty. Evaluate your algorithms at the scale of the entire Tesla fleet.

Code Foundations:

Throughput, latency, correctness and determinism are the main metrics we optimize our code for. Build the Autopilot software foundations up from the lowest levels of the stack, tightly integrating with our custom hardware. Implement super-reliable bootloaders with support for over-the-air updates and bring up customized Linux kernels. Write fast, memory-efficient low-level code to capture high-frequency, high-volume data from our sensors, and to share it with multiple consumer processes— without impacting central memory access latency or starving critical functional code from CPU cycles. Squeeze and pipeline compute across a variety of hardware processing units, distributed across multiple system-on-chips.

Evaluation Infrastructure:

Build open- and closed-loop, hardware-in-the-loop evaluation tools and infrastructure at scale, to accelerate the pace of innovation, track performance improvements and prevent regressions. Leverage anonymized characteristic clips from our fleet and integrate them into large suites of test cases. Write code simulating our real-world environment, producing highly realistic graphics and other sensor

data that feed our Autopilot software for live debugging or automated testing.

Tesla Bot:

Develop the next generation of automation, including a general purpose, bi-pedal, humanoid robot capable of performing tasks that are unsafe, repetitive or boring. We're seeking mechanical, electrical, controls and software engineers to help us leverage our AI expertise beyond our vehicle fleet.

- Gokul Raj.R
II - EEE

WIRELESS CHARGING FOR EVS:

In a world where charging electric cars is a key point in boosting the energy transition, other solutions can come alongside electric charging stations. One such solution is wireless charging. Wireless car charging is an enhanced version of smartphone charging with several differences. "Wireless inductive charging allows an electric vehicle [EV] to automatically charge without the need of cables," said Michael Rai Anderson, CEO of Plugless Power, in an interview with Power Electronics News.

Charging solutions for electric mobility:

When speaking about electric mobility, there are different ways to "refill" a vehicle with energy, including battery charging, battery swap, and hydrogen refueling . Rosina pointed out that hydrogen

refueling is used for hydrogen fuel-cell EVs, which represent an extremely small part of the EV market. In the case of battery swap, by using a combination of computer vision and wireless communication, the station can identify the exact location of each battery module to be swapped. We covered this topic more in depth on EE Times.

“To reach governments’ strict CO2 emission reduction targets, the electrification of vehicle fleets has become mandatory,” said Rosina. “Although different levels of electrification exist, the necessary emission reduction can be achieved only by a ‘strong electrification’ — in EVs and plug-in hybrid EVs.”

Technology:

The first person to theorize about “wireless” electrical energy transfer was Nicola Tesla in 1896. The operating principle is similar to that of a transformer and is based on the laws of magnetic induction. A primary circuit, called a transmitter, generates a time-varying magnetic field. A secondary circuit receives this field, called the receiver, which is connected to the device to be powered. The most important parameters to take into account are certainly the distance between the two circuits and their alignment. Poor alignment and a relatively large distance degrade performance and make energy transfer inefficient.

Magnetic induction charging uses the energy exchange between two pads, one located on the ground and one underneath the vehicle. The charging pad (on the ground) is approximately 1 m^2, while the receiving pad (on the car) is enclosed in a small device. In addition to the pad optionally mounted on the vehicle, the infrastructure consists of an induction charging station.

A receiver (receiving coil) is placed on the bottom of the vehicle, while several coils acting as transmitters are embedded in the road surface. The latter is supplied with electrical energy. This works as follows: The coils in the pavement produce a magnetic field by

means of current. The magnetic field ensures that the coil on the vehicle receives this and can transform it back into electrical energy. This produced energy is used to charge the battery that runs the motor.

Power management:

The charging is managed similarly to the current charging methods through a wired charger, through the EV's battery management system. Anderson pointed out, however, that even under this condition, the charge management may change slightly depending on the power output conditions of the wireless charging device.

"The key is to understand that the communication between the antenna is based on DC power; as the power that comes from the grid is AC, the power must be converted to DC for the transmitter antenna," said Anderson. "The receiver antenna receives the power as DC and then can be converted back into AC to interface with the same electrical infrastructure that the plug-in interface uses or stay in DC to interface directly with the DC battery management system. There is a slight drop in efficiency for each time that the power must be converted from AC to DC or from DC to AC. As such, most wireless charging devices will operate at approximately 92%, ±2% efficiency. However, this is not drammatically lower than a wired charging device. Wired charging tends to provide an efficiency of 96%, ±2%."

Considerations:

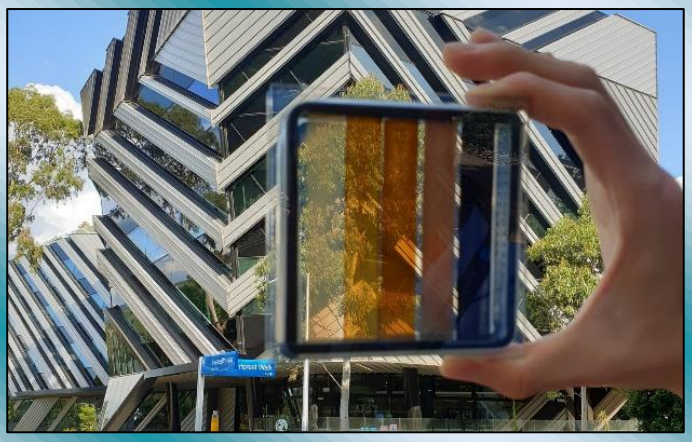
EVs are growing to dominate electrification, but range is still a very difficult issue, as is the issue of government regulations. Husain said, "Wireless charging is easier and is almost transparent to the user, but wired charging is more intuitive and people might like the feeling of plugging in their car. Wireless charging will not be faster than AC charging using the car's on-board charger, typically 11 kW up to 20 kW, but fast DC charging will go up to 300 kW to provide a very fast charge. It will be a long time until we can make wireless charging

part of the infrastructure and have a way for everyone to choose to use it, pay for it, and feel safe doing it."

In order to make wireless battery charging accessible to everyone and everywhere, a network of induction charging stations needs to be created, with the charging plates being embedded in the road surface. Induction charging while driving is the prime option for e-mobility. The only thing that is certain already today is that the network of fast-charging stations is continually expanding and that recharging electric cars will become increasingly easy as electric charging options evolve.

- Ariya.S.M
II - EEE

WINDOW GLASS THAT WILL PRODUCE THE ELECTRICITY:



Two square metres of solar window will generate the same amount of power as a standard rooftop solar panel, Australian researchers say.

Semi-transparent solar cells that can be incorporated into window glass are a "game changer" that could transform architecture, urban planning and electricity generation, Australian scientists say in a paper in the journal Nano Energy.

The researchers – led by Professor Jacek Jasieniak from the ARC Centre of Excellence in Exciton Science (Exciton Science) and Monash University – have succeeded in producing next-gen perovskite solar cells that generate electricity while allowing light to pass through. They are now investigating how the new technology could be built into commercial products with Viridian Glass,

Australia’s largest glass manufacturer. The research was also supported by the Australian Renewable Energy Agency (ARENA).

Scaling up the manufacturing process:

"Rooftop solar has a conversion efficiency of between 15 and 20 per cent," Jasieniak said. "The semi-transparent cells have a conversion efficiency of 17 per cent, while still transmitting more than 10 per cent of the incoming light, so they are right in the zone. It has long been a dream to have windows that generate electricity, and now that looks possible."

Co-author and CSIRO research scientist, Dr Anthony Chesman, said the team is now working on scaling up the manufacturing process. "We will be looking to develop a large-scale glass manufacturing process that can be easily transferred to industry so manufacturers can readily uptake the technology," he said.

Building gets free electricity:

Solar windows will be a boon for building owners and residents, and will bring new challenges and opportunities for architects, builders, engineers and planners. "There is a trade-off," explained Professor Jasieniak. "The solar cells can be made more, or less, transparent. The more transparent they are, the less electricity they generate, so that becomes something for architects to consider." He added that solar windows tinted to the same degree as current glazed commercial windows would generate about 140 watts of electricity per square metre.

Large windows deployed in high-rise buildings are expensive to make. The additional cost of incorporating the semi-transparent solar cells into them will be marginal. "But even with the extra spend, the building then gets its electricity for free!" Professor Jasieniak said.

Reconsider the positioning of buildings:

"These solar cells mean a big change to the way we think about buildings and the way they function. Up until now every building has been designed on the assumption that windows are fundamentally passive. Now they will actively produce electricity. Planners and designers might have to even reconsider how they position buildings on sites, to optimise how the walls catch the sun."

Lead author Dr Jae Choul Yu, also from Exciton Science and Monash, added that more efficiency gains would flow from further research. "Our next project is a tandem device," he said. "We will use perovskite solar cells as the bottom layer and organic solar cells as the top one."

Potential innovations in glass:

As to when the first commercial semi-transparent solar cells will be on the market, "that will depend on how successful scaling of the technology will be, but we are aiming to get there within 10 years," said Professor Jasieniak.

Jatin Khanna, Operations Manager for Viridian Glass, added: "The development of such solar windows presents an opportunity that could translate into the new glass innovations and technologies going forward." (mfo)

-Kannan.M
II EEE

AUGMENT REALITY:

Augmented reality (**AR**) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory. AR can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects. The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment).This experience is seamlessly interwoven with the physical world such that it is perceived as an immersive aspect of the real environment. In this way, augmented reality alters one's ongoing perception of a real-world environment, whereas virtual reality completely replaces the user's real-world environment with a simulated one. Augmented reality is related to two largely synonymous terms: mixed reality and computer-mediated reality.

The primary value of augmented reality is the manner in which components of the digital world blend into a person's perception of the real world, not as a simple display of data, but through the integration of immersive sensations, which are perceived as natural parts of an environment. The earliest functional AR systems that provided immersive mixed reality experiences for users were invented in the early 1990s, starting with the Virtual Fixtures system developed at the U.S. Air Force's Armstrong Laboratory in 1992. Commercial augmented reality experiences were first introduced in entertainment and gaming businesses. Subsequently, augmented reality applications have spanned commercial industries such as

education, communications, medicine, and entertainment. In education, content may be accessed by scanning or viewing an image with a mobile device or by using markerless AR techniques.

Augmented reality is used to enhance natural environments or situations and offer perceptually enriched experiences. With the help of advanced AR technologies (e.g. adding computer vision, incorporating AR cameras into smartphone applications and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulated. Information about the environment and its objects is overlaid on the real world. This information can be virtual. Augmented Reality is any experience which is artificial and which adds to the already existing reality.or real, e.g. seeing other real sensed or measured information such as electromagnetic radio waves overlaid in exact alignment with where they actually are in space. Augmented reality also has a lot of potential in the gathering and sharing of tacit knowledge. Augmentation techniques are typically performed in real time and in semantic contexts with environmental elements. Immersive perceptual information is sometimes combined with supplemental information like scores over a live video feed of a sporting event. This combines the benefits of both augmented reality technology and heads up display technology (HUD).

Hardware:

Hardware components for augmented reality are: a processor, display, sensors and input devices. Modern mobile computing devices like smartphones and tablet computers contain these elements, which often include a camera and microelectromechanical systems (MEMS) sensors such as an accelerometer, GPS, and solid state compass, making them suitable AR platforms. There are two technologies used in augmented reality: diffractive waveguides and reflective waveguides.

Display:

Various technologies are used in augmented reality rendering, including optical projection systems, monitors, handheld devices, and display systems, which are worn on the human body.

A head-mounted display (HMD) is a display device worn on the forehead, such as a harness or helmet-mounted. HMDs place images of both the physical world and virtual objects over the user's field of view. Modern HMDs often employ sensors for six degrees of freedom monitoring that allow the system to align virtual information to the physical world and adjust accordingly with the user's head movements. HMDs can provide VR users with mobile and collaborative experiences. Specific providers, such as uSens and Gestigon, include gesture controls for full virtual immersion.

Tracking:

Modern mobile augmented-reality systems use one or more of the -following motion tracking technologies: digital cameras and/or other optical sensors, accelerometers, GPS, gyroscopes, solid state compasses, radio-frequency identification (RFID). These technologies offer varying levels of accuracy and precision. The most important is the position and orientation of the user's head. Tracking the user's hand(s) or a handheld input device can provide a 6DOF interaction technique.

Networking:

Mobile augmented reality applications are gaining popularity because of the wide adoption of mobile and especially wearable devices. However, they often rely on computationally intensive computer vision algorithms with extreme latency requirements. To compensate for the lack of computing power, offloading data processing to a distant machine is often desired. Computation offloading introduces new constraints in applications, especially in terms of latency and bandwidth. Although there are a plethora of real-time multimedia

transport protocols, there is a need for support from network infrastructure as well.

Input device:

Techniques include speech recognition systems that translate a user's spoken words into computer instructions, and gesture recognition systems that interpret a user's body movements by visual detection or from sensors embedded in a peripheral device such as a wand, stylus, pointer, glove or other body wear. Products which are trying to serve as a controller of AR headsets include Wave by Seebright Inc. and Nimble by Intugine Technologies.

-Ajay
III EEE

DELIVERY DRONES:

A delivery drone is an unmanned aerial vehicle (UAV) used to transport packages, medical supplies, food, or other goods. Delivery drones are typically autonomous. In November 2020 the FAA proposed airworthiness criteria for type certification of delivery drones with an intent to initialize commercial operations. Zipline, Wingcopter, and Amazon Prime Air were amongst the 10 companies selected for this type certification.

Healthcare delivery:

In December 2013, the DHL parcel service subsidiary of Deutsche Post AG tested a "microdrones md4-1000" for delivery of medicine.

Drones can be used to transport medicinal products such as blood products, vaccines, pharmaceuticals, and medical samples.Medical deliveries are able to fly into and out of remote or otherwise inaccessible regions, compared to trucks or motorcycles. Medical drone delivery is credited with saving lives during emergency deliveries of blood in Rwanda and post-hurricane relief in Puerto Rico.

During the COVID-19 pandemic, drones made medical deliveries of personal protective equipment and COVID-19 tests in the United States[5], Israel,and Ghana. In partnership with the Ghana Ministry of Health, Zipline drones delivered thousands of COVID-19 vaccine vials in Ghana during 2020 and 2021. University of British Columbia (UBC) has. selected Drone Delivery Canada Corp for UBC's “Remote Communities Drone Transport Initiative” program. This solution will be used to transport a variety of cargo for the benefit of

the Stellat’en First Nation, located in the Fraser Lake area of Central Northern British Columbia.

Food delivery:

Drones have been proposed as a solution for rapidly delivering prepared foods, such as pizzas, tacos, and frozen beverages.

Early prototypes of food delivery drones include the Tacocopter demonstration by Star Simpson, which was a taco delivery concept utilizing a smartphone app to order drone-delivered tacos in San Francisco area. The revelation that it didn't exist as a delivery system or app led to it being labelled a hoax. A similar concept named the "burrito bomber" was tested in 2012.

Postal delivery:

Different postal companies from Australia, Switzerland, Germany, Singapore, the United Kingdom and Ukraine have undertaken various drone trials as they test the feasibility and profitability of unmanned delivery drone services. The USPS has been testing delivery systems with HorseFly Drones.

Ship resupply:

The shipping line Maersk and the Port of Rotterdam have experimented with using drones to resupply offshore ships instead of sending smaller boats.

-Abbas
III EEE

ULTRACAPACITOR:

An ultracapacitor, also known as a supercapacitor, or electrochemical capacitor, is a device for storing electrical energy which is growing rapidly in popularity. The design and mechanism of operation is somewhere between an ordinary capacitor and a battery, which opens up some interesting and valuable applications.

Like a battery, a single ultracapacitor cell consists of a positive and negative electrode, separated by an electrolyte. However, ultracapacitors store energy electrostatically, like a regular capacitor, not chemically like a battery - there is a dielectric separator dividing the electrolyte, also like a capacitor.

The small separation between electrodes permitted by this structure lead to much higher energy storage density than a normal capacitor. Whilst an ultracapacitor stores less energy than an equivalently sized battery, it can release it much quicker, as the discharge is not dependent on a chemical reaction taking place.

Because no physical or chemical changes occur when charge is stored, ultracapacitors can also be used many times over without degradation.

Nanotechnology in Ultracapacitors:

Nanotechnology research from the last few years has allowed us to begin to explore the potential of ultracapacitors, by providing materials which have the necessary properties for wide-ranging commercial applications.

Their energy density, short charging cycle, and wide range of operating temperatures makes them well suited for applications from efficient large-scale energy storage to very small portable/wearable devices. In the coming years, many experts predict that ultracapacitors will being to replace or augment battery and fuel cell systems in many areas of technology.

The electrodes for commercial ultracapacitors are usually made from nanostructured carbon-based materials, like carbon nanotubes, porous activated carbons, or carbon aerogels. These materials have a high surface area, and good conductivity, making them ideal for use in ultracapacitors.

There is a compromise to be made in the design of the electrode materials, however, as smaller nanopores have excellent surface area but restrict the movement of conducting ions, reducing the conductivity. The pore size must therefore be selected to suit the application of each specific ultracapacitor design.

Future Developments for Ultracapacitors:

Ultracapacitors using graphene electrodes show great promise, due to the remarkable electrical properties of the material. The technology is still in its infancy, however, and the degree of control over the electrode's structure which is needed is still difficult to achieve.

It is currently possible to make graphene ultracapacitors with equivalent characteristics to more established materials, but at far greater cost. In the near future, however, graphene technology is likely to take over this market, as the potential performance benefits are huge.

Applications for Ultracapacitors:

The performance benefits of ultracapacitors come into play most effectively when a large spike in power consumption, or a large-scale, repeated charging cycle is required.

- Electric or hybrid vehicles - to provide a quick burst of acceleration over short distances, or to start the main motor.
- Quick-charging electronic devices
- Waterproof/weatherproof energy storage (e.g. remote wind farms)
- Military vehicles (starter engines for tanks, submarines, compact power for missiles)

Sources and Further Reading:

- "Report on Energy: Batteries and SuperCapacitors" - EU ObservatoryNano
- Supercapacitor Briefing - Mitre.org

-Bharath Shanmugam

III EEE

FOOTSTEPS INTO ELECTRICAL POWER:

Pavegen Systems is a technology company that has developed paving slabs to convert energy from people's footsteps into small amounts of electrical power.

History:

Pavegen Systems was founded in 2009 by Laurence Kemball-Cook. Cook, a graduate in Industrial Technology and Design from Loughborough University, took on a university placement with E.ON, and proposed using footfall as a potential power source.
The development of the first prototype of the Pavegen flooring tile was funded by a Royal Society of Arts International Design Directions prize. The tile that converts kinetic energy from footsteps into electricity, while collecting data about walking traffic patterns.
The first generation tile was made from recycled polymer, with the top surface made from recycled truck tires. Power is generated when a footfall compresses the slab by about 5 mm (0.2 in). The exact technology is a secret, but PaveGen officials have said it involves electromagnetic induction by copper coils and magnets. Pavegen says each pedestrian generates enough to run an LED street lamp for 30 seconds. The technology was developed by Pavegen founder Laurence Kemball-Cook.
An improved tile was developed in 2016 which, according to the company, improved energy conversion by 'about 20 times'. The amount of energy generated has been criticised, with one calculation claiming that walking for 4 hours on PaveGen paving would generate 0.02% of the average European's energy needs. It has been suggested that the technology's strength rests in its ability to track volume and

direction of traffic flow, thus providing useful metrics in a range of scenarios.

Among other installations, the slabs have been laid at London's West Ham Underground station for the 2012 Olympic Games. In April 2013, a demonstration installation with Schneider Electric harvested energy from the runners in the Paris Marathon. PaveGen has also put these tiles on a public soccer field in Rio de Janeiro to allow play after sunset.

A study of a central building at Macquarie University in Sydney, Australia, suggested that if pavers covered the 3.1% of the floor that sees the most foot traffic, it would generate an estimated 1.1 megawatt-hour per year, about 0.5% of the building's energy needs.

In 2012, Pavegen raised £350,000 through London Business Angels, which helped the company create a tangible business. In 2015, the company raised £1.9m through the Crowdcube platform, allowing them to gain 1500 investors and valued the company at about £17m.

In 2015, Kemball-Cook acts as CEO of the company, For his invention, he was chosen as Businessman of the Year at the PEA Awards, and presented with a Shell LiveWIREGrand Ideas Award. He also was named as honorary Enterprise and Innovation Fellow by Loughborough University.

Distributors:

Pavegen have distributors in Australia, New Zealand, Korea, Singapore, Thailand, Portugal, India and Japan.

Criticism:

The Register points out that this device generates only "tiny, pointless amounts of energy". This borne out by an article published by the Institution of Mechanical Engineers in which the output from 54,267 steps on a Pavegen system is shown to have generated 217,028 watt-seconds, a mere 0.06 kWh.

-Mani Prakash
II EEE

VORTEX BLADLESS:

Vortex Bladeless Ltd. is a Spanish technology startup company that is developing a type of wind power generator which extracts energy from wind with no rotation, blades, shafts, gears, or lubricants, unlike wind turbines. It is based on the phenomena of aeroelasticity and resonance, termed aeroelastic resonance, harnessing energy from the wind on the emission of Theodore von Kármán's vortexes. This process is called vortex shedding or Kármán vortex street. It is a common problem for aeronautics and some architecture, and can be seen when flags flap back and forth in the wind. This effect allows the Vortex generator to oscillate with small movements.

This technology has some traits which are more similar to solar power than to large wind turbines, such as being better suited to autonomous operation and distributed generation of energy off the grid, for and on low-power systems.

Technology:

Vortex Bladeless is a vortex-induced vibration resonant wind generator, in contrast to horizontal-axis wind turbines (HAWT) and vertical axis wind turbines (VAWT) that work by rotation. Vortex's innovation comes from its unusual shape and way of harnessing energy by oscillation, where a fiberglass and carbon fiber reinforced polymer mast oscillates in the wind taking advantage of the emission of Von Karman's vortexes when a moving fluid passes over a slender structure. At the bottom of the mast, a carbon fiber rod moves an alternator that generates electricity with no moving parts in contact. Vortex Bladeless devices don't rotate. Thus, they cannot be termed turbines.

The Vortex technology seeks to overcome issues related to rotary wind turbines such as maintenance, amortization, noise, birds and environmental impact, logistics, and visual aspects. According to the firm, Vortex generators have a small carbon footprint and use a low amount of raw materials compared to rotary wind turbines of the same height. It is expected to have a low centre of gravity that allows for small foundation dimensions and a very low wake turbulence, so several Vortex generators can fit in the same area as one rotary turbine, possibly improving on the lower energy density per hectare that wind turbines usually achieve. However, the goal of the firm is not to compete with the wind turbine industry but to offer a small wind turbine alternative for the end-consumer market and for low-power systems, markets served poorly or not at all by larger scale wind power.

Vortex is a vertical, slender, cylinder-shaped device. It is composed of two main parts: a fixed base where the device is attached to an anchoring, and a flexible mast which, acting as a cantilever, interacts more freely with moving fluid in an oscillating movement. It has no gears or moving parts in contact, so it needs no oils or lubricants as do rotary machines. The device's operation barely requires maintenance and operating costs. All these features make them closer to solar power's features and make them more useful for distributed energy. A linear alternator transforms mechanical energy into electricity. It counts with neodymium magnets and its stator is located inside of the moving part of the device.

While converting mechanical energy into electricity, the alternator damps (cushions) the induced oscillation movement and simultaneously can modify the natural oscillation frequency of the moving structure. Thus, the lock-in range is increased while maintaining the resonance frequency in higher wind speeds. The firm patented a mechanism called tuning system for this task, based on magnetic repulsion. Unlike rotary wind turbines, this phenomenon can modify the apparent elasticity constant of the structure which depends on the oscillation amplitude, allowing it to grow as long as

wind speed grows. Despite its simplicity, 6 families of registered patents protect the design and technology worldwide.

Bladeless wind devices:

Vortex Bladeless is currently working on two future products that are expected to be commercially available in 2021. The specified goals for each model are:

- Vortex Nano – 1 metre (3.3 ft) high and 3 W nominal power output. Designed mainly to bring energy to off-grid locations for low-power systems, working along with solar panels. Stage: pre-production of a first beta series.
- Vortex Tacoma – 2.75 metres (9.0 ft) high and 100 W nominal power output. Designed mainly for small-scale residential and rural autonomous operation, working with solar panels. Stage: prototype, being developed.
- Vortex Atlantis/Grand – 9–13 metres (30–43 ft) high and around 1 kW nominal power output. Designed for residential and rural autonomous operation and complementary installation with solar panels over buildings and factories. Stage: projected but not being developed yet.

On Vortex technology, the amount of energy harnessed grows exponentially squared by height and cubed by wind speed. Thus, bigger Vortex devices are desirable since production costs grow more slowly than power generation with height, giving as a result more profitable and efficient devices able to work with higher winds. As of 2021, because of their small and medium-sized enterprises (SME) status, the firm is only working on these small wind turbine alternative devices.

-Kavya.S

III EEE

SOLAR FLOWER TOWER:

Solar Flower Tower is a hybrid power generator that utilizes solar and alternative fuels, including diesel fuel, natural gas, liquefied natural gas, biogas, and other biofuels, to provide a constant green power source targeted for community-sized production. A module, dubbed the Solar Flower Tower because it looks like a golden yellow tulip, creates about 100 kW of electricity. The basis of the design is to use solar heated compressed air to spin a micro turbine. What makes the micro turbine unique is the efficiency of smaller power blocks, which allows small-scale construction, meaning simpler operation and less land needed.

How The Tower Work:

In half an acre of land (about 40% of a football field), a solar tower module is surrounded by thirty heliostats reflecting the sun ray into a special solar receiver inside the module. The receiver heats the turbine's compressed air to about 1,000°C, and the heated air is sent into the turbine's expander to create electricity.

AORA:

Formerly known as EDIG Solar, AORA is an Israeli based company that develops solar-hybrid power generators. The EDIG group of companies has contracted engineering project with organizations such as Ministry of Defense (Israel), El Al Israel Airlines, and the National Health Service Provider. EDIG presently has a relationship with the Weizmann Institute of Science, providing engineering

services. It was at the Weizmann Institute of Science where the solar thermal technology was developed. After the technology was licensed to EDIG, continued advancement was developed until they decided to turned their new solar division into a sub-company, EDIG Solar, now known as AROA.

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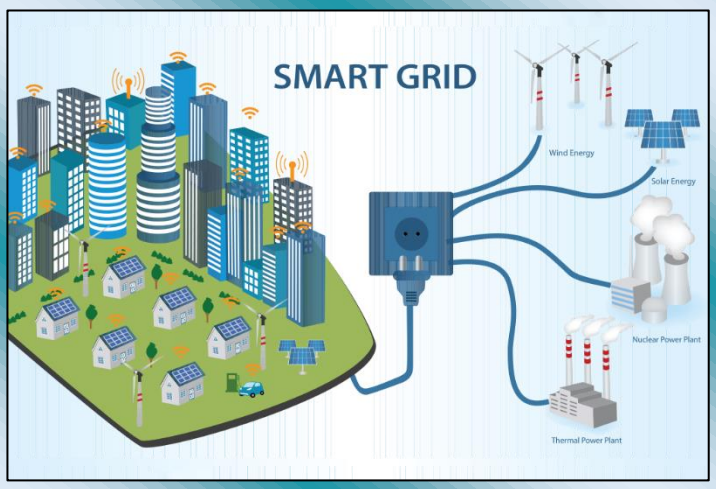
SMART GRID:



Maybe you have heard of the Smart Grid on the news or from your energy provider. But not everyone knows what the grid is, let alone the Smart Grid. "The grid," refers to the electric grid, a network of transmission lines, substations, transformers and more that deliver electricity from the power plant to your home or business. It's what you plug into when you flip on your light switch or power up your computer. Our current electric grid was built in the 1890s and improved upon as technology advanced through each decade. Today, it consists of more than 9,200 electric generating units with more than 1 million megawatts of generating capacity connected to more than 300,000 miles of transmission lines. Although the electric grid is considered an engineering marvel, we are stretching its patchwork nature to its capacity. To move forward, we need a new kind of electric grid, one that is built from the bottom up to handle the groundswell of digital and computerized equipment and technology dependent on it—and one that can automate and manage the increasing complexity and needs of electricity in the 21st Century.

What Makes a Grid "Smart?"

In short, the digital technology that allows for two-way communication between the utility and its customers, and the sensing along the transmission lines is what makes the grid smart. Like the Internet, the Smart Grid will consist of controls, computers, automation, and new technologies and equipment working together, but in this case, these technologies will work with the electrical grid to respond digitally to our quickly changing electric demand.

What does a Smart Grid do?

The Smart Grid represents an unprecedented opportunity to move the energy industry into a new era of reliability, availability, and efficiency that will contribute to our economic and environmental health. During the transition period, it will be critical to carry out testing, technology improvements, consumer education, development of standards and regulations, and information sharing between projects to ensure that the benefits we envision from the Smart Grid become a reality. The benefits associated with the Smart Grid include:

- More efficient transmission of electricity
- Quicker restoration of electricity after power disturbances
- Reduced operations and management costs for utilities, and ultimately lower power costs for consumers
- Reduced peak demand, which will also help lower electricity rates
- Increased integration of large-scale renewable energy systems
- Better integration of customer-owner power generation systems, including renewable energy systems
- Improved security

Today, an electricity disruption such as a blackout can have a domino effect—a series of failures that can affect banking, communications, traffic, and security. This is a particular threat in the winter, when homeowners can be left without heat. A smarter grid will add resiliency to our electric power System and make it better prepared to

address emergencies such as severe storms, earthquakes, large solar flares, and terrorist attacks. Because of its two-way interactive capacity, the Smart Grid will allow for automatic rerouting when equipment fails or outages occur. This will minimize outages and minimize the effects when they do happen. When a power outage occurs, Smart Grid technologies will detect and isolate the outages, containing them before they become large-scale blackouts. The new technologies will also help ensure that electricity recovery resumes quickly and strategically after an emergency—routing electricity to emergency services first, for example. In addition, the Smart Grid will take greater advantage of customer-owned power generators to produce power when it is not available from utilities. By combining these "distributed generation" resources, a community could keep its health center, police department, traffic lights, phone System, and grocery store operating during emergencies. In addition, the Smart Grid is a way to address an aging energy infrastructure that needs to be upgraded or replaced. It's a way to address energy efficiency, to bring increased awareness to consumers about the connection between electricity use and the environment. And it's a way to bring increased national security to our energy System—drawing on greater amounts of home-grown electricity that is more resistant to natural disasters and attack.

Giving Consumers Control

The Smart Grid is not just about utilities and technologies; it is about giving you the information and tools you need to make choices about your energy use. If you already manage activities such as personal banking from your home computer, imagine managing your electricity in a similar way. A smarter grid will enable an unprecedented level of consumer participation. For example, you will no longer have to wait for your monthly statement to know how much electricity you use. With a smarter grid, you can have a clear and timely picture of it. "Smart meters," and other mechanisms, will allow you to see how much electricity you use, when you use it, and its cost. Combined with real-time pricing, this will allow you to save money by using less power when electricity is most expensive. While

the potential benefits of the Smart Grid are usually discussed in terms of economics, national security, and renewable energy goals, the Smart Grid has the potential to help you save money by helping you to manage your electricity use and choose the best times to purchase electricity. And you can save even more by generating your own power.

Building and Testing the Smart Grid

The Smart Grid will consist of millions of pieces and parts—controls, computers, power lines, and new technologies and equipment. It will take some time for all the technologies to be perfected, equipment installed, and systems tested before it comes fully on line. And it won't happen all at once—the Smart Grid is evolving, piece by piece, over the next decade or so. Once mature, the Smart Grid will likely bring the same kind of transformation that the Internet has already brought to the way we live, work, play, and learn.

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BIOGRAPHY

ELON MUSK

Elon Musk is a South African-born American entrepreneur and businessman who founded X.com in 1999 (which later became PayPal), SpaceX in 2002 and Tesla Motors in 2003. Musk became a multimillionaire in his late 20s when he sold his start-up company, Zip2, to a division of Compaq Computers.

Musk made headlines in May 2012, when SpaceX launched a rocket that would send the first commercial vehicle to the International Space Station. He bolstered his portfolio with the purchase of Solar City in 2016 and cemented his standing as a leader of industry by taking on an advisory role in the early days of President Donald Trump's administration. In January 2021, Musk reportedly surpassed Jeff Bezos as the wealthiest man in the world.

Musk was born on June 28, 1971, in Pretoria, South Africa. As a child, Musk was so lost in his daydreams about inventions that his parents and doctors ordered a test to check his hearing. At about the time of his parents' divorce, when he was 10, Musk developed an interest in computers. He taught himself how to program, and when he was 12 he sold his first software: a game he created called Blastar. In grade school, Musk was short, introverted and bookish. He was bullied until he was 15 and went through a growth spurt and learned how to defend himself with karate and wrestling.

Musk's mother, Maye Musk, is a Canadian model and the oldest woman to star in a Cover girl campaign. When Musk was growing up, she worked five jobs at one point to support her family. Musk's father, Errol Musk, is a wealthy South African engineer. Musk spent his early childhood with his brother Kimbal and sister Tosca in South Africa. His parents divorced when he was 10.

Musk launched his first company, Zip2 Corporation, in 1995 with his brother, Kimbal Musk. An online city guide, Zip2 was soon providing content for the new websites of both The New York Times and the Chicago Tribune. In 1999, a division of Compaq Computer Corporation bought Zip2 for $307 million in cash and $34 million in stock options.

In 1999, Elon and Kimbal Musk used the money from their sale of Zip2 to found X.com, an online financial services/payments company. An X.com acquisition the following year led to the creation of PayPal as it is known today. In October 2002, Musk earned his first billion when PayPal was acquired by eBay for $1.5 billion in stock. Before the sale, Musk owned 11 percent of PayPal stock.

Musk founded his third company, Space Exploration Technologies Corporation, or SpaceX, in 2002 with the intention of building spacecraft for commercial space travel. By 2008, SpaceX was well established, and NASA awarded the company the contract to handle cargo transport for the International Space Station—with plans for astronaut transport in the future—in a move to replace NASA's own space shuttle missions.

Musk is the co-founder, CEO and product architect at Tesla Motors, a company formed in 2003 that is dedicated to producing affordable, mass-market electric cars as well as battery products and solar roofs. Musk oversees all product development, engineering and design of the company's products.

Five years after its formation, in March 2008, Tesla unveiled the Roadster, a sports car capable of accelerating from 0 to 60 mph in 3.7 seconds, as well as traveling nearly 250 miles between charges of its lithium ion battery.

With a stake in the company taken by Daimler and a strategic partnership with Toyota, Tesla Motors launched its initial public offering in June 2010, raising $226 million.

In August 2008, Tesla announced plans for its Model S, the company's first electric sedan that was reportedly meant to take on the BMW 5 series. In 2012, the Model S finally entered production at a starting price of $58,570. Capable of covering 265 miles between charges, it was honored as the 2013 Car of the Year by Motor Trend magazine.

In April 2017, Tesla announced that it surpassed General Motors to become the most valuable U.S. car maker. The news was an obvious boon to Tesla, which was looking to ramp up production and release its Model 3 sedan later that year.

In September 2019, using what Musk described as a "Plaid powertrain," a Model S set a speed record for four-door sedan at Laguna Seca Raceway in Monterey County, California.

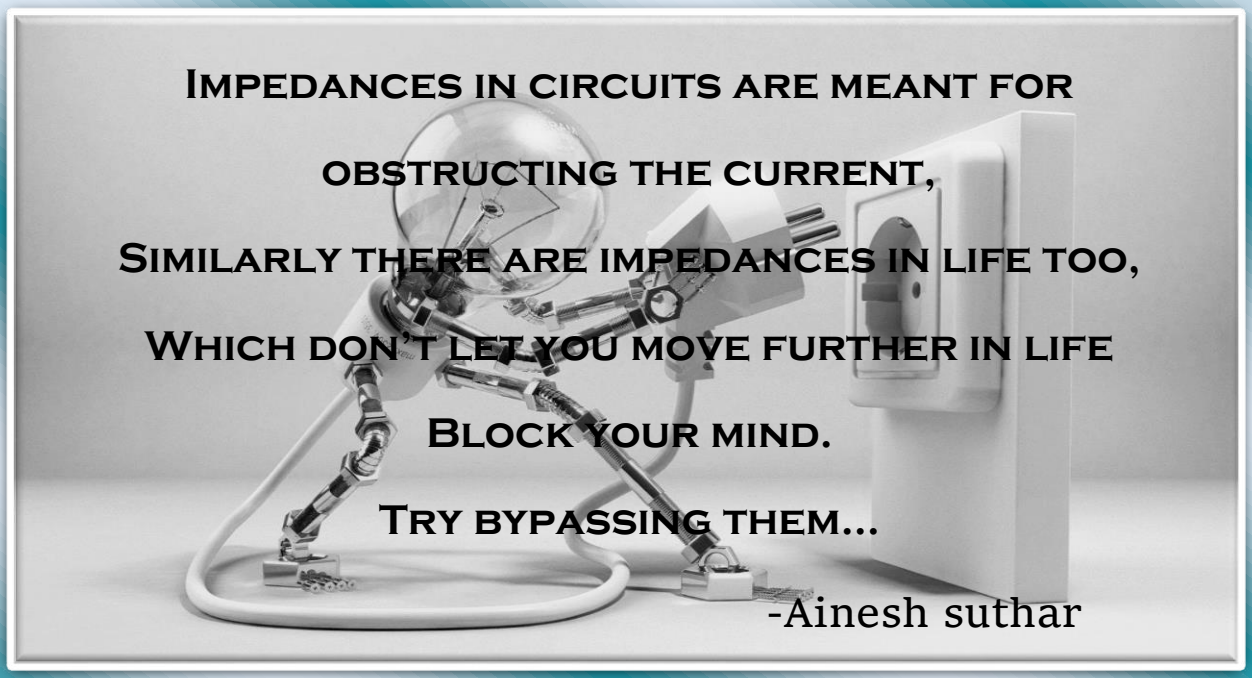
The Model 3 was officially launched in early 2019 following extensive production delays. The car was initially priced at $35,000, a much more accessible price point than the $69,500 and up for its Model S and X electric sedans.

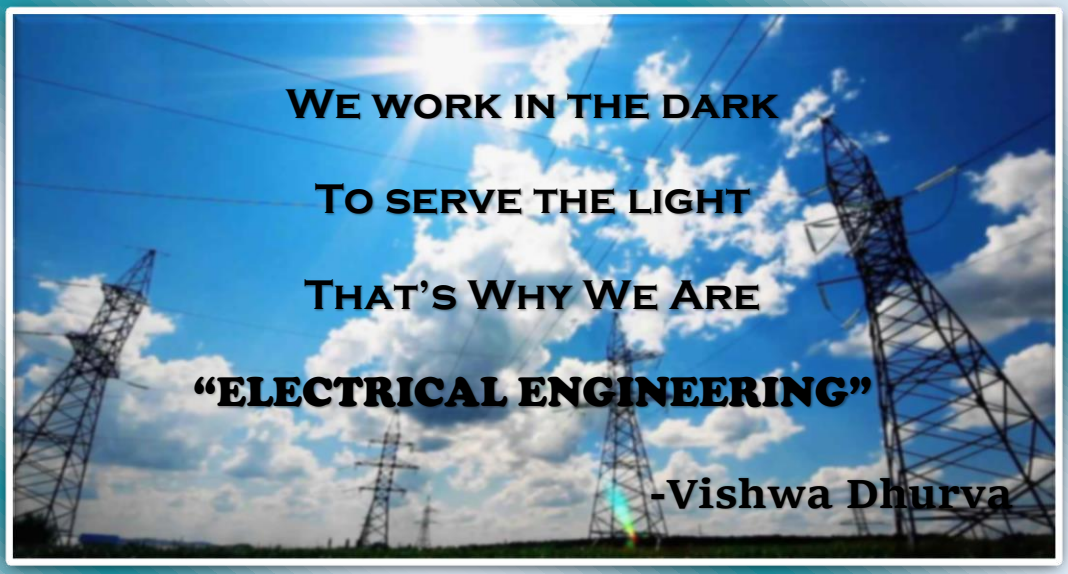
After initially aiming to produce 5,000 new Model 3 cars per week by December 2017, Musk pushed that goal back to March 2018, and then to June with the start of the new year. The announced delay didn't surprise industry experts, who were well aware of the company's production problems, though some questioned how long

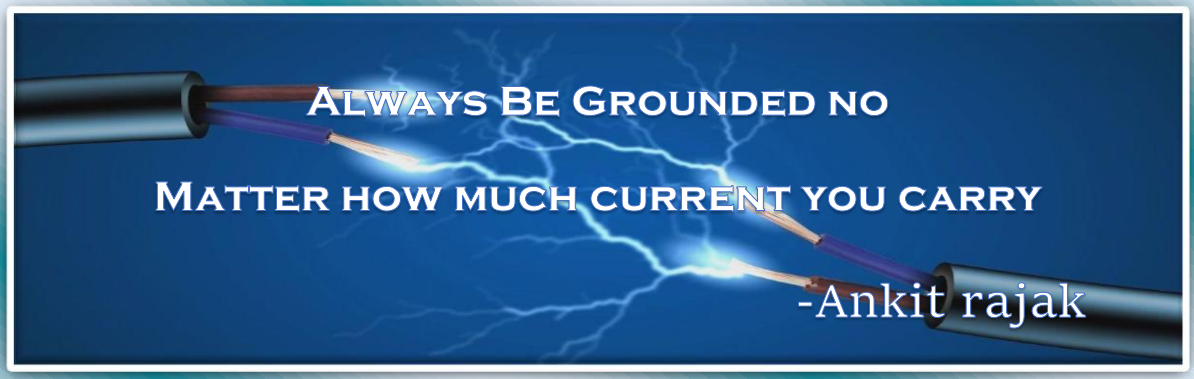
investors would remain patient with the process. It also didn't prevent Musk from garnering a radical new compensation package as CEO, in which he would be paid after reaching milestones of growing valuation based on $50 billion increments.

By April 2018, with Tesla expected to fall short of first-quarter production forecasts, news surfaced that Musk had pushed aside the head of engineering to personally oversee efforts in that division. In a Twitter exchange with a reporter, Musk said it was important to "divide and conquer" to meet production goals and was "back to sleeping at factory."

POEMS


Impedances in circuits are meant for
obstructing the current,
Similarly there are impedances in life too,
Which don't let you move further in life
Block your mind.
Try bypassing them...
-Ainesh suthar


We work in the dark
To serve the light
That's Why We Are
"ELECTRICAL ENGINEERING"
-Vishwa Dhurva


Always Be Grounded no
Matter how much current you carry
-Ankit rajak


THE EEE
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That's EEE
Empowering educations to Excellence,
That's EEE
Endurance Everfresh Enchanting
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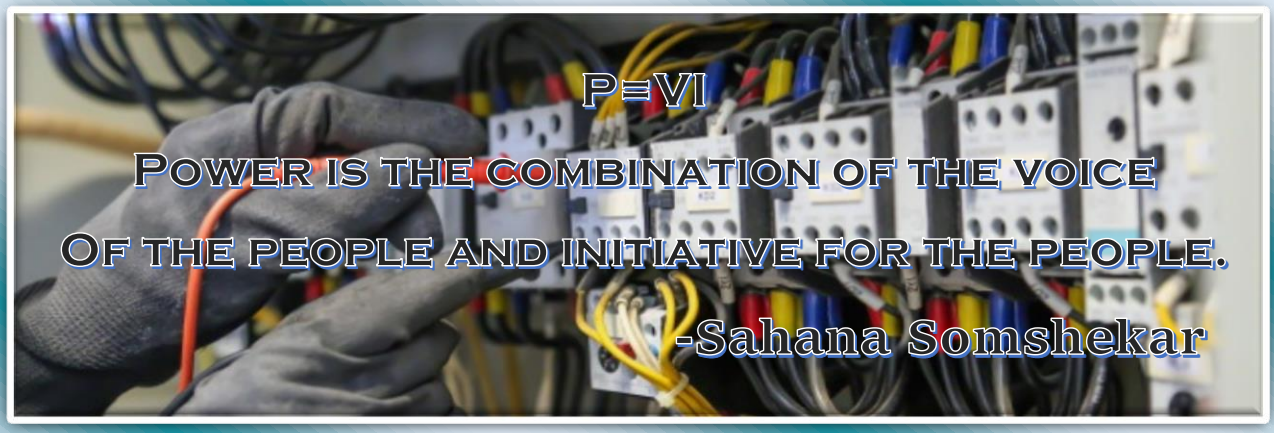
That's EEE
Are you an EEE?
Check & Make Yourself an EEE
-Saiakala Kamandula


P=VI
Power is the combination of the voice
Of the people and initiative for the people.
-Sahana Somshekar

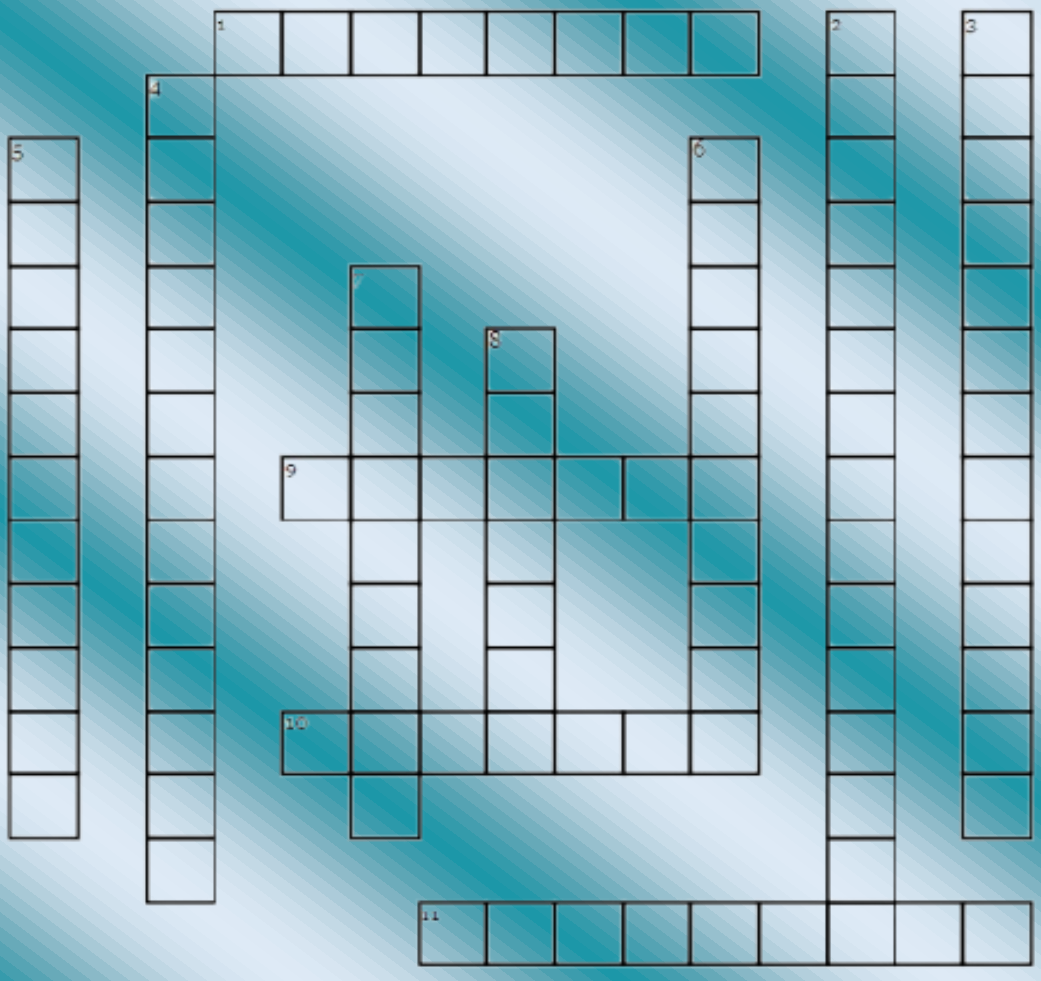
CROSS WORD PUZZLE

Across:

1. A circuit where the circuit is divided into two or more paths is a _____ circuit
9. _____ is a flow of electrical charge.
10. _____ is an electromotive force for potential differences expressed in volts
11. The atoms of a _____ easily accept and pass on electrons.

Down:

2. When there is an unbroken path on which electrons flow it is called a _____.
3. A _____ is an electrical circuit through which current can flow uninterrupted path.
4. A _____ is a closed circuit in which the current follows on a path.
5. A discontinuous circuit through which no current can flow is called a _____
6. The electrical restriction of electric flow is called _____.
7. The atoms of _____ do not accept and pass on electrons.
8. A _____ is a route in which



RIDDILES

QUESTION:

1. **I'm tall when I'm young, and I'm short when I'm old. What am I?**
2. **What is full of holes but still holds whater?**
3. **What question can you never answer yes to ?**
4. **What is always in front of you but can't be seen?**
5. **What can you break, even if you never pick it up or touch it?**
6. **What goes up but never comes down?**
7. **A man who was outside in the reain without an umbrella or hat didn't get a single hair On his head wet. Why?**
8. **What gets wet while drying?**
9. **What can you keep after giving to someone?**
10. **What can't talk but will reply when spoken to?**

ANSWER:

1. The future
2. A promise
3. Your age
4. A candle
5. A sponge
6. Are you asleep yet?
7. He was bald
8. A towel
9. Your Word
10. An echo


EEE
ENGINEERING
ELECTRICAL AND ELECTRONIC