# TECNO SAVIOR

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Matoshri College of Engineering & Research Centre, Nashik

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## Vision

"To Establish Omnipotent Learning Centre Meeting the Standards to Evolve as a Lighthouse for the Society."

## Mission

- Setting up state-of-the-art infrastructure
- Instilling strong ethical practices and values
- Empowering through quality technical education
- Tuning the faculty to modern technology and establishing strong liaison with industry
- Developing the institute as a prominent center for Research and Development
- Establishing the institute to serve a Lighthouse for the society

## Quality Statement

"We, Matoshri College of Engineering & Research Center are committed to practice a system of Quality Assurance that inculcates quality culture, aiming at quality initiation, sustenance and enhancement of quality comprehensively ultimately leading the institute as Center of Excellence."

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## *Wonders of civil engineering in India* — *Dr.Amol Saner*

**Victoria Memorial, Kolkata**

Built to highlight the glory of British Empire in India, this monument amalgamates the best of Mughal and British architectures. This imposing monument was inaugurated in 1921 paying tribute to Queen Victoria. At present, this monument has a remarkable assemblage of maps, paintings, weapons, coins, sculptures, artifacts, stamps, etc.

**Golconda Fort, Hyderabad**

Golconda Fort, a spectacular monument, is situated on the western periphery of Hyderabad City. This majestic fort pours out the rich cultural heritage of ancient India. Muhammad Quli Qutub Shah, as an insignia of Nawabi culture, built the fort in 1525. Golconda Fort was popular for its diamond trade and it is widely believed that the famous 'Kohinoor' diamond originated here. The meticulous details and fine architecture of the fort fascinate the travelers and history lovers from all over the globe.

**India Gate** is without a doubt the first monument that comes to mind when we cogitate about Delhi. In my opinion, it is the biggest epitome of Delhi Tourism. It was initially known as the All India War Memorial as it incurs the memoir of thousands of Indian Soldiers who died in the First World War. Sir



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Edwin Lutyens designed this magnificent monument and the construction was completed in 1931. An undying flame known as 'Amar Jawan Jyoti' is positioned underneath the arch of this edifice. This flame reveres the martyrs.

**Sanchi Stupa, Madhya Pradesh**

Sanchi is famous as a paradigm of Buddhist architecture and culture. Sanchi Stupa is the most momentous of all the monuments in Sanchi. Moreover, Sanchi Stupa is among the most preserved stupas in the central part of India as well. During the reign of Shunga, Sanchi Stupa was expanded and decorated with stairways and railings. A beautiful harmika was placed on the top of the edifice. The monument is bejeweled with astounding designs and motifs. Interestingly, Lord Buddha has been emblematically represented in Sanchi Stupa in the figure of a tree and other inanimate forms.

**Gateway of India, Mumbai**

Even 'an utterly beautiful monument positioned right on the shore of azure Arabian Sea' seems an unfair description of Gateway of India's grandeur. Built with reinforced concrete and yellow colored basalt

rock, Gateway of India acts as the symbolic representation of Mumbai's prosperity all over the globe. This huge archway on edge of the water at Apollo Bunder was built by the Indian Government to commemorate the visit of British monarch King George V and Queen Mary in 1911. George Wittet, a famous architect of British India, designed it. The monument is designed in Indo-Saracen style. The first significant event that happened here was the passing of the last troop of British Army in colonial India- First Brigade of Somerset Light Infantry troops.

**Jantar Mantar, Jaipur**

The Jantar Mantar of Jaipur is the biggest stone observatory of the world. Constructed by Maharaja Jai Singh in the 18th century, Jantar Mantar holds fourteen geometric devices used to compute the time of the day. This monument is listed among the UNESCO World Heritage Sites in India.

**Taj Mahal, Agra** Listed among the Seven Wonders of the World, the Taj Mahal is the emblem of eternal love. The Taj Mahal was built in 1653 by Mughal emperor Shah Jahan. Built with white marble, this monument is among the UNESCO World Heritage Sites. This epitome of love leaves the visitors awe-struck with its architectural magnificence. In the grandeur of moon, it excels like a flawlessly carved diamond; looking as if instantly out of some magical saga.
Source : https://www.tourmyindia.com/blog/25-wonders-of-india/

# Technosavior

## *How to Make A Building Earthquake-Proof* *H.M.Pawar*

Source : https://www.bigrentz.com/blog/earthquake-proof-buildings

To design an earthquake-proof building, engineers need to reinforce the structure and counteract an earthquake's forces. Since earthquakes release energy that pushes on a building from one direction, the strategy is to have the building push the opposite way. Here are some of the methods used to help buildings withstand earthquakes.

1. Create a Flexible Foundation

One way to resist ground forces is to "lift" the building's foundation above the earth. Base isolation involves constructing a building on top of flexible pads made of steel, rubber, and lead. When the base moves during the earthquake, the isolators vibrate while the structure itself remains steady. This effectively helps to absorb seismic waves and prevent them from traveling through a building.

2. Counter Forces with Damping

You might be aware that cars have shock absorbers. However, you might not know that engineers also use them for making earthquake-resistant buildings. Similar to their use in cars, shock absorbers reduce the magnitude of shockwaves and help buildings slow down. This is accomplished in two ways: vibrational control devices and pendulum dampers.

Vibrational Control Devices

The first method involves placing dampers at each level of a building between a column and beam. Each damper consists of piston heads inside a cylinder filled with silicone oil. When an earthquake occurs, the building transfers the vibration energy into the pistons, pushes against the oil. The energy is transformed into heat, dissipating the force of the vibrations.

Pendulum Power

Another damping method is pendulum power, used primarily in skyscrapers. Engineers suspend a large ball with steel cables with a system of hydraulics at the top of the building. When the building begins the sway, the ball acts as a pendulum and moves in the opposite direction to stabilize the direction. Like damping, these features are tuned to match and counteract the building's frequency in the event of an earthquake.

3. Shield Buildings from Vibrations

Instead of just counteracting forces, researchers are experimenting with ways buildings can deflect and reroute the energy from earthquakes altogether. Dubbed the "seismic invisibility cloak", this innovation involves creating a cloak of 100 concentric plastic and concrete rings in and burying it at least three feet beneath the foundation of the building.

As seismic waves enter the rings, they are forced to move through to the outer rings for easier travel. As a result, they are essentially channeled away from the building and dissipated into the plates in the ground.

4. Reinforce the Building's Structure

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To withstand collapse, buildings need to redistribute the forces that travel through them during a seismic event. Shear walls, cross braces, diaphragms, and moment-resisting frames are central to reinforcing a building.

Shear walls are a useful building technology that helps to transfer earthquake forces. Made of panels, these walls help a building keep its shape during movement. Shear walls are often supported by diagonal cross braces. These steel beams have the ability to support compression and tension, which helps to counteract the pressure and push forces back to the foundation.

Diaphragms are a central part of a building's structure. Consisting of the floors of the building, the roof, and the decks placed over them, diaphragms help remove tension from the floor and push force to the vertical structures of the building.

Moment-resisting frames provide more flexibility in a building's design. This structure is placed among the joints of the building and allows for the columns and beams to bend while the joints remain rigid. Thus, the building is able to resist the larger forces of an earthquake while allowing designers more freedom to arrange building elements.

Earthquake-Resistant Materials

While shock absorbers, pendulums, and "invisibility cloaks" may help dispel the energy to an extent, the materials used in a building are equally responsible for its stability.

Steel and Wood

For a building material to resist stress and vibration, it must have high ductility — the ability to undergo large deformations and tension. Modern buildings are often constructed with structural steel — a component of steel that comes in a variety of shapes that allow buildings to bend without breaking. Wood is also a surprising ductile material due to its high strength relative to its lightweight structure.

Innovative Materials

Scientists and engineers are developing new building materials with even greater shape retention. Innovations like shape memory alloys have the ability to both endure heavy strain and revert to their original shape, while fiber-reinforced plastic wrap — made by a variety of polymers — can be wrapped around columns and provide up to 38% greater strength and ductility.

Engineers are also turning to natural elements. The sticky yet rigid fibers of mussels and the strength-to-size ratio of spider silk have promising capabilities in creating structures. Bamboo and 3D printed materials can also function as lightweight, interlocking structures with limitless forms that can potentially provide even greater resistance for buildings.


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## *This House is Built to Withstand the Force of a Tsunami* *P.S.Sathe*

https://www.smithsonianmag.com/innovation/house-built-withstand-force-tsunami-180949455/

The architect highlights the fact that the remodeled 40s-era home was modified to exceed the strict building safety requirements outlined by the Federal Emergency Management Agency and the Army Corp of Engineers for local waterfront houses. Officials have grown keenly aware of the region's susceptibility to widespread flooding. The Cascadia Subduction Zone, one of the largest active faults in North America, sits about 50 miles offshore. This 680-mile stretch of colliding tectonic plates, which runs from Vancouver Island down to northern California, has unleashed cataclysmic destruction in the past, most recently in 1700 when a 9.0 earthquake caused nearby trees to sink and generated a massive tsunami that rose as high as 33 feet as it barreled its way toward Japan's coast.

While modern-day settlements have yet to suffer such a catastrophe, the looming threat has prompted local communities to begin bracing for a dreaded scenario. Last year, residents of the coastal city of Westport voted to fund a project that involved turning an elementary school into the first tsunami-resistant emergency shelter in the nation. By 2015, the roof deck, which sits 55-feet above sea level, will be remodeled to accommodate as many as 1,500 evacuees.

Nelson, who specializes in waterfront homes, believes his Tsunami House can be scaled up. And since his design has received some acclaim, he's gotten more inquiries from potential clients, even one from as far away as New Jersey who's looking to redesign his property in the aftermath of Hurricane Sandy.

"Even though the buildings there use the same principle as the one we designed, they basically don't do more than put a house on stilts," he added. "What we've shown is that you can make a home that can withstand disasters and also look beautiful."



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## *Made in Japan: Earthquake-Proof Homes* — *R.L Kshatriya*

Source : https://www.asme.org/topics-resources/content/made-in-japan-earthquake-proof-homes

Earthquakes don't kill people. People's houses in the midst of earthquakes kill people. Look at the statistics—or the photographs—and you'll know that the vast majority of fatalities from earthquakes large or small come from buildings, or parts of buildings, falling on people.

What better way to avoid tragedy then, but by tossing a house in the air when an earthquake comes?

That's the general idea behind the levitating house developed by the Japanese company Air Danshin. The product of inventor Shoichi Sakamoto, the house sits, during more stable times, on a deflated air bag. When sensors feel a tremor, they switch on a compressor within a second. The compressor pumps air into an airbag, inflating it within a few more seconds, and ultimately lifting the entire house a good three centimeters off its supposedly earthquake-proof concrete foundation. There the structure will hover, its inhabitants able to casually go about their business, for the duration of the quake. Then the airbag deflates and the house gently settles back down.

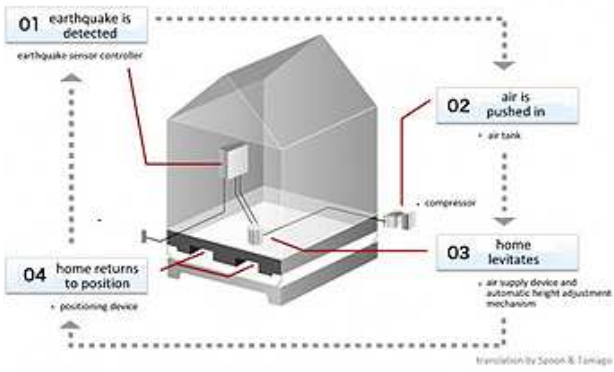



Diagram of how a house would levitate during an earthquake.

**Image: Air Danshin**

The company built such a house on a "shake table" and equipped it with a few inhabitants, some furniture, and a couple of glasses of wine. When the mock tremors hit, in front of a rapt, hardhat-outfitted audience, the denizens hardly noticed, and not a drop of wine was spilled. The system will be added to new, otherwise typically built homes of an appropriate weight, and can be retrofitted to existing structures as well.

**Minimizing Damage**

"It would take care of a smaller earthquake, I would think," says Deke Smith, Executive Director of the Building Seismic Safety Council and the buildingSMART alliance, part of the National Institute of Building Sciences, Washington, DC. "It would dampen some of the motions certainly. I think it would

be more of a comfort thing than a minimizing damage thing. But I don't know that if you invested in it that you will have eliminated any problems with earthquakes for your structure."

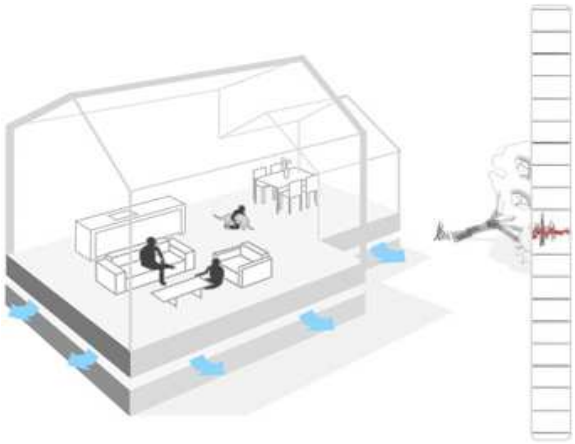
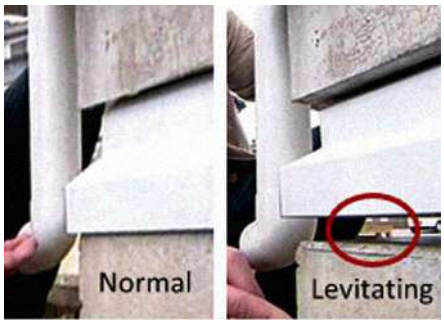


**Image: Air Danshin**

Air Danshin's shake test dealt only with side-to-side motion and most earthquakes are not limited to a two-dimensional plane. Three centimeters of levitation will only protect a house from earthquakes that don't rise higher than three centimeters. Never mind the question of what would happen to a floating house hit by a tall wave of a quake. It would likely slip right off its foundation. Or, conceivably, a strong tornado might more easily carry the structure off to Oz.

**Improving Design**

Another problem is that the first tremors that would activate the system may very well be the biggest, most destructive tremors of the earthquake. The airbag, were it able to inflate, might be pushing up against the rubble of an already damaged house. "Each earthquake has its own signature," says Smith. "Some might have a big jolt in the beginning, some in the end, some in the middle." Unfortunately, our seismic sensors are not yet at the level of those animals, including dogs, that can sense earthquakes before they happen, and long before humans or their technology do so. "If they figure that out, then you'd have something," says Smith.




Structure levitates 1 cm - 3 cm. **Image: Air Danshin**

However, even if Air Danshin's system is only good for that rare, lateral shaking earthquake which never moves the earth higher than three centimeters, and saves its biggest jolts for its finale, 88 Japanese homes are soon to be retrofit with the airbag and its assemblage. That's 88 experiments that will provide some data after the next quake. Atapproximately three million Yen a pop (over $37,000), it's also a sizable chunk of change.

"Going out and building some of them is good," says Smith. "That's how we keep improving. It may be an idea that will spur somebody else's thoughts in some other direction. It may be a viable piece to a larger solution someday.

**CIVIL ENGINEERING GRAND CHALLENGES: OPPORTUNITIES FOR DATA SENSING, INFORMATION ANALYSIS, AND KNOWLEDGE DISCOVERY**

The identified set of challenges include:

1. Estimating sea levels
2. Enhancing disaster management through infrastructure resilience
3. Reducing soil erosion
4. Improving building energy efficiency
5. Managing groundwater
6. Monitoring the health of infrastructure
7. Reducing traffic congestion
8. Improving construction productivity
9. Enhancing construction site safety

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## *The Seven Engineering Wonders of the 21st Century Modern World – as voted by young engineers*

*Poonam Dholi*

When many of us think of examples of engineering work, we automatically think of famous constructions such as Big Ben and the Eiffel Tower. We rarely consider the other innovations that have been produced, due to the sheer breadth and scope of the engineering world. PIF investigated the following list, put together by the 'This is Engineering' campaign (at the Royal Academy of Engineering), which identifies the possible Seven Wonders of the 21st Century Modern World that are often overlooked as triumphs of the engineering sector.

Gore-Tex Fabric

Gore-Tex Fabric is universally known for being a sustainable, waterproof fabric that is often used for sports and outdoor clothing and footwear. This is mainly because it is has been cleverly engineered to repel water whilst allowing perspiration to pass through. Gore-Tex Fabric is extremely robust, durable, protective, and comfortable which makes it a very popular product. Not only is Gore-Tex a modern day wonder, but is also a prime example of how most people won't realise that engineering played a big part in designing and creating it.

Hawk-Eye

Hawk-Eye is a computer software system that is utilised in numerous sports such as tennis, rugby, basketball, badminton, and volleyball. It is used as a way of visually tracking the movement and trajectory of a moving ball during a game. This kind of software has become a modern day blessing for many sport committees, since it has proven to be extremely useful in capturing effective game-play and aiding important decisions.

Dolby Atmos

Dolby Atmos is the impressive surround sound technology that is frequently used in cinemas, allowing you to completely immerse yourself in a surround sound bubble. By utilising audio objects and overhead speakers, Dolby Atmos is able to create powerful moving sound, which provides viewers with a more immersive cinematic experience. The creation of Dolby Atmos would not have been possible without the intuitive work of the engineers involved.

iPhone

The launch of the iPhone in the 21st Century completely revolutionised mobile communications in our modern day world, and is a prime example of an engineering triumph that is often overlooked by people. iPhones introduced us to the world of apps and access to the internet right in our pockets- something that now we have adapted ourselves and our lives around.



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YouTube

When YouTube was launched in 2005, no one could have predicted the impact it would have on digital videos and distribution. YouTube completely revolutionised the concept of streaming videos from one device to another, and has paved the way for services such as NowTv and Netflix. Since being obtained by Google, YouTube has now added 360-degree video, virtual reality, and live streaming to their ever growing list of services - all of which is possible due to the clever engineers that operate behind the scenes.

3D printed bone implants

One of the more recent engineering wonders is the development in 3D-printing technology. This technology is being used to create, out of ceramics that are similar to natural bone, custom-made structures that new bone can grow around. Additionally, these 3D-printed bone implants are bioactive, which means that they are able to encourage the growing bone to integrate with the implant. This new technology is already being implemented in the medical industry such as during surgery on the jaw and face, which will improve many situations for patients who require the implants.

Clean water

Simply put, clean, sanitary water makes the difference between life and death. Shockingly, one in six people around the world still do not have access to clean, safe water. While it has been standard practice for engineering to be used to provide clean water in developed countries for centuries, engineering innovation continues to work on water sanitation, distribution, and treatment.

## *Ten 'Fun and Exciting' Facts about Engineering* — *Dr.Swati Bhavasar*

1. The snowboard was invented by an engineer? With some engineering twists and turns along the way, the snowboard has become a marvel of geometry, chemistry, and biomechanics. Since the snowboard allows deft turns, ski manufacturers have quickly adopted some of the snowboard innovations, enabling skiers to turn with less effort.
2. Engineers design running shoes for protection, performance, and comfort? Engineers understand how much force travels from the ground through the shoe to the foot. Through the work of engineering, weight is distributed throughout the whole foot -- heel to toe.
3. A civil engineer created the slippery part of the water slide?
   A civil engineer designed a pumping system to circulate just the right amount of water to the flume. Without the right flow of water, there is no ride. Additionally, civil engineers have designed the slide to withstand the weight of people, the water, and even the force of the wind blowing on it.


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4. The launch and return of spacecraft, from the Apollo to the Shuttle, is a monumental engineering triumph?
   The space program has greatly expanded the world's knowledge base. The technological advancement by engineers in energy, communications, materials, structures, and computers, have made space travel possible.
5. The Ferris Wheel is considered one of the greatest engineering wonders in the world?
   The first Ferris Wheel was created by Pittsburgh, Pennsylvania engineer, George W. Ferris, in 1893. The wheel is supported by two 140-foot steel towers and connected by a 45-foot axle -- the largest single piece of forged steel ever made at that time.
6. Engineers make interactive television possible?
   Engineers are involved in all aspects of interactive TV technology, from designing new cables, to creating new film emulsions, to engineering better sound quality. This technology allows viewers to select any program, film, or game from more than 500 channels.
7. Engineers play an instrumental role in the theme park industry? Theme park engineers are involved in designing, building, lighting, and even controlling the crowd flow in theme parks around the world.
8. Companies and universities are using engineers to form the Virtual Reality and Simulation Initiative? This technology applies computer simulation and visualization to 3-D modeling projects, such as virtual offices.
9. Bioengineers are creating a new and exciting medical technology? This technology will utilize virtual reality to help surgeons reconstruct facial birth defects.
10. Computer engineers, in conjunction with animators, have created special effects in movies such as "Jurassic Park," "Forrest Gump," and "Interview with the Vampire"? Through "morphing" technology, images are digitally mastered to appear realistic.

## *Top 10 Computer Engineering Marvels* — *Dr.Varsha Patil*

**World's Largest Computer SAGE**


One of the first wide-area networks, Semi-Automatic Ground Environment (SAGE) was one of the key factors in the genesis of the Internet. Its construction began in 1957 and it became the part of the ARPANET (which evolved into the Internet we know today) in 1969.

IBM built it as to strengthen the radar and missile air defenses of the US during the Cold War. SAGE is made up of acre-sized computers at 20 different locations (known as Direction Centres) which are connected together by about 1,300 baud modems. Each of the Direction Centre was a window-less concrete cube that housed 2 CPUs operated one at a time. Each CPU weighed about 250 times and could

execute about 75,000 instructions per second. Each Direction Centre was connected to each other, few Command Centres, hundres of radar centres, microwave towers & AT&T telephone lines that ran through a central underground bunker.

SAGE was used to analyse the huge amount of data generated by radar installations across North America for timely action in case of Soviet missiles or bombers are spotted anywhere near the US. The sheer size of the United States, high speeds of the modern jet aircrafts, and huge number of possible attack vectors made SAGE quite useful for the US military. SAGE was also equipped with the technology to launch and control interceptor planes and air defense missiles, including the nuclear warhead CIM-10 Bomarc.

SAGE used the first mass-produced modem at the end of the telephone lines (Bell 101 modem which was the first device to use ASCII codes).

**World's Faster Supercomputer Tianhe-2**

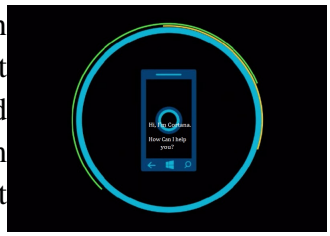
Supercomputer Tianhe-2 was developed by the National University of Defense Technology (NUDT) in Changsha, China. Top500, bi-annual ranking of the fastest computers on Earth, has ranked it as the world's fastest supercomputer for the third year in a row in 2014. Top10billion, a similar ranking, also ranked Tianhe-2 as the fastest supercomputer of the world for fourth time in a row. It is capable of 33.86 petaflops (quadrillion calculations per second) and is expected to reach 100 petaflops by 2018. In 2010, the top spot in the ranking was held by the Tianhe-1A.Developed by a team of 1,300 scientists and engineers, the Tianhe-2 is located at Sun Yat-sen University in Guangzhou. The supercomputer was envisioned to be used for simulation and analysis of government security applications.TH-2 is the world's largest installation of Ivy Bridge Xeon processors and Xeon Phi co-processor chips. The system has 16,000 computer nodes and each node has 2 Ivy Bridge processors and 3 Xeon Phu chips. It runs on Kylin Linux operating system which is developed by NUDT based on Simple Linux Utility for Resource Management (SLURM). The total computer complex would ultimately occupy 720 sq m of space.

**World's Smallest Computer is just 1 mm in size**

Michigan Engineers have designed the world's smallest computer. Programmed with a flashing light, this computing unit has a size of just 1 mm – smaller than a regular-sized pill. Dennis Sylvester (Professor of Electrical Engineering) and David Blaauw (Professor of Computer Science) at the University of Michigan have developed tiny computers that are capable of using solar power for wireless communication, still image and video processing and to make temperature and pressure sensors work. Millimeter sized computing designs by ME can perform on many alternating platforms. Each unit is assembled in layers and can be customized for a particular function.Research work is on to reduce the size of these computers to a third of a millimeter so that they can be placed inside biological cells and enable broadcasting and monitoring

of cellular-level activities. The testing has already been developed to place such computing units on top of tumours in cancer patients and record effectiveness of chemotherapy sessions.

**Virtual Assistant Cortana**



A breakthrough in Artificial Intelligence (AI), Microsoft used speech recognition and language comprehension research to create virtual assistant Cortana. This app beauty is built into the mobile version of Windows 10 and tries to hold dialogues with people. It also learns from its mistakes. Apart from MS's Cortana, Google Now and Apple's Siri are other virtual assistants that personify operating systems of today.

In the early interface prototypes, Cortana on your laptop and desktop can process voice commands to call Skype contacts, set reminders and read out your Calendar just like you do on your phones. Virtual Assistants are believed to be next wave of software revolution in the near future.

**Cancer Treatment Assistant Watson**


Watson, developed by the IBM, is an artificial intelligence masterpiece known for answer questions through techniques like natural language processing, automated reasoning, information retrieval, knowledge representation and machine learning technologies. Developed by a research team led by David Ferruci, it was named after the first CEO of the company – Thomas J Watson. It won a quiz Jeopardy! against the former champions Brad Rutter and Ken Jennings. During the game, it was not connected to the Internet.

Today, it helps cancer doctors to use genomic data to prescribe personalised treatment plans for patients. According to Manoj Saxena, Business Chief of IBM Watson, 90% of nurses use the guidance of Watson for cancer patients.Based on the DeepQA software of the IBM and the Apache UIMA (Unstructured Information Management Architecture) framework, Watson runs on the SUSE Linux Enterprise Server 11 operating systems and use Apache Hadoop framework. It was written in various languages such as C++, Java and Prolog.

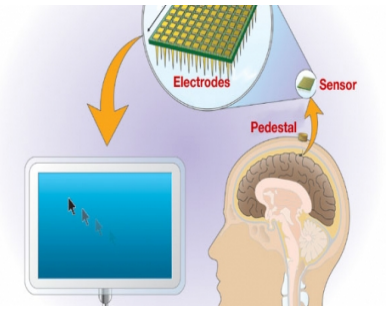
**Supercomputer K Computer**

K computer is named after the Japanese word 'kei', which means 10 quadrillion. This supercomputer is housed in the campus of the RIKEN Advanced Institute for Computational Science situated in Kobe, Japan. Fujitsu manufactured it. It has a distributed memory architecture with more than 80,000 computer nodes. Each of these nodes has a single processor and 16GB memory. Its operating system is based on Linux kernel and additional drivers have been installed to enable it to use all the hardware associated with it.

K computer is used for a number of things – disaster prevention, medical research and climate research. This supercomputer uses a proprietary 6D torus interconnect called Tofu. The computer uses water cooling system to reduce power consumption and bring down failure rate.

K was ranked as the world's fastest computer in June 2011 with a speed of 8.16 petaflops. Its computing efficiency ratio was 93%. By November that year, K became the first supercomputer to exceed 10 petaflops with a computing efficiency ratio of 93.2%. Yet by 2013, it had slid to the position of the world's fourth-fastest computer.

**BrainGate for Thought-Controlled Computing**




Designed by Cyberkinetics, BrainGate is a brain implant system built for people who suffer from amyotrophic lateral sclerosis (ALS) or spinal cord injury and are paralysed. This sensor, implanted into brain, monitors the brain activity of the patient and translates it into computer commands. At present, the sensor uses an external decoder device connected to a prosthetic limb. It has about 100 hair-thin electrodes that sense the electromagnetic activity of neurons related to specific brain areas. For example, the decoder device can decode electrical signals about arm movement going on in brain and make the robotic arm respond to it.

With the help of BrainGate, paralysed people can operate wheelchair or even a computer just with the help of their thoughts. In May 2012, Cathy Hutchinson – who had been paralysed for 15 years, was able to use the robotic arm through BrainGate to drink coffee from a bottle without any human intervention. Not commercially available yet, clinical trials for BrainGate 2 are still going on.

**Cost-effective 3D Virtual Reality System VuePod**

At Brigham Young University, students of the Department of Civil and Environmental Engineering have created a 3D immersive visualization environment called the Vuepod under Professor Dan Ames. The Vuepod has a massive 108 square feet screen (with 12 HD 55-inch 3D televisions) connected to a computer meant to support high-end graphics-intensive gaming. Images are controlled by a Wii remote that interact with a Bluetooth device called SmartTrack.

Low-cost drones equipped with LIDAR (Radars with lasers) scan the landscape and dispatch point data images which can be seen on the Vuepod.

This real-life computer-powered mega TV allows engineers to fly over or wander through 3D environments that are difficult to tread otherwise. With data sets taken of a particular area over various years, engineers will be able to see changes in natural landscape easily. Besides, it can also assist infrastructure monitoring (to check condition of highways over time or see affect on buildings due to earthquakes and weather).

The Vuepod is highly cost-efficient too. While similar systems cost about $10 million, the cost of Vuepod is just about $30,000.


**Google Glass**

Wearable computer by Google, Google Glass looks like a regular pair of glasses. An evolution of the smartphone, it is a super example of Optical Head-Mounted Display (OHMD) and Augmented Reality (AR) available

in the open market. Google Glass allows you to browse Internet, make calls, send text messages, download apps, read news, click photos and use Google Maps navigation without need of a handheld device.

You may also video chat with your friends using Google Hangouts and show them what you are seeing. Isn't it all so futuristic?

Google Glass has voice recognition system that allows you to execute tasks with the help of voice commands. Hardware of Google Glass is still on the modest side with 640X360 pixel display screen, 5 MP camera, and a battery life that lasts for only about 5 hours.

Time Magazine chose Glass as 'Best Inventions of the Year 2012'.

**Obsfucation to End Hacking & Viruses**


Professor Amit Sahai from the University of California has developed an 'Obsfucator' which is a breakthrough in cryptography. It obscures information by mixing random elements with files and making them meaningless for general public except for the end-user who runs the program in a certain way. Thus, hacking, infecting software and cyber crimes will become virtually impossible.

## *Data Science vs Software Engineering* — *Pankaj Aher,BE Computer*

**What Is Data Science?**

Data science is an interdisciplinary domain derived from computer science that uses several scientific processes and methods to study different kinds of data—structured, semi-structured, and unstructured. It involves using numerous technologies like data transformation, data purging, and data mining to study and analyze that data. While both data science and software engineering rely heavily on programming knowledge, data scientists focus more on manipulating large datasets.

A data scientist exploits a huge amount of data for prediction, understanding, intervention, and exploration. They focus on the value of approximation, the results of data analysis, and the understanding of its results. Like software engineers, data scientists aim to optimize algorithms and manage the trade-off between speed and accuracy. They coordinate with experts and work together to achieve a balance between the assumptions and results.

Data science requires specialized knowledge in analytics, statistics, and mathematics. Data science, as a separate and independent discipline, was conceived by William S. Cleveland, after which it became more popular across the world. Data science is a fast-growing field—the job of data scientist has been declared the third best in America in 2020.

**What Is Software Engineering?**

Software engineering, on the other hand, is the process of developing software by systematically applying the principles of engineering. A software engineer analyzes user requirements, then designs, builds, and tests software applications if they fulfill the set requirements.

# Technosavior

Prominent German computer scientist Fritz Bauer defined software engineering as "the establishment and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines".

Often the term will be used informally to refer to a range of activities related to system analysis or computer programming. It's related to several other disciplines like computer science, economics, management science, and system engineering.

Software engineering serves as a foundation for understanding software in computer science and helps in the estimation of resources in economics. It employs management science for labor-intensive work. It's currently one of the most widely chosen careers worldwide.

**Qualifications and Skills Required for a Data Scientist**

Like software engineers, data scientists are highly qualified professionals. While almost half of them have a postdoctoral degree, more than 80% have at least a master's degree in relevant fields.

To build a foundation in this field, you can start with a bachelor's degree in computer science, social science, engineering, or statistics. While a degree builds a solid platform for your tech career, you don't actually need one to get started. Alternative education programs may suit some aspiring data professionals.

**Other skills you should acquire include:**

- Familiarity with a toolkit, preferably a combination of coding, SQL, cloud tool, and command line. You can pick up these skills by taking a data science course or even a software engineering bootcamp.
- In-depth knowledge of R programming
- Technical knowledge of Python coding, Hadoop platform, Apache Spark, machine learning and AI
- Good communication skills and business acumen
- Strong team skills

https://www.thinkful.com/blog/data-science-vs-software-engineering/

## *Google Glass* — *N.LBhale*

Source : https://internetofthingsagenda.techtarget.com/definition/Google-Glass/**Colin Steele**

Google Glass is a wearable, voice- and motion-controlled Android device that resembles a pair of eyeglasses and displays information directly in the user's field of vision.

Google Glass offers an augmented reality experience by using visual, audio and location-based inputs to provide relevant information. For example, upon entering an airport, a user could automatically receive flight status information.

When the first version was launched in 2013, consumers immediately voiced their concern of the glasses being an invasion of privacy. Google Glass represented inescapable recording in everyday life. At first, Google attempted to rebrand the glasses as a tool for professionals such as surgeons or factory workers. However, concern remained and Google ceased all work on the Glass project in 2015.

In 2017 work resumed with Glass Enterprise Edition. This relaunch of the project focused all efforts on making a product that would benefit workplaces like factories and warehouses. In 2019, a new version of Google Glass was released -- the Glass Enterprise Edition 2.

**How Google Glasses work**

The Google Glass operating system (OS) is based on a version of Android. The OS can run application virtualization tools called Glassware that are optimized for the device. Glassware allows the device to deliver an app to the user, instead of a full desktop. The glasses have built-in Wi-Fi and Bluetooth connectivity and a camera for taking photographs and videos.

The smart eyewear uses motion and voice recognition to process commands from the wearer. A touchpad is also available on the glasses' rim. To provide the requested information, the device relies on sending small packages of information straight to the wearer through a micro-projector, using a private channel of communication that can only be accessed by the user.

Google Glass then uses a field sequential color (FSC) liquid crystal on silicon (LCOS) system to display images on the lens, allowing wearers to view the image in true colors. FSC refers to a color television system that transmits the primary color information in continuous images and then relies on the human's vision and perception to collect the information into a color picture. LCOS is a form of video display technology.

**Features of Google Glass**

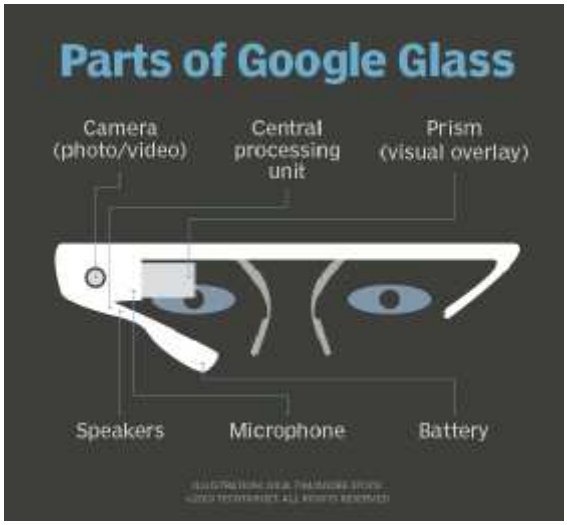
The key feature of Google Glass is the tiny semi-transparent screen located on the upper right hand side of the glasses. This display occupies only about 5 percent of the wearer's natural field of vision and is responsible for transmitting information to the user.

In order to view the screen, wearers must look up, placing the screen out of the direct line of vision. This feature is particularly important because bad placement of the display could lead to serious safety issues.

Other features of Google Glass include:

- The ability to take photos and videos and then share exactly what the user is seeing through Google Hangouts.
- The option to use the Google search engine through the glasses, using Wi-Fi or a smartphone's data connection.
- The ability to have translations streamed straight to the wearer through the screen.
- Reminders to complete certain chores or tasks with an added visual aspect that will prompt a notification to appear on the user's screen every time they look at a particular object.
- The ability to sync the glasses to calendars stored on phones or computers in order to receive reminders of events and meetings.

- Support of both voice and video calls. In the video calls, wearers can show the other person exactly what they're looking at instead of talking face-to-face.
- The ability to answer emails and text messages using voice dictation.
- Collaboration with Google Maps to provide step-by-step directions with a map displayed on the screen.
- The ability to respond to facial and head movements, such as allowing the user to tilt their head to scroll through a page or operate the device with eye movements.




**Benefits of Google Glass**

The most recent edition of Google Glass, Glass Enterprise Edition 2, is designed specifically for professional use, especially in environments such as factories, warehouses and hospitals. In these settings, the glasses provide the benefit of saving time and money and increasing safety.

Workers' safety is improved by the hands free feature and ability to stay connected to the network at all times.

Another benefit is the fact that the head mounted display is always accessible in the user's field of vision. Therefore, wearers can receive and send information and notifications without having to physically check a smartphone or mobile device.

The potential use of Google Glass by children with autism is another benefit of the device. Various studies are researching how Google Glass might be used to improve social interactions for kids with autism.

https://www.askiitians.com/iit-jee/article/top-10-electrical-engineering-marvels.html

**Three Gorges Dam**

Situated in China, the Three Gorges Dam on River Yangtze is used for power generation, power control and navigation purposes. Opened in 2008, this hydroelectric dam is the World's largest power station in terms of its installed capacity - 22,500 MW (mega-watts). It became fully functional on July 4, 2012, except for the ship lift which was expected to be operational by 2015. The ship lift is a kind of elevator for vessels weighing up to 3,000 tons.

Three Gorges Dam is also the second largest hydroelectric facility in annual energy generation. It is an example of historical engineering with state-of-the-art large turbines. Each main water turbine has a capacity of 700 MW and weigh about 6,000 tonnes each. The dam uses 4,63,000 tonnes of steel (enough to build as many as 63 Eiffel Towers).

**AVATAR**

AVATAR (**A**erobic **V**ehicle for Transatmospheric Hypersonic **A**erospace **T**r**A**nspo**R**tation) is manned single-stage reusable spaceplane (or hyperplane) which will be able to make horizontal takeoff and landing. It is being developed by the Defence Research and Development Organization (DRDO) and the

Indian Space Research Organization (ISRO) and is expected to be a model for low-cost military and commercial satellite space launches, and space tourism.

The first phase of scaled-down tests for AVATAR is planned for 2015 while the first manned AVATAR flight is planned for 2025. The challenge for electrical engineers working on a space shuttle is to make sure that all its electrical systems keep operating for about two decades without any maintenance in the hostile environment of space.

AVATAR is expected to be a ground-breaking piece of work for electrical engineers.

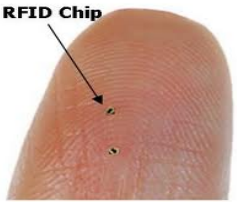
**Electric Cars**

An electric car is a light-weight urban car which runs using one or more electric motors, which uses electrical energy stored in batteries. It gives instant torque and smooth acceleration.

BMW i3, launched in 2014, has been certified by the EPA as the most fuel-efficient vehicle. The i3 REx has a combined fuel economy of 29 kW-hrs per 100 miles.

BMW i3 is the first zero-emission mass-produced vehicle which uses electric powertrain. It has won 2 World Car of the Year Awards this year, which include 2014 World Green Car of the Year, and 2014 World Car Design of the Year. It also won an iF Product Design Gold Award and 2 of the first UK Car of the Year Awards, which include UK Car of the Year 2014, and Best Super-mini of 2014.

**World's Smallest Microchip that You Can Swallow**




Kinetis KI02 is the world's smallest ARM-powered chip – a Microelectronics wonder. Manufactured by Freescale Semiconductors, it measures just 2 x 2 x 0.5 millimeters (about as large as two ants side-by-side). This microchip is a full microcontroller unit in itself with a 4KB RAM, 32KB flash memory, a 32-bit 48 MHz ARM Cortex-M0+ processor, a low-power UART and a 12-bit analog to digital converter. A complete tiny computer that can be swallowed! This microchip is a breakthrough in itself – especially for modern medicine.There are several other uses proposed for Kinetis KI02. MCU in shoes can let you know how many steps you have walked a day while plumbing MCU can let you know instantly about a leaking pipe – all through a watch or may be an iPhone app (just like the Tile tracker for your car keys and other important items that you frequently misplace).

**Adaptive Cruise Control**

Cars equipped with adaptive cruise control (ACC) technology are intelligent enough to slow down and speed up automatically to keep up with the car in front of you – preventing collisions. ACC allows

drivers to set a maximum speed. A radar sensor watches the traffic ahead of the car, locks on to the car ahead in the lane, and drivers can set the car to stay behind by a particular period of time (2,3 or 4 seconds) or particular distance. Often, adaptive cruise control is paired with a pre-crash system that issues alerts and starts braking whenever it senses danger ahead.

Ideal for stop-and-go traffic and rush-hour commuting, the ACC systems are available from $2,500 to as low as just $500. They typically use radars at a frequency band different than police radars (to avoid triggering radar detectors). Full-range Adaptive Cruise Control systems use two radars – one that sees up to 100 feet and other that sees up to 600 feet. However, newer ones are able to use a single radar system.

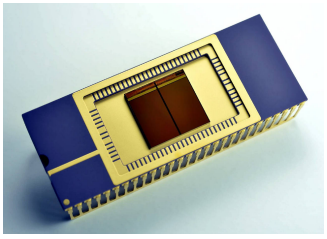
A much-coveted safe driving feature, cars with autonomous cruise control are ideal for long trips. Premium car manufacturers such as BMW, Audi, Ford, Honda and Hyundai are selling cars with ACC systems.

Till now, ACC systems do not use satellite support, roadside infrastructure or cooperative support from other vehicles. It is mostly based on on-board sensors only - an example of Control Engineering at its best.

**CuBox-i**

CuBox-i, the world's smallest computer is one of the most powerful mini-computer that can replace a smartphone, a tablet, a laptop, a desktop, and possibly even streaming devices like an Apple TV or Roku. Made by SolidRun, these energy-efficient low-cost tiny computers are sleek and elegant. It has jam-packet ports panel, a subtle logo and is just 2-inch long, thick and high.Offering industry's Price Power Performance Ratio (P3R), CuBox-i price starts at just $45. CuBox-i has solo, dual or quad i.MX6 Cortex A9 ARM processors (up to 1.2GHz each), up to 2 GB DDR-3 RAM, ARMv7 instruction set including NEON extension support, HDMI 1080p output, Infra-red receiver and transmitter, microSD for operating system storage etc.Epitome of simplicity, CuBox-i devices are made of highest quality materials and use an open source software platform.

**3-D Memory**



Chipmakers such as Samsung, Micron, and SK Hynix readily lapped up the 3D revolution. 3D memories are of two types – NAND flash memory type which is non-volatile and holds on to information even

when it is powered down, and Hybrid Memory Cube which stacks DRAM and adds layer of logic to boost speed.In NAND, memory designers layer cells straight to alleviate scaling issues and boost density. It is made with a 30- to 40-nanometer process, has bigger cells and more electrons.

In HMC, focus is not on storage of memory but in dynamic RAM. It is faster than the ordinary DRAM chip and off-loads most of the processing responsibility to the high-speed logic chip stack atop DRAM, connected using thousands of copper wires called through-silicon vias (TSVs).

**Ivanpah Solar Thermal Power Plant**

Ivanpah Solar Electric Generating System situated in the Mojave Desert in California is the World's largest solar power plant. An engineering marvel in itself, Ivanpah uses over 3,00,000 mirrors (heliostats) to reflect heat and light from the Sun onto boilers atop three of the towers here. Each of these towers is 150 feet taller than the Statue of Liberty.As water in the towers gets heated, steam is created and moves turbines. This produces enough clean and green electricity to power up 1,40,000 homes (about 392 megawatts).From a distance, mirrors look like a lake in the middle of a desert which is about four times larger than the Central Park in the New York City. It can be seen from the International Space Station.Solar thermal projects like Ivanpah are said to be more suited for India as we have plentiful of land and Sun while natural gas is as abundant as in the United States.

**Optical Link**

Electronic Engineering Professor Jelena Vuckovic of Stanford University has recently led a research in which a team of engineers designed and built a prism-like device that can split a beam of light into different colours and bend it to right angles.

Described as 'Optical Link', this tiny silicon slice has a bar code like pattern etched on it. When a beam of light shines at the link, light of two different wavelengths (colours) split off at right angles forming a T-shape. Eventually, this could be a big step towards developing computer systems that use Optics (Light) rather than Electricity (Wires) to carry data.

Professor Vuckovic claims that light can carry more data than a wire and it takes less energy to transmit photons than electrons.

**Spacecraft Radar Mappers**

Magellan - the Venus Radar Mapper and Cassini - the Titan Radar Mapper are some of the shining examples of Electrical Engineering marvels.Though an aging man-made satellite, Magellan spacecraft again made new when it was pulled from the elliptical orbit 5,285 miles above the Venus to just 105

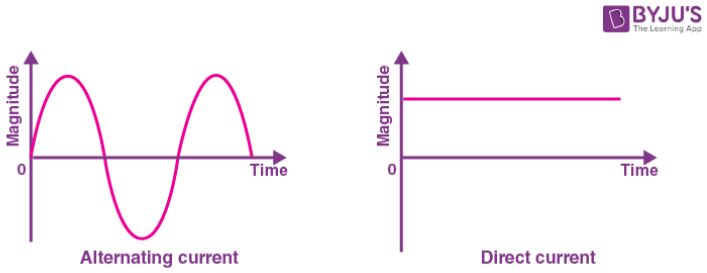
miles above Venus with the help of controllers. The Cassini Titan Radar Mapper is another high-tech Imaging achievement that can fire up several Electrical Engineers for a long time to come. Synthetic Aperture Radar images of Titan's surface obtained with the help of Cassini is of great interest to planetary geological processes. But to engineers, it is the radar mapper itself which is of major interest.

Magellan has two broad square solar panels, each measuring 2.5 meters across. They degraded gradually during the mission due to extreme and frequent temperature changes. The spacecraft was equipped with twin 30 amp-hour, 26-cell, nickel-cadmium batteries that got recharged whenever they received direct sunlight.

Cassini is the largest and most complex interplanetary spacecraft which is unmanned (include an orbiter and a probe). It was powered by 32.7 kg plutonium-238 batteries whose radioactivity produced electricity. Its instruments included a synthetic aperture radar mapper, an infrared mapping spectrometer, a charge-coupled device imaging system, a plasma spectrometer, a magnetometer and several other sophisticated devices.

## *What is Alternating Current?Basics* *A.E.Jagtap*

Alternating current can be defined as a current that changes its magnitude and polarity at regular interval of time. It can also be defined as an electrical current which repeatedly changes or reverses its direction opposite to that of Direct Current or DC which always flows in a single direction as shown below.




From the graph, we can see that the charged particles in AC tend to start moving from zero. It increases to a maximum and then decreases back to zero completing one positive cycle. The particles then reverse their direction and reach the maximum in the opposite direction after which AC again returns to the original value completing a negative cycle. The same cycle is repeated again and again.

Alternating currents are also accompanied usually by alternating voltages. Besides, alternating current is also easily transformed from a higher voltage level to lower voltage level.

Alternating Current Production

Alternating current can be produced or generated by using devices that are known as alternators. However, alternating current can also be produced by different methods where many circuits are used.

# Technosavior

One of the most common or simple ways of generating AC is by using a basic single coil AC generator which consists of two-pole magnets and a single loop of wire having a rectangular shape.

In this setup, the AC generator follows Faraday's principle of electromagnetic induction where it converts mechanical energy into electrical energy.

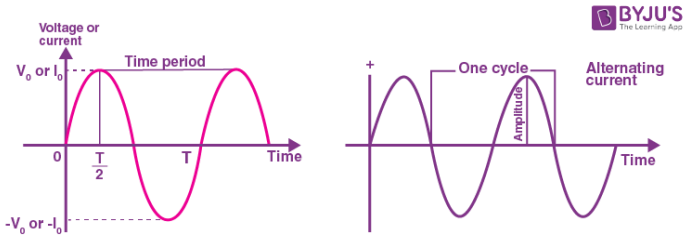
Application of Alternating Current

AC is the form of current that are mostly used in home appliances. Some of the examples of alternating current include audio signal, radio signal, etc. An alternating current has a wide advantage over DC as AC is able to transmit power over large distances without great loss of energy.

Alternating Current Waveform

Before we learn more about this topic, let us quickly understand a few key terms.

- The time interval between a definite value of two successive cycles is the period.
- The number of cycles or number of periods per second is frequency.
- The maximum value in both directions is the amplitude.




The normal waveform of AC in most of the circuits are sinusoidal in nature in which the positive half period corresponds with the positive direction of the current and vice-versa. In addition, a triangular or square wave can also be used to represent the alternating current waveform.

Audio amplifiers that deal with analogue voice or music signals produce irregular AC waves. Some electronic oscillators **produce square or sawtooth waves.**

**Average Value of AC**

Average value is usually defined as the average of the instantaneous values of alternating current over a complete cycle. The positive half cycle of asymmetrical waves such as a sinusoidal voltage or current waveform will be equal to the negative half cycle. Which implies that the average value after the completion of a full cycle is equal to zero.

Since, both the cycles do some work the average value is obtained by avoiding the signs. Therefore, the average value of alternating quantities of sinusoidal waves can be considered by taking the positive cycle only.

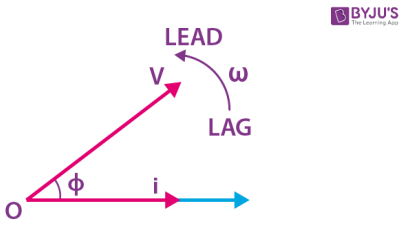
**RMS Value of AC Wave**

RMS value is defined as the square root of means of squares of instantaneous values. It can also be described as the amount of AC power that generates the same heating effect as an equivalent DC power.

Phasor Diagrams

The phasor diagram is used to determine the phase relationships between two or more sine waves propagating with the same frequency. Here, we use the terms “lead”, “lag” and also “in-phase”, “out-of-phase” to indicate the relation between one waveform with the other.

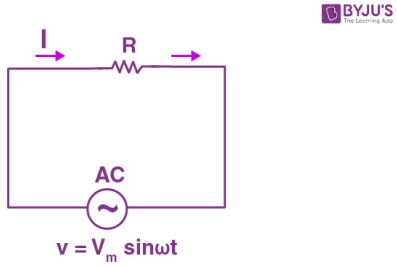
Phasor diagrams will be of the form:




AC Circuit Containing Resistance Only

The pure resistive AC circuit contains only pure resistance of R ohms. There will be no effect of inductance and capacitance in this circuit. The alternate current and voltage move along both the directions as backwards and forwards. Therefore, current and voltage follow a shape of sine.

In a purely resistive circuit, the power is dissipated by the resistors and phase of both voltage and current remains the same. Which means that the voltage and current reaches a maximum value at the same time.




Let the supply voltage be,

$v = V_m \sin\omega t$ ……(1)

The instantaneous value of current flowing through the given circuit is,

$i = v / R = V_m / R \sin\omega t$ ……(2)

From the equation (2), the value of current be maximum at $t = 90^0$, so $\sin t = 1$

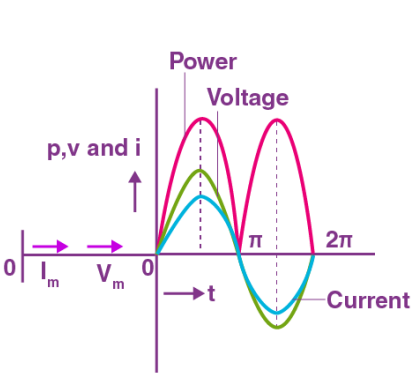
Then, the instantaneous value of current will be,

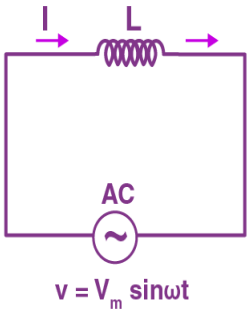
$i = I_m \sin\omega t$ ……(3)

So, by observing the equation (1) and (3), it is clear that there is no phase difference between the applied voltage and current flowing through the circuit. Meaning, phase angle between voltage and current is zero.

Hence, in a pure resistive ac circuit, the current is in phase with the voltage.

This can be expressed in a waveform as,




AC Circuit Containing Inductance Only

This type of circuit contains only inductance. There will not be any effect of resistance and capacitance in this circuit. Here, the current will lag behind the voltage by an angle of $90^0$.

The inductor will reserves electrical energy in the magnetic field when current flows through it. When this current changes, the time-varying magnetic field causes emf which opposes the flow of current. This opposition to the flow of current is known as inductive reactance.

Let the voltage applied to the circuit be,

$v = V_m \sin\omega t$ ……(1)

The emf induced in the inductor will be,

$E = -L \times di / dt$

This emf induced in a circuit is equal and opposite to applied voltage.

$v = -e$ ……(2)

Putting the value of e in (2) we get,

$v = (-L \times di / dt)$

Or

$V_m \sin\omega t = L \times di / dt$

Or

$di = V_m / L \sin\omega\, dt$ ……(3)

Integrating both sides, we get,

$$\int di = \int \frac{V_m}{L} \sin\omega t\, dt \quad \text{or}$$

$$i = \frac{V_m}{\omega L}(-\cos\omega t) \quad \text{or}$$

$$i = \frac{V_m}{\omega L}\sin(\omega t - \pi/2) = \frac{V_m}{X_L}\sin(\omega t - \pi/2) \ldots\ldots\ldots(4)$$

Here,

Inductive reactance is $X_L = \omega L$

The value of current will be maximum if $\sin(\omega t - \pi/2) = 1$

Therefore,

$I_m = V_m / X_L$ ……(5)

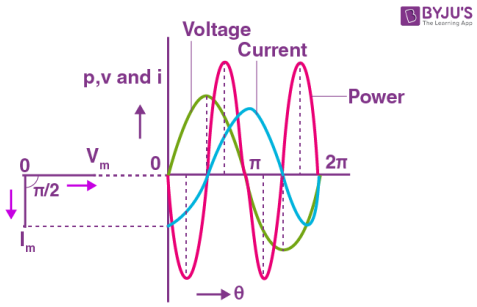
Apply the value of $I_m$ from (5) and put in (4)

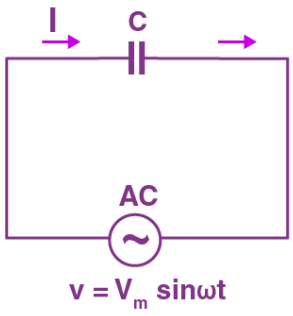
We get,

$i = I_m \sin(\omega t - \pi / 2)$

Which implies that the current in pure inductive ac circuits lags the voltage by $90^0$.

This can be expressed in a waveform as,




If the voltage and current are at its peak value as a positive value, the power will also be positive. Similarly, if the voltage and current are at negative peak then the power will be negative. This is because of the phase difference between them.

AC Circuit Containing Capacitor Only

This type of circuit includes a pure capacitor only. It will not affect the properties of resistance and inductance. The capacitor will store electric power in electric field.this is known as capacitance.

The electric field is developed across the plates of the capacitor when a voltage is applied across the capacitor. Also, there will not be any current flows between them.

As we know, a capacitor includes two insulating plates which are separated by a dielectric medium. Usually, capacitor works as a storage device and it gets charged if the supply is on and it gets discharged if the supply is off.

Let the voltage applied to the circuit be,

$v = V_m \sin\omega t$ ……(1)

Charge of the capacitor is,

$q = Cv$ ……(2)

Then, current flow through the circuit will be,

$i = dq / dt$

Substituting the value of q in the above equation we get,

i = d (Cv) / dt ……(3)

Now substitute the value of v in (3), we get,

$$i = \frac{d}{dt} C V_m \sin\omega t = C V_m \frac{d}{dt} \sin\omega t \quad \text{or}$$

$$i = \omega C V_m \cos\omega t = \frac{V_m}{1/\omega C} \sin\left(\omega t + \pi/2\right) \quad \text{or}$$

$$i = \frac{V_m}{X_C} \sin\left(\omega t + \pi/2\right) \ldots\ldots\ldots\ldots (4)$$

Where $X_C$ = 1/C which is capacitive inductance.

The value of current will be maximum if sin(ωt + π/2) = 1.

Then, the maximum value of current,

$I_m = V_m / X_C$

Substituting the value of $I_m$ in (4) we get,

$i = I_m \sin(\omega t + \pi / 2)$

This implies that the current flowing through the capacitor leads the voltage by $90^0$.

Source :

https://byjus.com/jee/alternating-current/

## *Alternative Energy Sources and Their Importance* — *Somnath Hadpe*

1. Hydrogen Gas

Unlike other forms of natural gas, hydrogen is a completely clean burning fuel. Once produced, hydrogen gas cells emit only water vapor and warm air when in use.

The major issue with this form of alternative energy is that it is mostly derived from the use of natural gas and fossil fuels. As such, it could be argued that the emissions created to extract it counteract the benefits of its use.

The process of electrolysis, which is essential for the splitting of water into hydrogen and oxygen, makes this less of an issue. However, electrolysis still ranks below the previously mentioned methods for obtaining hydrogen, though research continues to make it more efficient and cost-effective.

2. Tidal Energy

While tidal energy uses the power of water to generate energy, much like with hydroelectric methods, its application actually has more in common with wind turbines in many cases.

Though it is a fairly new technology, its potential is enormous. A report produced in the United Kingdom estimated that tidal energy could meet as much as 20% of the UK's current electricity demands.

The most common form of tidal energy generation is the use of Tidal Stream Generators. These use the kinetic energy of the ocean to power turbines, without producing the waste of fossil fuels or being as susceptible to the elements as other forms of alternative energy.

3. Biomass Energy

Biomass energy comes in a number of forms. Burning wood has been used for thousands of years to create heat, but more recent advancements have also seen waste, such as that in landfills, and alcohol products used for similar purposes.

Focusing on burning wood, the heat generated can be equivalent to that of a central heating system. Furthermore, the costs involved tend to be lower and the amount of carbon released by this kind of fuel falls below the amount released by fossil fuels.

However, there are a number of issues that you need to consider with these systems, especially if installed in the home. Maintenance can be a factor, plus you may need to acquire permission from a local authority to install one.

4. Wind Energy

This form of energy generation has become increasingly popular in recent years. It offers much the same benefits that many other alternative fuel sources do in that it makes use of a renewable source and generates no waste.

Current wind energy installations power roughly twenty million homes in the United States per year and that number is growing. Most states in the nation now have some form of wind energy set-up and investment into the technology continues to grow.

Unfortunately, this form of energy generation also presents challenges. Wind turbines restrict views and may be dangerous to some forms of wildlife.

5. Geothermal Power

At its most basic, geothermal power is about extracting energy from the ground around us. It is growing increasingly popular, with the sector as a whole experiencing five percent growth in 2015.

The World Bank currently estimates that around forty countries could meet most of their power demands using geothermal power.

This power source has massive potential while doing little to disrupt the land. However, the heavy upfront costs of creating geothermal power plants has led to slower adoption than may have been expected for a fuel source with so much promise.

6. Natural Gas

Natural gas sources have been in use for a number of decades, but it is through the progression of compression techniques that it is becoming a more viable alternative energy source. In particular, it is being used in cars to reduce carbon emissions.

Demand for this energy source has been increasing. In 2016, the lower 48 states of the United States reached record levels of demand and consumption.

Despite this, natural gas does come with some issues. The potential for contamination is larger than with other alternative fuel sources and natural gas still emits greenhouse gases, even if the amount is lower than with fossil fuels.

7. Biofuels

In contrast to biomass energy sources, biofuels make use of animal and plant life to create energy. In essence they are fuels that can be obtained from some form of organic matter.

They are renewable in cases where plants are used, as these can be regrown on a yearly basis. However, they do require dedicated machinery for extraction, which can contribute to increased emissions even if biofuels themselves don't.

Biofuels are increasingly being adopted, particularly in the United States. They accounted for approximately seven percent of transport fuel consumption as of 2012.

8. Wave Energy

Water again proves itself to be a valuable contributor to alternative energy fuel sources with wave energy converters. These hold an advantage over tidal energy sources because they can be placed in the ocean in various situations and locations.

Much like with tidal energy, the benefits come in the lack of waste produced. It is also more reliable than many other forms of alternative energy and has enormous potential when used properly.

Again, the cost of such systems is a major contributing factor to slow uptake. We also don't yet have enough data to find out how wave energy converters affect natural ecosystems.

9. Hydroelectric Energy

Hydroelectric methods actually are some of the earliest means of creating energy, though their use began to decline with the rise of fossil fuels. Despite this, they still account for approximately seven percent of the energy produced in the United States.

Hydroelectric energy carries with it a number of benefits. Not only is it a clean source of energy, which means it doesn't create pollution and the myriad issues that arise from it, but it is also a renewable energy source. The dams used in generating hydroelectric power also contribute to flood control and irrigation techniques.

10. Nuclear Power

Nuclear power is amongst the most abundant forms of alternative energy. It creates a number of direct benefits in terms of emissions and efficiency, while also boosting the economy by creating jobs in plant creation and operation.

Thirteen countries relied on nuclear power to produce at least a quarter of their electricity as of 2015 and there are currently 450 plants in operation throughout the world.

The drawback is that when something goes wrong with a nuclear power plant the potential for catastrophe exists. The situations in Chernobyl and Fukushima are examples of this.

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11. Solar Power

When most people think of alternative energy sources they tend to use solar power as an example. The technology has evolved massively over the years and is now used for large-scale energy production and power generation for single homes.

A number of countries have introduced initiatives to promote the growth of solar power. The United Kingdom's 'Feed-in Tariff' is one example, as is the United States' 'Solar Investment Tax Credit'.

This energy source is completely renewable and the costs of installation are outweighed by the money saved in energy bills from traditional suppliers. Nevertheless, solar cells are prone to deterioration over large periods of time and are not as effective in unideal weather conditions.

Resources

- http://www.afdc.energy.gov/fuels/natural_gas.html
- https://cleancities.energy.gov/

## *Electronics and Telecommunication Engineering* *D.D.Dighe*

Electronics Engineering is one of the largest and most sophisticated branches of engineering. It has made us available the equipments like Television, Radio, computers, telephones etc. Electronics has a major role in improving productivity in industries like oil, energy, agriculture and so many other important sectors of economy

An electronics engineer works in groups to design, fabricate, produce, test and supervise the manufacturing of complex products and systems i.e. electronic equipment and components.He works for a number of industries including hospitals, computer industries, electronic data processing systems for communication and in defense etc. They work with microprocessors, fiber optics, telecommunication, television, radios etc. Electronics engineering is a rapidly growing sector where there is excellent job opportunity for the skilled professionals.

**What Does an Electronics and Telecommunication Engineer do?**

1. Electronics and Communication Engineering branch deals with analog transmission, digital transmission, reception of video, voice and data, basic electronics, solid state devices, microprocessors, digital and analog communication, analog integrated circuits, satellite communication, microwave engineering, antennae and wave progression.
2. It also deals with the manufacturing of electronic devices, circuits, and communications equipment like transmitter, receiver, integrated circuits, microwaves, and fiber among others.

3. It aims to deepen the knowledge and skills of the students on the basic concepts and theories that will equip them in their professional work involving analysis, systems implementation, operation, production, and maintenance of the various applications in the field of Electronics and Communications Engineering.

**Scope of Electronics and Telecommunication Engineering**

Today, technology is growing at a rapid pace. In the coming future there is bound to be huge demand for competent engineers in electronic industry to cope this demand in technology. These engineers would be involved in creating and sustaining cutting edge technology to stay ahead in competition.

An electronic engineer can find job in Consumer electronics manufacturing organization, Telecommunication industry, IT industries, Health care equipment manufacturing industry, Mobile communication, Internet technologies, Power Electronics, and Other industries like steel, petroleum and chemical industry, directing control and testing production process.

Electrical technicians and technologists can specialize in technical sales, product representation, systems management, the design and manufacture of electronic devices and systems, or the installation, maintenance and repair of electronic systems and equipment. They may also work with computers and electronic equipment in the medical, manufacturing sectors.

**Career Prospects**

As an Electronics and Telecommunication engineer, various opportunities are there.

1. An electronics engineer can get a job in Central Government, State Governments and their sponsored corporations in public enterprises and the private organizations like All India Radio, Indian Telephone Industries, MTNL, National Physical Laboratories, AIR, Civil Aviation Department; Post and Telegraph Department; Co-ordination Department, National Physical Laboratory, Bharat Electronics Limited, Development Centers in various States etc.
2. Dealing in manufacture, sales and services of electronics consumer goods and appliances. Electronics engineers are also absorbed into the entertainment transmission industry, research establishments, and defense.
3. They can also take up teaching and research in one of the many engineering colleges in India or abroad.
4. They can also be employed by private companies manufacturing radio equipment and electronics such as Sony, Samsung etc.

5. In Ministry of Communication, All India Radio, DD. In information and broadcasting sectors, railways, police, BSF, CRPF and defense related organizations.'
6. In research organization like ISRO.

## *What is a Sensor? Different Types of Sensors and their Applications Pranali Kaiche*

We live in a World of Sensors. You can find different types of Sensors in our homes, offices, cars etc. working to make our lives easier by turning on the lights by detecting our presence, adjusting the room temperature, detect smoke or fire, make us delicious coffee, open garage doors as soon as our car is near the door and many other tasks.

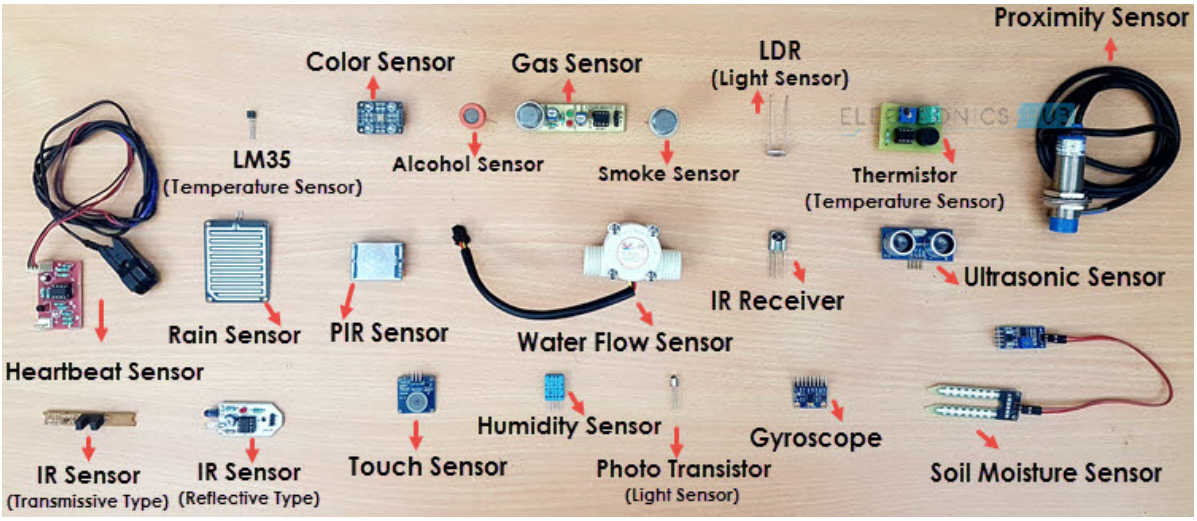
All these and many other automation tasks are possible because of Sensors. Before going in to the details of What is a Sensor, What are the Different Types of Sensors and Applications of these different types of Sensors, we will first take a look at a simple example of an automated system, which is possible because of Sensors (and many other components as well).

**What is a Sensor?**

There are numerous definitions as to what a sensor is but I would like to define a Sensor as an input device which provides an output (signal) with respect to a specific physical quantity (input).

The term "input device" in the definition of a Sensor means that it is part of a bigger system which provides input to a main control system (like a Processor or a Microcontroller).

Another unique definition of a Sensor is as follows: It is a device that converts signals from one energy domain to electrical domain. The definition of the Sensor can be better understood if we take an example in to consideration.




The simplest example of a sensor is an LDR or a Light Dependent Resistor. It is a device, whose resistance varies according to intensity of light it is subjected to. When the light falling on an LDR is

more, its resistance becomes very less and when the light is less, well, the resistance of the LDR becomes very high.

We can connect this LDR in a voltage divider (along with other resistor) and check the voltage drop across the LDR. This voltage can be calibrated to the amount of light falling on the LDR. Hence, a Light Sensor.

**Classification of Sensors**

There are several classifications of sensors made by different authors and experts. Some are very simple and some are very complex. The following classification of sensors may already be used by an expert in the subject but this is a very simple classification of sensors.

In the first classification of the sensors, they are divided in to Active and Passive. Active Sensors are those which require an external excitation signal or a power signal.

Passive Sensors, on the other hand, do not require any external power signal and directly generates output response.

The other type of classification is based on the means of detection used in the sensor. Some of the means of detection are Electric, Biological, Chemical, Radioactive etc.

The next classification is based on conversion phenomenon i.e., the input and the output. Some of the common conversion phenomena are Photoelectric, Thermoelectric, Electrochemical, Electromagnetic, Thermooptic, etc.

The final classification of the sensors are Analog and Digital Sensors. Analog Sensors produce an analog output i.e., a continuous output signal (usually voltage but sometimes other quantities like Resistance etc.) with respect to the quantity being measured.

Digital Sensors, in contrast to Analog Sensors, work with discrete or digital data. The data in digital sensors, which is used for conversion and transmission, is digital in nature.

**Different Types of Sensors**

The following is a list of different types of sensors that are commonly used in various applications. All these sensors are used for measuring one of the physical properties like Temperature, Resistance, Capacitance, Conduction, Heat Transfer etc.

We will see about few of the above-mentioned sensors in brief. More information about the sensors will be added subsequently. A list of projects using the above sensors is given at the end of the page.

**Temperature Sensor**

One of the most common and most popular sensors is the Temperature Sensor. A Temperature Sensor, as the name suggests, senses the temperature i.e., it measures the changes in the temperature.

There are different types of Temperature Sensors like Temperature Sensor ICs (like LM35, DS18B20), Thermistors, Thermocouples, RTD (Resistive Temperature Devices), etc.

Temperature Sensors can be analog or digital. In an Analog Temperature Sensor, the changes in the Temperature correspond to change in its physical property like resistance or voltage. LM35 is a classic Analog Temperature Sensor.

Coming to the Digital Temperature Sensor, the output is a discrete digital value (usually, some numerical data after converting analog value to digital value). DS18B20 is a simple Digital Temperature Sensor.

Temperature Sensors are used everywhere like computers, mobile phones, automobiles, air conditioning systems, industries etc.

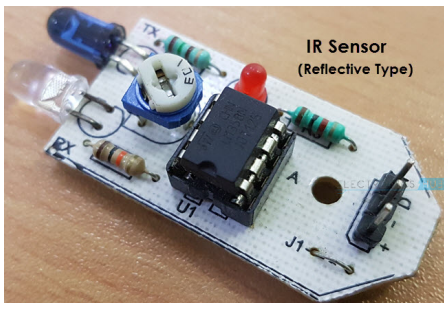
**A Proximity Sensor**

It is a non-contact type sensor that detects the presence of an object. Proximity Sensors can be implemented using different techniques like Optical (like Infrared or Laser), Sound (Ultrasonic), Magnetic (Hall Effect), Capacitive, etc.

Some of the applications of Proximity Sensors are Mobile Phones, Cars (Parking Sensors), industries (object alignment), Ground Proximity in Aircrafts, etc.

**Infrared Sensor (IR Sensor)**

IR Sensors or Infrared Sensor are light based sensor that are used in various applications like Proximity and Object Detection. IR Sensors are used as proximity sensors in almost all mobile phones. There are two types of Infrared or IR Sensors: Transmissive Type and Reflective Type. In Transmissive Type IR Sensor, the IR Transmitter (usually an IR LED) and the IR Detector (usually a Photo Diode) are positioned facing each other so that when an object passes between them, the sensor detects the object.





The other type of IR Sensor is a Reflective Type IR Sensor. In this, the transmitter and the detector are positioned adjacent to each other facing the object. When an object comes in front of the sensor, the infrared light from the IR Transmitter is reflected from the object and is detected by the IR Receiver and thus the sensor detects the object.

Different applications where IR Sensor is implemented are Mobile Phones, Robots, Industrial assembly, automobiles etc.

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**Ultrasonic Sensor**

An Ultrasonic Sensor is a non-contact type device that can be used to measure distance as well as velocity of an object. An Ultrasonic Sensor works based on the properties of the sound waves with frequency greater than that of the human audible range.

Using the time of flight of the sound wave, an Ultrasonic Sensor can measure the distance of the object (similar to SONAR). The Doppler Shift property of the sound wave is used to measure the velocity of an object.

**Light Sensor**

Sometimes also known as Photo Sensors, Light Sensors are one of the important sensors. A simple Light Sensor available today is the Light Dependent Resistor or LDR. The property of LDR is that its resistance is inversely proportional to the intensity of the ambient light i.e., when the intensity of light increases, its resistance decreases and vise-versa.

By using LDR is a circuit, we can calibrate the changes in its resistance to measure the intensity of Light. There are two other Light Sensors (or Photo Sensors) which are often used in complex electronic system design. They are Photo Diode and Photo Transistor. All these are Analog Sensors.

There are also Digital Light Sensors like BH1750, TSL2561, etc., which can calculate intensity of light and provide a digital equivalent value.

**Smoke and Gas Sensors**

One of the very useful sensors in safety related applications are Smoke and Gas Sensors. Almost all offices and industries are equipped with several smoke detectors, which detect any smoke (due to fire) and sound an alarm.

Gas Sensors are more common in laboratories, large scale kitchens and industries. They can detect different gases like LPG, Propane, Butane, Methane (CH4), etc.

Now-a-days, smoke sensors (which often can detect smoke as well gas) are also installed in most homes as a safety measure.

The “MQ” series of sensors are a bunch of cheap sensors for detecting CO, CO2, CH4, Alcohol, Propane, Butane, LPG etc. You can use these sensors to build your own Smoke Sensor Application.

**Alcohol Sensor**

As the name suggests, an Alcohol Sensor detects alcohol. Usually, alcohol sensors are used in breathalyzer devices, which determine whether a person is drunk or not. Law enforcement personnel uses breathalyzers to catch drunk-and-drive culprits.

**Touch Sensor**

We do not give much importance to touch sensors but they became an integral part of our life. Whether you know or not, all touch screen devices (Mobile Phones, Tablets, Laptops, etc.) have touch sensors in them. Another common application of touch sensor is trackpads in our laptops.


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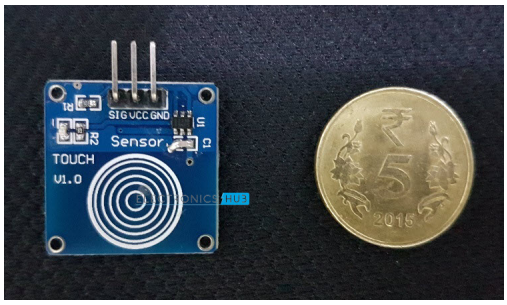
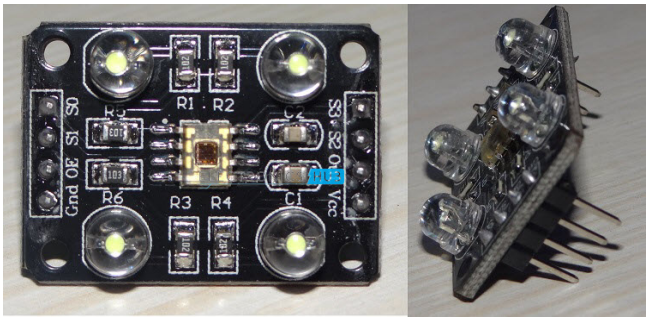
Touch Sensors, as the name suggests, detect touch of a finger or a stylus. Often touch sensors are classified into Resistive and Capacitive type. Almost all modern touch sensors are of Capacitive Types as they are more accurate and have better signal to noise ratio.




**Color Sensor**

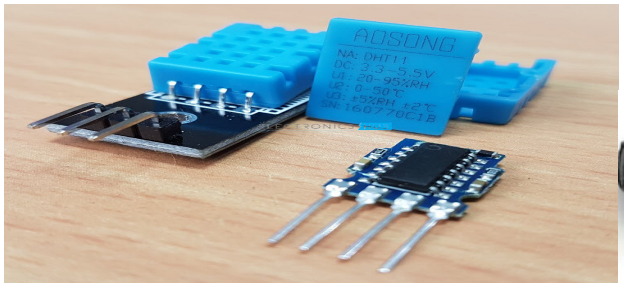
A Color Sensor is an useful device in building color sensing applications in the field of image processing, color identification, industrial object tracking etc. The TCS3200 is a simple Color Sensor, which can detect any color and output a square wave proportional to the wavelength of the detected color.

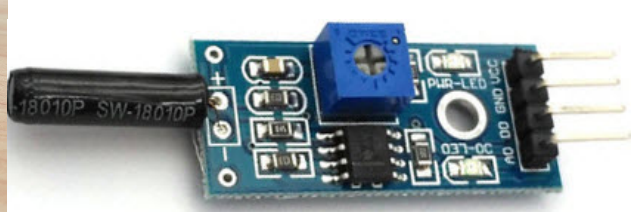



**Humidity Sensor**

If you see Weather Monitoring Systems, they often provide temperature as well as humidity data. So, measuring humidity is an important task in many applications and Humidity Sensors help us in achieving this.

Often all humidity sensors measure relative humidity (a ratio of water content in air to maximum potential of air to hold water). Since relative humidity is dependent on temperature of air, almost all Humidity Sensors can also measure Temperature.



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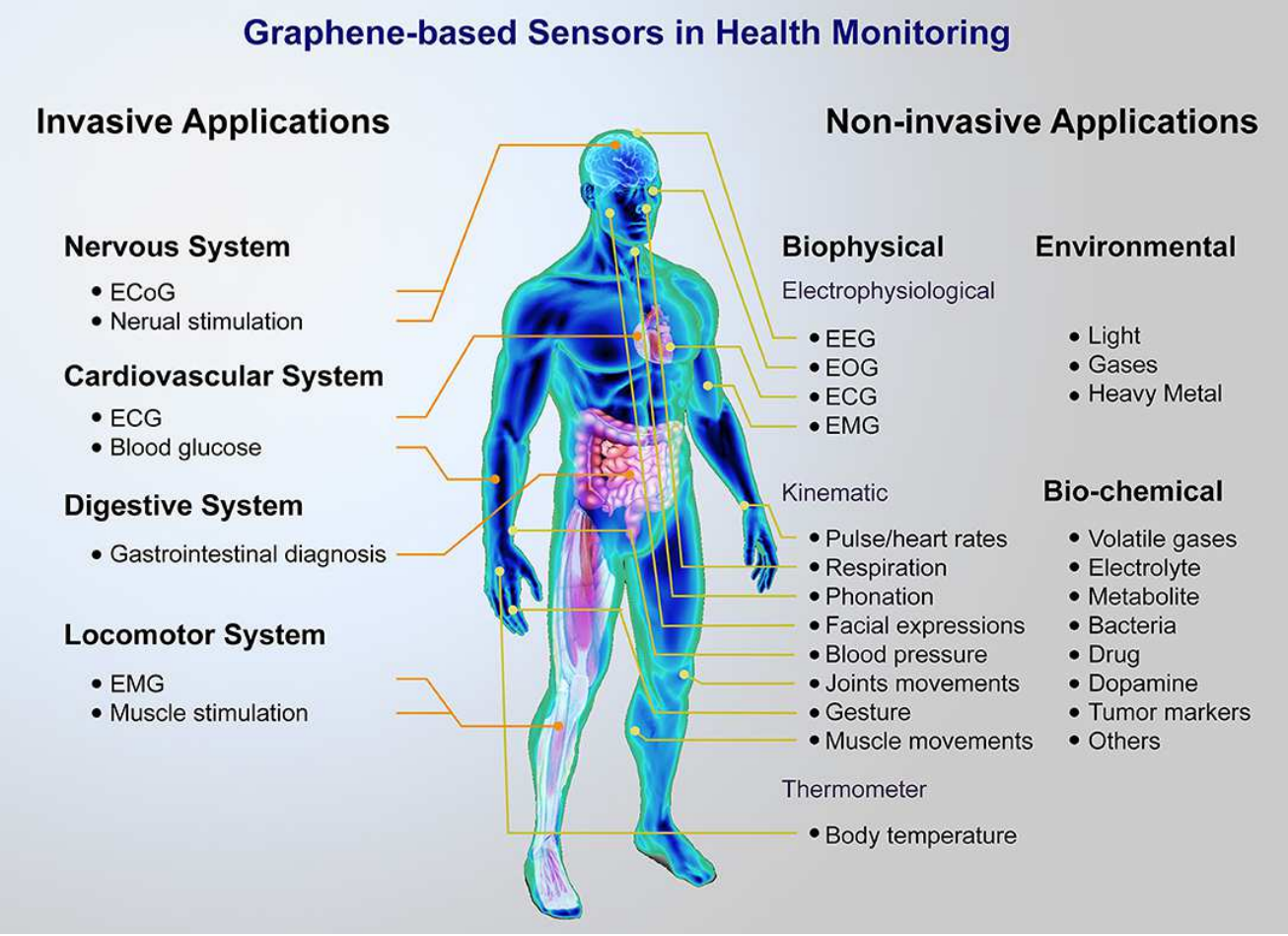
Humidity Sensors are classified into Capacitive Type, Resistive Type and Thermal Conductive Type. DHT11 and DHT22 are two of the frequently used Humidity Sensors in DIY Community (the former is a resistive type while the latter is capacitive type).

**Tilt Sensor**

Often used to detect inclination or orientation, Tilt Sensors are one of the simplest and inexpensive sensors out there. Previously, tilt sensors are made up of Mercury (and hence they are sometimes called as Mercury Switches) but most modern tilt sensors contain a roller ball.

Source : https://www.electronicshub.org/different-types-sensors/

***Sesnors for health monitoring*** ***Vishwas Wdekar***



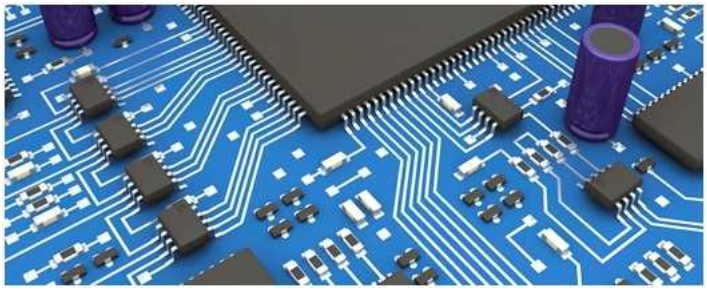
# Technosavior

## *Real Life Examples of Embedded Systems* *D.D AHIRE*

**Embedded Systems** are ruling our lives. Embedded Systems is an important subject of **electronics** which is mostly not given its due importance. If you talk about technology, you think about Laptops, Computers, DSLRs, Cameras, Mobile Phones, and Tablets. But you never think or talk about embedded systems that are running them. So, here we will tell you what the embedded system actually is and will also share various Real Life Examples of Embedded Systems.

An Embedded System is a Computer System that consists of both Hardware and Software. It is used to perform a particular job. Depending upon the type of Application it may or may not be programmable. The main part of Embedded System is a **microcontroller**, as the name suggests that is it controls all the operations required from it.

Real life examples of embedded systems include Mobile Phones, Cameras, Digital Watches, Laptops, Washing Machines, and Tablets etc. Mobile Phones, Laptops, and Tablets are a complete computer system but Digital Watches and traffic signals Washing Machines are not complete che computers systems yet they are embedded systems.

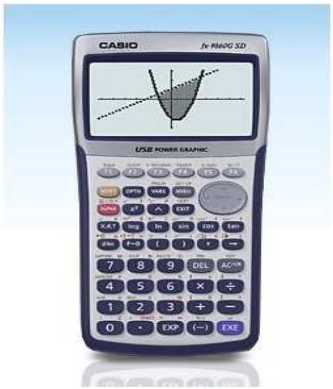


There are countless real-life examples of embedded systems. Here we are sharing some of them. Have a look.

**Calculator**

- This is one of the famous example in real life examples of embedded system
- The calculator is the most common example of an embedded system, I must say. We all used calculators in our daily life to solve our mathematical problems.
- A calculator is the embedded system that was developed very early.
- In the calculator, we give input from the keyboard, the embedded system performs the gives function like Add, Subtract etc and displays the result on LCD.
- Nowadays, the scientific calculators are used. They have a very high-performance processor.
- These calculators have the ability to perform the complex mathematical functions.
- These calculators can be programmable.

- It is just because of the embedded system, that these scientific calculators are advanced in





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**Industrial Robots**

- There are many examples of Embedded Systems in Industries.
- Nowadays, all the process are being taken towards automation.
- So, we need to mention Industrial Robots as the most important applications of embedded Systems.
- Industrial Robots are available in a variety of forms, each form has some different number of functions to perform.
- There are some Industrial Roots that can move tools, parts, materials etc.
- Some of the robots are used in the manufacturing of different equipment's whereas some are used in assembling different parts of equipments.
- The productivity rate has been increased by these Robots with Embedded Systems.
- These Robots are excessively used at those place where the access of humans is difficult.
- In order to understand, how the industrial robot works as an embedded system, you need to know about automated painting robots.
- Nowadays, these robots have decreased the need of humans as they perform the task in less time with excellent results.
- The operation performed by the robots are controlled through programming.
- The time required for the whole process to complete and the amount of paint required for that is already set.
- Another example of Industrial Robot is Assembly Robot.
- The function of such a robot is to assemble different parts.
- All the different parts are collected and assembled together in right sequence to form a final product.
- There are various examples of industrial robots that use the embedded system.

**Personal Digital Assistant**

- Personal Digital Assistant is also an embedded device made for personal use just like a personal computer in your hand.

- There are a lot of personal embedded devices around you like data organizers, Mobile Phones, Personal Digital Assistant etc.
- Personal Digital Assistant was used at the time before the invention of a Smartphone.
- It is a personal device that is used as information manager and can be connected to the internet.
- It has a touchscreen display with which the user interacts with the PDA device.
- The Personal Digital Assistant Devices with Keypads instead of Touchscreen display are also available.This device is user dependent in entering and storing information. It has light weight and performs various tasks.
- The data is input through its touchscreen display and the data is stored in a memory card and
- .


**Automated Teller Machine**

- You are much familiar with ATM, the machine for withdrawing money. That is also an example of embedded systems.
- ATM is a computerized device, nowadays, every bank has necessarily.
- You know well, how ATM works, how you have to input your ATM card and password and as a result, you receive your money.
- This machine consists of a card reader that is used to detect the card of the person and access important information through that card.
- Another part of the machine is a keypad, from which you enter your password and other commands.
- There is a screen on which information is displayed, the receipts are printed through a printer and cash dispenser delivers you your money.
- Through host computer, a network is established between a computer at Bank and ATM.
- The bank computer verifies all the data and stores the record of transactions.
- Microcontroller carries all the operations whether input or output.
- That's how this embedded system works.

**Automatic Washing Machine**

- This is also on of the famous application of real life examples of embedded systems
- Washing Machine at your home is another common example of embedded systems.
- You out all the dirty clothes inside the machine and push start button i.e. you input data.
- Wm is there to measure the weight of the laundry you have put inside.
- WM opens the valve to enable the clean water go inside.
- On the basis of load and water level, the valve gets closed.
- The rotating drum of the Washing Machine starts rotating and that's how washing starts.

- After washing cycle, the outlet valve opens to release all the dirty water.
- The sensor detects whether all the dirty water has been removed or not and opens or close the outlet valve.
- This whole process repeats and we get our clothed washed.

## *Communication system: EVOLUTION* — *Mansi Patil*

Humans have long dreamed of possessing the capability to communicate with each other anytime, anywhere. Kings, nation-states, military forces, and business cartels have sought more and better ways to acquire timely information of strategic or economic value from across the globe. Travelers have often been willing to pay premiums to communicate with family and friends back home. As the twenty-first century approaches, technical capabilities have become so sophisticated that stationary telephones, facsimile (fax) machines, computers, and other communications devices—connected by wires to power sources and telecommunications networks—are almost ubiquitous in many industrialized countries. The dream is close to becoming reality. Mobile wireless communications is a shared goal of both the U.S. military and civilian sectors, which traditionally have enjoyed a synergistic relationship in the development and deployment of communications technology. The balance of that long-standing interdependence is changing now as a result of trends in the marketplace and defense operations and budgets. These trends suggest that market forces will propel advancesin technology to meet rising consumer expectations. However, the military may need to take special measures to field cost-effective, state-of-the-art untethered communications systems that meet defense requirements.

In the final years of the twentieth century, all aspects of wireless communications are subject to rapid change throughout the world. Dimensions of change include the following:

- Vigorously expanding public demand for products and services;
- Dramatic changes worldwide in government policies regarding industry structure and spectrum management;
- Rapidly advancing technologies in an atmosphere of uncertainty about the relative merits of competing approaches;
- Emergence of a wide variety of new systems for delivering communications services to wireless terminals; and
- Profound changes in communications industries as evidenced by an array of mergers, alliances, and spin-offs involving some of the world's largest corporations.

These changes are fueled by opportunities for profit and public benefit as perceived by executives, investors, and governments. Although the patterns are global, the details differ significantly from country to country. Each dimension of change is complex and all of them interact. Overall, the dynamic

nature of wireless communications creates a mixture of confusion and opportunity for stakeholders throughout the world.

A principal attraction of wireless communications is its capability to serve mobile users. Because mobility is an important feature of military operations, the U.S. armed forces have always played a leading role in the development and deployment of wireless communications technology.

In the coming years, however, it appears that the commercial sector will have sufficient incentives and momentum to push the technical envelope on its own. At the same time, flat or declining defense budgets are motivating the military to adopt commercial products and services to an increasing extent. In contrast to other areas of information technology, wireless communications has yet to converge toward a single technical standard or even a very small number of them. Instead it appears that diversity will endure for the foreseeable future.

**SOURCE :**"1 PAST, PRESENT, AND FUTURE." National Research Council. 1997. The Evolution of Untethered Communications. Washington, DC: The National Academies Press. doi: 10.17226/5968.

## *Programming languages: Evolution* — *Shilpa Adke*

Programming languages continue to evolve in both industry and research, as systems and applications change. Today there is a wide variety of programming languages with different languages, syntax, and features. Developers can now use a language based on either the client's preference or their own. Language technology developed between 1967 and 1997, giving birth to some of the most popularly used programming languages even now. The swift growth of the internet in the mid-1990s was a major boost to the programming language world.

Evolution of Programming Languages

1. Python

Writing code, in many of the programming languages on this list, is complicated even for professional programmers. Created in 1991, Python became so popular because it's a very user-friendly language. It is a high-level programming language with an emphasis on code readability, vast libraries, and framework. Some of the noteworthy features of Python are:

- Open-source programming language
- Extensive support modules and community development
- Easy integration with web services
- User-friendly data structures
- GUI-based desktop applications

2. Java

On the other hand, Java, another high-level programming language that was developed in the 1990s, is the most popular among modern programmers. Java was initially developed for cable boxes and hand-held devices. However, it has upgraded so much that today, it is almost everywhere, from the World

Wide Web to smartphones to computers. It is one of the best programming languages and is widely used today after Python.

3. JavaScript

JavaScript is the next most popular programming language which built the internet. Created in just ten days in 1995, it is a feature-rich, object-based scripting language. It is one of the most used programming languages even today, and almost all the websites on the internet today are built on JavaScript. It has gone through a massive update and modernization over the last few years. The major JavaScript releases have added a lot of modern features, and the JavaScript today has vast differences compared to the Javascript of the previous decade.Master the JavaScript programming language in an all-inclusive JavaScript Certification training program that includes complete JavaScript fundamentals, jQuery, Ajax, and more.

4. C#

The evolution of programming languages continues with each passing year. C#, created by Microsoft, is known as one of the highly powerful programming languages in the Dot NET framework. It is an adaptable language that gives a comprehensive programming foundation that applies to Java, Objective-C, PHP, and more.

5. PHP

PHP, similar to Python, is another programming language developed by a single programmer as a side project during the 90s. Over time, more functionality was added to the PHP product, and it evolved into a full-fledged programming language. However, PHP seems to be losing its popularity and appeal with the rise of JavaScript.

6. C++

Inspired by C, Bjarne Stroustrup initially developed C++ as an extension to the C language. Although, over time, C++ has evolved into a multi-model, general-purpose programming language. It is mostly used in Microsoft products and desktop applications. Over the last decade, C++ has grown into one of the most well-known and widely used programming languages.

7. C

During the 1969–1973, Dennis Ritchie, a Bell lab engineer, developed a procedural, general-purpose programming language that directly compiled to a machine language. It has also easily influenced most of the other languages on this list. The C Programming Language gives the programmer complete control over the underlying hardware.

8. R

R is another widely-used programming language used for building statistical software as well as data analysis by statisticians and data miners. R programming language, along with its libraries, executes a wide variety of graphical as well as statistical techniques.

9. Swift

Swift is a general-purpose, compiled programming language that also offers high developer productivity. Swift was developed mainly to replace Objective-C in the Mac and iOS platforms. One of its USPs and the reason for its popularity is its language design. With a simpler, precise, and clean syntax as well as developer ergonomic features, it offers a more productive alternative to Objective-C in the Apple Ecosystem.

10. Objective C

Initially developed in the early 1980s, Objective-C is a general-purpose, object-oriented programming language. It is a primary programming language generally used for writing software for OS X and iOS. Its syntax, primitive types, and flow control statements are assumed from C, and more syntax is added for defining classes and methods.

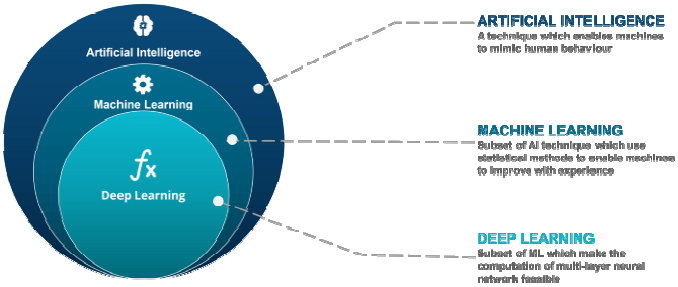
Programming languages have evolved a lot in the last 70 years, from creating some of the most challenging programs in assembly language to the most user-friendly python programs.

Over the last ten years, Simplilearn has kept up with the evolution of programming languages. We enable learners to acquire skills in the languages they need in their careers. We also offer courses to help programmers and developers to become project managers and development leaders. Invest your time and build your skills by learning new and improved programming languages to meet the demands of the ever-changing technological world.

## *Artificial Intelligence in Mechanical Engineering* — *J.H.Bhangale*

Artificial Intelligence and Machine Learning seems to be the current buzzword as everyone seems to be getting into this subject. Artificial Intelligence seems to have a role in all fields of science. According to Britannica **, "Artificial intelligence (AI)**, is broadly defined as the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings." By intelligent beings it basically means humans … but maybe not all humans…so anyway,It is usually classified into. Artificial Intelligence is a broader term which in cooperates Machine Learning. Machine learning uses statistical methods to allow machines to improve with experience.Deep Learning, again, is the subset of Machine Learning which uses multi layer neural networks that mimic the human brain and can learn incredibly difficult tasks with enough data.

# Technosavior




Artificial Intelligence and its subsets ( Source: Edureka)

We are going to talk about Deep learning methods and its possible role in the field of Mechanical Engineering. Some common examples could be **Anomaly Detection(Machine Learning)** and **Image based Part Classification(Deep Learning)**. The focus will be on Image based part classifiers and why we need them.

Firstly, what is an image classifier? The ever famous AI which recognizes cat-dog pictures should come to mind. Here's a link to the code of such a program. The data-set used contains images of cats and dogs, the algorithm learns from it and then is able to guess with 97% accuracy whether a randomly shown image is a cat or a dog.


)

Bolt or Nut or Locating Pin or Washer? Will the AI be able to tell?

We will attempt a similar code but using Nuts, Bolts, Washers and Locating Pins as our Cats and Dogs….. because mechanical engineering.So how does it work? An algorithm is able to classify images(efficiently) by using a Machine Learning algorithm called Convolutional Neural Networks(CNN) a method used in Deep Learning. We will be using a simple version of this model called Sequential to let our model distinguish the images into four classes Nuts, Bolts, Washers and Locating Pins. The model will learn by "observing" a set of training images. After learning we will see how accurately it can predict what an image (which it has not seen) is.

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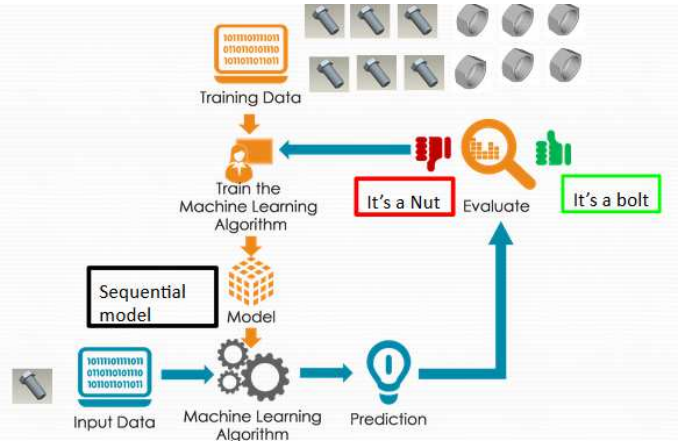


Data-set

We downloaded 238 parts each of the 4 classes (Total 238 x 4 = 952) from various part libraries available on the internet. Then we took 8 different isometric images of each part. This was done to augment the data available, as only 238 images for each part would not be enough to train a good neural network. A single class now has 1904 images(8 isometric images of 238 parts) a total of 7616 images. Each image is


Images of the 4 classes. 1 part has 8 images. Each image is treated as single data.

**Methodology**

The process took place in 7 steps. We will get to the details later. The brief summary is

- **Data Collection**: The data for each class was collected from various standard part libraries on the internet.
- **Data Preparation:** 8 Isometric view screenshots were taken from each image and reduced to 224 x 224 pixels.
- **Model Selection :** A Sequential CNN model was selected as it was simple and good for image classification



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- **Train the Model:** The model was trained on our data of 7616 images with 80/20 train-test split
- **Evaluate the Model:** The results of the model were evaluated. How well it predicted the classes?
- **Hyper parameter Tuning:** This process is done to tune the hyper parameters to get better results. We have already tuned our model in this case
- **Make Predictions:** Check how well it predicts the real world data

Source https://towardsdatascience.com/artificial-intelligence-in-mechanical-engineering-a9dd94adc492

## *Artificial Intelligence and its Alliance with Mechanical Engineering D.D.Palande*

Source: https://www.teslaoutsourcingservices.com/blog/artificial-intelligence-and-its-alliance-with-mechanical-engineering/Bhagwati Pathak

Artificial Intelligence has already become an essential part of our lives. Several sectors like Politics, Media, and Engineering, etc. are capitalizing all of the capacity of Artificial Intelligence. Hence, we are consuming the services of AI in known or unknown ways.

Humans created Artificial Intelligence for us to imagine a healthy, secure, connected and creative future ahead. Mechanical Engineering plays a catalyst in the above process of Imagination. In today's era, education courses are helping us to create people who can bring the distance of Humans and Machines closer. Which can help create new products, systems, and avenues?

Let us start from the basic,

**What is Artificial Intelligence?**

Artificial Intelligence, well-spoken as A.I is a unit of computer science that works towards creating and building smart appliances/machines which are capable of doing similar or more amount of work than human tendency. Work that requires human intelligence but can be done by Computer Science. A. I simulate and emulate a human's behavioural pattern through machines.

**Mechanical Engineering?**

Mechanical Engineering is a branch of engineering dealing with Design, construction and machines. Within this, a significant area which is related to Artificial Intelligence is Mechanical Design.

Mechanical Design comes to be a sub-set for Mechanical Engineering.

In Mechanical Engineering Design, we can see the way toward concocting a part, framework or stream to meet desired/needed need. Here, we can see the amalgamation of Science and mathematics. Mechanical Design is a process to design the required component, system, or process, which is necessary to meet the final result. Mechanical Engineering – Mechanical Design and its relation with A.I is majorly used by a Product Design Company.

**Artificial Intelligence and Mechanical Engineering.**

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The sector of Mechanical Engineering is the primary consumer of Artificial Intelligence as a technology. It is more than any other industry; it is consumed the most in Mechanical designs or engineering works. Sections of Mechanical Engineering like Robotics, Automation, or sensor technology, uses Artificial Intelligence as a technology. So it is easy to say that Mechanical Engineering disseminates the application and use of AI in the eco-system.

**Benefits of AI for Mechanical Engineering**

There are different areas where AI impacts the Mechanical Engineering process. The idea behind the work of AI remains the same. It performs activities without humans yet with increased tendency as compared to humans. It is prioritizing the automated part of work, where we feed the computer with data, and as per the command, the machine/process continues its function.

We can feel the impact of AI in different areas, such as:

**Manufacturing**

Many processes in the manufacturing industry require Mechanical Engineering to be done with components, products, processes, etc. Artificial Intelligence is currently used in similar processes of Mechanical Engineering. Whether in Components, Products, or Processes. It is making sure about its presence being felt. There are many other processes and technologies which are becoming easy – fast and efficient with the help of Artificial Intelligence. Machine's which can do more work than human tendency and that too with least effort of humans into it is the main goal here. When the above objective is achieved or worked upon, it will send serious implications to different areas of the sector. (And at some places, connections have already started affecting the scenarios)

That's what AI is impacting in the current era for the manufacturing industry. People of the sector are also scared off them losing the jobs.

**Mechanical Design**

Whenever we start the process of building a component/product/flow, the first step of it would be of Mechanical Design. Different sectors of services are provided through mechanical Design. To list the few as; Product Design, Machine Design, Mechanical Component Design, Tooling and Fixture Development, Mold Design, Casting Design. All are coming under the umbrella for Mechanical Design Services. A. I. can majorly impact Product Design Services when it comes to designing the concept, examining the product, and also during the manufacturing of the product.

**Big Data Storage and Usage through IT.**

Data has proved its presence everywhere. Even the processes and function of Mechanical engineering requires the usage and storage of Data. When it comes to mechanical engineering, the primary area where Data is needed the most is machine learning. Yet another segment of mechanical engineering. Machine learning has changed the perception of the potential of mechanical engineering. It provides better efficiency/flexibility and quality of systems with the help of data, resulting in the improvement of processes and systems in mechanical engineering. It is one of the critical drivers of development for mechanical engineering.

Coming back to the discussion of AI's impact, Artificial Intelligence has a significant role in the increasing trend of Machine Learning. A. I has its comfort zone when it comes to relying on Huge Data and Large Algorithmic learnings. Machine learning, as discussed earlier, is dependent mostly on the constant generation of data and its analysis. A. I learn through those large sets of data and various commands that engineers might have to give in the first place.

**There are a few other ways where Artificial Intelligence does help during the process of Mechanical Engineering. Such as,**

- Stress Estimation of 3D Structures: Estimating the amount of stress while designing and manufacturing 3D structures.
- Material Evaluation for different Services: Evaluating materials, its strength – durability – quality and helping in a more exceptional manufacturing process.
- Structure Generation: While Generating a Structure, AI can help through its algorithms and data storage. It is making the process efficient and transparent.

As we discussed, the Impact of AI on mechanical engineering. There are both sides available to Artificial Intelligence: Good and Bad.

**The Good Ones**

- A. I. can create a negligible amount of error, required that the programming is done in the best possible way. Compared to A. I, Humans have a probability of creating more errors in the work.
- Compared to Human Speed, it is much faster w.r.t. Work.
- A. I. lessens the amount of risk attached to the functioning and decision-making process. Through its algorithms and data, it is created to choose only the best possible result.

**The Bad Ones**

- AI reduces the risk attached to work through its attributes of data and algorithms. But the same process eradicates the Human element attached to the entire process. Resulting in an impact on Moral of the employees.
- AI lacks creativity.
- The judgment process of AI is not dynamic, i.e., according to situations. It might not give the best possible output in a condition of Natural Calamity, Disaster, or any on-ground damage.

**Conclusion**

Artificial Intelligence isn't a long listed dream anymore. More and more industries are taking advantage of it and providing some fantastic results that can help human eco-system. Yes, AI might affect an industry's HR by eradicating the least essential employee. Yes, it might kill the human element attached to the process. Yet, against all of it, it is helping our generation to imagine an entirely new world by impacting the different fields.

# Technosavior

## *What is Industry 4.0—the Industrial Internet of Things (IIoT)? Dhatrak V.K*

Industry 4.0 refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0, also sometimes referred to as IIoT or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and **supply chain management**. While every company and organization operating today is different, they all face a common challenge—the need for connectedness and access to real-time insights across processes, partners, products, and people.

That's where Industry 4.0 comes into play.

Industry 4.0 isn't just about investing in new technology and tools to improve manufacturing efficiency—it's about revolutionizing the way your entire business operates and grows. This resource will provide you with an in-depth overview on the topic of Industry 4.0 and IIoT, including information on the following:

- The Evolution of Industry from 1.0 to 4.0
- Basic IIoT Concepts and Glossary of Terms
- Smart Manufacturing Use Cases
- Whom is Industry 4.0 For?
- Benefits of Adopting an Industry 4.0 Model
- Challenges to Consider and Overcome
- How Epicor Can Help Your Business

The world of manufacturing is changing. To survive and thrive now, you have to be willing to invest in Industry 4.0. This resource will help you get started.

Evolution of Industry from 1.0 to 4.0

Before digging too much deeper into the what, why, and how of Industry 4.0, it's beneficial to first understand how exactly manufacturing has evolved since the 1800s. There are four distinct industrial revolutions that the world either has experienced or continues to experience today.

The First Industrial Revolution

The first industrial revolution happened between the late 1700s and early 1800s. During this period of time, manufacturing evolved from focusing on manual labor performed by people and aided by work animals to a more optimized form of labor performed by people through the use of water and steam-powered engines and other types of machine tools.

The Second Industrial Revolution

In the early part of the 20th century, the world entered a second industrial revolution with the introduction of steel and use of electricity in factories. The introduction of electricity enabled

manufacturers to increase efficiency and helped make factory machinery more mobile. It was during this phase that mass production concepts like the assembly line were introduced as a way to boost productivity.

The Third Industrial Revolution

Starting in the late 1950s, a third industrial revolution slowly began to emerge, as manufacturers began incorporating more electronic—and eventually computer—technology into their factories. During this period, manufacturers began experiencing a shift that put less emphasis on analog and mechanical technology and more on digital technology and automation software.

The Fourth Industrial Revolution, or Industry 4.0

In the past few decades, a fourth industrial revolution has emerged, known as Industry 4.0. Industry 4.0 takes the emphasis on digital technology from recent decades to a whole new level with the help of interconnectivity through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems. Industry 4.0 offers a more comprehensive, interlinked, and holistic approach to manufacturing. It connects physical with digital, and allows for better collaboration and access across departments, partners, vendors, product, and people. Industry 4.0 empowers business owners to better control and understand every aspect of their operation, and allows them to leverage instant data to boost productivity, improve processes, and drive growth.

https://www.epicor.com/en-in/resource-center/articles/what-is-industry-4-0/

## *Mechanical Engineering Marvels* — *V.S.Daund*

**Nano Engine that Works on a Single Atom**

The most efficient engine of the world is the one that runs on a single atom! This nano-engine designed by Johannes Roßnagel's is a four-stroke one. It means that it compresses and heats, and then expands and cools – again and again to transform changes in temperature into mechanical energy.

Roßnagel is an Experimental Physicist at the University of Mainz in Germany. His engine does not use internal combustion and is less than a micrometer in length – making it the tiniest engine of the World.

This nano engine first traps a single atom in a cone of electromagnetic energy using tiny electrodes. This energy cone squeezes tightly over the atom. The physicists then place two lasers on each end of the cone – one to heat the atom at the pointy end, and the other at the base of the cone to cool it back down using a process called Doppler Cooling. The heating and the cooling is done at the same resonance at which the atom vibrates naturally. This temperature change makes the atom run and forth along the length of the cone as it expands and contracts. The sound waves created through atom's oscillation can be harnessed.

According to the Roßnagel, this engine can attain the efficiency which can surpass the Carnot Limit – the cap of engine efficiency limit according to the Laws of Thermodynamics.

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**Dialysis Machine for Newborns**

Italian researchers have come up with a new small dialysis machine for newborns who suffer from kidney failure. The team was led by the Dr Claudio Ronco, Director of the Department of Nephrology at San Bartolo Hospital in Vicenza. Adult-sized dialysis machines available today were difficult to use for newborns that have tiny blood vessels. It cannot be used on babies that weigh less than 6.6 pounds. Called CARPEDIEM (Cardio-Renal Pediatric Dialysis Emergency Machine), this mini-version of regular dialysis machines can be used on babies and kids weighing between 4.4 pounds to 22 pounds.

The new machine uses tiny catheters to protect infant's blood vessels and can handle very low blood flow and infiltration.

**Dronies – the Nano Drones**

World's tiniest flying machines, dronies or nano drones are autonomous flying quadcopters. They can fly and move in formation indoors. Thet can also dance in sync without the use of external sensors or on-board infrared sensors. Produced by Drovionics, drone avionics attracts much interest from the industry. From delivering parcels to providing security cover to aerially inspect damage in pipelines, dronies have many potential uses. They can even operate independently of continuous human supervision.

Dronies are designed for indoor flying right now with a 2.4 GHz transmitter with a signal strength that extends up to 30 metres. The present version of dronies has a recommended distance of 2-10 metres between the controller and the dancing dronies. The coordinated flying and navigation abilities of dronies allow choreography on the basis of 6-axis aerial acrobatics.

**World's Fastest Unmanned Spaceship New Horizons Probe**

Launched on: January 19, 2006

Top Speed: 58,536 km/hr or 36,373 mph

New Horizons planetary probe is finally about to reach Pluto soon after a nine-year journey. Launched by NASA, this modern and sophisticate spacecraft uses novel technologies to cut down its travel time. It is the fastest spacecraft ever to leave the planet Earth and is travelling at a speed of about 31,000 miles per hour.

On July 14, 2015, the probe is expected to be just 7,750 miles above Pluto's surface making it possible for us to see objects that are roughly the size of a football field from above. Its ultraviolet spectrograph will also allow space scientists to study the composition and structure of the atmosphere on Plutio.

Pluto is over 30 times farther than the Sun and hence, it is taking a long time to reach there. After reaching Jupiter, the speed of New Horizons probe picked up significantly – by about 4 km/sec. The

# Technosavior

Kuiper Belt has been an elusive space in the study of the Solar System and studying Pluto is expected to reveal new information about how the solar system formed and evolved.

The size and shape of the New Horizons spacecraft is comparable to a grand piano glued to a satellite dish that is almost as big as a cocktail bar. Its body is like a triangle while its main structural column is a 7075 aluminium alloy tube which is set between the radio dish antenna at its front flat side and the launch vehicle adapter ring at its rear side. This tube carries the titanium fuel tank. The RTG attaches with a 4-sided titanium mount as titanium provides both strength and thermal isolation to the system.

The spacecraft structure is bigger than necessary to allow for mass distribution and shielding from radiation of the RTG. Inside, the structure is painted black to allow radiative heat transfer and add warmth to the spacecraft.

New Horizons has 16 thrusters – four larger ones for trajectory corrections and 12 smaller ones for attitude control and spin-up or spin-down maneuvers.

**Manned Spacecraft Apollo 10 CSM**

Launched on May 26, 1969

Top Speed: 39,896 km/h or 24,790 miles per hour

Apollo 10 Command/Service Module Charlie Brown – the fourth manned mission in the United States Apollo space program – was actually meant as a dress rehearsal for the actual landing on the Moon during Apollo 11 mission. Like Apollo 11, it had flight-experienced crew and its Lunar Module came to within 8.4 nautical miles of the lunar surface. Apollo 10, however, has a record to its name too. In 2002, it set up a record of highest speed attained by a manned vehicle during the return from the Moon.

It is the only Apollo crew – all of whose members got to fly subsequent missions aboard Apollo spacecraft. They also hold the distinction of being the only humans to fly farthest away from their homes on Earth's surface. Apollo 10 was also the first space mission to make live color TV transmissions to Earth.

**Robo-Fly may soon be used in Rescue Operations**

Robo-fly is a tiny, insect-sized robot designed by Harvard scientists. RoboBee or Robo-Fly weighs less than a gram and has superfast electric muscles that allow it to flaps its wings 120 times per second and make tethered flight. It is made from carbon fibre. After 12 years of research by the Robotics team, this micro-robotics wonder work came into being after solving two key technical challenges – building a sub-millimeter scale for precise and efficient measurements, and creating artificial muscles for the fly.



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With just a 3 cm wingspan, it is the smallest device to fly like an insect. Right now, the power supply and instructions to the bee are provided by a tiny tether on board its body. The research is going on to make the fly capable of making independent decisions and how to give it a viable power supply.

Robobee is a marvel because the reduced size of the robot meant that engineers had to work without using nuts, bolts, gears and rotary motors. They also used origami techniques to cut designs from flat sheets, folded them up and glued them together. Besides, at micro-scale levels, even a small amount of turbulence can cause severe flight disturbances. Hence, Robobee has to react very rapidly. Its artificial wing muscles use a piezoelectric actuator which is a thin ceramic strip that contracts when electric currents run across it.

These artificial robots are expected to work for search and rescue operations, as well as artificial pollination.

**LTM 11200-9.1 - World's Strongest and Tallest Telescopic Crane**

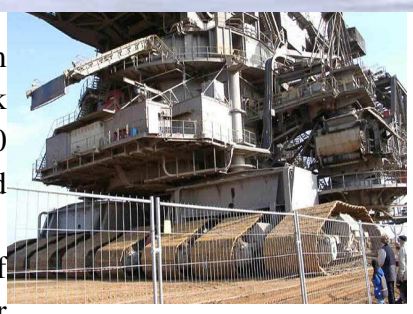
Liebherr LTM 11200-9.1 is undoubtedly the strongest mobile crane in the world. It can carry as many as 12 adult Blue Whales at once (weighing around 1,200 tons in all). It can also carry as many as three of the world's biggest wind turbines easily – which are 650 feet tall and weigh around 354 tons).

LTM's has an 8-part telescopic boom that can extend up to 328 feet. Adding a lattice job, its maximum lift height can be extended up to 630 feet – more than 50 stories high.

LTM itself weights over 220 tons. The crane has a 6-cylinder 240 kW engine as well as a 500 kW engine for the 9-axle carrier that is 65 foot tall. When the crane is shifted from site-to-site, its 100-ton boom (about as long as the truck itself) is shipped separately.

**Bagger 288 – World's Largest Land Vehicle**

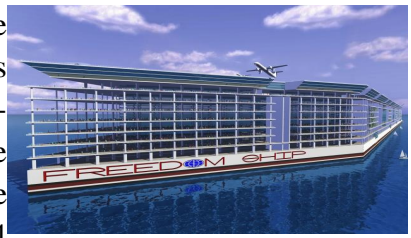
Bagger 288 or Excavator 288 weights 1,35,000 tons and is the largest land vehicle in the world. Thus bucket-wheel excavator was made by the German company Krupp for the energy and mining firm Rheinbraun to remove overburden from coal mining at the Hamback stripmine. Bagger 288 can excavate 2,40,000 tons of coal or 2,40,000 cubic metres of overburden daily (which is comparable to a football field dug about 30 metre deep).



This giant machine is 220 m long and about 96 m high. The chassis of the main section is 46 m wide – which sits on 3 rows of 4 caterpillar track assemblies. Each track is about 3.8 m wide. With large surface areas, tracks place little ground pressure and allows the excavator to travel over gravel, earth and even grass. Maximum gradient over which the excavator can climb is 1:18.

The turning radius of the excavator is about 100 metres.

**The Freedom Ship**




The Freedom Ship is a floating city that is expected to materialize soon. This mile-long ship will have buildings that are about 25 stories tall stacked close to each other. It is envisioned to be the largest man-made structure on Earth and there are talks that it could also be made into an independent country. The Freedom ship is designed to be 4,500 feet long, 750 feet wide and 350 feet high. It would be over 4 times longer than the Queen Mary.

This luxury city is not going to be a cruise ship but a place to live, work or visit which will continuously go around the globe covering the coastal regions of the world. It will have an extensive duty-free international shopping mall, residential space, schools, banks, hotels, offices, warehouses and light manufacturing and assembly enterprises too. The airport on the top deck of the ship can serve small private commercial aircrafts which can carry up to about 40 passengers each.

Magnetic Hybrid Motorbike

Tokyo-based Axle Corporation has designed a new electric motorbike that can be charged at home like a regular cellular phone and can travel noiselessly up to 180 kilometers on a single charge. It takes about 6 hours to fully charge the battery and it can attain a maximum speed of up to 150 kilometers per hour.

The bike uses a hybrid magnetic motor SUMO (a hybrid of a permanent magnet and an electromagnet which is built inside the rear wheel of the bike. According to the manufacturers, this mini-scooter is 7 times more cost-efficient than gas-powered scooters.

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