

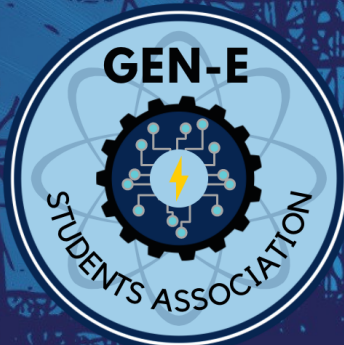


**AMRITA**  
VISHWA VIDYAPEETHAM  
DEEMED TO BE UNIVERSITY

School of  
Engineering

# Elektron

AY 2021-22  
ISSUE 01



**Students Association of EEE & ELC ( GEN-E )**

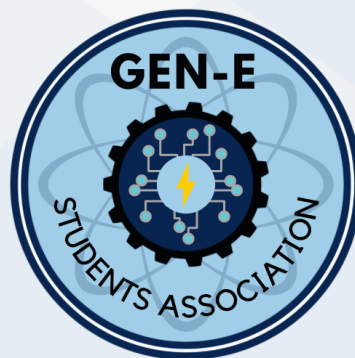
Department of Electrical and Electronics Engineering

# WHAT IS GEN-E?

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## INTRO>

Gen - E is a student association, from the department of Electrical and Electronics Engineering (EEE) and Electrical and Computer Engineering (ELC), which aims to strengthen the intra-department student network and provide a space for everyone to explore their technical interests and offer opportunities off-academics. And as a part of this initiative, we are proud to bring back the department magazine, Elektron, with an aim to make this a platform for all EEE and ELC students to share on.



# FACULTY'S MESSAGE

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I am quite pleased and excited about the magazine. I see this magazine as a venue for nurturing creativity and inspiring innovation which are two essential elements for successful education.

We believe that every student deserves a high-quality education. With technology evolving at a rapid rate, the classrooms alone might not be able keep pace with it. This is the gap that GEN-E is trying to bridge. This magazine is one of many activities to facilitate knowledge about the latest trends in creative manner.

My sincere congratulations to the entire GEN-E team for their tireless effort even during this hectic schedule. I wish it all the success and hope this tradition will be carried through by the following batch of students to come.



**Sarath TV**  
Assistant Professor (Sr.Gr)  
Department of EEE  
(GEN-E, Faculty Incharge)

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# EXOSKELETONS

MODERN&gt;

## WHAT ARE EXOSKELETONS ?



As stated by Gordan E. Moore, cofounder of the Intel corporation, the number of transistors in a microchip would double every two years so that in upcoming years the computing power would reach a point where the computing ability of the human brain will be on a normal personal computer. By 2045, most probably, we will have automated robotic systems walking among us, potentially almost seeming like a human. But hey, that's by 2045, it's 2021 now where exoskeletons are more advanced and automated robots are still being improvised day by day.

Before we delve into the topic, what are actually exoskeletons? Exoskeletons are robotic suits worn externally to help a human in various activities and work in tandem with the user to perform a task with ease.

The concept of exoskeletons has undergone many revisions and many iterations before it is what we see today. It will for sure undergo many such in its way ahead, but few iterations stand out the other.

- It all started much before mankind, thought of it by the great inventor Leonardo da Vinci around the year 1495.
- In 1890, Russian engineer Nicholas Yagin, developed it as a passive apparatus for assisting movement.

- A much different version under the name pedomotor was developed by inventor Leslie C. Kelley in 1917 which operated on steam power with artificial ligaments to supplement human power with external power.
- Only in the 1960s, mobile machines integrated with human movements began to appear co-developed by General Electric and the US Armed Forces going by the name Hardiman, increasing the power by a factor of 25. When equipped with an exoskeleton, lifting a 240 kg piano felt like lifting a 10kg dumbbell.

An exoskeleton can be either passive or active. An active exoskeleton is one where the motors and pneumatic controls are independent whereas a passive one just aids or helps the action in a very minimal way. Despite the daunting infrastructure and construction, active ones are very efficient and powerful ones. It uses a vivid range of actuators like hydraulic, pneumatic, electric, mechanical etc. and in turn, they can be utilized in multiple areas of applications like defence, healthcare, civil and rescue related fields.

Some of the main components are:

**Power source**, an IC engine powered by diesel preferably works on delivering the required power (approx. 500W). Hydrogen cells have begun replacing IC engines in upcoming prototypes as IC engines consume non-renewable energy and also create a lot of pollution.

**Frame**, usually made of inexpensive and easy-to-mold materials and are expected to be lightweight. Currently aluminium alloys are used predominantly, materials like fiberglass, carbon fiber and carbon nanotubes are fancied.



# EXOSKELETONS

[CONT.>](#)

**Air muscle**, a recently developed cutting edge technology that mimics human muscles. It is lightweight, yet powerful as it uses pneumatic activators, hydraulic cylinders & electronic servo motors.

**Joints**, though it might sound simple as an age-old component, the flexibility and freedom of rotation are very hard to achieve in practice. Spinal flexibility as seen in humans is mimicked and can only be found in a few as accurate alignment is challenging.

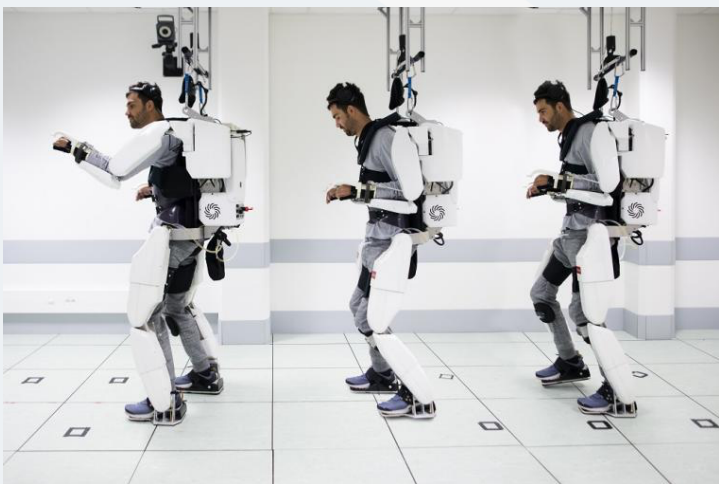
**Embedded systems**, which are required to control and coordinate all the sensors and actuators, acts as the heart of the system. Thanks to improvements in Machine Learning and Artificial Intelligence for making the suit more adaptable to the user's usage.

Any robotic system has its own degree of autonomy. Real time assistance of a human is required for robots with low degree of autonomy; the exoskeletons come under this category. A robot with medium degree of autonomy requires only the supervision of humans while a robot with high degree of autonomy can make decisions on its own and doesn't require human interventions and an example under this category would be autonomous robots. As it needs a high degree of automation, these robots demand time to learn and assess the situation, sculpting itself to be more precise and accurate meanwhile the exoskeleton requires only physical automation. The degree of automation is decided based on the application.



Even though for most of the applications researchers and developers design robots with high degree of automation, one area where exoskeleton is used immensely is to aid people who are specially abled. It has restored hope in people who have been amputated for medical reasons like tissue damage. These days, bionic legs and hands are developed that augment human walking and running. These bionic limbs sense nerve pulses and decode into intended movement patterns and work accordingly but the communication is only one way, so the microcomputers at the bionic limbs can only receive signals from the nerves but cannot send signals back to nerves. So, one cannot sense the bionic limbs back. But once this bidirectional communication is made possible, the bionic limbs would become a part of the body and mind, making people a cyborg.

Have you ever wondered if you could try one? Countries like Japan and the USA have been showing a lot of interest and have investments going into the field of exoskeletons and they are successful enough to make the world look back at them. Apart from making an appearance in MCU's Iron Man trilogy, manga and anime, these exoskeletons have a significant probability of being the present and future.



Tharunnrajah & Ashwin Ananth  
3rd Year EEE

# OVERVIEW ON EMBEDDED SYSTEMS

## TECH>

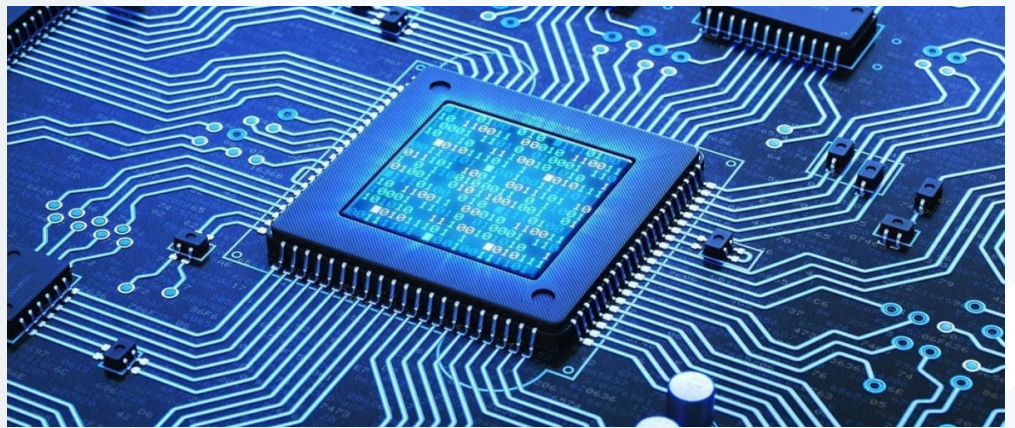
## WHAT ARE EMBEDDED SYSTEMS ?

How exactly does one define "Embedded Systems"? Google states the definition as, "A combination of a computer processor-," but you're not preparing for your exams or viva. You're just here to read something interesting. The average human doesn't want to know the intricacies in the brains of a smartphone. An engineer, however, is expected to know each and every crucial detail behind the workings of anything under the sun.

Each and every smartphone (be it Android or iPhone which has some real good computing power though) has a built in RAM, motherboard and storage integrated into a single component known as a SOC (System On a Chip). These SOC's are the best way to introduce Embedded Systems. These SOC's are designed by ARM, Qualcomm, MediaTek and Samsung (Exynos) and are fabricated by the Taiwan Semiconductor Company (TSMC) in various nanometre sizes relevant to current industry standards.



These Embedded Systems are components comprising of microcontrollers, its peripherals and its accompanying sensors (you know, the component responsible for auto rotate). A microcontroller is responsible for calculating whatever instructions that are thrown at it. The whole of the humankind has a specific set of rules to follow, likewise for the components as well. These microcontrollers follow an architecture to operate, an Instruction Set Architecture, if you will, which is designed by an architect (duh). Based on the architecture, the size of the instructions and the space taken to execute those instructions are defined. The world knows 2 different types of architecture - Harvard and Von Neumann. Harvard Architecture is seen on X86 chips used by AMD (or Intel if you're in team blue) while the latter is used in the ARM chips.



All of these components are made to work together to achieve the desired result. But, how long should an instruction execute? You see, every instruction is not the same. The same way that upma and biriyani isn't the same (Or Pulao, since there isn't a Veg Biryani). The Harvard architecture allows each instruction to take the required size while the Von Neumann architecture is like your superior who expects you to work with fixed sets or sizes. The architecture also decides whom the processor talks to - Harvard Architecture lets the processor talk to both the memory and the data while Von Neumann lets the processor to talk only with the memory (Hence, the fixed size).

That was pretty much the tip of the iceberg. Coding the neural schema, tuning the A.I and perfecting the performance of the chip is a talk for another day. Next time, ask your Google assistant for a joke. Making people laugh isn't easy in all aspects.

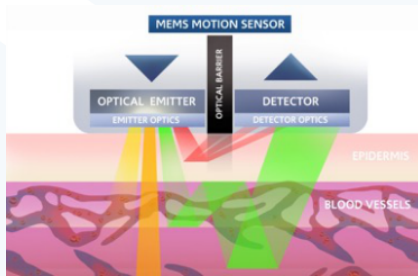


# HEART RATE SENSOR

## MEDTECH>

## WHAT IS A HEART RATE SENSOR ?

An optical heart rate sensor measures pulse waves, which are changes in the volume of a blood vessel that occur when the heart pumps blood. Pulse waves are detected by measuring the change in volume using an optical sensor and green LED. It is used for personal monitoring device that allows one to measure/display heart rate in real time or record the heart rate for later study. It is largely used to gather heart rate data while performing various types of physical exercise.



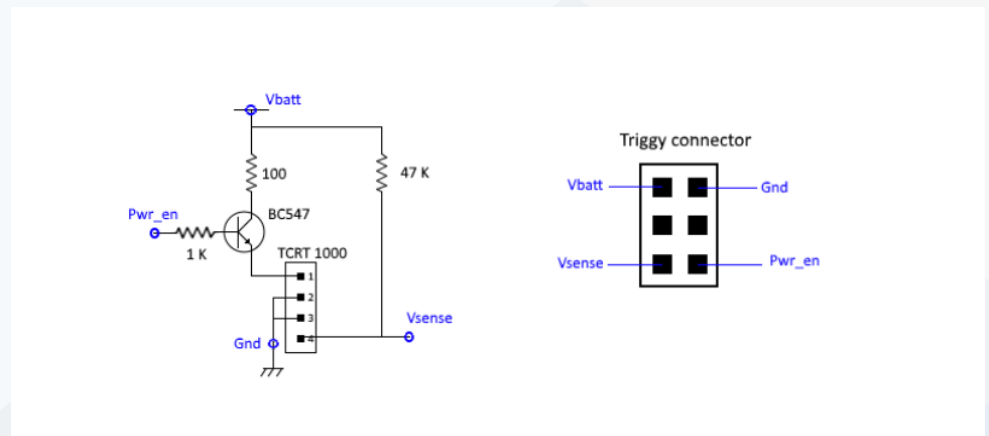
## WORKING PRINCIPLE

Pulse/heart rate is the wave of blood in the artery created by contraction of the left ventricle during a cardiac cycle. The strength or amplitude of the pulse reflects the amount of blood ejected with myocardial contraction (stroke volume). Normal pulse rate range for an adult is between 60-100 beats per minute.

## WORKING OF HEART RATE SENSOR

- Heart rate monitors work by measuring electrical signals from your heart.
- They are transmitted to a wristwatch or data centre. Many models let you analyse data via a computer and having that data allows you to interpret your workout and better understand the benefits from your exercise.

This sensor has a pair of transmitter and receiver. Using a photodiode allows it to detect reflective light from the body and this signal is sent to the microcontroller to detect heartbeat.

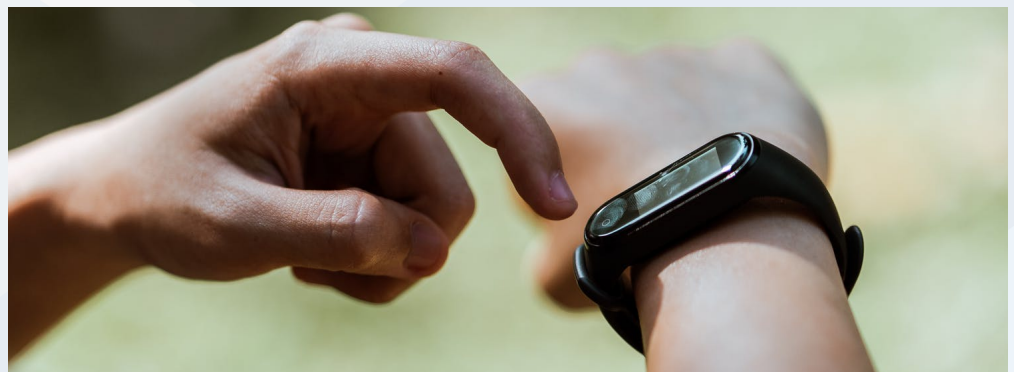


**BLOCK DIAGRAM :** (TCRT 1000 in smart watches)

Example is TCRT1000 in smart watch which is given in block diagram, having 4 pins-

1. Pin 1: To give the supply voltage to the LED
2. Pin 2 and 3 are grounded.
3. Pin 4 is the output.

Pin 1 is also the enable pin and pulling it high turns the LED on and the sensor starts working. It is embedded on a wearable device that can be worn on the wrist and the output can be sent wirelessly (through Bluetooth) to the computer for processing.





# GRADUATE RECORD EXAMINATION

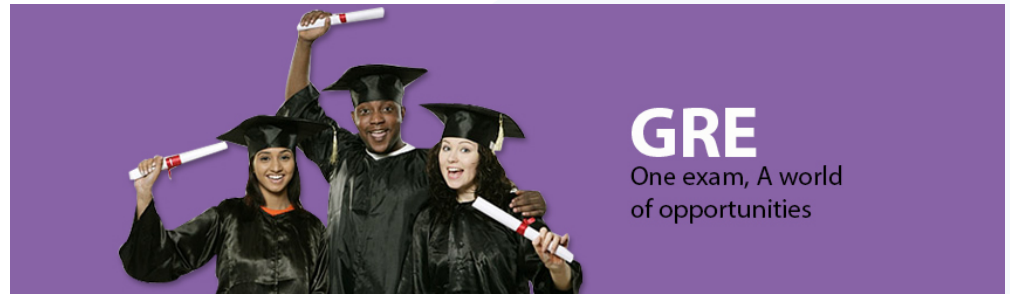
## CAREER>

### WHAT IS GRADUATE RECORD EXAMINATION ?

The Graduate Record Exam, or GRE, is taken by aspiring engineers wishing to study abroad; and is considered to be THE exam to give, in case you're aiming to go abroad to live the American dream, or any other dream for that matter. Note that while there are many colleges that also take in students without them having to write the exam, having a good score will only validate your standing amongst others who apply to the college of your preference.

We will now take a look at the steps one might want to follow if the student wishes to write the exam, as well as an appropriate timeframe within which to plan his preparation and give the exam. The exam is fairly easy, and it is up to the candidate whether to take up coaching for the exam or not.

## GRADUATE RECORD EXAMINATION OVERVIEW



### Registration

First and foremost, the candidates will need to create an ETS account. (ETS is the agency that is responsible for conducting the GRE exams throughout the world). Select the type of exam they want to take – the GRE General or GRE Subject Test. Select the date when they want to appear for the GRE Exam and find the nearest test center.

### Exam dates

The test is available in both computer and paper delivered mode. While the paper-based test only occurs on certain days of the year, the GRE computer-based format of the test happens every month. Candidates are eligible to take the GRE General Test once in 21 days and up to five time-continue in a rolling 12-month period (365 days). There are no fixed official GRE dates and you can choose any date according to your convenience and availability. The exam date that you choose should be at least two months before your first application deadline. The application deadline is also to be kept in mind before booking their GRE test slot.

### Giving the exam

The applicants should make sure that their scores reach the college/university before the deadline. It is advised to take the required standardized tests by October or November of the year before the Fall semester. If you are applying for the Spring semester, take the tests before June of the previous year.

### Scores/results

The GRE test scores will be available in your account on the GRE website 10-15 days after your test date. Once received, the scores can be sent to your selected colleges and universities. The GRE score is valid for a period of five years from the day of the exam.

### Academics/ application process

The academic semester usually starts in early September and goes on till the end of May. The academic year can either be started in September and finished by December (Fall Semester) or started in January and finished by May (Spring Semester).

The application deadlines are in December for the Fall semester and October for Spring semester. Applications are generally accepted between December and January at most US universities.

# TECHNOLOGY

# WIRELESS ELECTRICITY

FUTURE>

## INTRODUCTION

Imagine placing your laptop on a table and it gets charged. Or the new version of your gadget that doesn't need any cables to charge batteries. Sounds too good to be true, right? These scenarios are possible by wireless power transfer. You may think that, on paper it may sound good, but it's actually being done in practice. WiTricity develops wireless charging technology that has a capability to charge multiple devices at a time and over the distance.

This idea is not actually new. Wireless energy transfer has already been experimented by Nikola Tesla. As it was radioactive, most of the power was wasted and the idea didn't work out. In 2007, a team from Massachusetts Institute of Technology which was led by professor Marine Soijacic experimentally demonstrated a step towards accomplishing Nikola Tesla's dream. They succeeded in lighting up a 60W bulb without wires from a power source kept at a distance of 2 meters. The setup to light the bulb wirelessly could transfer energy with 40% efficiency.

## WITRICITY'S TECHNOLOGY



WiTricity's technology is based on the magnetic resonance concept. When there are two objects (source and the device) of same resonating frequency, they exchange energy without having any effect on surrounding objects.

The major advantage is that the source doesn't have to be in direct contact with the device. The transfer occurs efficiently even with the humans and walls in between source and device. Regarding safety, WiTricity's non-radiative power transfer works on magnetic fields and is 100% safe in nature. WiTricity interacts very weakly with the human body. To make sure the temperature and magnetic field would meet regulations, the team did many more simulations and confirmed that results were within the GCC safety Guidelines.



Companies such as Toyota, Thoratec have already licensed the technology for use in hybrid-electric vehicles, smartphones, wearable electronics, and heart pumps. Another board, Intel, has licensed WiTricity's wireless desktop system. They are also trying to draw power from nano paints (on exteriors of a house) that become active with sunlight. WiTricity could help to cut down those fat electricity bills.

WiTricity can make our lives much more convenient. Most importantly this technology charges your gadgets without even thinking about it. You place your gadget on a table and it gets charged. Imagine your life without electric wires, there will be no electric shocks, even all the remote areas will access the electricity. The entire world can change unimaginably and has a good probability to become the future.

# ELECTRONIC RANGE SENSOR

## TECH&gt;

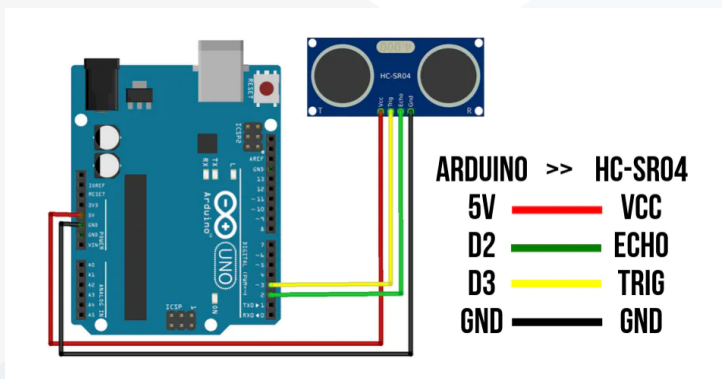
## Components used:

Arduino UNO, Ultrasonic sensor (HC-SR04), Jumper wires, Breadboard.

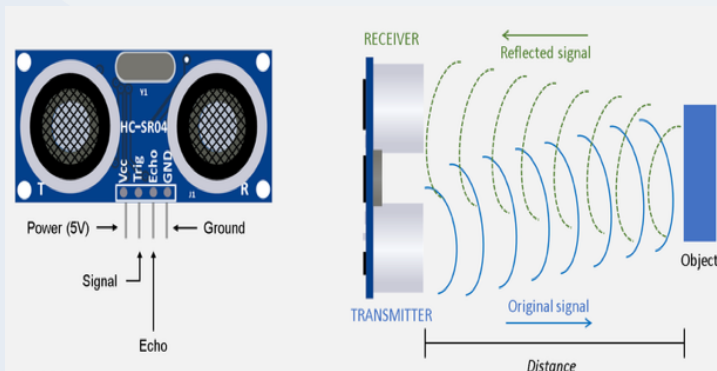
## Software used:

Arduino IDE (Language - C)

## Circuit Diagram:

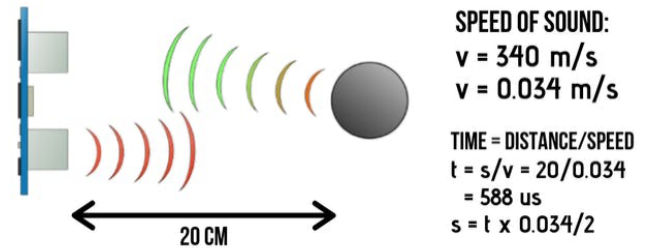


## About the sensor:



Ultrasonic Sensor measures distance. It emits a 40kHz ultrasonic wave which gets reflected to the sensor upon contact with an object or obstacle on its path. Considering the travel time of the wave and the constant speed of sound in a particular medium, the distance can be calculated.

The Trigger Pin is an output pin. The Echo Pin is an input pin which the Arduino reads and obtains the desired values. The Echo Pin outputs the time that the sound wave travelled in microseconds.



## About the code and working:

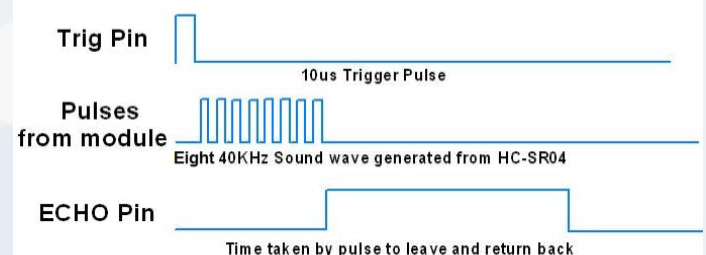
Set trigPin to LOW state for 2  $\mu\text{s}$  to ensure that it's empty. Next, set the trigPin on HIGH state for 10  $\mu\text{s}$  to generate the ultrasonic wave. Using pulseIn() function read the travel time and store it in the variable "duration".

This function has 2 parameters:

1. Variable name of the Echo Pin
2. State of the pin (HIGH or LOW)

HIGH means the function will wait for the pin to go HIGH caused by the bounced sound wave and starts timing. The pin goes LOW when the sound wave ends, then the timing is stopped. The function returns the length of the pulse in microseconds. To get the distance, we will multiply the duration by 0.034 and divide it by 2 as what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. We print the value of the distance we calculate on the Serial Monitor.

## Ultrasonic HC-SR04 module Timing Diagram



## Source Code:

<https://github.com/ssshivashanker/Electronic-Range-Sensor.git>



# VIRTUAL CRYPTOCURRENCY

## TRENDING>

## WHAT IS CRYPTOCURRENCY ?

It all started with Elon Musk stating it as "probably a good thing," driven by curiosity, people started to explore the world of cryptocurrency. But it all began before the founder of Tesla came into the picture, when Satoshi Nakamoto, credited as the founder of cryptocurrency, published a paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System," in 2009.

Cryptocurrency is a form of digital currency which is secured with the help of cryptography. They are maintained with the help of decentralized online ledgers which are built using blockchain technology. While the start was provided by Bitcoin in 2009, new competitors started to emerge in 2011 and today, we have more than ten thousand types of digital currencies with most of them following the guidelines with which Bitcoin was established. The most famous types of cryptocurrencies are Bitcoin, Ethereum, Tether, Dogecoin and Polkadot. Each and every cryptocurrency available is designed with a new function building up on the existing ones, like Ethereum has a programmable blockchain while Polkadot operates with two blockchain networks and so on.



Bitcoin being the first cryptocurrency has the largest market followed by Ethereum, which is known as digital silver. Bitcoin works through majority agreement rather than trust, here, everyone follows the same rules and thereby leading to the trust factor getting neglected and hence being known as a trust-less system. The absence of regulations in the world of cryptocurrency makes it more prone to scams and cybercrimes. Cryptocurrency is backed by a decentralized system of networks and the transactions that are carried out are unspecified when compared to the transparency of credit cards and since they are not backed by any governing body, the risks involved in terms of security are high. While cryptocurrency removes the intermediaries and improves the cost efficiency, it does not provide the price stability of the traditional system.

The birth of Bitcoin was considered as the foundation for a revolution in the finance system. Traditional currency is administered and managed by government recognised financial entities like banks. One of the main goals of cryptocurrency is to cut these intermediaries out of the system. Without these intermediaries, users have greater control over their finances in cryptocurrency. Also, cryptocurrencies offer more efficient transactions when compared to the traditional systems, although the traditional system is more user friendly. The last two years have been big for cryptocurrencies, but what does the future hold?

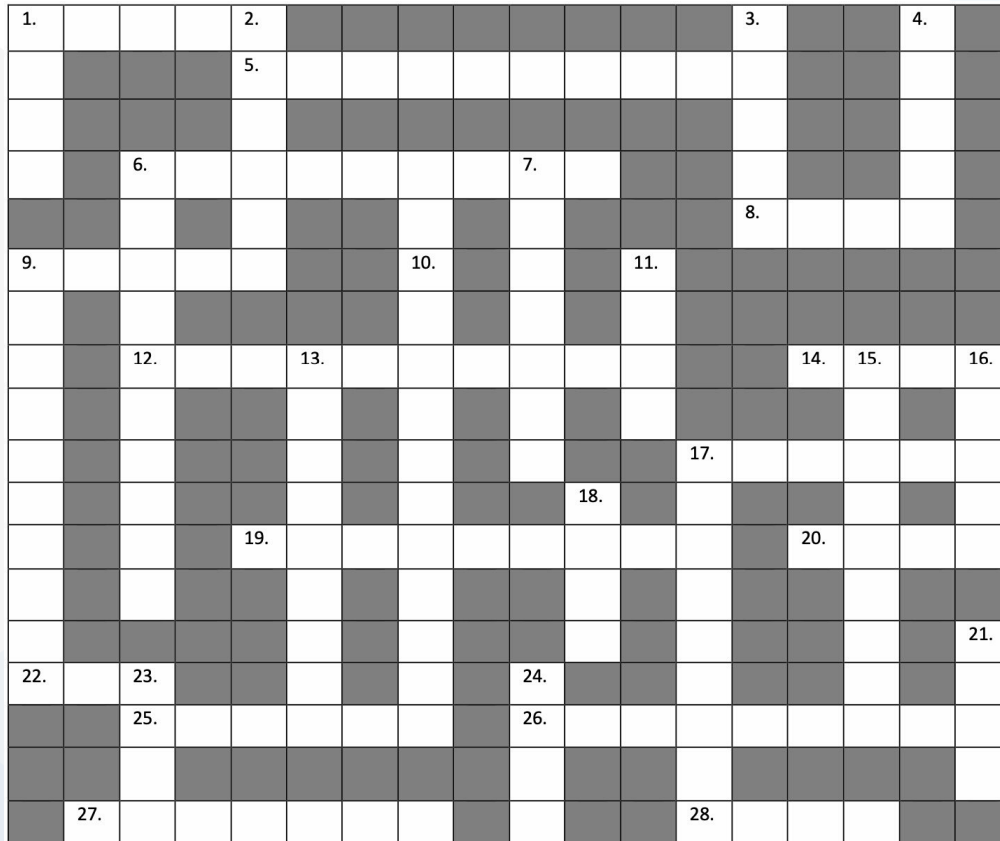


This market is just born and is currently evolving, it is too early to determine the future of the system based on the recent developments. Steps are now being taken to form regulations for the transactions and bring the cryptocurrencies into an institutional governance. Cryptocurrency is a risky commitment; it is a system where one should be prepared to lose what he invests and therefore should always stick on to the traditional system for long term investments. Cryptocurrency is a solid opportunity, but it should always be remembered that a computer crash can erase the entire digital wealth of the people.



# BRAIN-TEASER CROSSWORD

## PUZZLE>



### DOWN

1. related to mouth
2. a doughnut shaped construct made of circularly wound coils
3. two carbon atoms linked to an oxygen atom
4. to cancel a test
6. the ability of an object or material to resume its normal shape after being stretched or compressed; Stretchiness
7. a branch of chemistry
9. an optical instrument used for viewing distant objects
10. relating to projectiles or their flight
11. an organic compound
13. the combination of apparatus for producing a single electrical effect

### ACROSS

1. a planet's path
5. a doctor who treats cancer
6. the process of biological development of species
8. corrosion of a metal
9. this word is a suffix to circuitry devices
12. violent or uneven movement of fluids
14. relating to cultivation of plants
17. a kinetic projectile
19. relating to or arising from the work of Sir Isaac Newton
20. bile obtained from an animal
22. subscriber identity module
25. to light on fire
26. father of a very important table used worldwide for science
27. the quantity expressing the magnitude of internal friction in a fluid, as measured by the force per unit area resisting uniform flow (adjective)
28. a form of energy

15. to cover [steel or iron] with a layer of a certain element to prevent it from rusting
16. an American multinational corporation and technology company which is the world's largest semiconductor chip manufacturer by revenue
17. a measurement of the amount of data that can be transferred from one point to another within a network in a specific amount of time
18. the metal
21. a disturbance in a medium that carries energy without a net movement of particles
23. musical instrument digital interface
24. to produce and discharge

## KNOW YOUR FACTS

# DID YOU KNOW?

### FACTS>

Lightning is a discharge of electricity in the atmosphere. Lightning bolts can travel at around 130,000 miles per hour and reach nearly 54,000 °F in temperature & unleashes five times more heat than the sun.

Enough sunlight reaches the earth's surface each minute to satisfy the world's energy demands for an entire year.

The term electricity comes from the Greek word "elektron", which means amber. This is a reference to the experiments performed by Thales on pieces of amber, resulting in the discovery of static electricity.

In the 1880s, there was a "war of currents" between Nikola Tesla and Thomas Edison. Tesla helped invent AC current and Edison helped invent DC current, and both wanted their currents to be popularized. AC won the battle because it's safer and can be used over longer distances.

Although electricity is neither a renewable nor non-renewable source of energy, it often comes from both renewable and non-renewable sources.

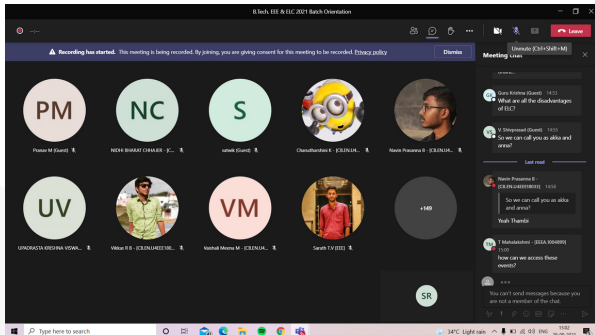
Contrary to popular belief, Thomas Edison did not invent the first light bulb. But he did invent a bulb that stayed lit longer than a few seconds, along with 2,000 or so other electricity-related products – from fuses to sockets to switches – that we still use to power households today.

Google processes around 3.5 billion searches per day, or around 40,000 every second. While it takes a matter of seconds to type a query and press enter, conducting 10 Google searches chews through enough energy to power a 60-watt lightbulb.

While concern about exposure to radiation is valid, some research shows that you will get more radiation over your lifetime from being around personal electronics than from being near a nuclear power plant.

In the average home, 75% of the electricity used to power electronics is consumed while the products are turned off (on standby).

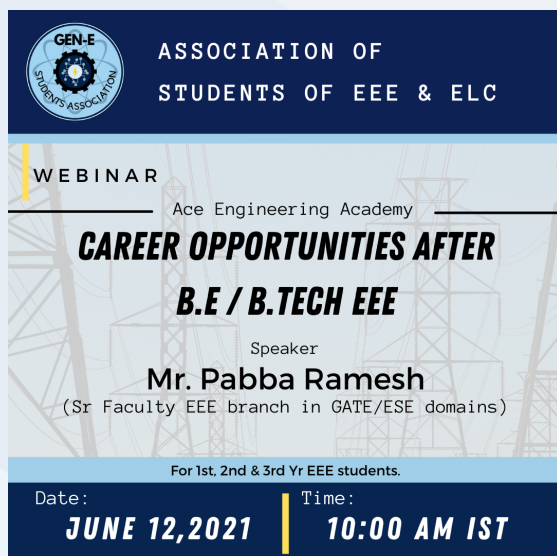
# EVENTS UNDER GEN-E



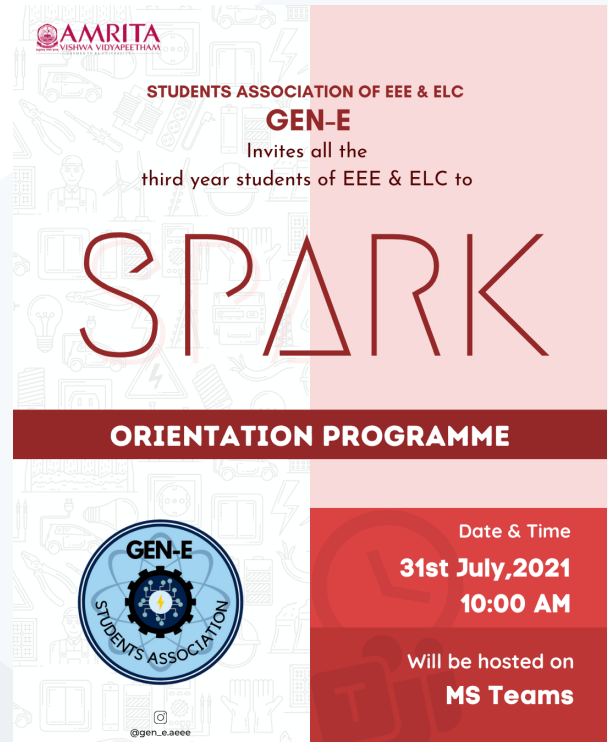
B.Tech 2021 EEE & ELC Orientation



Seminar:  
Current trends in Embedded Automotives



Webinar:  
Career Opportunities after B.Tech EEE



Spark Induction



Workshop : Placements 101




# ARCHIVES


# EVENTS UNDER GEN-E

**MAKING THE MOST OUT OF YOUR B.TECH AND MS**


PLUG-IN - A EEE Fraternity Alumni Talk series



**Surya Murugalan**  
CB.EN.U413160  
Graduate student - AI and ML  
University of Waterloo  
Canada




**Kuralamudhan Arutselvan**  
CB.EN.U411124  
Sr. Automation Engineer  
XPO Logistics  
USA



**Vikhash Karthik**  
CB.EN.U414055  
Project Engineer  
SEL  
USA

**Venue:** At the comfort of your home  
**Time:** 7 30 – 8 30 PM IST, August 30  
**Attendees:** All students/Alumni of Amrita are welcome!

Plug In - 1



presents

## OPEN HOUSE

*Discuss the Ideas, not to win but to Progress*

**Exclusively for 3rd years**

**14.08.2021**  
@  
**5 - 6 pm**

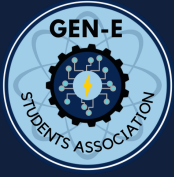


Open House - 1

## GEN-E RENDEZVOUS >







# OUR MENTORS



**Dr. Balamurugan S**  
*Chairperson & Professor*



**Dr. Jayabarathi R**  
*Vice-Chairperson & Associate Professor*



**Krishna Prakash N**  
*Assistant Professor*



**Sarath T V**  
*Assistant Professor*

Our mentors have guided us through everything from the beginning. Their support and guidance makes everything possible.

CORE TEAM

# OFFICE-BEARERS

---



**Swetha R**  
PRESIDENT



**Krishna Viswas**  
VICE PRESIDENT



**Malavika K**  
TREASURER



**Gowtami Ramesh**  
SECRETARY



**Vaishali Meena M**  
JOINT SECRETARY



**Navin Prasanna B**  
JOINT SECRETARY



**Gnana Krithik S**  
JOINT SECRETARY



**Hari Raghav R**  
LEAD EXECUTIVE



CORE TEAM

# OFFICE-BEARERS

---



**Vikkas RB**  
EXECUTIVE



**Charu Dharshini K**  
EXECUTIVE



**K Neethika**  
EXECUTIVE



**Nidhi B. Chhajer**  
EXECUTIVE



**Vijayaraja T**  
EXECUTIVE



**Sri Ram Gupta M**  
EXECUTIVE



**Lakshmi Sai Jahnvi S**  
EXECUTIVE

MAGAZINE TEAM

# OUR TEAM

## CONTENT



Vaishali Meena M



Nishanth

Hari Krishna J



Saktivel



Sneha Arunkumar



Nitesh

S S Shivashanker



Navya Santoshi



Tharunnrajah



Nawin Balajee

Ashwin Ananth



Gunalan



Aswin Venkatesh



Gowtham C Dev

Pranav Balasundaram



Adithya H



## DESIGN



Sri Ram Gupta M



Adithya Krishnan

Hari Raghav R



Dhpathi



Hardesh



Gokul

Aadhith



Deepak Sai P

