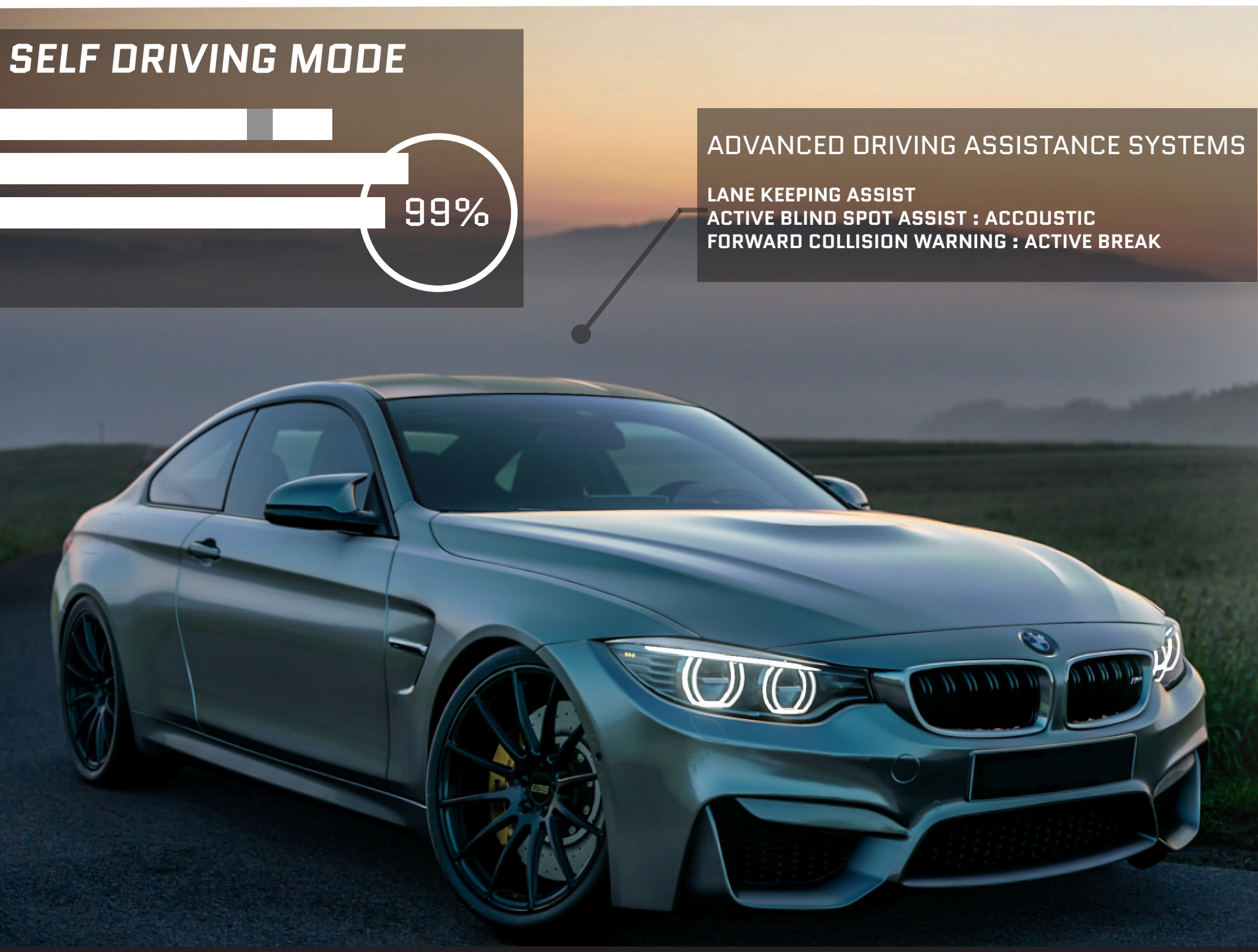
MECHANICAL DEPARTMENT PRESENTS

MECHON

EDITION 4
ISSUE 2 & 3



AUTOMATION IN AUTOMOBILES

MESSAGE BY DIRECTOR OF IQAC

DR. R.R.SEDAMKAR

It is a moment of pride for me to announce the release of ‘MECHON’ magazine’s seventh issue. The magazine portrays the writer’s intellect and enables them to share their innovative ideas. I gladly acknowledge the efforts taken by the students and staff of Mechanical Department who have taken the initiative to promote the writing and publishing skills of students. I’m sure the magazine has helped the students to share and express their thoughts in an articulate manner.

Achievements of students have also been mentioned which will be a motivational factor for other students to achieve the standard of excellence. I am immensely pleased to say that that we have achieved our aim of turning this into reality. I would like to congratulate the students, teachers, alumni and everyone else involved in publishing its seventh edition. I wish everyone loads of success and a bright future.

MESSAGE BY MENTOR

DR. SANJAY KUMAR

I feel esteemed to be a part of the seventh issue of the e-magazine of the Mechanical Engineering Department. With Number of batches passed-out, the Department has shown great potential. Our students have shown tremendous potential not only in academics but also in co-curricular activities and extracurricular activities.

At the International conference, faculties and students have published technical papers in International journals. Some of the papers were also published in Tata McGraw Hill Publication. For the overall personality development of students, apart from academics, participation in co-curricular and extra-curricular activities is the need of the hour. Students are encouraged to participate in National level competitions,and have won 1st prize at hackathon. All these activities help in their holistic development, as a result of which they get admitted into reputed universities and get placed in prestigious companies. I commend all faculties, students and staff members for their hard work in publishing the e-magazine, which represents the insights of the Mechanical Department. I wish them Best of Luck !

MESSAGE BY HEAD OF DEPARTMENT

DR. SIDDHESH SIDAPPA

I am delighted to know that our students have succeeded in publishing the seventh issue of ‘MECHON’ for the academic year 2020-2021. ‘MECHON’ the departmental magazine has the prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down their illustrative and innovative ideas.

This magazine is intended to bring out the hidden literary talents in the students an teachers to inculcate strong technical skills among them. I congratulate and thank all the students and faculty coordinators who have made untiring efforts to bring out this magazine. I wish them all the very best for releasing more such magazines in the future.

MESSAGE BY FACULTY IN-CHARGE

MR. PAWAN TIWARI

It gives me immense pleasure to present the seventh issue of ‘MECHON’ e-magazine of the Department of Mechanical Engineering. It is the talent and outlook of our students which is portrayed through this magazine. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas. It also enables the students to be aware of their changing surroundings and to consistently learn about new technologies.

I take this opportunity to thank our respected Principal Dr. B. K. Mishra, Director of IQAC Dr. R. R. Sedamkar, Mentor Dr. Sanjay Kumar, Head of Department Dr. Siddesh Siddapa, and all the faculty members for their perpetual inspiration and kind support. I believe that this edition will prove to be a success. I express my heartfelt gratitude to the editorial committee for their relentless efforts, the young writers for their valuable articles and all those who have been a part of ‘MECHON’

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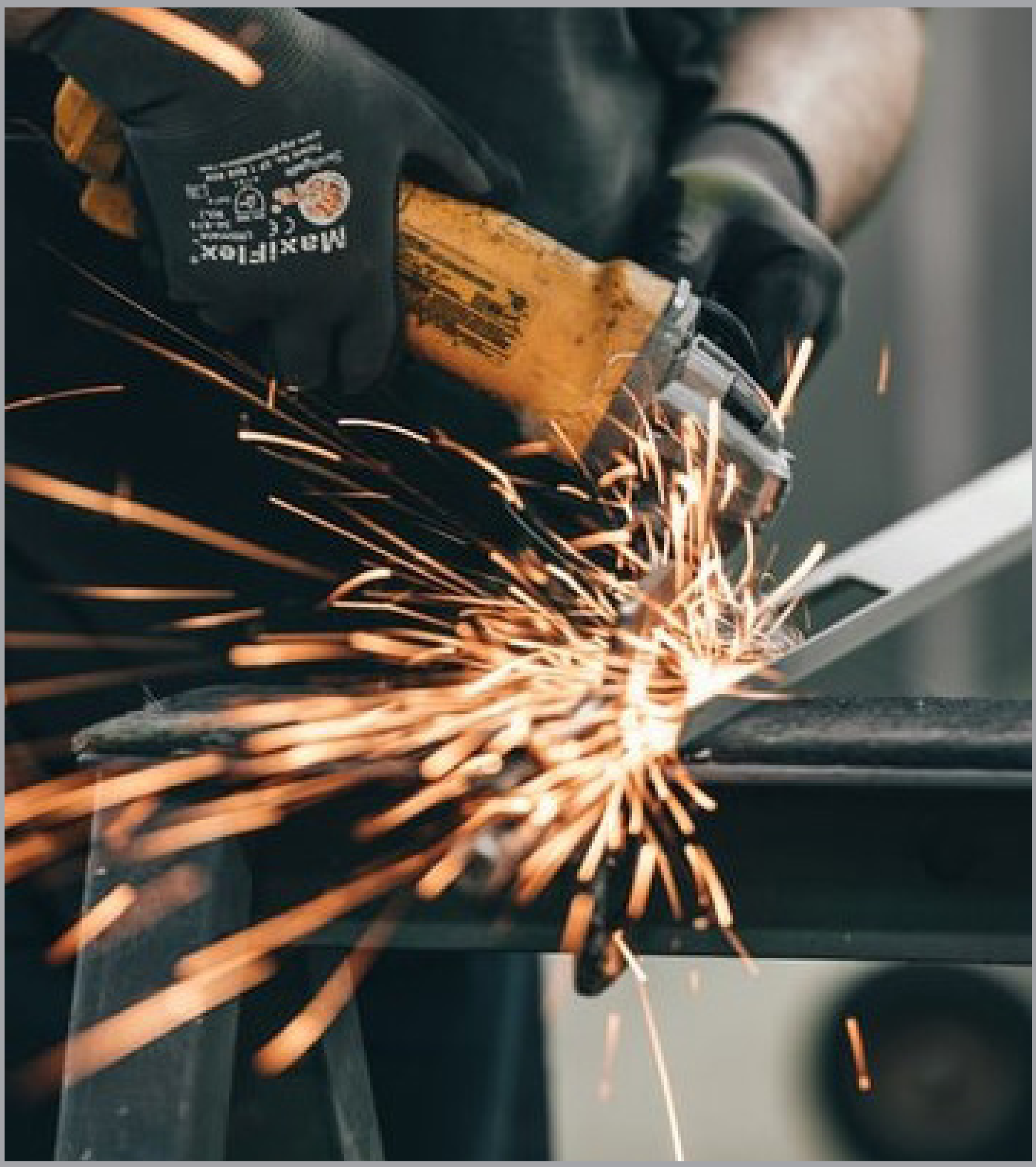


AUTONOMOUS VEHICLES: THE FUTURE OF INDIAN AUTOMOBILES

Introduction:

Over the past decade or more, advances in the automotive and technology sectors have expanded the potential for computerized automation of the driving task. Multinational companies, such as Apple, Google, and Uber, have begun research and development of autonomous vehicles (AVs). AVs have onboard computers, rather than occupants, managing all vehicle movements. AVs may take off with a revolution in the transportation sector on a huge scale across various nations and continents. World has witnessed a rapid advancement in autonomous technology integrated with artificial intelligence based approaches which has further boosted self-driving vehicles to arrive at the forefront of public interest.

Autonomous Vehicle:

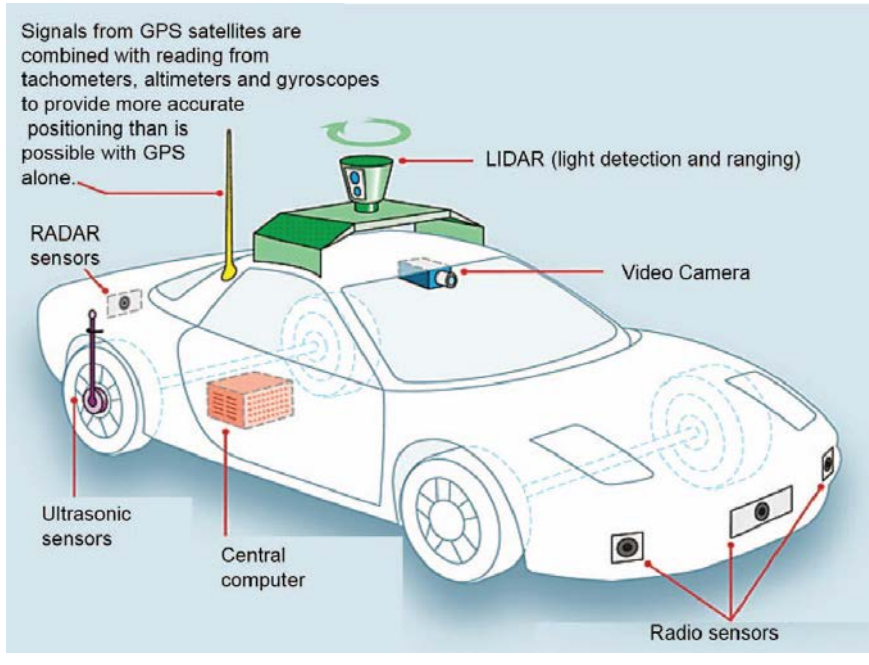
A fully autonomous vehicle can be defined as a car which is able to perceive its environment, decide which route to take to its destination, and drive it. In other words we can say Autonomous cars are the future smart cars anticipated to be driver less, efficient and crash avoiding ideal urban cars of the future. To reach this goal automakers have started working in this area to realize the potential and solve the challenges currently in this area to reach the expected outcome. AVs have gained importance since the 2010s when several countries allowed the use of these vehicles in road traffic. Various car manufacturers like Nvidia, Audi, Ford, BMW and Volvo would be launching high level automated vehicles or even Level 4 AVs by 2021 (Liljamo, Liimatainen & Pöllänen, 2018). In recent times, the manufacturing of Autonomous Vehicles (AV's) have made a huge progress as several automotive players, and tech giants are investing huge capital on it.

Objectives of Autonomous Vehicles:

The main objectives of an autonomous vehicle are:

(a) Perception
(b) Motion Planning
(c) Navigation
(d) Behaviour

(a) Perception: It is the ability of the vehicle to understand its immediate environment. This will help the vehicle to avoid collision between vehicles and also to keep a check on any kind of obstacles which may come in the vehicle path. Nowadays there are many electronic devices



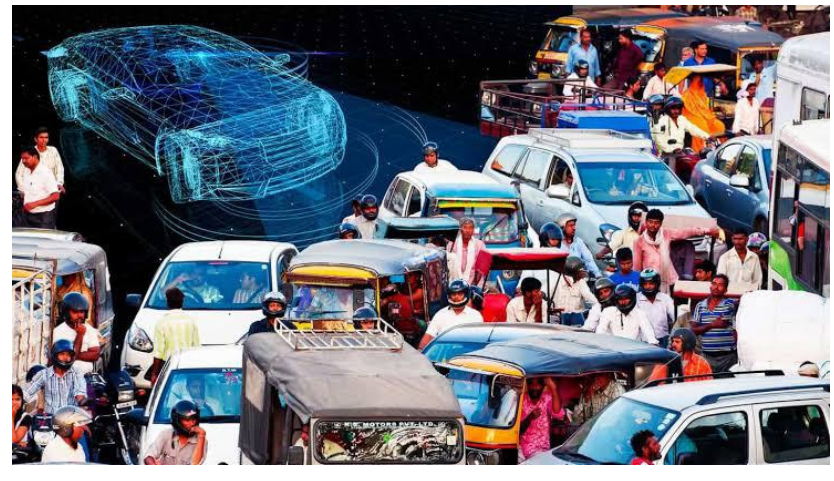
available in the market which can be used for this purpose. LiDAR, RADAR, GPS to name a few. Light Detection and Ranging, or LiDAR, systems determine obstacles by using laser range finders which emit light beams and calculate the time of flight until a reflection is returned by objects in the environment. The other common device used in autonomous vehicles for perception is mono vision cameras.

(b) Motion Planning: Motion planning involves performing low level operations towards achieving high level goals. It's very complex to plan the path of an autonomous vehicle in a dynamic environment, especially when the vehicle is required to utilize its full capabilities. Motion planning consist of path variables Steering (direction), Speed which are to be controlled to avoid any kind of mishap.

(c) Navigation: Vehicles also use sensor suites for localization, i.e. determining their own position in the world. The use of global positioning systems (GPS) is essential for localization. To triangulate their global coordinates, vehicle GPS systems receive signals from orbiting satellites. (d) Behavior: Once the vehicle has perceived its environment, completed the motion planning and navigated the route, it's time to act. So on the basis of all detailed parameters an autonomous vehicle takes decision. There are many challenges like Lane Analysis, over taking faced by an autonomous vehicle

Barriers to implementation of AVs in India:

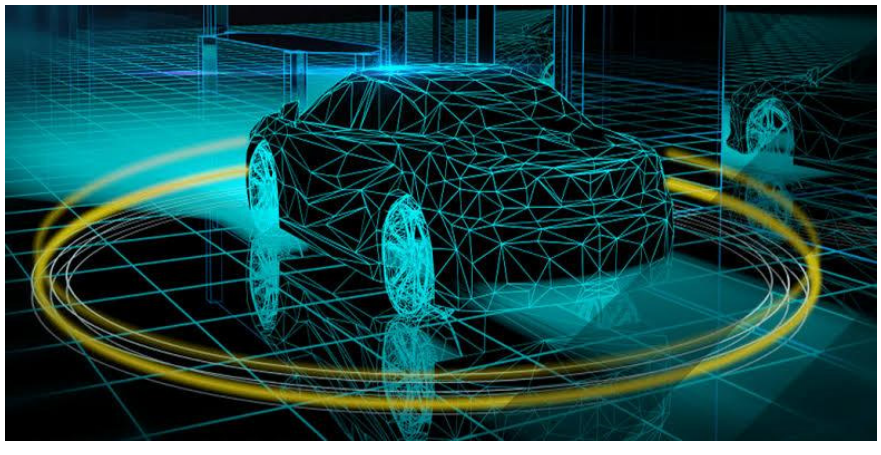
Autonomous vehicles come with lots of benefits such as reduced driver stress, mobility for non-drivers, increased safety, increased fuel efficiency and reduced pollution to name a few. But still there will be many challenges which will act as barriers in implementation of this technology. Some of the major challenges are: Cost, Technology challenges, Removal of old cars, Unemployment issue, Security & Privacy concern, Standards & Regulation. That's why major foreign automotive players do not see India as a favourable market for AV's. Another key obstruction in the country for AV's are poor roads and transport infrastructures that lead to most of the road accidents. Indian vehicle rules will also be a challenge for AV's as the Indian Motor Vehicles Act, 1988 does not currently allow fully



automated systems in the country. So, before automated vehicles become a common sight on Indian roads, the automotive players and the lawmakers should adapt to address the multifaceted regulatory, legal and privacy issues that AV's will pose. There are several barriers that AV's face. Vehicle costs, AV certification, Litigation, liability and perception electronic security Privacy.

Opportunity for AVs in India:

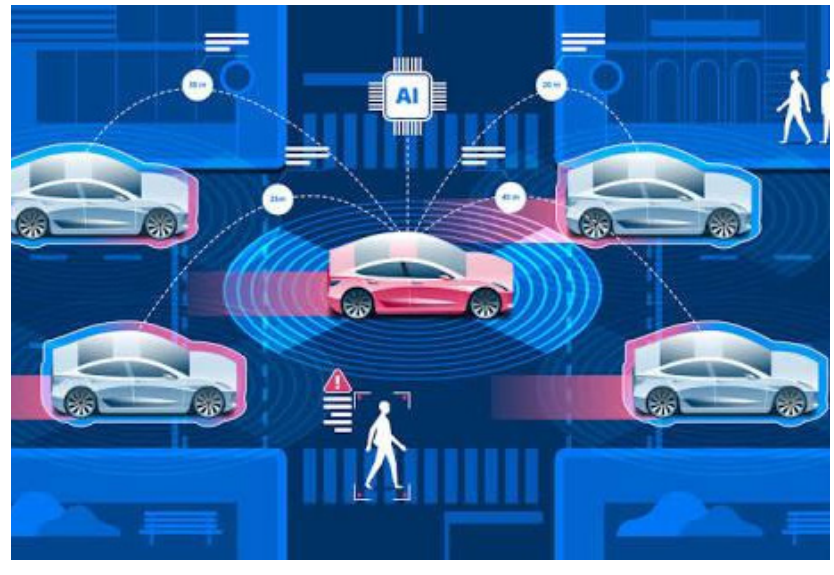
This year, Mountain View, CA-based company Intel selected India for its automated driving solutions, starting to collect data on traffic patterns, roadside behavior and infrastructure conditions in the country. To create algorithms that could be used in India to promote automated driving, the company is planning to utilize the data collected. However, autonomous mobility will probably mean robotic tractors rather than robotic cars. This is because Escorts, a tractor company is already developing level-2 autonomous technology, providing tractors with the ability to auto-steer and leverage geo-fencing through the global positioning system (GPS), the first prototype of which was introduced in the mid of this year. On the other hand, in April last year, Mahindra also showcased a semi-autonomous tractor and came up with plans for a fully-autonomous vehicle in the coming years.

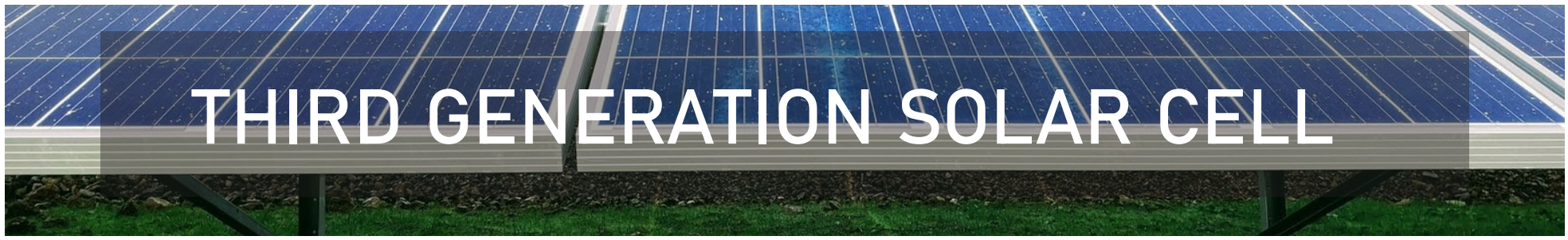


Conclusions:

There seems to be a lot of potential for autonomous vehicles be it transport or research. This technology will be very handy in solving many traffic related problems such as parking and traffic congestion, accidents by considerably reducing the travel stress. For military purpose autonomous vehicles can be a boon. It can considerably reduce the casualty, can play a vital role in search operations, clearing mines and providing supplies to troops. With increase in electronics and computerization of vehicles there is more concern of cyber-attacks. If the vehicles are lost from the grid or connection is lost with the controller, there must be safe plans that could be used. Keeping the high cost of sensors and equipment used in Autonomous vehicles, more research should be done to introduce new technologies by which this cost can be brought down. This can also be a big challenge.

- Mr.Rajeshwar S.Deshmukh
Dy. HOD/ AP
Mechanical Department





THIRD GENERATION SOLAR CELL

The amount of energy supplied to the earth in one day by the sun, is sufficient to power the total energy needs of the earth for one year. Solar energy harvesting is one of the promising solutions of future energy crises generated due shortage of fossil fuel and petroleum. Escalating penetration of Solar energy owing to environmental benefits coupled with increasing electricity demand is expected to propel market growth. Technological innovations related to lowering production cost and to improve performance efficiency is expected to propel demand. PV solar modules cost $96 per watt in the mid-1970s improvements reduced production cost to under $1 per watt.

A solar cell, or photovoltaic cell, is an electrical device that transforms light energy to electricity directly by the photovoltaic effect. It is a physical and chemical phenomenon. At present, crystalline silicon (Si) is a representative solar cell material, accounting for the highest share of over various types of solar panels, now the massive shift towards the third-generation solar cell specially “Perovskite Solar cell”.

First generation solar cell includes single and polycrystalline silicon material with conversion efficiency around 10 to 20%

Second generation solar cell using less material (Thin film) while maintaining the same efficiency as first generation. These cells are less expensive and an easy manufacturing process. Cadmium telluride(CdTe) cells can be made very thin and have achieved 22% efficiencies in lab cells. cadmium telluride(CdTe) cells are currently the largest non-silicon market share. Copper, indium, gallium, diselenide usually referred to by the acronym CIGS cells are projected to be better

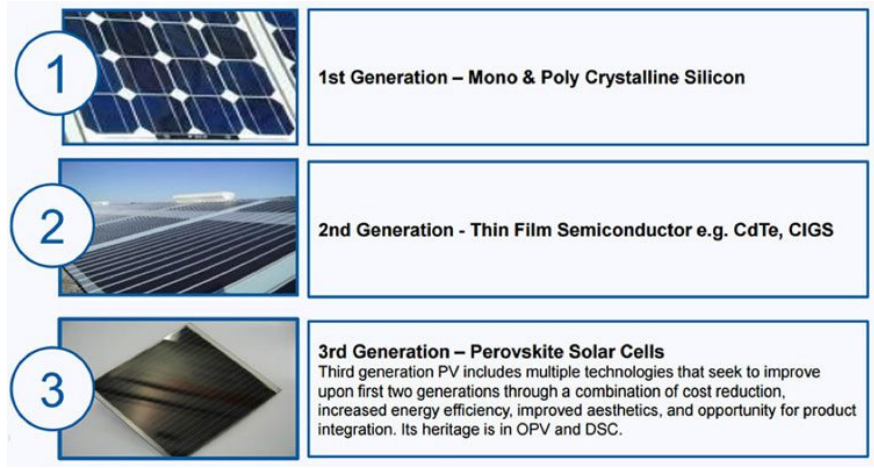
Comparison of Perovskite solar cells

Characteristics	CdTe	CIGS	Crystalline – Si	Perovskite
Raw material cost	Low	Medium	Low	Low
Finished material cost	Low	High	High	Low
Fabrication cost	Medium	Medium	High	Low
Energy payback period	Medium	High	High	Low
Levelized cost of energy (LCOE)	Medium	High	High	Low
Efficiency	Medium	Medium	High	High

in cloudy conditions and have achieved a maximum efficiency of 22% in a lab setting.

Third generation solar cell having excellent potential for large scale solar electricity generation. These solar cells are usually small molecules like quantum dots/wires, quantum wells or super lattice technologies. Third generation solar cell technologies are at the research & precommercial stage. This includes a range of alternatives to cells made of semiconducting p-n junctions ("first generation") and thin film cells ("second generation"). A typical organic photovoltaic (OPV) device consists of one or several photoactive materials sandwiched between two electrodes.

Perovskite solar cells have shown outstanding progress in recent years with rapid increases in conversion efficiencies, from reports of about 3% in 2006 to over 25% in 2020. While perovskite solar cells have become highly efficient in a very short time, a few challenges like stability and environmental compatibility remain before they can become a competitive commercial technology. Perovskite materials have excellent properties of light absorption, charge-carrier mobilities, and lifetimes, resulting in high device efficiencies with chances to realize a low-cost, industry-scalable technology. These cells are derived from ABX3 crystal structure of the absorber materials most used are hybrid organic- inorganic metal halide-based materials, as light harvesting active layer. The most commonly perovskite absorber is methylammonium lead trihalide (CH3NH3PbX3, where X is a halogen ion such as iodide, bromide or chloride), with an optical bandgap between ~1.55 and 2.3 eV depending on the halide content. In another recent development, solar cells based on transition metal oxide perovskites and heterostructures thereof such as LaVO3/SrTiO3 are studied.



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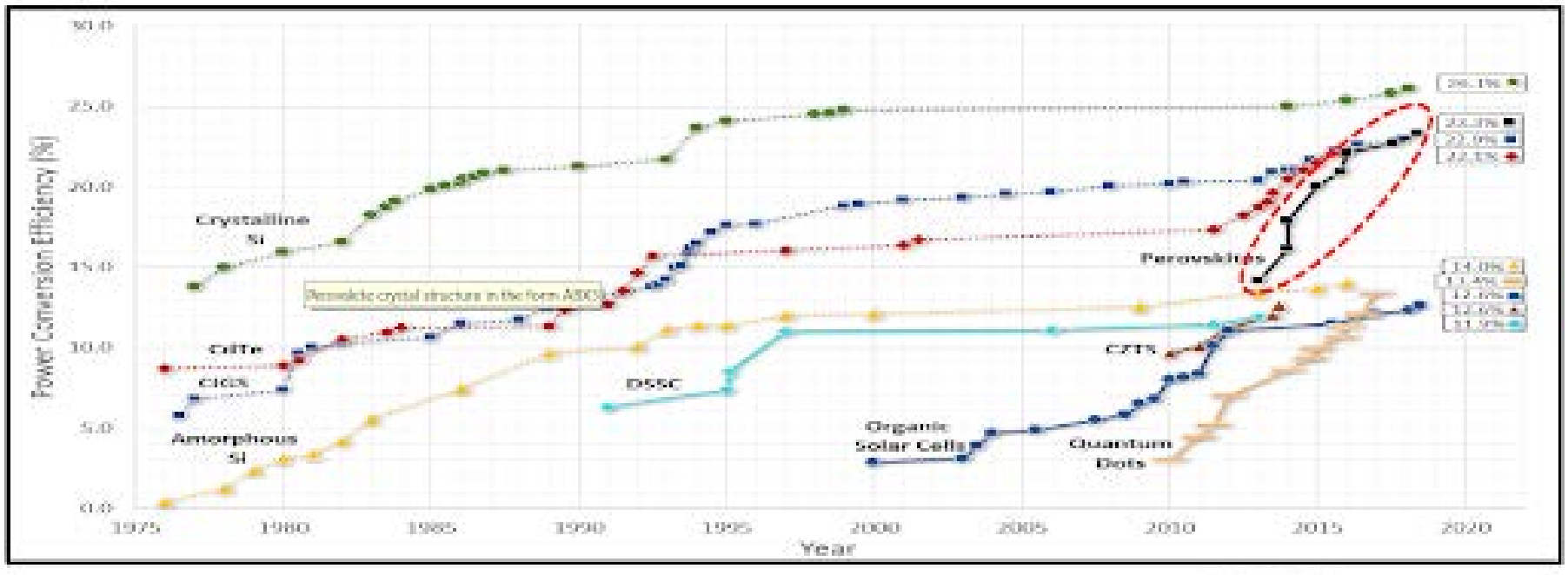
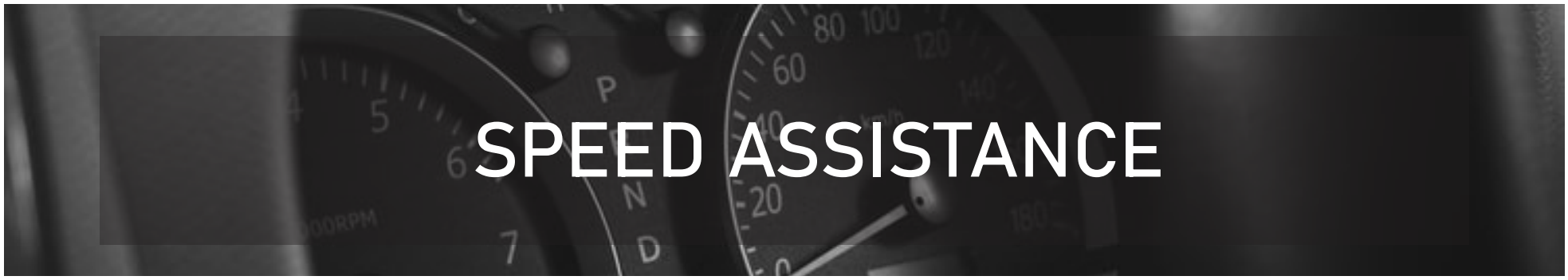


NREL, USA

AGE OF AUTOMATION



SPEED ASSISTANCE

Abstract :

The number of accidents happening in today's era is increasing day by day due to over speeding and hence, Mercedes S class, 2018 model has come up with an advanced technology which will not only tackle speed issues but also driving assistance. In this, Speed Assistance of Mercedes S Class, 2018 Model will be reviewed and an alternative idea on Speed Assistance which includes, a CCTV at traffic signals or near an area that has speed restrictions and if any car passes in front of the CCTV in high speed or crosses the speed limit it will send a signal to the car. The receiver in the car will get the signal and then it will bring the car to the normal speed.

Introduction :

Nowadays, everyone is in a hurry to finish their work and get back to their normal life. Due to this, we often forget to take safety precautions. Especially road safety for example, over speeding in an area where over speeding isn't allowed, breaking traffic rules and not using helmets which may cause accidents and sometimes may even lead to loss of life. In this what comes as a disturbing fact, 25 kids die every day in India in road accidents, if one takes into account the total accidents involving kids in India annually (2017 Figures), the number stands at a whopping 9,408. There are speed limits particularly in some areas, if that speed limit is not exceeded then we can reduce the number of accidents happening but we fail to follow the speed limits and since to overcome this issue we can use inbuilt systems in our vehicles which will take speed limit of the given area and will not allow the vehicles to go beyond that. There are some car companies working on this as using it as an inbuilt system which will regulate the speed according to the given area and notify the person driving through the driving screen which then will help in reducing the number of accidents every day and we can save more lives without taking risks.

Methodology :

To overcome these problems, many car companies decided to have this inbuilt safety system in the car itself. Using image recognition and data sourced from the navigation, the system can notify the driver of the permitted maximum speed on the selected route and it also provides information about any overtaking restrictions

and speed limit in wet conditions.

Moreover it can also spot no-entry signs, speed limits and people on a zebra crossing. Visual and audible warnings are issued, depending on the situation. As this system is already in use as 'SPEED ASSISTANCE SYSTEM' in Mercedes S class and with a reference to this there is an alternative idea which is controlling the speed of a car with the help of a Vehicles Speed Sensor (VSS).

There are some ways of communication:

LAN - LAN can be created by different communication technology like :

1- WiFi (for low range)

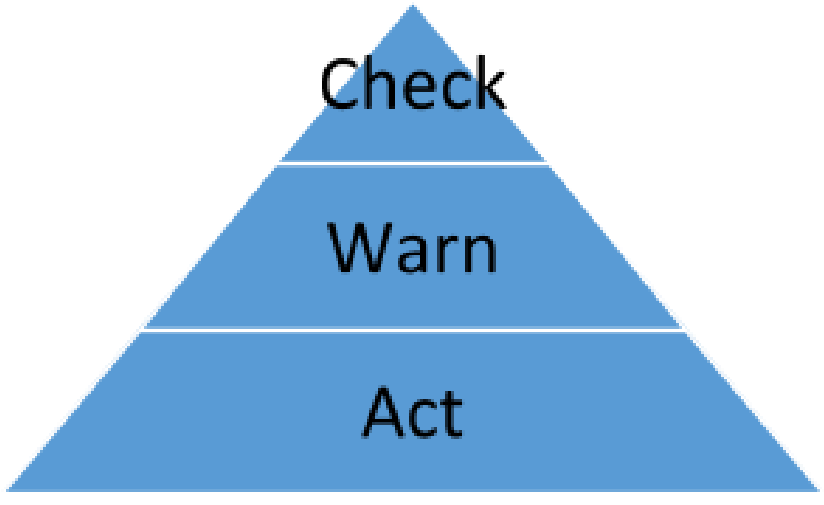
2- Lora (for high range - in Km)

Internet :

Internet access can be given to the car using GSM (Global System for Mobile communications) board. When external sensor detects the speed, it will send data to server with car's number and if any information is updated to in the server, car will get notifications about it and from that data car can be stopped using electric actuator as GSM board can receive SMS too, so it can also be done through SMS.

Working :

When a car tries to enter an area where there are speeding restrictions and tries to increase the speed, then the VSS will calculate the speed of the car and if the car exceeds the speed limit, then CCTV will detect it and send a wireless signal to the car's ECU (Electronic Control Unit) and when the signal is received by the ECU it will process the signal and take actions according to the program which is given to the system and it will also send notification to the drivers screen. The warnings will be given thrice and even after that, if the speed is not reduced by the driver the ECU will automatically reduce the speed lower than the speed limit of the area. The device will be programmed in such a way that it will not be applicable to the vehicles used in emergency services such as Ambulance, Fire brigades and other civil service vehicles because, if this system is used in the civil services vehicles it may cause difficulties in emergency situations. Using this technology, a driverless car which will run on the signals provided by the sensors and the cameras can be built, which will also include the features of Drivers Assistance.



Conclusion :

Using this technology we can reduce the number of accidents. Conclusion of the idea is to reduce the number of accidents caused by over speeding. Since maximum of our nation's youth drive vehicles without obeying traffic rules and we can save our youth which is the future generation of the nation.

- Yesha Yadav
S.E. MECH B

ELECTRONIC STABILITY PROGRAM

What is the use of Electronic Stability Program or Electronic Stability Control (ESP/ESC)?

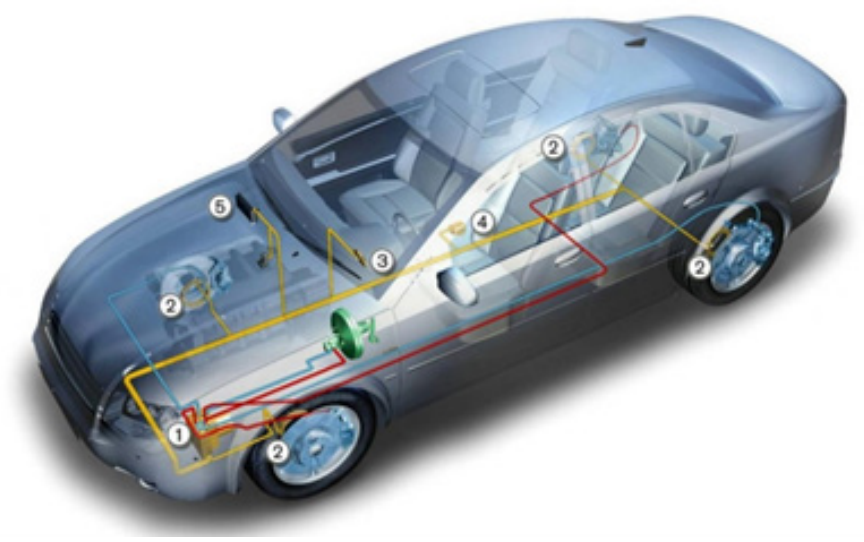
When you are driving a car at high-speed and suddenly come across an obstacle, you will be bound to take a sharp turn or apply brakes to avoid an accident. While doing so, you might lose control and skid off the road. Also, the car you are driving may roll over. So, to avoid this kind of situation, the manufacturers introduced Electronic Stability Program or Electronic Stability Control system. The term ESP stands for Electronic Stability Program while the term ESC for Electronic Stability Control. It is an intuitive safety system which can foresee driving intentions. The ESP helps the driver to maintain the course of the wheel. It does so by applying brakes to the respective wheel in action. Secondly, it can also adjust the engine performance in critical conditions. However, the main purpose of the ESP is to enhance vehicle stability. This is how ESP improves stability by eliminating the chances of skidding.

Basic Components of Electronic Stability Program or Electronic Stability Control:

1. Hydraulic Unit
2. Wheel speed sensors
3. Steering angle sensor
4. Yaw rate and lateral acceleration sensor
5. Engine Control Unit

The Working of Electronic Stability Program or Electronic Stability Control:

The speed sensor detects the speed of each wheel. Then the sensors forward this data to ECU continuously. The steering angle sensor regulates the position of the steering wheel by measuring the actual steering angle. Basically, the Yaw rate and lateral acceleration sensors determine the exact location of the vehicle with respect to the driver's input. The ECU then processes this input data, and if the sensor data varies suddenly, the ESP detects that the vehicle is facing a difficult driving condition. Thus, the system can detect if there is an obstacle in the path or a very sharp turn. In such conditions, the system applies the required braking force only on the wheels in need. And this is how the driver's control over the vehicle is restored. This system has a plus point as compared to the ABS and TCS systems. This is because it can actually assume the behaviour of a vehicle, by sensing a change in the drive.



When the Electronic Stability Program comes into effect, it gives an indication in the form of a glowing indicator in the instrument cluster. In most of the cases, the driver feels no difference in the working of the vehicle, except the enhanced control when the ESP starts working.

Sr.No.	Abbreviation	Full Form	Used By
1	DSC	Dynamic Stability Control	BMW
2	VSA	Vehicle Stability Assist	Honda
3	VSC	Vehicle Stability Control	Toyota

While referring to the Electronic Stability Program or Electronic Stability Control, the majority of vehicle manufacturers use the term ESP. However, some manufacturers use the following custom acronyms.

- **Simran Nair**
  S.E. MECH B

AUTOMATION IN TESLA

Tesla Motors, Inc. is an American electrical vehicle company based in PaloAlto, California. It was founded in July 2003 by two engineers, Martin Eberhard and Marc Tarpenning.

The company expertises in electric vehicle manufacturing, battery energy storage and solar roof tile manufacturing. It also operates multiple production and assembly plants. Its main vehicle manufacturing facility is at Tesla Factory which is in California, Nevada, New York and Shanghai.

Technology Used:

Tesla is equipped with eight cameras around the vehicle for a full 360 view, plus a front facing radar and long range ultrasonic sensors. It uses a powerful machine learning computer system (called the Full Self-Driving Computer, aka Hardware 3) which was available to people in early 2019.

Supported Models:

All current Tesla vehicles i.e (Tesla Model S, Model X and Model 3) all support Autopilot and Full Self-Driving features as an option, AP2 and above. Older Tesla models (released before-2016) with AP1 have an older version of Autopilot that doesn't have all the current latest features.

The Tesla Automation Strategy:

Elon Musk appears to be focused on the capabilities empowered by Tesla's new "Full Self-Driving" feature, a system that integrates a new in-vehicle computer, fleet-level data learning, and large scale neutral network training.

Tesla Autopilot 1 – AP1:

1. Front camera (single monochrome)
2. Front radar with range of 525 feet / 160 meters (Bosch Mid-range radar sensor)
3. 12 ultrasonic sensors with 16 ft range / 5 meters
4. Rear camera for driver only (not used in Autopilot).
5. Mobileye EyeQ3 computing platform.

Tesla Autopilot 2 – AP2 :

1. Front cameras (3 cameras, medium, narrow and wide angle)
2. Side cameras (4 total, 2 forward and 2 rear-facing, on each side).
3. Rear camera (1 rear-facing)
4. Front radar with range of 525 feet / 160 meters (Bosch Mid-range radar sensor).
5. 12 ultrasonic sensors with 26 ft range / 8 meters.
6. NVIDIA DRIVE PX 2 AI computing platform.

The core features of AP1 and AP2 were

almost the same. The only update was that AP2 includes navigation on auto-pilot (on-ramp to off-ramp). More cameras and upgraded sensors were installed on AP2. Basically, AP2 had greater computing power.

Tesla AP2.5 Update :

Tesla introduced a minor upgrade to the AP2 hardware variants in mid-July of 2017, known as AP2.5 (although, not officially by Tesla). It comprises an enhanced forward radar, a Continental Advanced Radar Sensor ARS410, with slightly longer range i.e (558 ft / 170 m) and the NVIDIA DRIVE PX 2 with a secondary node enabled (for redundancy). It was a relatively minor update and doesn't appear to have any remarkable functional benefits currently.

Tesla AP3 / Hardware 3 (Full Self Driving Computer) – early 2019 :

In 2018, Tesla announced Hardware 3 (AP3) Full Self-Driving or 'FSD Computer', in short. This allows for 10 times the current processing power and cheaper costs to produce. Current AP2 owners will be able to upgrade their NVIDIA cards to FSD hardware. The Full Self-Driving computer began rolling out to all Tesla vehicles in April 2019. The FSD Computer / Hardware 3 / AP3, began installing in all Tesla vehicles in late April of 2019. Upgrades for customers with AP2 who purchased FSD, are expected to come in late 2019.

Hardware 3 Full Self-Driving (FSD) Improvements :

Now that Tesla has updated its Autopilot options, it's clear that the Full Self-Driving (FSD) option will be the primary beneficiary of Hardware 3 improvements. It is expected to see constant-increasing autonomous capabilities being slowly removed from Tesla vehicles with that option anyone who purchases FSD variants will also receive Hardware 3.0.

Autopilot vs. Full Self-Driving Option :

Tesla has two levels of autonomous driving – "Autopilot" and "Full Self-Driving" (FSD). Tesla previously offered a different tier called "Enhanced Autopilot", but that has since been discontinued after the release of these new options. Tesla's Autopilot is standard now and is essentially an adaptive cruise-control plus automatic steering (lane keeping) system while Full Self-Driving contains more autonomous driving-like features like automatic lane changes, Navigate-on-Autopilot, Summon and Auto-park.

- Yash Parneria
S.E. MECH B

INTELLIGENT SECURITY & SAFETY SYSTEMS IN AUTOMOBILES

In today's emerging world, technologies are booming at every place to nourish our humanity. There has been enormous advancement in automobile technologies in past years and much more is still to come. However, accidents and vehicle thefts are still very common in many areas. Though many new technologies have come up to safeguard our vehicles, thieves always find a way to bust into one.

Automation is not a stranger to the automobile industry. It has evolved from being used to make vehicles to being used to drive the vehicles. Self-driven cars have already hit the road and it won't be long for them to turn the tables of the current automotive industry. Many companies and individuals are coming up with new ideas to enhance the driverless technology. The main concern is to avoid road accidents caused due to technical or human errors.

Safety Systems :

A self-driving vehicle must avoid any obstacle in front of it and steer perfectly to the destination. The path to be followed can be set up using GPS which has been in use for a long time and nowadays most of the cars, starting from mid-range to luxury, all have GPS systems monitoring them. Still cars require proper lane marking to guide them. It will surely take time to make them run in rural areas since the roads are narrow, unmetalled and don't have lane markings.

Also, it has to avoid colliding with another car which might be overtaking it or while making a turn. All the obstacles coming in the way like pedestrians and other vehicles, are monitored by cameras and sensors installed on the body of the vehicle such that they cover all the surrounding area and there are no blind spots. The sensor modules on the front track the lanes and keep an eye for traffic lights.

A huge problem might arise if the sensors break down or malfunction due to an unprecedented (unknown) phenomenon. There is also an On-board Diagnostic system which checks through the components for failures and malfunctions. For now, vehicles

are not capable of self-repairing major defects, but minor software issues can be fixed. Also, some sensors must function even if someone is driving manually to prompt alerts like red lights. There can even be provisions to check if the driver is dozing off or is in abnormal health and take precautions.

Security Systems :

Now, coming towards the security part, a self-driven vehicle should be capable of detecting any suspicious activity like an attempt to theft, damage to vehicle, etc. even when it's idle or parked. The sensors and micro cameras will continuously monitor the surrounding when the car is on standby. The alert won't go off if there is someone just passing by because if that happens it would just create a nuisance all the time.

If any suspicious person tries to open the car with by any means other than the specific key then it will pass an alert to the owner's phone. The recordings of the camera sensors are saved on a storage device in the car and can be extracted by the owner whenever he wishes. As the technology will advance a new system might come which could analyze a recording and decide to delete it or keep it. As we know the normal cars these days can be unlocked remotely from a distance using the remote key by just pressing one button. These systems have their unique IDs given by the manufacturer.

Most of the leading car manufacturers have started gradual implementation of these features. The electric and hybrid cars serve as a huge platform for these smart techs to show their utilities and improve them. Let's hope to see major advancements in the coming years.

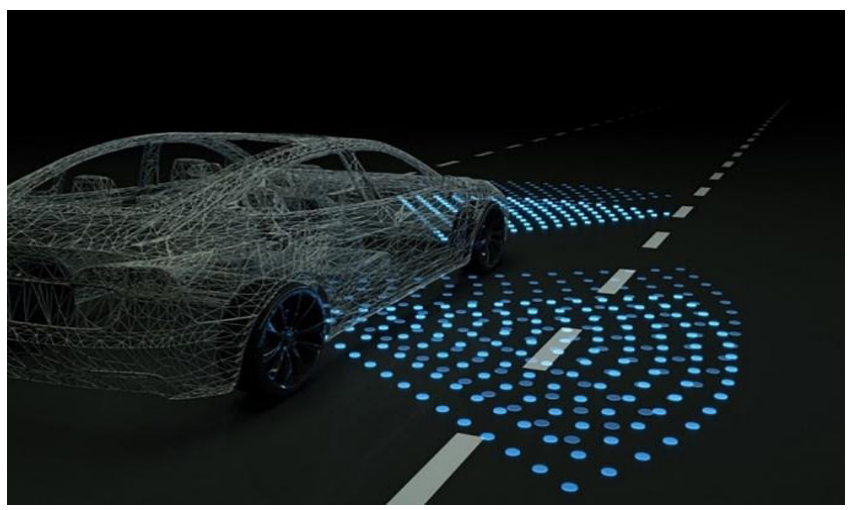
Example - BMW Car Security system :

BMW began offering its own version of OnStar, BMW Assist, with its 2007 series of cars. BMW Assist includes most of the features that make OnStar so popular: automatic collision detection, communication with a BMW response specialist and remote door unlocking. BMW also claims it will work with police to help with stolen vehicle recovery. Because the system uses a GPS system for tracking and a cellular system for communication, much like OnStar does, BMW can potentially work with police to provide GPS tracking data

Conclusion :

Safety and Security Engineering are very closely related disciplines.They both focus on system-wide features and shall be an integral of the development process.

- Harsh Gore
S.E. MECH B



AUTOMATED PARKING AND ADVANCEMENTS

Abstract :

Automated parking has seen a lot of advancements from the time it was introduced in the early 90's. This feature has been in the car for a long time now and it can be considered as the stepping stone to full autonomous vehicles. The automated parking has been given different names by different companies but the principle remains the same. The main elements of today's parking systems have been completely changed from the old one.

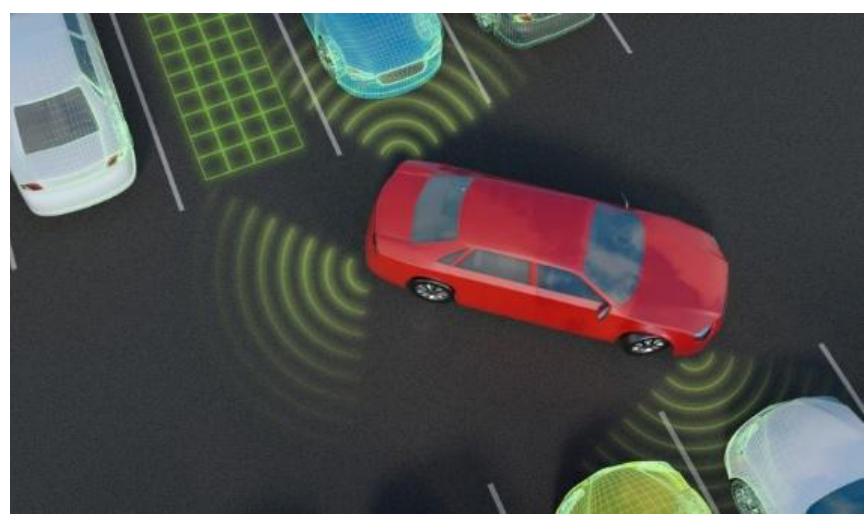
History :

The need for this feature was very important because it is seen that there is a large number of people around the world who face the problem while parking, especially parallel parking. The world's first automated parking system was installed on an electric car called Ligier in the mid 90's.The first commercial use of automated parking system was first done in 2003 by the Japanese car maker Toyota it's product called as Prius. The system was named as Intelligent Parking Assist. In 2006 Lexus came up with its self-parking system in its new redesigned model LS sedan. In 2009 Ford came up with parking assist systems; it was first installed on the Lincoln model and then was given with other models as well. Bosch had planned to control the whole parking of the cars from a smartphone in Bmw's i3 model.

Concepts :

The initial stages of the systems consisted of 4 wheel steering configurations. The car's all 4 wheels would go 90 degrees to perform a parallel parking but this was not so successful as it would create tyre marks on roads. The process of 4 wheel steering is being under process, not only for automated parking but also for better handling of cars nowadays. The older cars particularly those made in early 70's had a spare wheel installed in the rear. This spare wheel would be operated for parking which would take the cars side-ways making it easy for the drivers.

Automatic parking can be considered as a system which uses different sensors and the rear camera and helps the car to steer on it's on and park the car properly in an selected parking area. There are different technologies but the base is common, most of them use algorithms and it coordinates with the camera



of the car to calculate the amount of space needed to park as well as the amount of rotation of the steering wheel. This system primarily uses a sub-system called as ultrasonic systems. This sub-system is also used in parking sensors. This sub-system uses ultrasonic proximity detectors which are installed on different locations like front, rear bumpers and the sides of the car. These emit pulses which are reflected by the objects in the environment and the detectors calculate the distances of various objects. Then the computer in which there is a pre-installed algorithm calculates the steering angle of the car depending on the different objects and the dimensions of the car.

Methods of operations :

Some companies offer to move and park the car with the help of smart keys of the car. The vehicle can be also used as a remote control car up to a specific distance. Major car companies have an infotainment screen so the whole car can be seen from the top avoiding any chances of blind spots.

Safety concerns :

It seems that there are lot of advancements in this kind of systems but still there are many problems. The major one is with the sub-system that is the ultrasonic system. There are objects that cannot be detected in ultrasonic radars which are small pipes and flat objects. There was an incident in which a homeless guy was lying under the car and the sensors did not detect him as there are no sensors installed under the car. This kind of accident can often happen. So there should be some remedy for the solution too.

Conclusion :

The auto industry has seen a lot of advancements in this direction from automated sensors to fully autonomous parking .There are some drawbacks but hopefully we can resolve it using the innovations in the AI and the other parts of the cars. In 2020, phase two of the project is expected to commence with the deployment of a full fleet of self-parking Audi cars. By 2030, the self-parking garage is targeting availability to the broader AV market. It is estimated that parking garages specifically designed for self-parking cars can take up 60% less space than traditional lots (as cars can park much closer together and elevators and stairs are no longer required).

- Varanshu Rathod

S.E. MECH B

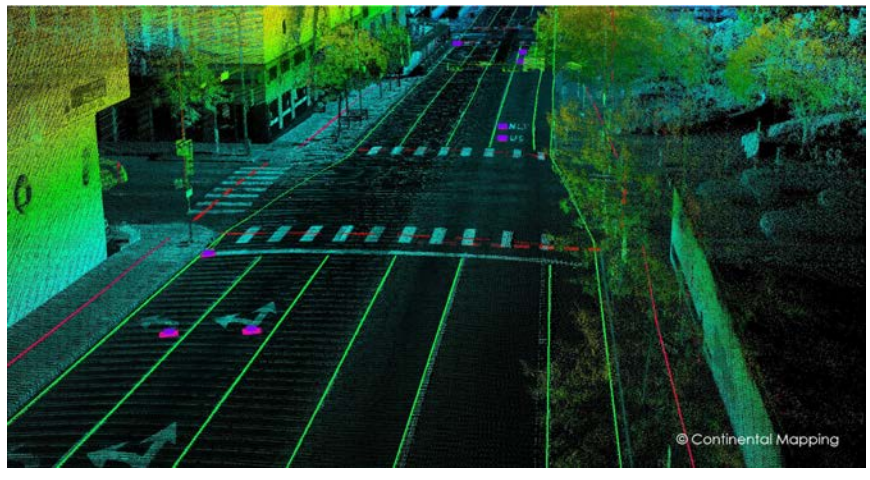
SONAR BASED NAVIGATION SYSTEM IN AUTONOMOUS VEHICLE

Introduction :

Detecting unexpected obstacles and avoiding accidents is an important task for any autonomous vehicle. To sense the structure of the environment and navigate the vehicle under a variety of conditions, different sensors are used. The basic sensors employed so far were colour video cameras and the ERIM3-D laser range finder. Detecting obstacles and taking an appropriate decision is a crucial task for any mobile system so as to navigate safely through its environment. Obstacle detection is feasible using colour video images or ERIM range images. However, owing to the data acquisition process and the required intensive image filtering, these types of insight systems are generally not very well suited for a quick reaction to unexpected problems. Especially within the case of collision avoidance, a sensor is required which will supply the relevant information fast with little processing overhead and interact with actuators at the level of the vehicle. Sensors that satisfy these requirements are for example sonars, infrared sensors, pulsed 1-D laser range finders or microwave radar. Compared to light based sensors. Sonars have the benefit of not getting confused by transparent or black surfaces. On the other hand, the wavelength of ultrasound is much larger than the wavelength of lights i.e. usually around 4 mm as compared to 550 run light. Therefore, unless the transducer faces the reflector surface during a traditional direction, only rough surfaces or edges can reflect sound waves. However, most world outdoor surfaces nearly always have a kind of surface roughness that permits sonar to detect the thing. It was therefore decided to use sonar sensors for the collision avoidance system of the autonomous land vehicle .The system is configured in such a way that more sensors can be added easily in the future. These sensors don't necessarily need to be sonars but are often the other sort of point range sensor. In the future it's intended to integrate a minimum of one other sort of range sensor into the system, most likely laser or radar based.

Hardware configuration :

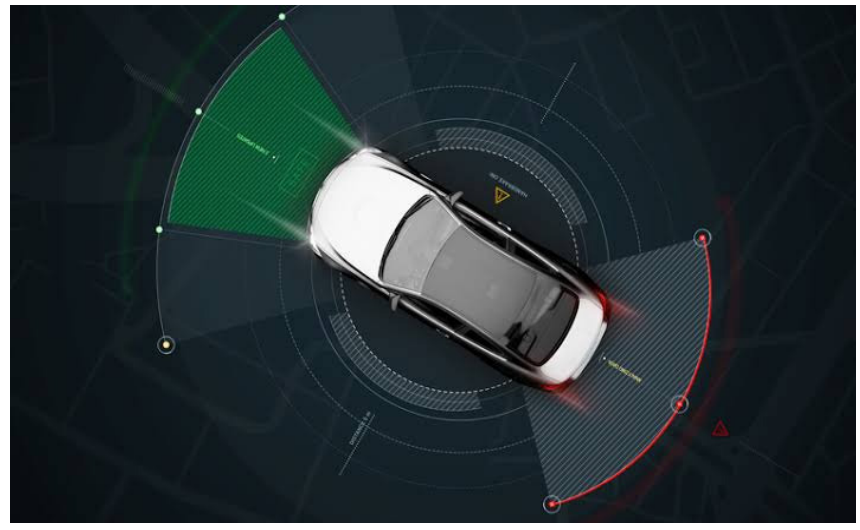
Sonar sensors have already tested successful for indoor mobile robots. An outdoor environment, however, adds some additional constraints on the sort of sensor which will be used. Specifically the sensor should be robust against moisture, dust particles and noise from the vehicle engine and other sound sources. Therefore an open type electrostatic transducer like the Polaroid can't be used. Instead a locked type piezoceramic



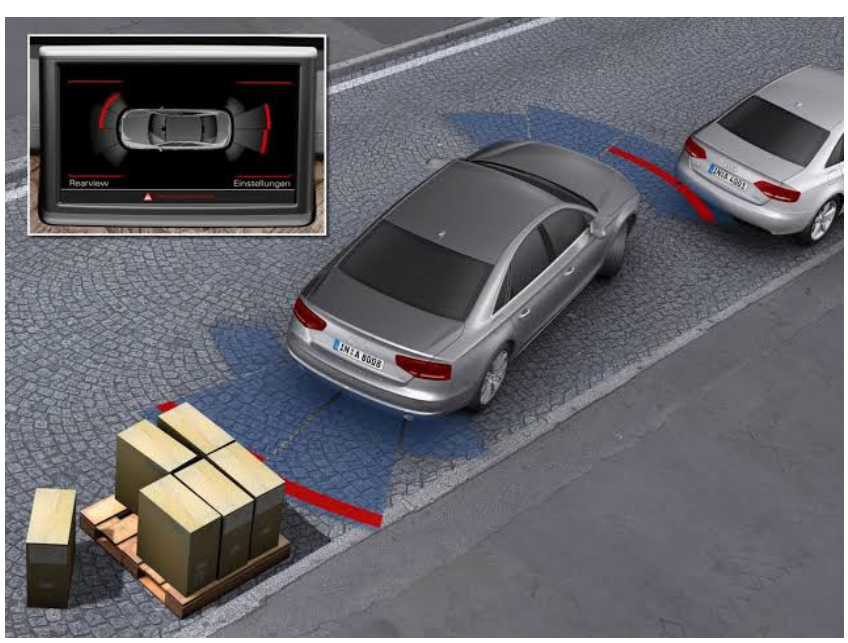
transducer working at a frequency of 80 kHz was nominated. The high operating frequency makes this sensor fairly robust against auditory noise, while still providing an operating range up to six ms the beam angle of the sensor is nearly 5' i.e. at the three dB intensity fall far away from the main axis. Based on these characteristics a total of 5 sensors were chosen so as to supply honest area coverage ahead of the vehicle with an inexpensive spatial resolution. The sensors are mounted on a guide rail such that their position and alignment are often freely adjusted with the help of certain sensor configurations or environments that can cause acoustic interference between individual sensors. Therefore the hardware provides the power to settle on the precise trigger time of every sensor. In most circumstances the sensors are mounted such that they point far away from one another. In this case all sonar is triggered at the same point in time. At present a measurement rate of 9 Hz is used, which is based on the following calculations. For very good reflectors we can assume a maximum operating range of 8 m, which corresponds to a time of flight of sound in air of roughly 50 ms. Thus echoes are considered during a receiving period of Trec = 50 ms. after triggering the sensor In order to avoid measurement errors due to multiple echoes. Only the range of the primary echo is measured. The sensors are retriggered after an additional wait period of Twait = 60 ms. which ensures that all detectable echoes from previous pulses are attenuated below the detection threshold. Thus the total cycle time T = Trec + Twait = 110 m s. Each sensor dimension is tagged with the location of the vehicle.

Sonar map :

The previously described sensor system can now be castoff to build an area grid map. The grid map is called local because it contains only information about the immediate surroundings of the vehicle. The vehicle position is kept at a hard and fast point within the map. As the vehicle moves, objects within the map are moved from cell to cell relative to vehicle position. Once an object falls outside the map boundary it's discarded and therefore the information is lost. Using just a local map has the advantage that error accumulation owing to dead reckoning is kept small, since only relative movements are considered. On the opposite hand the disadvantage is that information is lost and thus no global information is out there. However if desired, sequences of the output from the local map could be combined and included in a larger global map. At present the world covered by the local map is 16.4m x 16.4 m. Each grid cell



is taken to cover the area of 0.4 x 0.4 m2. Hence the map consists of 41 x 41 cells. The reason for taking such a coarse resolution for each cell was that most applications of the system do not require a high accuracy also the sonar itself does not always provide a highly accurate measurement. For the particular sensor chosen, the measurement accuracy is about f 1 m. However, counting on the environment, the sensor can also deliver noisy results. The reason lies within the poor angular resolution of the sensor. Echoes may be detected from an object at a far range in the main lobe or from a good reflector at a closer range in a side lobe. Depending on the relative signal strengths and movement of the sensor the range reading may oscillate. A similar effect also can happen when an echo reflected multiple times is received. Each cell has a set of parameters or annotations associated with it, which is described below: 1. Object type: this parameter is used to indicate if the object in that cell was seen at the current sensor reading or if it WBS seen at a previous reading. If it had been seen only at a previous reading then the thing type indicates that it must have moved thereto particular cell thanks to vehicle motion only. 2. Position specifies the x-y position of the body with respect to vehicle position. 3. Count this parameter counts the number of times an object was detected in a particular cell.



Feature selection and tracking :

The data composed by the sonar map can now be used for autonomous vehicle navigation functions. A basic navigation function is the tracking of features in the environment and using this information to determine a path that the vehicle can drive. The following paragraphs describe a way by which the vehicle uses its sonar sensors to drive on a path parallel to a feature like a wall, railroad or parked car when tracking cars parked on the right hand side of the road. The side of the car facing the road is fairly well detected. Usually sonar does not detect smooth surfaces very well because of specular reflections. However, in most real world environments such as this one, there are no perfectly smooth surfaces. In this case the sonar obtains echo proceeds from corners and projections like door handles, mirrors, wheels, etc. The vehicle is to be driven on a path parallel to the curve formed by the parked cars, keeping a continuing distance from the cars (usually around 3 m). Therefore the parameters of that curve need to be calculated first, using the info from the sonar map .For reasons of computational simplicity and decreased noise sensitivity a least square fit of a straight line was chosen. All computations are performed with reference to the vehicle origin which is at a hard and fast position within the sonar map. Data points for the road fit are selected by choosing only data points that appear during a specific area within the sonar map

- **Gaurav Yadav**
S.E. MECH B

LIDAR IN AUTONOMOUS VEHICLES

Abstract :

Advanced Driver Assistance Systems (ADAS) supported LiDAR sensors are the foremost innovative and efficient technologies for autonomous vehicles. Along with Visualization and RADAR based systems, LiDAR systems provide accurate data, precision in object finding and recognition in ADAS. The combination of RADAR, LiDAR and Vision-based systems is very effective in creating a secure and automatic driving experience.

Introduction :

The whole automotive industry is looking forward to autonomous vehicles and aided technologies. Automotive companies are arising with innovative technologies in Advanced Driver Assistance Systems, using new and affordable sensors. For inclusive vehicle safety solutions, ADAS systems can't be hooked into just vision and RADAR based systems; they require more efficient systems capable of providing highly accurate data for improved driver assistance. Whereas vision and RADAR based sensors are capable of providing a high level of automation to vehicles, the conception of a fully automated self-driving vehicle is impossible without LiDAR-based sensors. Self-driving cars equipped with LiDAR sensors offer complete automation under all driving modes. LiDAR-based ADAS systems alongside vision and RADAR-based sensors take complete control over the vehicle, managing the speed and steering control, thereby providing a remarkably safe driving experience.

What are automotive LiDAR systems?

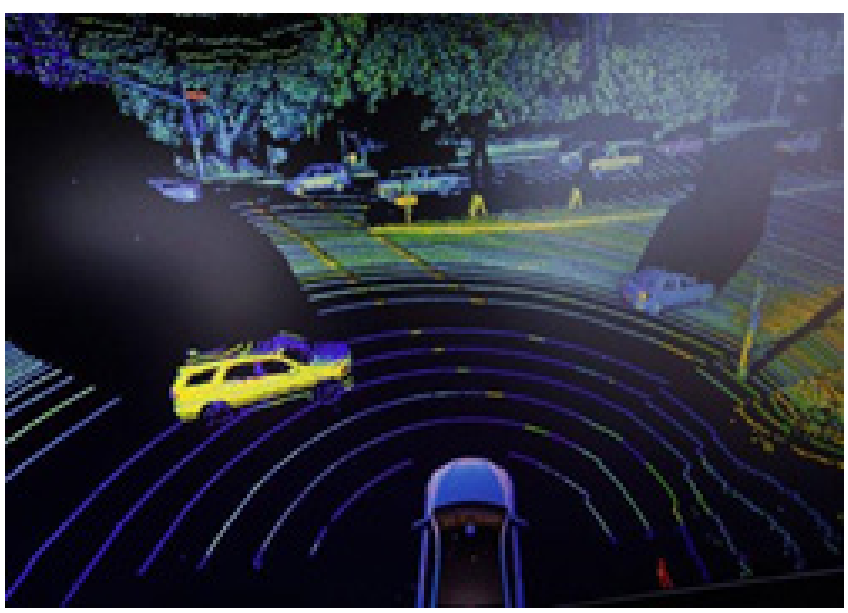
LiDAR stands for light imaging, detection and ranging. LiDAR sensors emit invisible laser lights to scan and detect objects in the near or far vicinity of the sensors and create a 3D map of the objects and surroundings on the display screen. In automotive applications of the LiDAR technology, most of the LiDAR sensors are installed on the highest of the vehicle. LiDAR Sensors continuously rotate and generate thousands of laser pulses per second. These high speed laser beams from LiDAR are continuously emitted in the 360-degree surroundings of the vehicle and are reflected by the objects in the way. With use of complex machine learning algorithms, the data received through this activity is converted into real-time 3D graphics, which are often displayed as 3D images or 3D maps of the surrounding objects.

Types of LiDAR sensor:

Automotive LiDAR sensors can be classified in two categories on the basis of the technology in use:

1. Electro-mechanical LiDARs are traditional LiDARs systems, which can be considered as first generation LiDAR sensors for automotive applications. These mechanical spinning LiDAR system sensors are assembled from multiple moving parts, which are arranged to produce and emit an array of laser beams towards the targeted area. Electro-mechanical LiDARs are quite bulky, very expensive and prone to wear and tear in tough terrain. They are installed on the highest of the vehicle and continuously rotate to scan the environment of the vehicle and typically cover an extended range.

2. Solid State LiDAR Unlike traditional electro-mechanical LiDARs, solid state LiDARs are built entirely on one chip. All the components of the LiDAR systems like emitter, receiver and processors are integrated on the single chip of the solid state LiDAR. Being on microchips, solid state LiDARs are compact in size. Also, they are not visible upon installation, light in weight and cost efficient. Since there are no moving parts in these LiDAR systems, they are fixed in front, rear and sides of the vehicle. Solid state LiDAR has optical emitters, which send a burst of laser photons without having to adjust the direction of the transmitters. The light, emitted in specific patterns, collides with the objects in the way and bounces back to the system's receiver. The processor in the LiDAR system fetches this data constantly and produces a real time 3D map of the vehicle's surroundings. Solid state LiDAR is the future scope for LiDAR based ADAS systems because it is very durable, reliable, affordable and commercially viable.



How LiDAR accompaniments Vision and RADAR based ADAS systems:

All the three sensor modules complement one another to supply complete driver assistance. While vision-built structures support in high visibility conditions, helping by providing parking assistance, knowing traffic signs, identifying road markings and more, RADAR-based systems perform in low visibility conditions, covering a relatively longer range. When it comes to sensing the vehicle's surroundings with a 360-degree field of view, LiDAR-based systems are highly accurate in object detection and recognition of 3D shapes, even for longer distances (100-200 meters).LiDAR system's 3D mapping capability also helps in differentiating between cars, pedestrians, trees, people, or other objects, while also calculating and sharing details of their velocity in real time.

- Harshit Toshniwal
S.E. MECH B

CONNECTED AND AUTOMATED VEHICLE

Abstract :

Connected and Automated vehicles are transformative technology which have potential to change future of vehicles. This resulted in the growth of research related to CAVs in recent times. Comprehensive review has been done on the following 3 topics ,

- CAV's Collision free navigation
- CAV's Pedestrian detection and protection
- Inter CAV communication.

Introduction :

Connected and Automated vehicles (CAVs) (a.k.a. connected and autonomous vehicles and driverless cars) is a transformative technology that has great potential for reducing traffic accidents, enhancing quality-of-life, and improving the efficiency of transportation systems. Bajpai (2016) show cased the positive effects CAVs should have, compared to present experiences. For example, the reduction of distance in between vehicles for increased capacity but not raising delay times ends with a higher throughput. Other benefits may include declined emergency room patients, reduced car insurance premiums, and smaller sizes of traffic enforcement departments. Also, Bajpai noted that sharing a vehicle through third-party companies or individuals would lower the number of cars owned. The number of vehicles per household may drop with availability of driverless cars returning home to be used by other household members. Ride-sharing with autonomous vehicles can have a greater impact on available properties located within densely populated areas. Researchers (MRCagney, 2017) pointed out that individuals who did not have a license to drive would benefit greatly from CAVs by relying less on traditional forms of public transportation. The requirement for large parking areas will go away from rising use of autonomous car sharing that constantly scans for potential fares to pick-up. The constant hunting for riders will drive up the actual miles travel per vehicle compared to current standards. As mentioned, road incidents should be lower than present figures with the removal of human error in autonomous cars. It is estimated the traffic accidents will drop by 70% in 25 years.

CAV's Collision free Navigation :

One of the key aspects to the success of CAVs is the ability to avoid collisions with other vehicles. The primary option for avoiding most accidents is braking. However, in some scenarios, braking is not the best option or even a viable one due to high levels of traffic or the need to accelerate. A secondary method that needs to be considered is steering. Whether it is steering, braking, a

combination of both, or some other means, a CAV needs to be able to respond to many circumstances where an accident may occur with the best countermeasure. This is where vehicle maneuverability can play a key role in the success of CAVs. Current forms of autonomous collision avoidance have proven to increase the overall effectiveness of vehicle accident prevention. The Kusano et al. dive deep into several forms of autonomous collision avoidance methods to show the positive correlation between effectiveness and the increase of the number of collision avoidance systems used. In particular, using pre-collision system (PCS) algorithms for forward collision warning, pre-crash brake assist, and autonomous pre-crash braking, the authors simulate how crash speed is progressively reduced as each system is added on. Tests are run first with forward collision warning; compared with the systems without it, a 14% decrease in velocity change is observed (Kusano and Gabler, 2012). As pre-crash brake assist, and autonomous pre-crash braking are added on, respectively, the change in velocity continues to decrease by 10%, with each autonomous extension (Kusano and Gabler, 2012). The authors also note that in a real-world application, outside parameters (e.g., sensor limitation and weather) can affect the percentages.

Connected and Automated vehicles (CAVs) Pedestrian detection and protection:

The center for disease control and prevention discloses that over 180,000 non-fatal injuries were due to vehicles in 2015. Also, reports from the National Center for Statistics and Analysis reveal that there was a 9.5% increase in pedestrian vehicle fatalities from 2014 to 2015 (NHTSA, 2017). Pedestrians pose the biggest hurdle to the success of CAS due to their high risk of injury and fatality when involved in vehicular accidents. CAS has been proven to aid in the performance of human drivers' ability to reduce pedestrian-vehicle collisions. With the continuous advances in autonomous collision avoidance and due to the limits in human capabilities, CAS can prove to be safer for pedestrians than human drivers altogether. As can be seen in the collision avoidance section, braking is one of the principal autonomous accident prevention methods. Because AEB reacts 2 to 4 times faster than a human driver, the European New Car Assessment Program (NCAP) is implementing requirements that vehicles must have some form of AEB to receive high safety reviews. Currently, the primary AEB sensors being utilized to detect pedestrians are cameras, with radar sensors used as auxiliary aids. Cameras and short-range radars typically have the capabilities to identify pedestrians up to 60 m away, while long-range radars can go up to 180 m. Therefore, AEB reacts proportionally to a vehicle's speed, acceleration, and distance from a pedestrian.

Conclusion :

Within the past decade, the advancement of technology that is built into or applies to CAVs is improving at a significant pace. While recent studies and experiments that we have discussed show success, the next step will be to integrate the components into a single platform without security or operating conflicts. Combining collision and pedestrian avoidance into the intersection navigation control without elevated risk will be a major hurdle for the general population's safety.

- Aryan Upadhyay
S.E. MECH B

SELF DRIVING HARDWARE

Sensors:

A tool that measures or finds a property of the setting. Classes of sensors include:

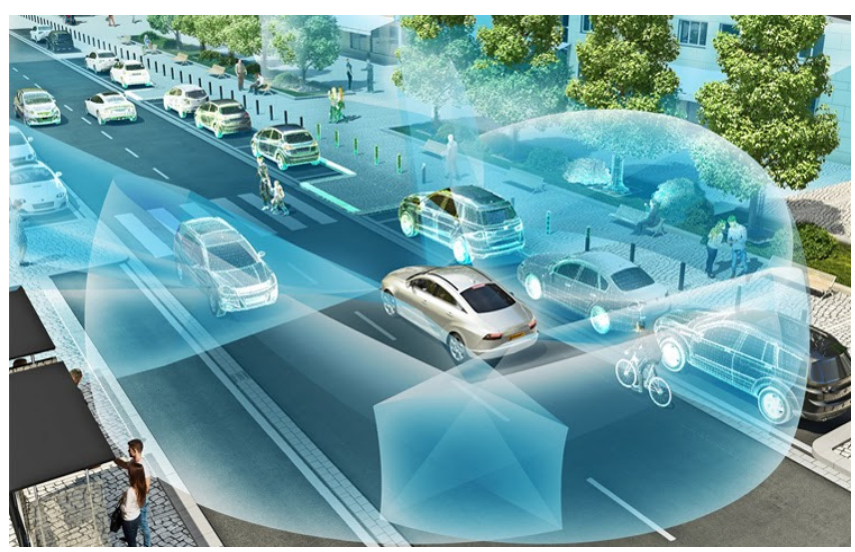
1. Exteroceptive (Extero = Surroundings)
2. Proprioceptive (Proprio = Internal)

Camera :

Camera is the most typical and widely used device in autonomous driving. Camera's area includes a passive, light-collecting device that is a unit nice at capturing wealthy, elaborate information at a few scenes. In fact, some teams believe that the camera is the sole device actually needed for self-driving. However state of the art performance isn't however potential with vision alone. Whereas talking regarding cameras, we have a tendency to typically tend to speak regarding 3 necessary comparison metrics. We have a tendency to choose cameras in terms of their resolution. The resolution is that the range of pixels that make the image. Thus it is a means of specifying the standard of the image. We will additionally choose cameras on the premise of the field of read. The sphere of read is outlined by the horizontal and vertical angular extent that's visible to the camera, and might be varied through lens choice and zoom. Another necessary metric is that the dynamic varies. The dynamic vary of the camera is the distinction between the darkest and therefore the lightest tones in a picture. High dynamic vary is important for self-driving vehicles because of the extremely variable lighting conditions encountered whereas driving particularly at nighttime. There's a very important trade off of cameras and lens choice that lies between the selection of the field of read and determination. Wider fields of read allow a bigger viewing region within the setting.

LiDAR :

LiDAR stands for lightweight detection and move device. Measuring instrument sensing involves shooting lightweight beams into the setting and measuring the mirrored come. By measuring the quantity that came lightweight and time of flight of the beam. Each in intensity in vary to the reflective object may be calculable. Measuring instruments typically embrace a spinning part with multiple stacked lightweight sources. And output a 3 dimensional purpose cloud map that is nice for assessing scene pure mathematics. As a result it's a full of life device with its own lightweight sources, measuring instruments don't seem to be laid low with the environments lighting.



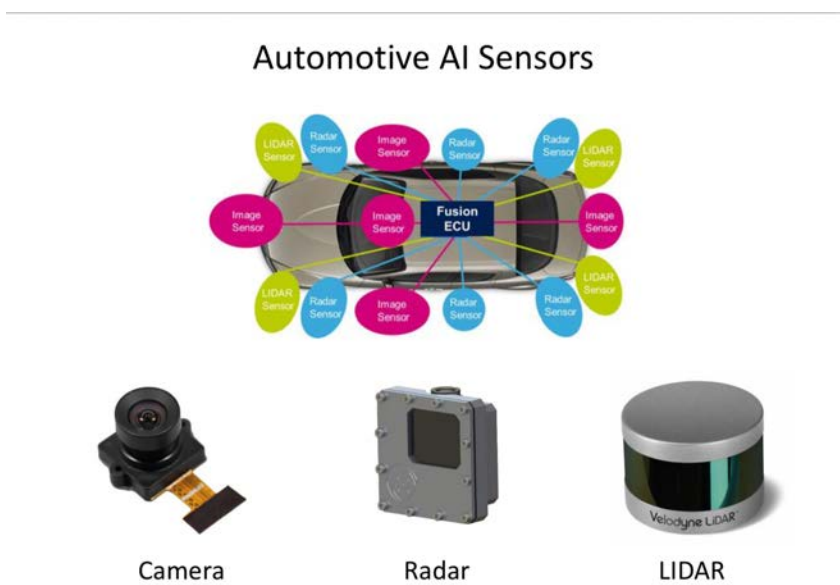
High-resolution, solid-state measuring instrument. While not a motion part of the standard LiDARs, these sensors stand to become very low-priced and reliable. Due to being enforced entirely in semiconducting material. HD Solis State measuring instrument area unit still a piece current.

RADAR :

RADAR stands for Radio Detection and Ranging. RADAR sensors are around longer than measuring instruments and robustly detect giant objects within the setting. They're significantly helpful in adverse weather as they're largely unaffected by precipitation. Radiolocation area units chosen supported detection vary, field of read, and therefore the position and speed measuring accuracy. Radiolocation is generally on the market as either having a large angular field of read however short varies. Or having a slender field of read however an extended vary.

SONARS :

Ultrasonics or SONARS represent sound navigation and movement. That live of varying mistreated sound waves. Measuring instrument area unit sensors that area unit short aim cheap move devices. This makes them smart for parking eventualities, wherever the ego-vehicle has to create movements terribly getting ready for alternative cars. Another great point regarding measuring instruments is that they're low-priced. Moreover, a bit like radiolocation and measuring instruments, they're unaffected by lighting and precipitation conditions. Measuring instrument is chosen and supports some key metrics. The most varying they'll live, the detection field of read, and their value.



Proprioceptive Sensors :

Global Navigation Satellite Systems GNSS for brief, like GPS. A mechanical phenomenon measuring units or IMU's. GNSS receivers accustomed measure ego vehicle position, velocity, and typically heading. The accuracy depends tons on the particular positioning ways and therefore the corrections used. Also, the angular rotation rate and accelerations of the ego vehicle is measured by the IMU, and therefore the combined measurements may be accustomed to estimate the 3D orientation of the vehicle. Wherever heading is the most vital for vehicle management.

Wheel Odometry Sensors. :

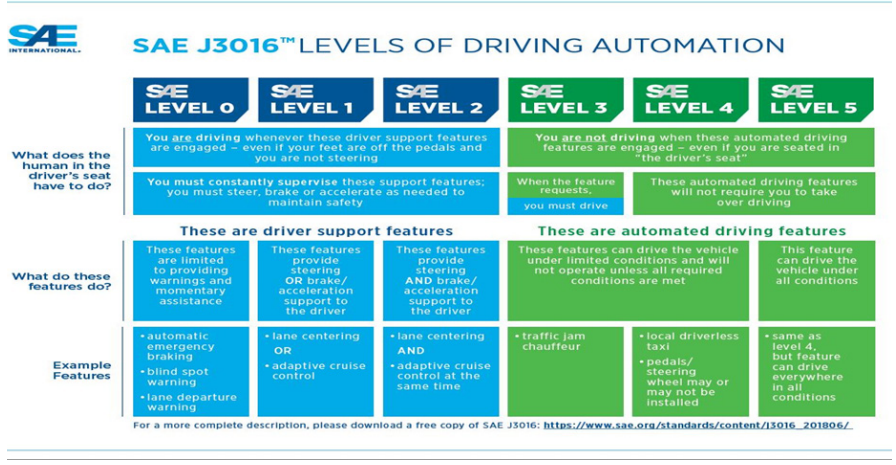
This sensor tracks the wheel rates of rotation. These wheel rates are used to estimate speed and heading rate of change of the ego car which is the same as the sensor that tracks the mileage on your vehicle.

- Rohit Yadav
S.E. MECH B

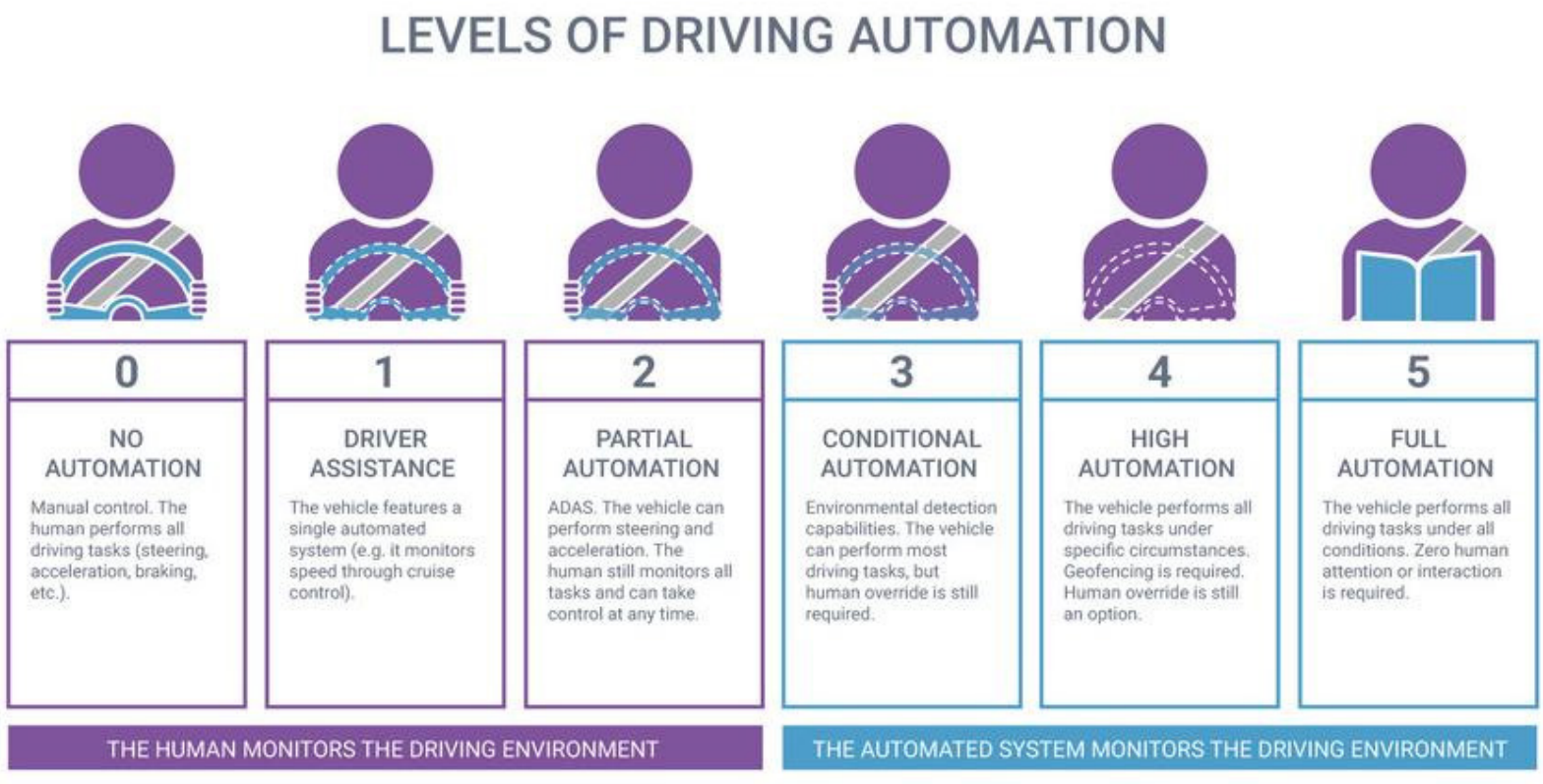
DIFFERENT LEVELS OF AUTOMATION IN AUTOMOBILES

Since a long period scientists are trying to bring automation in the industry of automobiles. Since 1920 experiments have been constructed on automated cars and self-driving, in 1950 promising trials took place and since then a tremendous and constant growth in the automation of automobiles has been observed. Whatever level of self-driving cars we see or hear today are gradually and very slowly developed throughout the last 70 years through constant research and experiments. This capability achieved by the scientists of automations and self-driving can be divided in a particular format so that the self-driving cars can be studied effectively and more research and experiments can be achieved and conducted in this field. The Society of Automotive Engineers (SAE) has divided the Self-Driving Levels into 5 levels. They are:

Level ZERO (0) - No Automation
Level ONE (1) - Driver Assistance
Level TWO (2) - Partial Automation
Level THREE (3) - Conditional Automation
Level FOUR (4) - High Automation
Level FIVE (5) - Full Automation



- Rohit Yadav
S.E. MECH B



DUAL PORT ELECTRIC CAR CHARGING SYSTEM

Introduction :

This rticle is a brief disclosure regarding the use of a second port for charging the electric car. An electric car is an automobile that uses one or more electric motors. The electric motors using energy stored in rechargeable batteries, usually Lithium-ion batteries are used. In the 1880s the first electric cars were produced. After the advancement in internal combustion engines, and mass production of cheaper petrol (gasoline) and diesel vehicles, the production of electric vehicles declined. Then in the year 2008 renaissance occurred in the field of electric vehicles as there were advances made in batteries, and the desire to reduce greenhouse gas emissions due to global warming and improve urban quality. Government incentives by several national governments have been established for plug-in electric vehicles such as tax credits, subsidies, and other incentives to promote the adoption in the mass market of new electric vehicles, the current maximum tax credit allowed by the US Government is US$7,500 per car. Electric cars are quieter, and have no tailpipe emissions and lower emissions in general as compared with internal combustion engine cars. The global stock of pure electric passenger cars rounded to almost 5 million units, as of December 2019; Representing 64.2% of all plug-in passenger cars in use. Though there is rapid growth experienced, the global stock of plug-in electric cars can be represented by just about 1 out of every 250 vehicles i.e. (0.40%) on the world's roads. The plug-in car market is adopting fully electric battery vehicles.

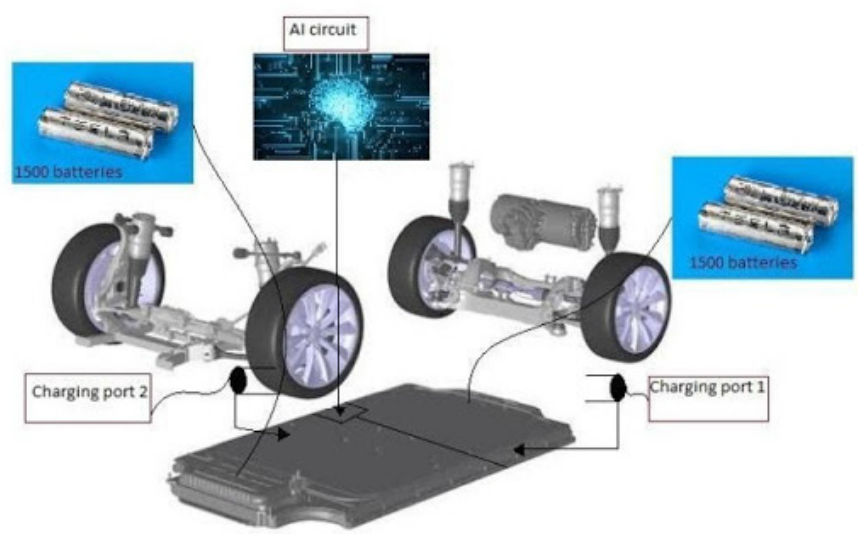
Problems :

Charging Spots and Charging time issue.

Electric cars being the backbone of future innovations, governments of different countries have raised charging stations for charging the vehicle. The electric cars can be charged by Superchargers which are the power stations; they provide a range of 100 miles for 20 min of charge. You can also charge on the regular home supply current but the range is 5-6 miles for 1-hour charge. Though you can set a whole new super charger at your place, it costs approximately $5000 U.S which is quite too much costly.

Thus charging is a quite a big loop hole in the greatest innovations of all time.

Pictorial Form :



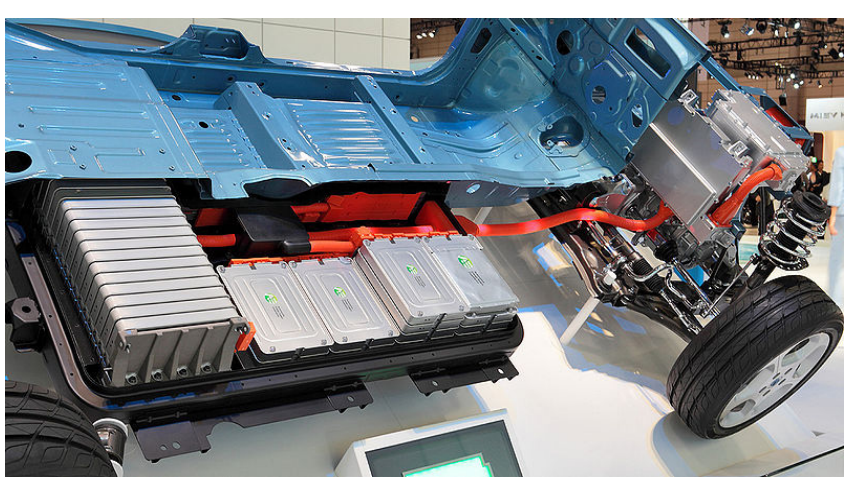
Concept :

If suppose we take 3000 lithium-ion batteries and split them into two parts. One-part consists of 1500 batteries and the other with remaining 1500 batteries. Then by creating one more charging port on the opposite side of the previous one and charging one of the set of batteries through it and the other set through the previous port. Thereafter we will place a circuit board (AI Circuit) in between them there by making sure the batteries get proper charging through both the ports without creating any sort of problem while taking the source from 2 different power outputs as well as providing the partition between the two sets of batteries.

AI Circuit- During the initial stage of charging the circuit acts as a break bridge. After this process once both the set of batteries are fully charged and after we are finished removing both the charging cables, the same circuit board will act as a bridge. And thus the whole set of 3000 batteries will act as a single power supply unit.

Merits :

Least time required to charge a single car using dual port. Reducing the cost of replacement of battery. (Dividing the battery into two sections enables it to replace it individually, i.e. if any of the sets gets damaged you just have to replace the singular set rather than the whole 3000 batteries.)



Demerits :

Electric vehicles being initially a costly investment, the innovation might increase the cost a bit, though reducing time is a major factor in this idea.

Research and Development in EV Battery:

As of December 2019, billions of US dollars in research are planned to be invested around the world for improving batteries. Europe has plans for heavy investment in electric vehicle battery development and production, and Indonesia also aims to produce electric vehicle batteries in 2023, inviting Chinese battery firm GEM and Contemporary Amperex Technology Ltd to invest in Indonesia. Ultracapacitors- Electric double-layer capacitors (or "ultracapacitors") are used in some electric vehicles, such as AFS Trinity's concept prototype, to store rapidly available energy with their high specific power, in order to keep batteries within safe resistive heating limits and extend battery life.

Conclusion :

Every coin has two sides, so this innovative idea also has some positive as well as negative sides. But in the bigger picture, the least time requirement, simple mechanism, and effective power charging are the advantages which one can't deny. If you have an emergency and can't afford to drain the battery whose replacement is quite costly ($50000 U.S for Tesla Y model) the dual port charging enables you to serve you 2 times the charge, provided by the single port charging system.

- Bhavesh Singh
T.E. MECH B

DYNAMIC WIRELESS CHARGING SYSTEM

Introduction :

World is shifting towards electrified mobility to reduce the pollutant emissions caused by nonrenewable fossil fueled vehicles and to provide the alternative to pricey fuel for transportation. But for electric vehicles, traveling range and charging processes are the two major issues affecting it's adoption over conventional vehicles.With the introduction of Wire charging technology, no more waiting at charging stations for hours, now get your vehicle charged by just parking it on parking spot or by parking at your garage or even while driving you can charge your electric vehicle. In today's world we are shifting towards wireless transmission of data, audio and video signals, Then why can't we think of transmitting power.

The great scientist Nikola Tesla for his limitless amazing inventions in which wireless power transfer is one of them. As he started his experiment on wireless power transmission in 1891 and developed the Tesla coil. In the early 90's with the primary goal to develop a new wireless power transmission system Tesla started developing the Wardenclyffe Tower for large high-voltage wireless energy transmission stations.

Problem Statement :

There is rapid development in battery and charging technology, but this is causing uncertainty. The question then arises to many, 'Which charging technologies will become the gold standard?' The problem is for people living in apartment blocks, or houses without a private parking space. Whereas the home charging system will further no longer remain a trend as it is now.

Solution Statement :

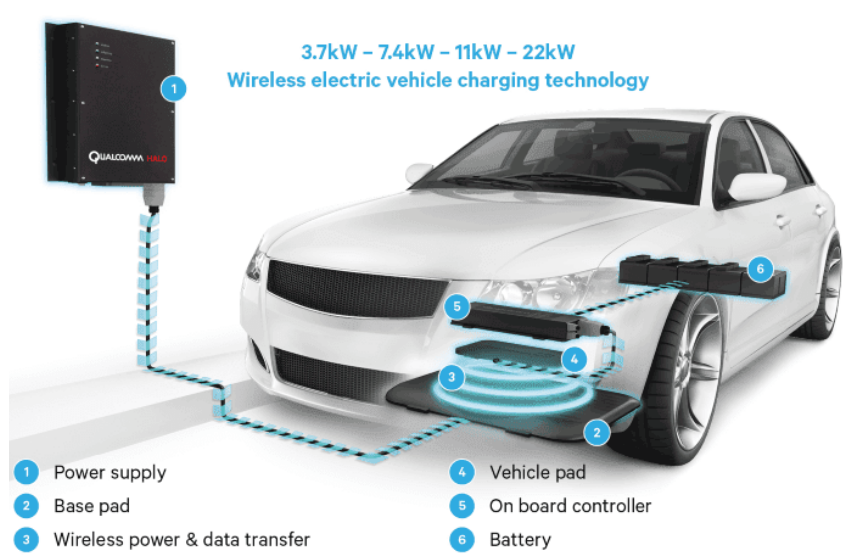
Let's consider a Driverless Ridesharing Electric Vehicle pulls over as you exit a building, it takes you to your destination, and then proceeds to drive passenger after passenger. It doesn't ever need to stop to recharge its battery! The energy thus generated by nearby resources is supplied wirelessly from the drive when the vehicle is moving on the road.

Types of wireless charging systems :

1. Static wireless charging system
2. Dynamic wireless charging system

1. Static Wireless Charging System

Here the electric vehicle is charged when it remains on one position. Thus we could easily park the Vehicle at a parking spot or in



a garage. So the vehicle incorporated with WCS gets charged. The transmitter is fixed underground and receiver is fixed in vehicle's bottom. In order to charge the vehicle the transmitter is aligned with the receiver. The charging time depends on the power supply and the distance between the transmitter & receiver and its pad sizes. This Static wireless charging system is best to build where EV is being parked for a certain time interval.

2. Dynamic Wireless Charging System (DWCS)

In DWCS, a vehicle gets charged while it is in motion. The power is transferred through air from a transmitter which is stationary to the receiver coil in the moving vehicle. By using this system in electric vehicles the travelling range could be improved as the continuous charging of its battery while driving on roadways. This reduces the need for large energy storage. Thus reduces the weight of the vehicle.

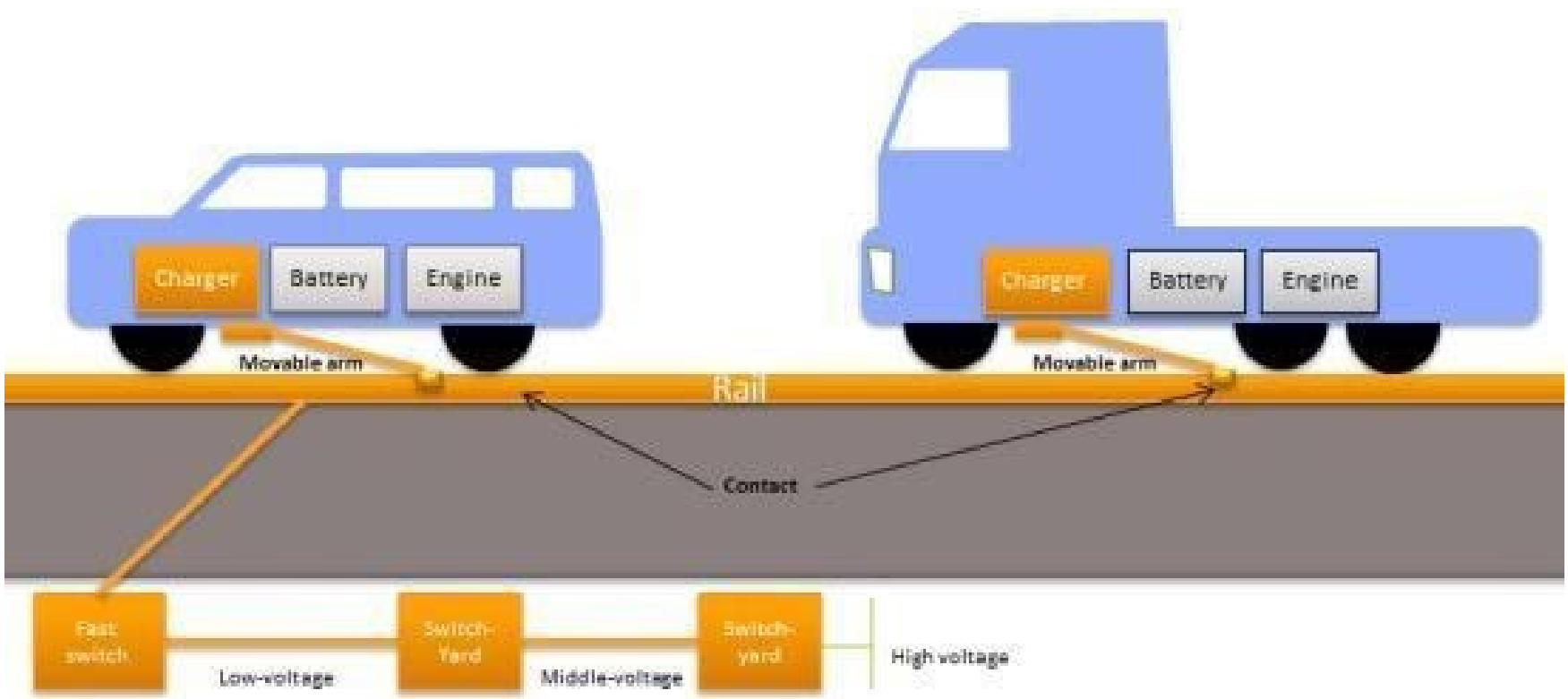
Working principle of inductive wireless charging system :

The working principle of Inductive wireless charging systems is Faraday's law of induction. The transmission is wireless and power is achieved by mutual induction of magnetic field between transmitter and receiver coil. When the AC supply is supplied to the transmitter coil, it creates an AC magnetic field that passes through a receiver coil and thus magnetic field moves electrons in the receiver coil causes AC power output. The AC output is first rectified and then filtered to charge the electric vehicle energy storage system. The power transferred depends on frequency, as well as mutual inductance and distance between transmitter and receiver coil. The operating frequency of this system is between 19 to 50 KHz.

Merits :

It is Convenient – Just park your car near the charging station and go shopping. By the time you are back, the car would be charged and you just can drive back home without hassles of plugging or unplugging heavy charging connectors

It is a necessity due to climate conditions. In the places where the temperature would be at -20 degrees Celsius. This technology would always be helpful as one wouldn't need to come out of



the car to plug the charging connector. The risk of forgetting that car is plugged and starting the vehicle. Wireless charging doesn't have this risk as no physical connection. It can be charged irrespective of the connector compatibility with just the mutually compatible wireless charging system. This system increases more opportunities for autonomous features as Hyundai recently launched their wireless charging stations with auto parking feature. Once the car is fully charged it will automatically move to another vacant position in parking and let other cars charge at that place.

Demerits :

High cost – This technology being in the nascent stage, still the cost of wireless charging is more. Hazardous strong electromagnetic field which may be harmful to the people around. This field also interferes with the other electronic devices around.

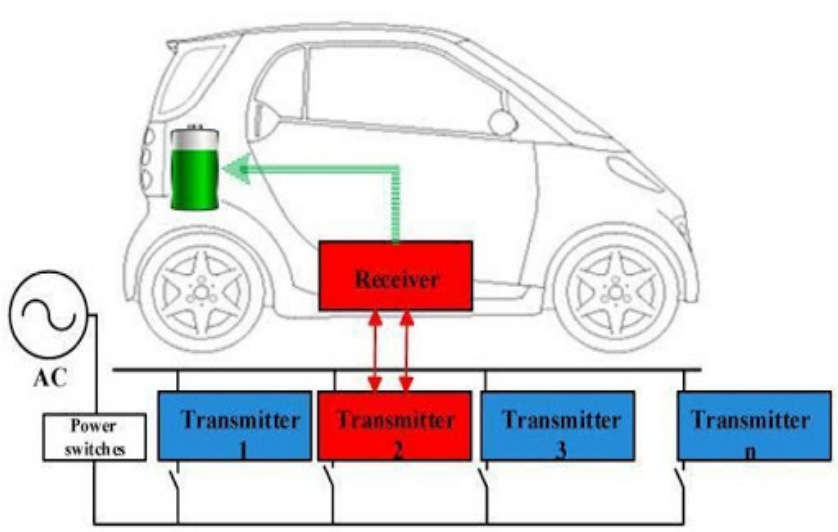
Complicated power electronic circuitry and design because of the power transfer due to induction technology.

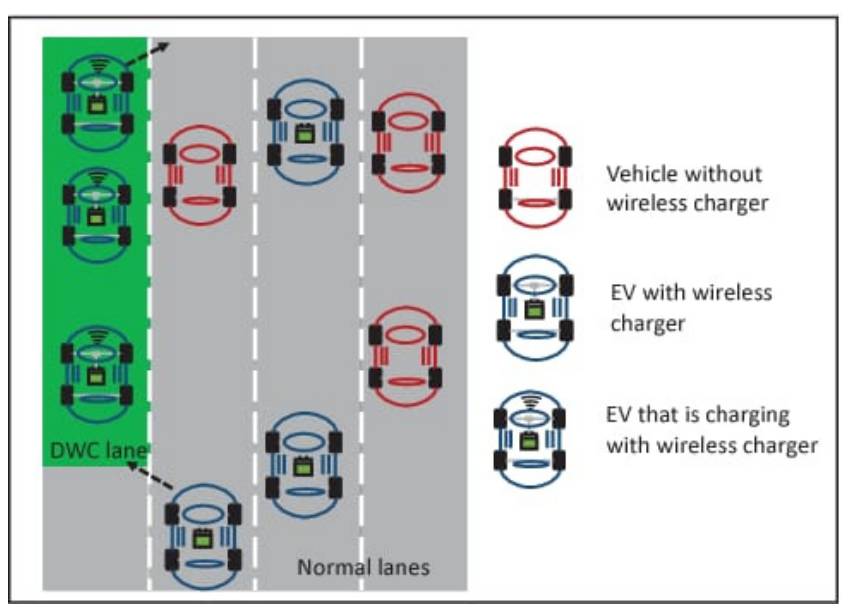
Additional weight on the electric car to facilitate the wireless feature. This is because the car should have an adaptor to facilitate the wireless charging.

Conclusion :

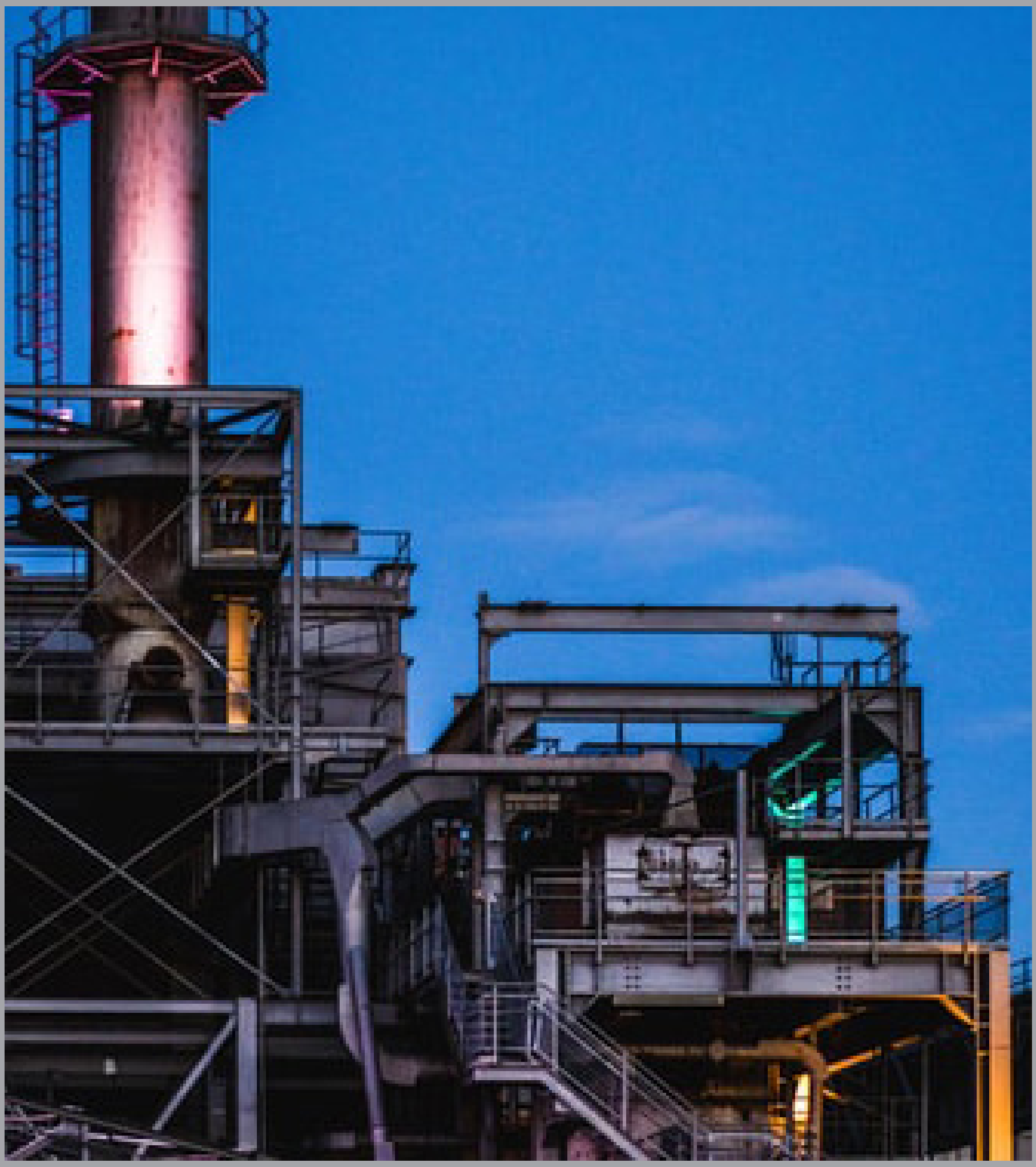
The dynamic wireless electric vehicle charging system (D-WEVCS) is a promising technology, which can reduce the problems associated with range and cost of EVs. It is the only solution for future automation EV. A few challenges still need to be overcome, such as developing the infrastructure and improving energy efficiency. However, the benefits of wireless charging have so much appeal that it's only a matter of time until it becomes the most popular method of charging your electric vehicle. It is clear that automobile electrification is unavoidable because of surroundings and electricity associated troubles. Wireless charging will offer many benefits as compared with wired charging. Especially, when the roads are electrified with wireless charging capability, it will provide the foundation for mass market penetration for EV regardless of battery generation. With technology development, wireless charging of EV can be brought to fruition. Further studies in topology, manage, inverter design, and human safety are nevertheless needed in the close to term.

- Bhushan Kadam
T.E. MECH B





INDUSTRIAL AUTOMATION



COBOTS

Abstract:

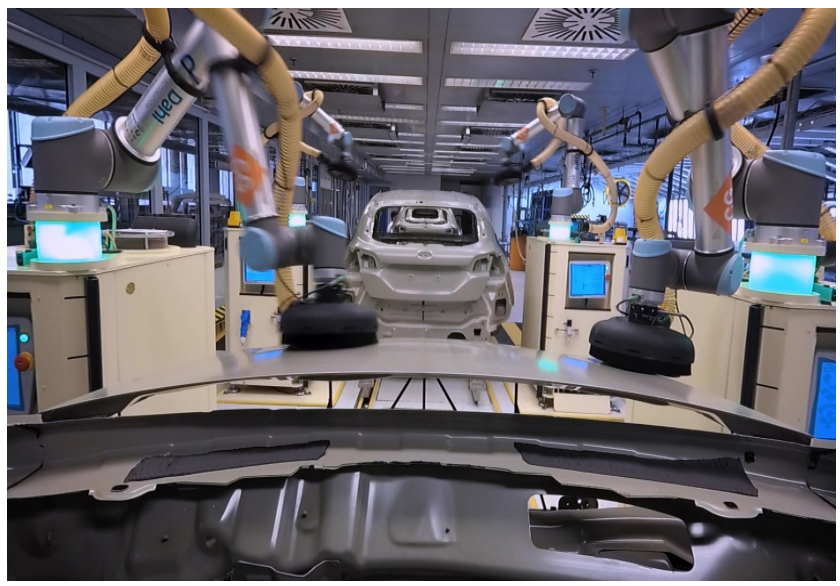
Cobots plays an important role when it's comes to Automotive Sector. As industries were growing in the 1900s the need for a robot that shares workplace with human and help human in effective production. Here Cobots or collaborative robots comes into picture. Cobots are designed to work in conjunction and in close proximity. Cobots are made to perform human tasks. Unlike robots, Cobots made to interact with human. Cobots can be described as hardware version of AI with which we interact via software.

History:

Various concepts related to robots can be found from around 400 BC. For reference, drawing from famous inventor Leonardo da Vinci from1495 who tried to develop a mechanical knight. But the real robot used in industries were in 1937. The credit of inventing the first Cobot is given to J. Edward Colgate and Michael Peshkin. They described it as a method for direct physical interaction between a person and a computer-controlled manipulator. Over the years as technology got better so are the Cobot. In 2004 a German based developer KUKA released their first Cobot known as LBR3, it was a lightweight Cobot with its own motion power. It was developed after a long collaboration between KUKA and the German Aerospace Centre Institute.

Concepts:

Cobots are robots that are specifically made to increase productivity, they don't replace human but help humans to increase productivity, that is they work alongside humans. Cobots are used where more than human efforts are required for example lifting heavy load or tightening a screw at a particular torque, etc. Cobots take humans away from hazardous tasks during manufacturing process. Unlike industrial robots that require huge space for operation, Cobots work alongside humans they are often surrounded by safety guarding. Cobots are flexible deployment which can be relocated as compared to robots which are often at fixed location. Cobots are easy to operate, they often are light weight and compact. Cobots are also quite economical as compared to robots. Where industrial robots required to be separated from human, cobots are specifically designed to work with humans. Facilities around the world are using Cobots that work directly with humans to help in improving production activity like lifting, inspection, assembly and handling. Cobots can also carry to works like spray painting and welding.



Automotive applications:

Cobots are a great piece of engineering when it's comes to industrial automotive sectors. Cobots increases productivity by miles. The above example accurately shows the importance and helpfulness of a Cobot the polishing work if done by a worker will not only takes hours to complete by a hum but also will require a skilled worker to complete the job, but with help of a Cobot we can pre-set the pressure which is needed to be applied and also the areas to be covered.Above is another great example of Cobots, if a cobots is designed to carry heavy weight it can do it really well, imagine if a worker have to carry heavy stuff everyday to overcome this stuff Cobots are best for the job.Cobots are great at precision work. Cobots not only complete the works faster than a human worker but it's precision is no match compared to the humans. Cobots are great at precision work. Cobots not only does the work faster than the humans but they also helps in creating a better environment between the workers.

Advantages:

Cobots are made for easy programming, quick setup, flexible automation and collaborative and safe work. Traditional robots require a lot of time to program simple actions whereas Cobots have user friendly software and mobile applications. Cobots can manually be set to a certain position and save that position which save time while coding a software. Normal industrial robots take days sometimes week to assemble whereas Cobots can be assembled within hours thereby saving the precious time which improve productivity as assembly is simple, Cobots are highly flexible which is required in today time as it not only be used in one department but in various different departments. Cobots are highly accurate with an accuracy up to 0.1mm. Cobots can be programmed for repeating the same process with the same amount of pressure and tension which helps in quality control. Cobots increases productivity and optimize processes.

Safety concerns:

As more and more machines are coming out of their cages it is important for the manufacturers not to assume that all Cobots are inherently safe. Safety is a big concern when it comes to Cobots, but Cobots can be quite safe if the operator read the handling manual. Proper training and good maintain can reduce accidents. Cobots are regarded safer than a bulky industrial robot but proper care should be taken while operating Cobots. For example, a Cobot may be safe to work around employee but, the end of the arm of the Cobot that contains a sharp knife or a welding tool at the end might be hazardous, so proper care should be taken by manufacturers that a Cobot should not cause more harm than good.

Conclusion:

To summarize, we can say that in around 40 years the industrial robot has change drastically. Cobots are the future of manufacturing. Cobots are not meant to replace human but help human in effective manufacturing. The main goal of using Cobot is to optimize the manufacturing process, that is to achieve maximum goal with minimal costs. By using cobots we can minimize errors. The initial cost of equipping Cobot is obviously high but in long run it can save money and will result in a profit.

- Prithvi Shah
S.E. MECH B

RECENT DEVELOPMENT OF AUTOMATION IN VEHICLE MANUFACTURING INDUSTRIES

Nowadays, meeting the customer's demands within time with accuracy is a major task for automobile industries. To satisfy the customer's demands and for better performance, Automation plays an important role for various types of industries like production, manufacturing, engineering, automobile, medical, defense, aerospace and space etc. The automotive industry is the most common user of industrial robots as it involves a wide variety of tasks such as manufacturing and assembly which involves operations such as welding, cutting, painting, etc. A typical automotive industry consists of body shop, paint shop, chassis line and a final assembly line in the body shop .The sheet metals are used to make the outer structure of the vehicle, with the help of robots for spot welding, and material handling, and in addition to this, the robots are also used to apply adhesives and sealers during the assembly. Moreover, in the automotive industries, wheel loading is the process to attach the wheels on the vehicle body when the production line is moving at some random speed. Currently, this task is done by workers manually working on shifts. Therefore the cost of wheel loading is nearly a million dollars every year. Hence the automated wheel loading process is at higher demand and hence industrial robots have increased in the industry because of their flexibility and accuracy. It can be done by visual servings and by macromicro manipulators which increase the bandwidth of the system. The manipulators are controlled by programs and are directed by coordinates in the production line. The vision system identifies the wheel hub position and orientation while the production line is moving. Even a slight error can damage the car body, hence to improve the vision system various sensors, hybrid vision systems, and intelligent control systems are used to complete the complicated assembly process and huge amounts of time and resources can be saved by adopting automation which will have a great impact on the industry. However, automated production has been increasing in the industry with the increase in the demand of accuracy, precision, higher productivity and quality, and also due to unskilled workers. Just like how the heart of the automobile in the automobile industry is the engine, in vehicles the preparation of the engine is done in a way to provide maximum efficiency, which is one of the major expectations of the user. Amongst various losses in the engine, heat losses are the major losses which happen due to the valve clearances in the automobile which can be corrected by automation with

high accuracy, then with the help of manual operators the valve adjustment machine is used in production operated by a control system. Initially the engine is fixed in the pallets and is conveyed to the center of the machine. The upper dead point is fixed to the piston and is set with the indexing unit of crank angle where the valve clearance can be adjusted by the machine which leads to higher efficiency of the engine. Moreover, the industrial globalization of trades has increased in recent years and has changed the manufacturing industrial relations. The industrial relations which are under pressure to change, point out that unions of the industry need to rethink their role in the society and become more involved in the decision making process of firms. In many cases technology, especially CNC technology is either too expensive to purchase. Since a flexible automation unit is involved in the industry to produce automobiles, the automation can involve many industrial production changes and can meet the demands of the customer on time. As of using this high-end technology, the industry is taking a revolution in the field of automation production. To overcome the issues in the assembly processes, highly functional multi-arm robots will be an indispensable element in the next generation production system.

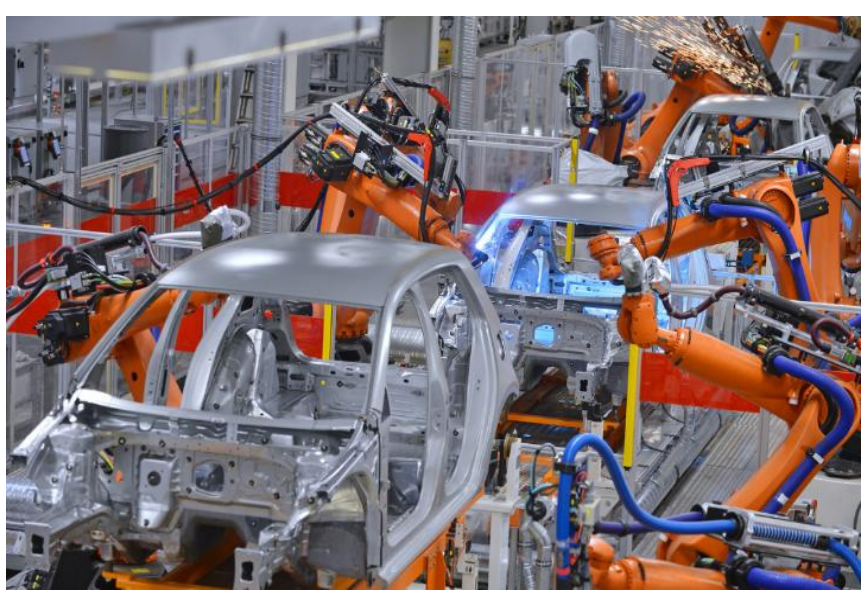
The development of standardized assembly uses highly rigid, Cartesian coordinate types manipulators for executing various assembly jobs. This configuration can form the basis for the future assembly advancement processes in terms of mid to long range plans for quality and price competitions. The objective of the development was to perform assembly job analysis.

The multi arm robots possess enough dexterity to carry out complex and both-hands assembly, and it has the flexibility to perform various types of assembly, and also the capacity to work at high speed operations. In addition, it has a very narrow width to keep the assembly line short, and a wide operating range and structure which ensures safety, visibility and accessibility which allows the robot to keep the down time to minimum levels. The dual arm allows the robot to work at various independent movements simultaneously. After realizing the complexity, the advancement of the manipulators have also led to triple arm robots, it has a reliable design and can perform various operations at assembly line and reduces the production time increasing the accuracy and productivity of the plant.

The automobile industry has a huge demand for the product but the innovation of a new product grows when the variety of the product to be manufactured reduces production volume which causes shorter development. The use of electric vehicles

also helps to improve the automation of a product as it requires a fixture. In case of innovating a new product it requires 25% of the manufacturing cost of the product as the research is carried out in such a way that a new fixture is developed with lower cost and is flexible in handling. The changing of fixtures reduces the flexibility but for the physical parameters of different parts the number of fixtures used can be reduced if the product variety is reduced because of which fixture development can be reduced and a new one can also be avoided. Even though fixtures increase production in the production system, investment cost is higher and if the dedicated fixture is used, it reduces the flexibility and also restricts itself to similar geometry and dimensions. If high volume of production is carried out, flexible fixtures have lower reduction on the amount of fixture required. Then, the results for the case with the fixture body states that the changing of fixture becomes more economical also reducing variety in product. However, in recent days the use of electric and combustion vehicles are more preferable to use as the fixtures are more advantageous.

The automated vehicle driving replaces the work of thedrives from controlling the vehicle activity to supervising theaction of the vehicle and in some cases it is just a fall backlevel, the use of machine interface has to give a support to thedrive interaction, like handling control in the automation and should help in supervising the automation and driving vehicle, the driving the vehicle, the automations provides support todriver by informing about current task, action, and intention, that indicators help in providing a reliable level in the field ofautomation and the use of text boxers are to provide the messages to the drivers, when the automation is increased it ensures the trust and acceptance in the level of safety in controlling the vehicle, human machine interface helps the safety and using of automated driving in the ergonomic principles of these interfaces are taken into account the legibility may lead to mental loads and other visual problems when the information is provided human machine interface is received and display a good position out when the drivers expected that view might be in the position of failing to load and provide attention when required, the cause is to set the principles and design criteria of the initial set of data about the automation of the vehicle is provided and is made the research and this is the initial point and the automated vehicle is still emerging and this provides the guidance to the level of automation in the vehicle and verification of the automation with the vehicles



- Alok Yadav
T.E. MECH B

AUTO INDUSTRY INTERVIEWS

INTERVIEW

NIMIT MAHESHWARI

Nimit Maheshwari, 23, is a graduate of Batch of 2018, from Mechanical Engineering, TCET. He was the Vice-Chairperson of SAE INDIA - TCET (A.Y. 2017-2018). His keen interest in technology and automobiles led him to one of the prestigious universities, Aachen University of Applied Science - FH Aachen, Germany, for Mechatronics Engineering Program and did his internship at Mercedes-Benz.

What is Mercedes Benz all about?

As everyone knows, Mercedes Benz is the founder of automotive automobiles and was the first company to make a chassis based car. Since then, they have been on this journey to make world class vehicles. They have been in all sectors like commercial vehicles, luxury vehicles and recently started manufacturing f1 vehicles. In the last race that took place in Barcelona, Mercedes Benz secured the first and third place. So it is a proud moment for me to work in such an industry.

How do you feel after getting your dream job?

For me, it has always been about setting goals, and my goals have been clear from the very beginning. Right from the start of the second year of mechanical engineering, I was interested in the automotive sector and so I undertook many projects like quad torc, SAE BAJA. We formed our team with the permission of college and started from scratch. I am yet to go higher in my career level and let's see how far it goes.

How did this journey to Germany start for you?

I always had this feeling that I had to be better than what I was. I always used to look up to my seniors. We consulted our seniors who were the first batch of mechanical engineering of TCET at all times. From my second year I started learning German language. Professor Ashwin Pathak from humanities and sciences who taught us engineering mechanics, advised us to learn German language because all the major automobile industries are based in Germany and by the end of fourth semester I completed the first level of German language. I also searched for different opportunities in Germany for mechanical engineers. I came across a site developed by the ministry which provides all the information about higher studies in Germany. By fifth semester I shortlisted all the colleges in Germany. I also appeared for GRE in the fifth semester in which my score was 319. So after learning the German language and appearing for GRE, I appeared for IELTS in the seventh semester. So that's how my journey started.

Apart from academics, what other activities did you do?

It was much much harder than it sounds because I was busy 24/7 for 365 days as I had my assignments, responsibilities as the captain of team technocrats, quad torc, and the vice chairperson of SAE. I also participated in competitions like MUN.

Describe your role/position in Mercedes Benz?

I joined as an intern at Mercedes Benz and I'm in the research and development sector. My job is basically to improve the current driver assistance projects. So whenever any customer faces an issue, my task is to rectify the faults in our products.

Other than mechanical engineering studies, what other qualities should a student possess to make way into their dream company?

The basics of MATLAB which is essential for working in a company is something that we as mechanical engineers are not taught. For automotive companies, it could be CANOBIN. All of it breaks down to the basics of programming. So knowing at least one language is necessary e.g. python, C++ etc. Apart from that, interpersonal skills, communication skills, leadership qualities are the skills they look for.

As you said you are in the research sector, how do you conduct research studies in the automotive sector?

I'm towards the IT side of the research sector or towards the backend side because my task is generally collecting data from users whose cars are facing problems and analysing them. Furthermore, I pass on the advice required for rectifications in the product. But there is something more towards the autonomous side, for e.g. developing projects for autonomous driving, developing sensors, developing point cloud data and a lot of other stuff. For this we follow a procedure, we go through a lot of research papers or patents and then we give our inputs and the final call is given by the manager as to what system has to be used. Before the manager makes his decision, we as engineers have to make prototypes as to what kind of services have to be used. So it's basically a long process which includes all the study into research.

How should students meet with the expectations of the industries?

What the industry expects from you as a mechanical engineer is to be all rounder. It expects you to know something of everything and also they expect you to know how to learn something you don't know about. They expect you to refine your own work. Basically they look for someone who is a good learner, so if you don't know about a particular thing, you can learn that and continue the given job.

As we know that Mercedes Benz is already so advanced, so where do you see the industry in the coming years?

As you know that Mercedes Benz is already advanced in autonomous driving. For e.g. If you take an S-class and turn on the driving assistance mode, you don't even have to touch the steering and the car will take all the curves and turns and also change the lanes if necessary. Tesla is leading in the autonomous sector but Mercedes Benz is catching up and we truly desire to surpass them in the upcoming years. In driver assistance, there are four levels defined by SAE and Mercedes Benz is already on the second level and in the next five to six years we tend to bring in a lot more upgradations

so that you just have to give commands to the car about the location and you can sit back and watch a movie and have a snack. But this will only be possible if we are able to communicate between the roads and the cars. Furthermore, in the next 10-12 years there would be no need for traffic signals as the cars would be able to communicate with each other through wireless means which would avoid accidents.

What kinds of scholarships are available for students who want to pursue their masters in Germany?

In countries like the USA and Canada, scholarships are quite much defined by your GRE scores and apart from that you can apply for additional scholarships which is based on your academic track record and according to that the scholarship percentage is decided. As far as Germany is concerned, most of your education is sponsored by the German government, every college and research organizations are funded by the government itself. So in most of the public universities you do not have any tuition fees. You just have to pay a certain amount for a student card which helps you travel to different places in the whole state of Germany. If you opt for private universities in Germany, the fees are quite low compared to the private universities in the USA.

What other extra curricular activities other than studies are needed when you go for masters?

The more you can show about the extracurricular and cocurricular skills apart from studies, it's good for you because the curriculum that is followed in India is well defined. If you stick to it, it won't take you far so you should have as many internships as you can and also complete some courses online. You should also take part in competitions like MUM, SAE Baja etc as they help you in writing SOPs for the universities you're applying to.

What message would you like to give to the upcoming engineers to motivate them?

My only suggestion to the young engineers would be to explore, never stop learning and do not limit yourself to your own branch. Just find fun in whatever you do. Keep participating in extra curriculum activities as that will teach you how to maintain the balance between studies and your interests. In the field of Engineering, if you have interest in any branch, keep researching and reading research papers on that topic. It will help you gain more knowledge

INTERVIEW

VENKATESH MODI

Venkatesh Modi, 24, is a graduate of Batch of 2018, from Mechanical Engineering, TCET. He was the Treasurer of ASME-TCET (A.Y. 2016-2017). With his deep interest in the Automotive sector, he worked at Volkswagen Pvt. Ltd. for 2 years and will be starting his Masters Program for MS. MME TIME at RWTH Aachen University, Germany, known as one of the leading institutions in Science and Research.

Can you describe what Volkswagen is about?

Most of you might be knowing, Volkswagen stands for people's car (volks-people; wagon-car) basically focuses on quality and safety over everything else. It is a multinational company. It has over 11 subsidiaries which include Porsche, Ducati, Lamborghini, Fiat, etc. they also have their own commercial vehicle unit and in India where they only manufacture passenger vehicles and the plant is located at Sakan, Pune. It is quite a good company for youngsters to work in and provides a lot of scope and has skilled manpower over there.

Can you tell us something about the new technologies which are used for increasing efficiency?

Currently they are using automated laser welding for the roof of a car and in India, it is the only plant that uses automated laser welding for complete roof operation. The main technologies I would say are automation in robots which are used for welding, other than that they use a lot of production techniques like kanban cards and just in time techniques etc. Technology wise, everything is connected by a server. You can know about the history of a car at any time and the present location of the car.

Describe your role in the company?

First year I was a graduate internship trainee in the company and my department was the fault elimination process which is also known as FELLER APSTALEP PROCESS (FAP). It falls under quality assurance and my role was to coordinate with a team of around 20 people who dealt with recurring defects and many other plant issues which we have to resolve. Every year there was a management meeting where we had to present these issues and get decisions or funds depending on whatever is needed to solve these issues. After that I joined as an officer in quality assurance again, but this time my role was working on market service. There is a huge company named JD power which conducts surveys of products in various domains. My domain was car service in which we get to know whether the customers are liking our cars or what kinds of problems they are facing and we try to solve their problems inside our plant. Other than that I'm also making test plans for new cars that are going to launch next year.

Apart from mechanical engineering skills, what other skills do industries want students to possess?

Other than mechanical skills, I think soft skills are very important in a company as well as presentation skills. The main thing I learnt was how to make presentations which consist of all information within a page so when you present something to a person who is at a very high post in management, we just need a page that consists of all information that we need to provide. You also need to be detail oriented. You cannot miss any point in the presentation in front of the management and if you do, it is considered to be a big blunder. Other than that you should specialize in any one domain (you should not be jack of all trades). Focus on something you like and pursue that.

Where do you see the automobile industry in the next five to six years?

In the next 5-6 years, it will transform a lot. But speaking of India, I don't think there will be a big transformation in the next 5-6 years because it is already taking place for example Kia Motors is already coming in with their automation. So the farthest the automobile industry would go in India would be EVs not much in manufacturing and automation.

How should students fill the gap between company requirements after their graduation?

A major factor is internship, you should do as many internships as possible and try to get them for at least a month or more because in less than a month you don't get to learn anything. Whenever you get holidays after exams, try for an internship, it doesn't matter if it's your second year or your third year but you should get internships and you should search for papers that are published online about whichever industry you're interested in e.g.; newspapers, articles. You should also participate in events such as quad-torc and SAE BAJA. They'll help a lot because these competitions are well recognised by all the major companies and they will ask questions about your project. Other than that if you're able to do any online courses in whichever field you're interested, that'll be very helpful.

What were the challenges faced by you when you were an engineering student and how did you tackle those?

My batch was the 3rd batch in TCET for mechanical engineering so I was not sure if I'd get placement in a core company. So the main challenge at that time was getting a job in a core company. From the second batch only 1 student was placed in a core company and from our batch 3 students were placed in core companies. So getting into the dream company was the biggest challenge. Other than that, everything was managed quite well and just focus on your skills.

What did you enjoy the most about working in a team?

From the start of our studies, I was always a part of some or the other team. I was also in our college cricket team and in the quad-torc team so I was quite a team player, and while working in a team you learn to manage a lot of people, even the people with different behaviours, attitudes and different kinds of knowledge. You also get to know about the different aspects of the industry through the past experiences of various people. For example; if I have experience of 2 years and I have a team of nine people and each individual has an experience of 2 years, then collectively we will have an experience of 20 years. Hence when experiences from a lot of people come together you learn many things.

When we go for an interview what do they expect from us?

The interviewer might have interviewed around 300 candidates already, so they know that you are very aware of the technologies or the things going on in the industry. They will ask you about the basics of their particular industry and above all they will see how good a candidate you are and how well you can handle pressure. They will check if you are a team player or not. They will look for someone who they can train easily. Also they will ask you about your future plans so be ready with that.

How should the students cope up with technologies like Artificial Intelligence/ Machine Learning in the syllabus along with core mechanical subjects?

Core mechanical knowledge is not enough. Other than that IoT, industry 4.0, automation, ML etc should be covered by students because engineers are going to be a lot in demand in the coming years. Talking of teachers, they cannot do much in this aspect because they cannot change the syllabus. So you should learn the core subjects to their best and take efforts and try to learn things by yourself and you can also participate in workshops.

Do you think it is necessary to pursue higher education?

I personally like to learn new things and I would suggest you go for higher education but if someone is happy with his job and his current profile, he should continue working as he is. While working also you can simultaneously learn new things. Both these things have their own pros and cons, it totally depends on the particular individual what he/she has aimed for and how well they can manage things.

What message would you like to give to the upcoming engineers to motivate them?

My message would be to focus on your studies but not to the extent that you detach yourself from the outside world. Also have knowledge about what's going on in the industries you're interested in and follow your passion. Stay connected to the industry and keep your CGPA above average i.e. more than 7.5 because companies have a minimum criteria for recruitment. Also, have a hobby, so when you're having a bad day, you can just do the thing you like and clear your head so that the next day you are refreshed. If possible, try to participate in most of the events like quad-torc, SAE BAJA etc.

PROJECTS

MANUFACTURING & CHARACTERIZATION OF NANOPARTICLES ENHANCED COMPOUNDS

Abstract :

In Recent year, there is a lot of research going on in the field of Nano- technology. Emphasis is being put on developing composites that have comparatively reduced weights but at the same time provide a larger amount of strength for use in various industries. The best and the most being researched enhancement is incorporating nano-particles into the development of composites. Typical Nano-enhanced composite are light weight material with high strength hence it is very attractive and also used in aerospace, automobile and many other industries. Nanotechnology is one of the most powerful ways to enhance the properties of the material. Nano material is mixed with Prepregs to increase and enhance the properties. Current paper outlines the role of nanotechnology in resin and challenges fabricating Nano- enhanced composites. Several problems arise while fabricating the Nano-reinforced composite. Out of these, important problems are stated in this paper. This paper also consists of a list of the equipment required to develop the composite material. This paper consists of important problems that arise when fabricating the Nano-enhanced composite.

Keywords:

Nanoparticles, Composites, Prepregs, Graphene, Carbon Fiber, Mechanical Stirrer.

Introduction :

Nanoparticles :

Nanoparticles are particles between the range of 1nm and 100nm in dimension with a layer surrounding it called an interfacial layer. The interfacial layer is an important part of nano scale matter, after-all affecting all of its different properties.

Most nanoparticles are classified into different types according to the size and shapes, physical, morphology and chemical properties.Out of which many of them are carbon based nanoparticles, polymer nanoparticles, ceramic nanoparticles, metal nanoparticles, semiconductor nanoparticles and lipid based nanoparticles.Nanoparticles are advanced materials having recently gained increasing popularity due to their scientific and Technological significance. They have a wide range of uses such as catalyst with a huge activity and mainly focusing on metal semiconductor junction, optical sensor and modifier of polymeric films for packaging.

Functionalized Graphene Amine :

Graphene, which is a carbon based nano particle, is used in this particular research. Graphene contains high mechanical, electrical and thermal properties. Graphene is thin and light weight but at a same time incredibly strong. Graphene is the strongest 2D element with just a single carbon atom in it. Graphene used for our research was 99% pure functionalized graphene amine. We used functionalized graphene rather than pristine

graphene as functionalized graphene readily creates bond with epoxy. If pristine graphene is used then epoxy is first heated and then graphene is added with vigorous stirring in a mechanical stirrer. Graphene is used in different applications. Many researchers have been performed to incorporate graphene in composite material to enhance different properties like thermal property as the graphene conductive element it is used for heat dissipation. Other applications for graphene are energy storage devices like supercapacitors and batteries, anti–corrosion coating, precise sensors, and solar panels.

Composite Materials :

A composite material also called as a composition material or abridge to composite, which is the most common name is a material made from homogenous constituent material with significantly different physical or chemical properties that, when in cooperation, produce a material with characteristics dissimilar from the individual components. The individual component remains separate and well defined within the finished structure, converting composites from mixtures and solid solutions. Composites materials are generally used for building bridges, racing car bodies, shower tubs, storage tanks, boat skeleton and swimming pool panels.

Carbon Reinforced Composite :

In these researches, carbon fiber (400gsm) is used as the fiber and Epoxy (Araldite + Aradur) is used as a matrix. Carbon fiber reinforced composite is made by hand layup process. We have conducted testing on the carbon fiber reinforced composite as it is a widely used composite material and manifest some exceptional properties. Further properties are enhanced by mixing graphene in carbon fiber composite. Graphene enhances not only mechanical properties but also thermal, electrical and structural. Graphene also protects composite from de-lamination by making bonds within the epoxy. Graphene enhanced composite are currently used to make car and airplane outer body as it has high strength to weight ratio.

Graphene Enhanced Composites :

The presence of graphene in the composite results enhanced conductivity and strength of the composites. Combination of graphene with various composite not only reinforced the composite but also introduced new mechanical and electrical properties to composites. Most important property of the graphene enhanced composite is its fracture toughness which makes them an important material in engineering.

Research Objectives :

When nanoparticles are incorporated with composites they can produce various results depending on the manufacturing methodology and the type of nano-particles used. The composite attains mechanical properties according to these variations. Our aim is to study the effects of graphene nano-particle enhanced carbon fiber composites and its characterization. The specific objectives of this research are listed below:

- Study the effects of nano-particles
- Enhance mechanical properties of carbon fiber composites.
- Identify existing difficulties faced by nano-particle enhanced composite manufacturers.
- Identify new problems and difficulties that we will come across throughout the course of our research.

- Attempt to solve the problems mentioned above.

Methodology :

Prepregs are partially cured ready to use matrix systems which are reinforced with carbon fiber. These prepregs cure completely under heat and pressure to form extremely strong but lightweight composite structures. In our course of experimental research, we will be preparing four types of composites and then comparing the mechanical properties of the same. The composites are as listed below.

- Carbon Fiber Reinforced Composite (CFRC) (0% Graphene)
- Graphene enhanced Carbon Fiber Reinforced Composite (CFRC) (1% Graphene)
- Graphene enhanced Carbon Fiber Reinforced Composite (CFRC) (1.25% Graphene)
- Graphene enhanced Carbon Fiber Reinforced Composite (CFRC) (1.75% Graphene)

The methodology used to prepare these types of Pre-pregs & composites is as discussed below.

1. Taking the required amount of resin according to the batch size calculations and mechanically stirring it for 15 minutes to avoid any voids formation.
2. Adding the required amount of Graphene (1, 1.25, and 1.75%) and mechanically stirring it for 45 min so that we get a void free homogenous mixture. This step will not be performed in case of 0% graphene composite specimen.
3. Cool the mixture to room temperature and then add Hardener. Stirred for another 15 minutes.
4. A layer of carbon fibre fabric is layered with nano particle rich epoxy to form a prepreg.
5. We make 5 prepared layers and let it partially cure in the oven for 54 min at 80°C.
6. The fabrication set up is prepared on a plain glass piece by cleaning it and applying a release agent on it.
7. Placing five layers of partially cured Prepreg sheets on top of each other.
8. Next, stacking a layer of peel of ply which helps in easy removal of the composite after the fully curing process.
9. On top of it, adding the breather sheet which absorbs excess epoxy resin which may flow out.
10. Enclosing the entire specimen sheet in a vacuum bagging film with the help of a sealant tape so that there are no leakages.
11. On one side of the vacuum bagging film we place the nozzle.
12. One end of the hose pipe is connected to the outlet of the vacuum pump while the other end is connected to the inlet of the nozzle.
13. The vacuum pump removes the air from the sealed or confined space and applies a uniform pressure at 760 mm of hg. This is done to pressurize the Prepreg sheets so that they adhere firmly.
14. Maintaining the vacuum, we let the specimen to fully cure in the oven at 80°C for 4 hours.
15. After fully curing the specimen we let it post cure at room temperature for 12-24 hours.
16. After the curing process we peel off the sheets and we get the composite of the desired thickness.
17. The composites are then cut according to the ASTM standards for testing.

Expected outcomes :

By incorporating these Nanoparticles into the Carbon Fiber reinforced Composite, we aim to formulate and validate the methodologies that should and should not be followed while manufacturing the Nanoparticles enhanced Composite. Also, the thermal and mechanical properties of the composites will be enhanced

Conclusion :

During the course of this research project we studied a number of research papers that have been published earlier. By this literature review, we were able to distinguish clearly the various problems faced during the manufacturing of composites like delamination and agglomeration to name a few. This helped us to briefly draw our problem definition. Additionally, the research papers helped us to decide the various materials that we should consider for our project. By thorough study we decided to incorporate Graphene Nanoparticles into carbon-fiber based composites. By incorporating Functionalized Graphene Amine into epoxy resin and then laying it over carbon fiber sheets, we were able to manufacture and test these enhanced composites for its mechanical properties. We realized that a previous research was done which suggested that the graphene enhanced the properties to the most efficient scale when added between 1% to 2% by weight of epoxy resin. Thus, we decided to go further deep between this 1% to 2% by weight. We therefore tested the properties for different composition of graphene Nanoparticles and decided to produce composite sheets that contained 0%, 1%, 1.25% and 1.75% of graphene by weight fraction of epoxy resin. The test samples were then tested for its mechanical properties like tensile and impact strength. Also, carbon fiber has higher mechanical and electrical properties as compared to fiberglass and thus carbon fiber was used. The only disadvantage carbon fiber has is that it shatters on impact. Nano particles are incorporated into the carbon fiber composites to minimize shattering of the carbon fiber composites.

After testing the composite samples for its tensile and impact strength for various weight % of functionalized graphene amine the following points can be concluded-

Graphene enhanced composites show the best result when incorporated between the weight % between 1 to 2% rather than greater weight percent.

Thus from the complete research project, we can conclude that enhancing epoxy based carbon fiber composites with functionalized graphene amine between the weight percent of 1 to 2%, we can definitely enhance the properties of the composite manufactured and can provide a strong composite material for applications that require high strength but has a restriction to weight.

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VEHICLE PAYLOAD ESTIMATION

Abstract :

With the increase in the transportation of goods by road there were certain rules defined to make sure safety on road. More than 40% of the transportation of goods takes place by roads. There are certain rules that are to be followed while transporting goods through the road by the vendor. And one of them is not carrying more than the specified weight allowed for that truck model. The losses due to under loading and overloading fines can be tremendous. For this there is a necessity of a method that can weigh the payload of the trucks so that profits are higher and optimum use of resources can be done. The first device that comes to our minds is the weighbridge, as it is the most widely used device now. A weigh bridge is the most accurate way to know the payload. It is more efficient to go on a weighbridge and measure the load than to measure it separately while loading.

Keywords :

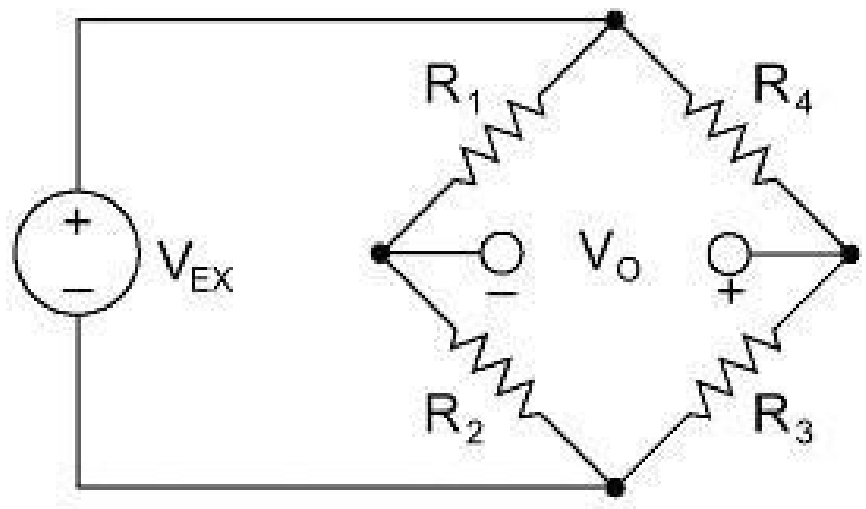
Payload, axle-deflection, onboard.

Introduction :

Weighing the payload of the vehicle has never been easy. There are two methods that can be used to measure the payload .

1. Measuring the payload during the loading of the truck or.
2. Using the weighing bridge.

While measuring the load during the loading can be easy if there are products of the same weight, it can become a difficult task if there are goods of varying weight. So, this method is rarely used in the market as it is inefficient and time consuming if the goods are of different sizes. This is where the weighing bridge comes into picture. A weighbridge is a large set of scales which is usually mounted on a rigid concrete foundation. It is used to weigh the entire road vehicle and their goods. It has an electronic or computerized screen which shows the heaviness of the vehicle gauged. Weighbridges are primarily utilized for weighing enormous vehicles like trucks or rail holders where movement of products is done through vehicles. Solid and precise weighing helps the business by giving them the accurate figures to keep their goods inward and goods outward. By weighing the vehicle when empty and when loaded, the difference in the weight can be calculated to know the payload. This is the



easiest technique available in the market for measurement of the truck load. Though it is easiest, it is a time consuming process.

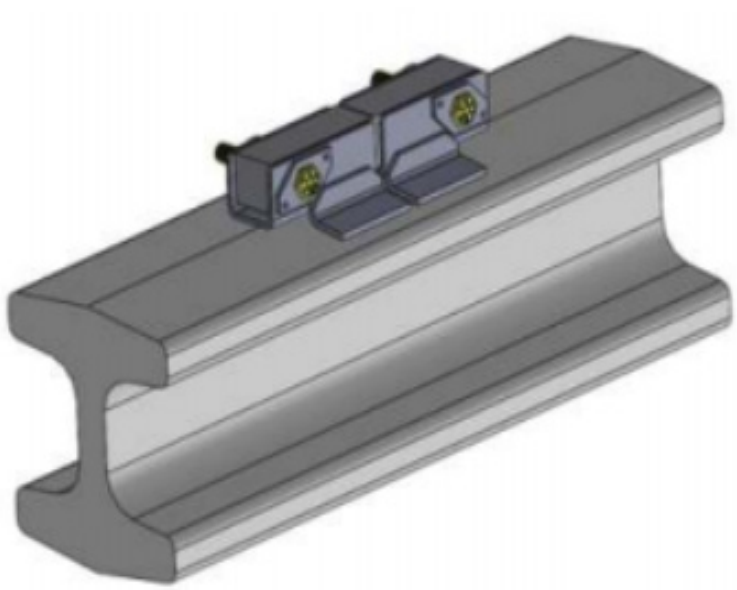
A device that could be fitted in the truck which would tell you how much weight you're carrying could save your time, money and increase your profits. Proper weight distribution on all the axles can be done to improve the axle life and excessive wear and tear. As the device will be mounted on the truck, the measurement of the payload can be made anywhere provided the truck is standing on a plain surface parallel to the ground. Not only there is feasibility of measuring the payload anywhere but unlimited measurements can be done just by investing once in this device. The nature of this device to be portable, doing innumerable measurements and one-time investment makes it a better option over the conventional weighing bridges to measure payloads. As the device will be mounted on the truck, the measurement of the payload can be made anywhere provided the truck is standing on a plain surface parallel to the ground. Not only there is feasibility of measuring the payload anywhere but unlimited measurements can be done just by investing once in this device. The nature of this device to be portable, doing innumerable measurements and one-time investment makes it a better option over the conventional weighing bridges to measure payloads.

Working :

- Displacement sensor 2 is designed to determine the axle load or cargo weight in vehicles with a suspension system by measuring the distance from the chassis to the axle. Output signal voltage from 1.5 to 3.5. To install properly your sense different 0 2 it is necessary to find out the suspension travel from a fully loaded to an empty state it is recommended to install the sensors so that the angular movement of its level is maximum when the vehicle is loaded from empty to full and the same time it is necessary to exclude the possible excess of limiting angels from - 40 to 40 degrees based on these the mounting location of the sensor should be selected as well as the length of the connecting levellers from the mounting kit.
- Sometimes you can estimate the suspension travel by installed bomb stops the sensor is installed using a mounting kit containing a lever a rod visalistic elements as well as mounting brackets and fasteners the sensor is mounted on the vehicle frame the lower end of the rod is attached to the abstract element of the axle using brackets from the mounting kit to trim the rod you must first remove the elastic element after installation install it back a rod is installed in the elastic elements so that the elastic elements can work in all directions do not install rod too deep into the rubber elements the rod is attached via elastic elements with pins to the point of attachment of the UN sprung weight and to the lever when installing the pins into the elastic element we recommend covering the pin whether this goes crease when installing the sensor on the front axle it is sometimes easier to fix the lower end of the rod in the bump stop a hole is drilled in it and a thread with a diameter of 8mm is cut into which the pin for fastening the reward from the marketing kit is screwed.
- When mounting the sensor to the front

axle you can weld a corner directly onto the axle , a hole is made in the corner to which the lower end of the rod is attached.

- In case this spring works on the two excels at the same time, additional reward should be used. In the middle it will be connected with a vertical measuring road so we measure the average vertical displacement of the two axles after the sensor reasons stalled it is connected with the cable with the systems controller Euro sense difference t.
- When all the sensors are connected we should connect all systems elements in one. The free Connector of the difference t unit must be closed with a cable plug. Setting up the weighting system. When you first start the program, a login a window will appear to access the program. You need to click on the registration link and alink and a registration form will open in PGA format which must be filled out and sent to GSK mechatronics. After you are provided with the I.D. and password you must feel in the appropriate fields in the box at the entrance and click on the login button a check mark that is in front of remember means that the next time you start the program the I.D. and password will be automatically filled with the latest data .After entering the program you can select the interface language in the language menu first of all you need to connect the service adapter your sense destination 0 2 to your notebook using a U.S.B cable using the key set on Destination 0 2 to transfer the adapter to walk with errors 485 interface and your device should appear in the ports. COM and LPT type in the device manager. We establish a connection with the adapter for these open the settings COM import settings menu in the window that appears to enter the COM port number and data rate which should be selected to be 19.200 bound. A successful connection of the program with the euro sense destination 0 2 adapter is indicated by the status bar to establish a connection with the weighting system it is necessary instead of euro cents display errors which are connected to Euro sent to cable to connect your sense destination 0 2. In the type of truck dropdown list in the search profile window select that appropriate configuration enter that parameter as indicated by the red rectangle. If you choose another type of truck. The list of required parameters will change. The next step is to set top of the location of the census in the system.



- Enter the serial numbers in accordance with the census location in a particular place or more to transport for is open the corresponding window in settings location of sensors in the system select the location and number of sensors on the axle for your specific vehicle configuration. Then in the addressing table in the serial number column enter the serial numbers of your sense do you differ team configuration blocks.

According to their location and click on this setup addresses and loading of parameters button in case of successful setting of addresses and load and loading of parameters the corresponding dialog box will be displayed in case of an error in setting of addressing and loading of parameters an error message will be displayed ,these can occur if not all configuration blocks are correctly connected or serial numbers are entered incorrectly. It should be noted that if there are no lifting axles in the trunk and two sensors are placed one for each side then the following options for searching the location of the sensors are identical in the truck. It is assumed that all airbags in the case of air spring suspension on the sides have a common safety and there is no difference in which of the pillows to put a pressure sensor.

Conclusion :

Another two-dimensional redirection sensor, taking FSR as its essential material, has been proposed and shown in this work. The sensor comprises five concentric rings and is mounted vertically to the hub of the objective shaft. When the bowing of the shaft happens at the position where the sensor is mounted, the ordinary weight will be forced on the FSR film, along these lines causing the difference in FSR's opposition. A printed circuit board with terminal networks (partitioned into four estimating stages) and an incorporated circuit with the capacity of killing the crosstalk impact are intended to The connection between the bowing edge and the zone proportion. measure the yield voltages of FRS film. In light of the particular adjustment strategy, the diversion and the twisting course of the objective shaft can be gotten from the deliberate voltages. The exploratory outcomes dependent on a model of the proposed avoidance sensor show a decent consistency between the hypothetical worth and the measured esteem. For a pole with the length of 140 mm, the estimation scope of avoidance can reach to 30 mm. For the four estimating periods of the model sensor (in +x, +y, −x, and −y headings), the sensitivities are 40.37, 32.8, 37.77, and 39.47mV/mm, the nonlinearities are 5.4%, 2.2%, 5.8%, and 2.7%, and the hysteresis are 7.1%, 12%, 11.7%, and 13.2%, separately. Moreover, the assessed bowing bearing is in great concurrence with the genuine direction. The proposed sensor can be utilized in numerous functional applications where the estimation of huge and multidirectional twisting is required.

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ENERGY CONSERVATION IN AIR ENGINE USING HYBRID MECHANISM

Abstract :

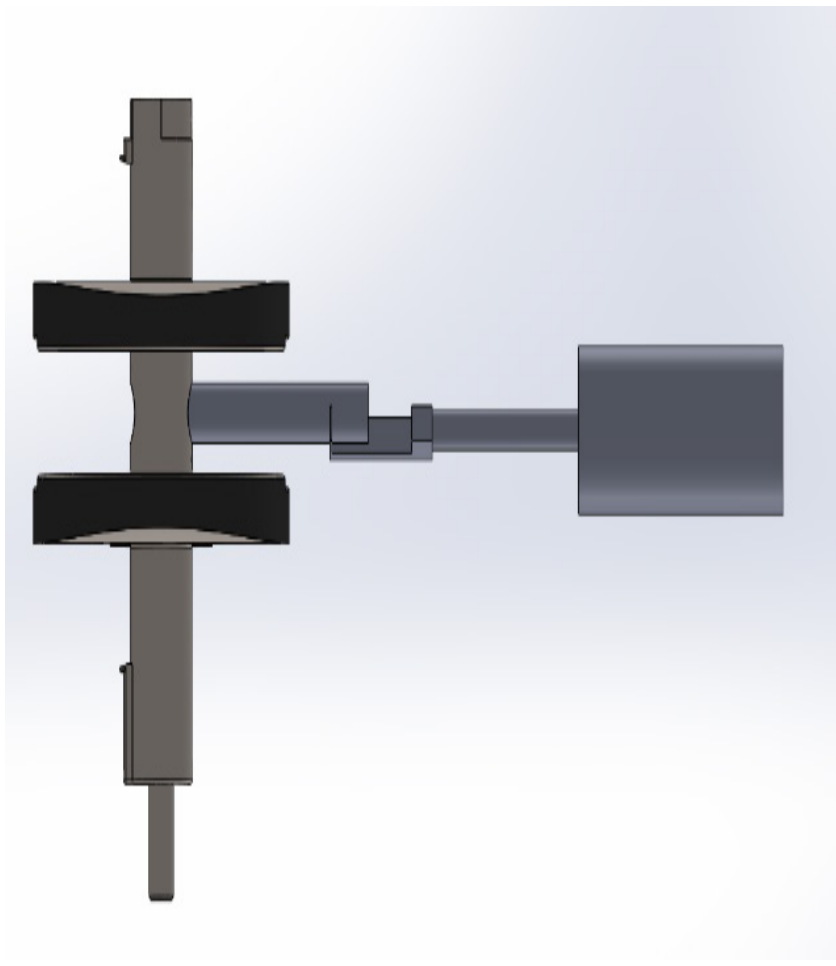
The expense and contamination with gas and diesel vehicles is inconceivably high to create vehicles is exceptionally high to create vehicles fuelled by different energies. one of the options is the utilization of compacted gas to get capacity to run a vehicle. The ecological contamination inside the metropolitan urban communities is expanding quickly essentially because of the misrepresented scope of fuel steam-controlled vehicles. Compacted air stuffed by power utilizing a mechanical gadget. The power interest for pressure air ought to be thought of while registering in general intensity. Because of the particular and ecological agreeable properties like compacted gas for putting away vitality could be a method that is not exclusively conservative and clean, anyway also prudent. In this way, air is considered joined since quite a while ago run energizes which can run the vehicles. This paper gives a framework of total vehicles quickly and bit of leeway and inconvenience of the compacted air innovation and guarantees the packed gas is that the different fuel for the vehicles.

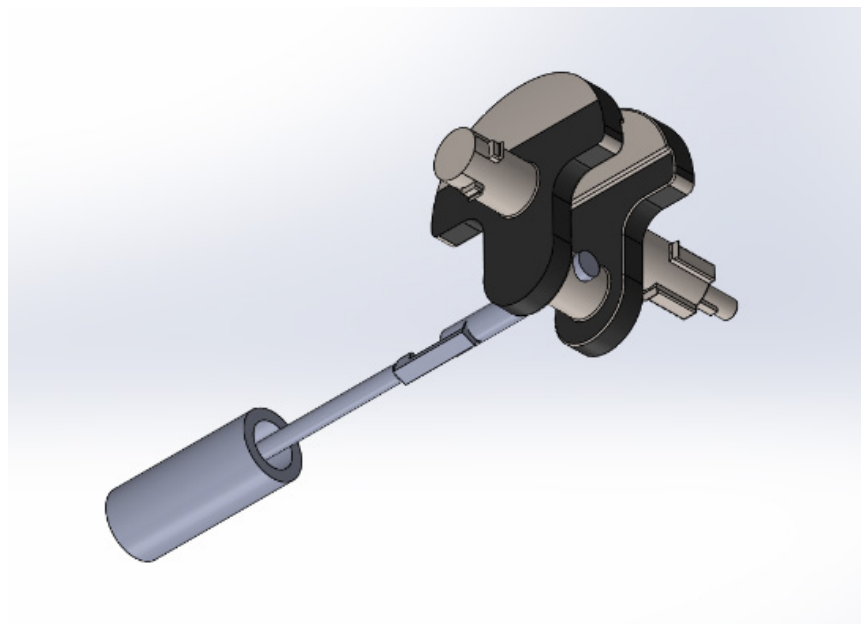
Keywords :

Metropolitan, overstated, mechanical gadget, steam-fueled vehicles

Introduction :

The air motor is the main source inside the seat scale power crossover bit of ground. The obligation of the air motor is to change over the vitality kept in packed gas to develop movement at the yield shaft. Since we tend to be endeavoring to supply an ‘’eco-friendly’’, gears, we’d quite recently like the motor





to utilize compacted gas similarly as with proficiency as feasible. Moreover, the speed of the yield shaft ought to be generally perfect with the rest of the half and half force train. There are numerous specialized edges that misuse this motor, similar to no ignition happening inside the chamber, working temperature of motor is unfathomably going to close temperature. This aids in lessening mileage of the motor parts. Moreover, there's no danger of sound. This progressively prompts wash working of motor. additional specialized edges are that there'll be no need for placing in cooling framework or propelled fuel infusion framework frameworks. This makes the arranging less confused. As no ignition happens which finishes in wash working of the motor with least mileage, this may require less support.

The transportation segment faces pleasant and squeezing difficulties, together with atmosphere effects of gas emanations, local wellbeing effects of criteria poisons, and political and financial effects of raw petroleum reliance. While numerous progressive arrangements are being created to decrease the effect of autos, as misrepresented mileage guidelines and quickened selection of half breed vehicles, progressive new methodologies ought to try and be assessed. One such possibility is found in compacted gas Engine (CA Engine), that is steam-controlled alone by packed gas kept in an exceedingly vehicle on-board pressurized tank. Advocates of this innovation guarantee CA Engines are greener and less expensive to control, since they do not expend petroleum derivatives and turn out zero tail-pipe discharges, while giving the capacity and execution required for light-obligation vehicle use. because of CA Engines works in an exceedingly two-stroke instrument (development and fumes feed), with an end goal to tackle the vitality in compacted gas, here is an undertaking to run A current two-stroke ICE on air with least feasible alterations and confirm if the idea of running existing cars on air is

SR NO	COMPONENTS	COST ESTIMATION (approx)
1)	Compressor	7500/-
2)	Piston	2000/-
3)	Connecting rod	2000/-
4)	Wheel axle	2500/-
5)	Wheel	1500/-
6)	Battery	6500/-
7)	Total	22000/-

so a potential different to over reliance on fossil inferred fills. The capacity expected to run the mechanical gadget are regularly obtained from various sustainable power source assets which can bring about network/ home essentially based air fuelling stations diminishing the estimation of transportation of any fuel. This paper is pointed toward the investigation of a CA Engine Kit regarding infusion edge and weight, power of activity and assessment of its suitability as a transportation plausibility when contrasted with hydrocarbon and electrical vehicles.

Working:

At the initial stage, we use the compressor to draw compressed air as our fuel for the working. The pressure we are using for running the engine is around 10 bar. Once the air is passed to the piston-cylinder arrangement that makes piston moves, this motion is provided to the crankshaft through the connecting rod causing rotation of the crankshaft to adhere to the mechanism provided. After this, the crankshaft tends to rotate the axle on which the wheel is mounted.

Now, once the wheel is rotated this completes the initial working of the air engine. Henceforth the hybrid mechanism comes into consideration, where we are using a battery, alternator, rectifier and regulator as shown in the above figure. After the initial stage where the wheel is in motion we have implemented an alternator connected to the axle of the wheel through a belt drive. Due to this alternator is rotated and charged through the rotation of the wheel. The charged alternator is used to charge and store the energy in the battery through suitable mechanisms and the battery is stored. Once the battery is charged, this charge is used to run the wheel through a rotary motor when the compressor is turned off. Therefore the working of our project is completed and the vehicle can run by both means i.e through air as well as battery.

Conclusion :

These days proceed with need of vitality is increments, yet fundamentally ordinary wellspring of vitality is restricted because that rate on cost of oil is likewise proceeds climbed step by step. To fulfill their need, exchange fuel or vitality is required. In any case, while considering substitute fuel some of elements are to be viewed as accessibility, economy, and condition cordial and so on., in view of that CAT (Compressed Air Technology) is the best innovation which tends motor to zero contaminations. On the off chance that further improvement is completed with pressure investigation, thermodynamic examination, limited compacted vitality misfortune and different misfortunes then proficiency of CAE might be further increments.

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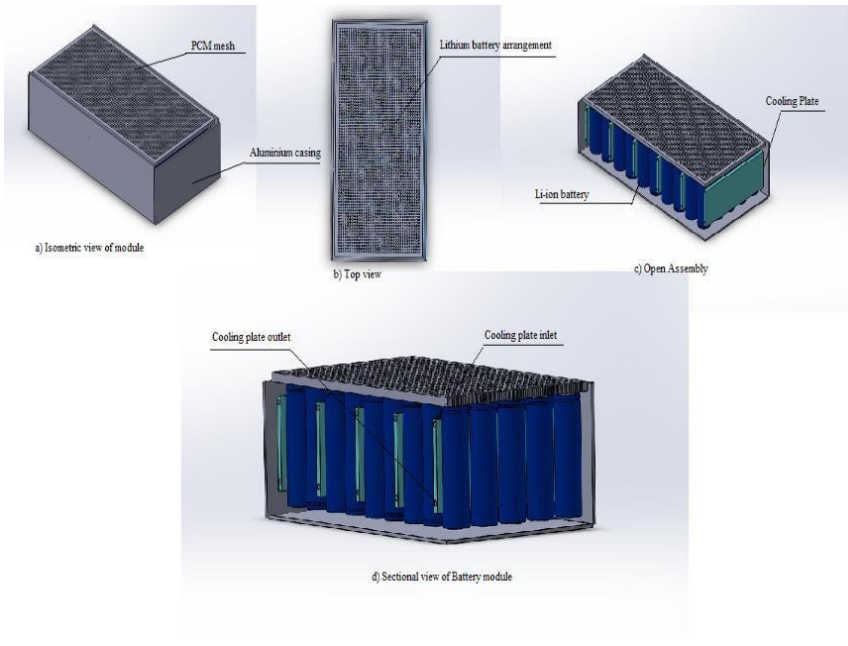
THERMAL MANAGEMENT OF LITHIUM-ION BATTERY SYSTEM

Abstract :

With the advancement in the field of automobile and scarcity of fossil fuels for the energy need there is a need for alternative sources of energy which can provide the same kind of action. Vehicles equipped with lithium-ion batteries are in trend due to their clean-energy source and having much higher density, higher charge current and lower self-discharging rate. however, their overall performance and lifetime operation are strongly dependent on temperature. Temperature rise above 700 causes thermal runaway of the Lithium-ion battery thereby affecting battery performance rate and recharging ability. This project aims at developing thermal management systems for lithium-ion batteries. Henceforth providing an effective cooling solution to thermal runaway. As the heat generated by cells and modules need to be dissipated for best performance, liquid cooling plates equipped with heat pipes, along with a side layer of phase change material (PCM) filled with paraffin increase the heat transfer rate thereby preventing the thermal runaway of the battery. To increase the thermal conductivity of phase change material, paraffin along with nano particles of graphene can be used to increase the heat transfer rate. Battery packs consisting of Lithium-ion cells separated by a separator matrix along with liquid cooling plates between each cell layer act as an effective solution. The addition of PCM layer also makes the temperature distribution even more uniform across the cells.



Keywords :

Phase change Material(PCM), Lithium-ion, Liquid Cooling plate, energy density.

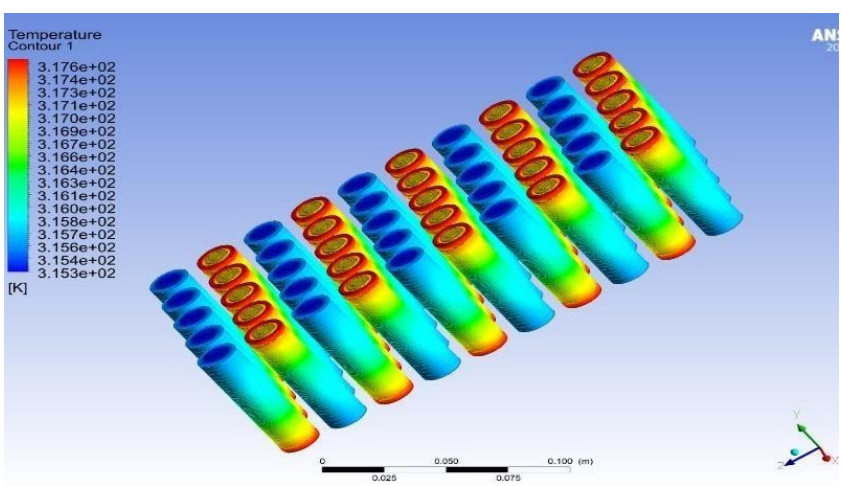
Introduction :

The depletion of global oil resources conjugated to the effort of reduction of the carbon dioxide has made the development of Electric Vehicle / Hybrid Electric Vehicle a major issue for the future. In the upcoming years, advancement in the field of automobile as well as the rise in emissions level of greenhouse gases along with air pollutants, which in turn accompany economic development have become major problems. Energy needs of particular areas are totally dependent and similarly, each module of the battery pack should be around 5ºC. As an alternative to active cooling, passive cooling systems based on phase change phenomena can be potentially advantageous.

Problem Definition :

Problems: Although LiBs have high energy density, electric current and lower self-discharging rate, their performance are strongly affected by temperature rise due to heat generation and charge reaction, and thermal runaway may occur when the battery temperature exceeds 70 °C, condition where all the cell tends to get heat up thereby reducing the charge carrying capacity and ultimately it will lose the recharging ability and the performance.on fossil fuels which in turn leads to economic development. Therefore, it is urgent to develop some alternative to fossil fuels for energy, in particular highly efficient renewable energy sources. All these kinds of vehicles use batteries as energy sources instead of using fossil fuels. The battery used to provide power to the EV/HEV and thus providing a clean source of energy.

Among all the other rechargeable batteries, Lithium-ion batteries show the most significant result to use for vehicles. Lithium-ion batteries have high energy density, power density, better cycle life and are environmentally friendly; they are widely used as clean- energy sources. In terms of this, the Lithium-ion battery technology globally used in electric applications has been designated as the best candidate due to its higher energy density and lower self-discharge. The International Energy Agency (IEA) stated in 2016 that the number of Electric Vehicles in the world has reached 2 million. However, it is proved that the lifetime of Lithium-ion batteries and their performance over the period are strongly affected by temperature rise. Temperature has an important impact on reliability, life span, safety and performances. The battery life is reduced by corrosion of the components when higher temperatures superior to 500 are reached. Besides, decompositions of materials in the battery can lead to safety issues such as explosion or too much heat generation in the battery pack. The operating temperature of the battery must be kept between 25 ºC & 38 ºC for achieving optimized performance and higher lifespan. At very cold temperatures, the battery performs sluggishly due to high internal resistance. Efficient cooling systems need to be designed for maintaining the battery in the prescribed temperature range. Moreover, to get away from the situation of destroying the battery pack, even distribution of temperature throughout the battery cell must be achieved. To achieve the temperature distribution uniform throughout the cell, the temperature difference between each cell.



Solution: To eliminate this problem our project aims to develop a Thermal Management System using (phase change material and Heat pipes) to ensure proper Temperature control. In addition to heat pipes in relation with cooling plate design, Phase change material (PCM) stated on solid/liquid phase change can be used for passive cooling, which has a high potential in reducing elevated temperature during high heat generation or thermal runaway of system also it will help to overcome intermittent discharge and in overcoming performance losses at cold temperature.

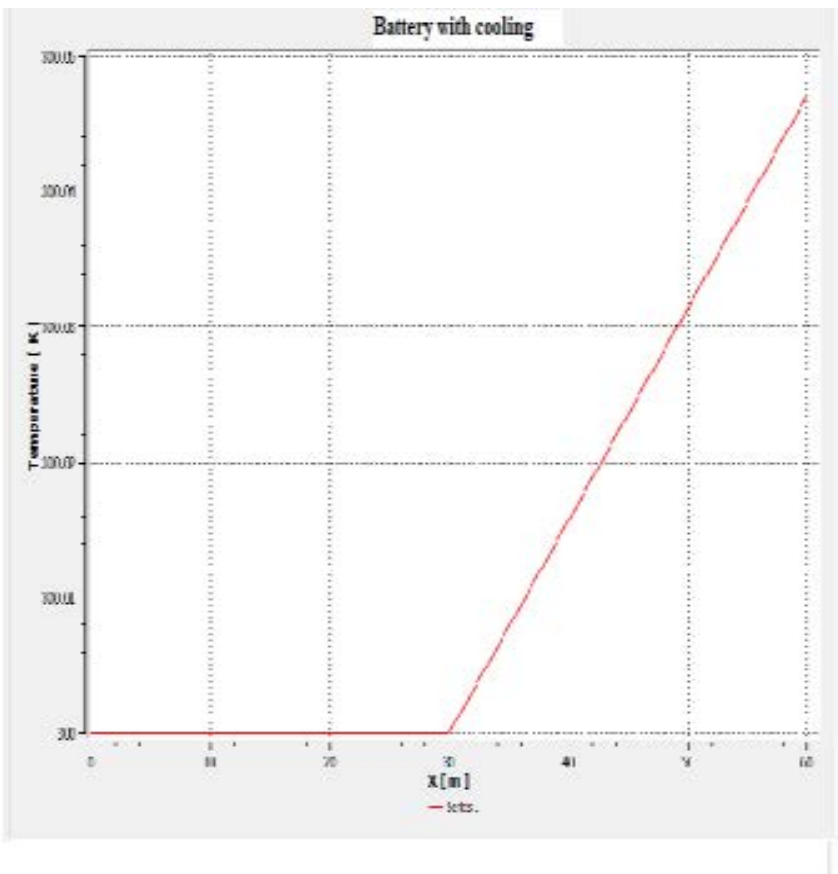
Objectives :

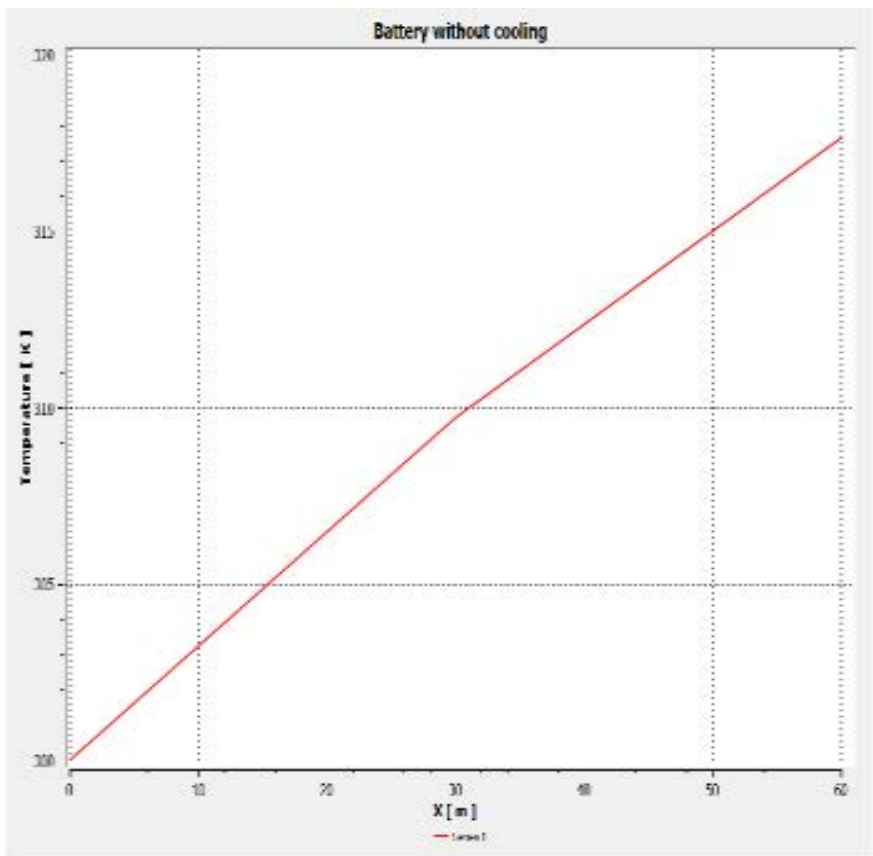
The objective of this project is to design a thermal management system which will help the automotive industries, by implementing systems from thermal run away thus improving the performance of batteries pack used in electric vehicles.

- To improve current thermal management systems in electric vehicles.
- To study the cooling effect of the phase change materials in the battery pack.
- To study the effective properties of Phase change material (PCM) and Heat pipes.
- To improve the cooling system of Lithium-ion batteries.
- To design a safety free system for Electric vehicles.

Methodology :

The setup provided by the group works on the phase changing property of material and liquid cooling. Because of this we are able to increase the overall thermal conductivity of the system and thus optimizing cooling of Li-ion batteries. By designing suitable attachments, the setup will be able to optimize and increase the battery life of electric vehicles under all conditions. This is one of the many configurations which is going to be used in the thermal management of the electric vehicle battery. The arrangement consists of a cell tab followed by a porous container or aluminum foam embedded with the phase change material; namely, paraffin wax; followed by a heat pipe and then the whole arrangement is repeated till the last tab is reached. The phase change material does not have the optimum thermal conductivity required for proper operation, so to increase the thermal conductivity the aluminum foam is used. This is the arrangement which provides surface cooling to each individual cell. We will also incorporate cooling plates at the top and bottom to provide tab cooling. The aluminum foam acts as a suspender as well as a catalyst (to increase thermal conductivity). The working fluid used in the setup is a mixture of water and glycol. Active components like coolant pump, sink (reservoir) and radiator are also used. A number of arrangements; like, using phase change material to provide





tab cooling and cooling plate to provide surface cooling, optimizing the geometry of the cooling plate to provide maximum cooling rate etc., will be tried to maintain the temperature of the battery at an optimum temperature i.e. 350 C to 450 C.

Conclusion :

In this experimental setup on a modified battery cooling system consisting of a new design of cooling plate and pcm type heat exchanger we can expect several outcomes based on the calculations and analysis done until now, which are as given below

1. Some of the basic outcomes is to have a well distributed temperature graph with a proper temperature range. Reduction in the overall battery size and its weight. Reducing its manufacturing as well as its running cost. To increase the capacity so as to provide a higher range with less frequent charges.
2. The placement of cells in the battery pack affects the cooling of the cell which is a phenomenon due to the air flowing from the bottom of the electric vehicle. this incoming air due to the ducts gets transformed into a turbulent flow which thus helps in the cooling of the battery pack.
3. In this system with modified cooling plates and PCM the heat generated is dissipated more uniformly. The advantage of using an active cooling component with a passive cooling gives us a lot of benefits such as in time shifting of the active cooling. the overall vehicle range is increased by this kind of cooling system.
4. PCM in the HE is really a good agent to absorb the heat but it is seen as to have a low thermal conductivity which is tackled by using a foam or graphene nanoparticles. The inclusion of graphene increases the conductivity and also helps in maintaining the structure of PCM. This pcm heat exchanger ensures to keep the battery in the optimum temperature range throughout the operation. In the start of the operation a higher amount of heat is cooled by the pcm than the cooling plate due to its latent heat.
5. It is observed that the pcm is weight sensitive, that is if we increase the quantity of it, it just increases the weight of the overall vehicle but it also increases the latent heat carrying capacity and also decreases the power required for the battery cooling system. Which suggests proper research to find a balancing point so as to get the best of both the world.

Overall a modified battery pack was constructed with an optimized and better cooling plate design with an addition of PCM based heat exchanger which helps the battery pack to avoid thermal runaway. The positioning of the cell array is also tweaked so as to help the cooling pattern It also consists of silicon pads or a thermal paste which helps in heat transfer. It is expected to result in giving an optimum pressure drop in the cooling plate tubes and keep the cell within a certain temperature range.

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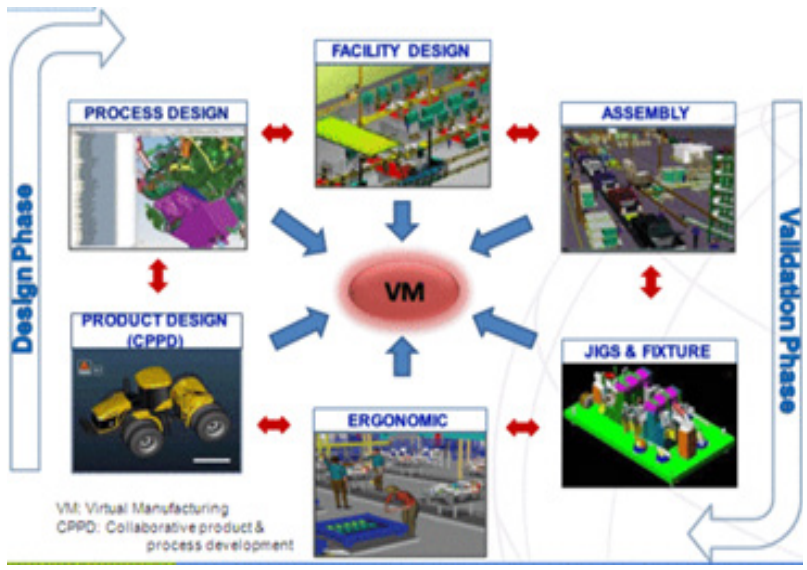
VIRTUAL MANUFACTURING IN AVIATION

Abstract:

Digitization and intelligentization of the manufacturing process is the need for today's industry. The manufacturing industries are currently changing from mass production to customized production. The rapid advancements in manufacturing technologies and applications in the industries help in increasing productivity. The Industry 4.0 trend is pushing the evolution further, because of both evolutions in the visualization technologies and integration with other smart factory solutions. The recent development in 3D technologies is bringing new opportunities for optimizations in aerospace manufacturing. The objective of the paper aims to provide an overview on Virtual manufacturing, its importance and how it will change the future scenario in the Aerospace industry.

Introduction:

Production is a very important part of the economy and is a medium-term activity that combines product, process, and resources. Competition between industries is getting stronger and more challenging in the current economic climate of globalization. Therefore, in order to adapt to the rapidly changing market needs and winning conditions, today's productive businesses have to solve TQCS queries (reduced processing time, best quality, very low cost, efficient service). Nowadays the industrial world is making drastic changes as products become more complex, processes are more advanced and use less technology and basic technology as market needs. The competitive advantage in production has shifted from the archetype of mass production to something based on rapid response and flexibility.



What is Virtual Manufacturing?

The term Virtual Manufacturing(VM) is now widespread in literature but several definitions are attached to these words. First we have to define the objects that are studied. Virtual manufacturing concepts originate from machining operations and evolve in this manufacturing area. However one can now find a lot of applications in different fields such as casting, forging, sheet metalworking and robotics (mechanisms). The general idea one can find behind most definitions is that "Virtual Manufacturing is nothing but manufacturing in the computer". This short definition comprises two important notions: the process (manufacturing) and the environment (computer). VM is defined as "manufacture of virtual products defined

as an aggregation of computer based information that provides a representation of the properties and behaviors of an actualized product". Some researchers present VM with respect to virtual reality (VR). On one hand, in VM is represented as a virtual world for manufacturing, on the other hand, one can consider virtual reality as a tool which offers visualization capabilities for VM. The most comprehensive definition has been proposed by the Institute for Systems Research, University of Maryland, and discussed in Virtual Manufacturing is defined as "an integrated, synthetic manufacturing environment exercised to enhance all levels of decision and control".

Types of virtual manufacturing (VM):

Virtual manufacturing can be categorized into two groups according to the

A. Type of Product and Process Design:

- Design-oriented Virtual Manufacturing: During the design phase the VM focused on construction provides production details to the design engineer. Parts or all of the machine has been modified and tested to test the performance and strength of assembly. The purpose is to increase product design and design process through production simulation to achieve production objectives such as Design for Assembly (DFA), quality, flexibility.

- Production-oriented Virtual Manufacturing: Simulation technology is used in planning production or in new process models to evaluate and improve production processes based on Integrated Product Process Development and to test the order and production flow of the process.

- Control-oriented Virtual Manufacturing: Analysis technology is used to control models to simulate production line production operations or workshops to obtain complete control based on real models and processes.

B. Type of System Integration:

- According to the definitions proposed by Onosato and Iwata, every manufacturing system can be decomposed into two different subsystems:

- Real Physical System (RPS) An RPS is composed of substantial entities such as materials, parts and machines that exist in the real world.

- Real Informational System (RIS) An RIS involves the activities of information processing and decision making.

- Virtual Physical System (VPS) A computer program that mimics the answers of a real physical system is a visual physical system, represented by a factory model, a product model, and a production process. Production process models are used to determine the interaction between the factory model and each product model.

- Virtual Information System (VIS) A computer program that mimics RIS and generates RPS control commands is called a 'virtual information system (VIS).

Benefits of Virtual Manufacturing:

Virtual Manufacturing builds confidence in producers by being able to deliver quality products that will be marketed during and during the initial investment. The benefits of VM from a product perspective,

will improve product quality, reduce the number of body model models, allow more comparisons of production products, facilitate product design and processes. And from a production perspective, it will improve process confidence, reduce material waste, reduce tool costs, lower production costs and improve production processes. Launching VM offers several benefits such as ensuring high quality tools, short cycle production time without false startups, and increasing the design and production of a better production system, greater product flexibility, faster customer feedback on investment impact and improved delivery system, and customers.

Drawbacks in Virtual Manufacturing:

First, setting up a VM system requires a huge investment of material resources, simulation software and people. With regard to the availability of simulation models, each time at each level a new model should be developed even though the previous model has already been developed. Thirdly, the compatibility of VM software with hardware is essential for better performance as software relies on the latest IT technologies. Considering the issues mentioned above, several hot topics are raised in the VM research area: On human-computer interfaces users expect to interact with a computer in a human-like manner. Improving not only graphical integration but also text combination, voice, visual interface is required. Any type of planning work can be supported and improved by imitation. The goal to be achieved is to use a combination of simulation programs in planning and construction tools so that the benefits can be achieved with minimal effort. Computer Aided Design (CAD) data should be influenced by the automatic production of simulation models. The goal is to automatically create simulation models that are ready for CAD data extraction for more information. Using the flexibility of the CAD model is a necessity instead of building a completely new CAD model. A major setback is a combination of real and simulated computer hardware in machine tools and the development of a production system known as Hybrid System Simulation. The actual devices, such as the machine controller, will be connected to a machine-made model to test the operation of the machine during production. The purpose of Virtual Prototyping is to move closer to the most reliable and accurate simulation models, capable of realizing virtual reality under static and dynamic conditions. The function of a VM is to integrate the results of various types of simulations to predict the virtual reality of a machine tool, tool and operation during the mechanical process.

The future in aerospace industry:

Virtual Production in the aerospace industry is used in FEA to design and expand components, e.g. reducing the weight of the frames with integrated construction, in imitation of 3D-kinematics arranging automatic riveting equipment and other functions that address the unpopular reality of taxpayers we see to support complex and service functions (the employee sees the necessary details within his mirrors). The simulation of human activities by mannikins allows for a description of the visual environment of meeting, retention and training activities. The latest developments in more and more complex reality promise new applications in aircraft manufacturing. The ability to resist and / or mix digital

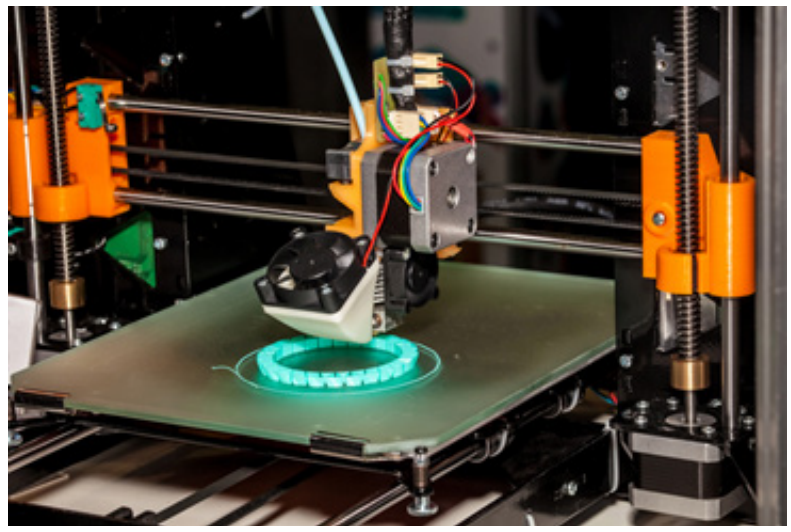
jokes with real physical objects (such as a jet sling, or parts from a supplier) will bring new immersion power to the building. This will bring more flexibility to construction, stronger integration with suppliers and a continuous manufacturing process.

Augmented Reality in Aerospace

Aerospace at the forefront of 3D design:

The aerospace industry has been at the forefront of the adoption and construction of 3D design. These technologies bring benefits that are well suited to the needs of the domain and lead to significant gains in productivity. The introduction of CAD solutions in the 1980s had a huge impact on the aerospace industry by accelerating the construction of aircraft. It has also enabled significant gains in design complexity leading to more efficient solutions. This affects both the performance of the aircraft and the production process itself (reducing material consumption and cost). These changes are especially welcome in the aerospace industry because of the importance of design (which is very important in aircraft operations) and the high cost of production and production methods.

The use of 3D technology in Aerospace is increasingly growing beyond the original product design and has an impact on the entire production process. This brings significant production benefits, but also requires data consolidation efforts and common goals.



3D Printing

Conclusion:

Now-a-days almost every industry is reshaped thanks to up-to-date technological advances, such as virtual manufacturing, or artificial intelligence, and the aerospace industry is no exception. It now appears that VM will stimulate the need to design both for manufacturability and manufacturing efficiency. Aerospace enterprises that integrate virtual manufacturing solutions into their product and process validation methods can expect massive time and money savings associated with physical prototyping, not to mention costs avoided when they can evaluate part and component production in advance.

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Battling Covid-19 with Foot-Operated Sanitizer Dispenser Stands

Abstract:

Sanitizers remove bacteria from the surface up to a certain safe level.. During the recent outburst of the global pandemic of COVID-19, sanitizers have proven to be the greatest shield against the virus, as various studies have shown that the corona virus is rendered inactive by the use of sanitizers. However, there is still a risk of contracting the virus in public places, where many people touch the same sanitizer bottle. The virus can easily spread from one person to the other, if a person who is a carrier of the virus touches the sanitizer bottle. The foot-operated sanitizer dispenser totally eliminates the use of hands required for pushing the sanitizer bottle pump. The main aim of this paper is to explain the various aspects of a basic foot-operated sanitizer dispenser which include its mechanism, parts, construction, costs, materials, working etc. Also it suggests various modifications in the basic model that can be implemented to make the dispenser stand more convenient and adaptable.

Introduction:

Contactless technology is the need in this COVID-19 pandemic. Coronavirus spreads when an infected person comes in contact with other people and this chain continues. Although sanitizers help by preventing the spread of this virus, there is always a risk when the same bottle is touched by an infected person as well as other people. So in this case any mechanism that may help to avoid hand contact with the sanitizer bottle and at the same time is cheap and durable would be helpful. The foot-operated sanitizer dispenser is recently gaining popularity as it is further safe-guarding people against the coronavirus. This machine is totally hands free, hence preventing the spreading of germs/viruses through touch. This dispenser is usually placed in hospitals, offices and other public places. For using the foot-operated sanitizer dispenser, the user needs to press the pedal by using his/her foot and place his/her palms in front of the sanitizer bottle. A small amount of sanitizer automatically gets dispensed into the palms of the user on pressing the pedal. This invention thus prevents spreading of the virus due to its complete hands-free operation.

Basic Mechanism:

The mechanism used in this product is known as Foot-Activated Lever Mechanism. In this mechanism, a great amount of force can be produced by applying a small amount of force by a human foot on a pedal. On pressing the pedal, the entire mechanism gets linked and the mechanism is activated. The mechanical energy released after the activation, results in a linear motion in the top part of the product. This up and down motion thus presses the pump present in the sanitizer bottle, and sanitizer is dispensed. For the optimal performance of the foot-activated lever mechanism, several factors need to be considered:

1.The relation between foot and the fulcrum position.
2.The dimensions of foot.
3.The relation between the linkage points of the pedal and the application points of force exerted by foot.
4.The amount of force applied against the pedal movement.

Basic model of foot-operated sanitizer stands:

1. Base Dimensions: 350 x 210 mm, thickness= 3mm Materials: Hot rolled metal sheet, 50 Rs/Kg Cost: Rs.90
Function: Base is one of the most important parts of this dispenser. It bears the entire weight of the machine. The base also provides a steady balance to the stand.
Features: The Base should be totally flat to provide stability to the entire system
A coat of corrosion resistant paint is applied to the base to avoid corrosion. To increase the firmness of the base, it can also be bolted to the ground.
2. Pedal Dimensions: width=32mm, height=15mm, length=20mm, thickness=12 mm
Material: CRCA (Cold Rolled Close Annealed) Square Metal pipe, 60Rs/Kg
Cost: Rs. 15
Function: Pressing the pedal triggers the entire mechanism Features: The pedal must be able to withstand the amount of force applied by the user. Also, the pedal forms an integral part of the foot-activated lever mechanism.
3. Inner Fixed and outer movable pipe
Dimensions: Inner pipe diameter- 19mm, Thickness- 2mm, Length- 965mm, Outer pipe Diameter- 25.40mm, Thickness- 1.5mm, Length- 910mm

Material: CRCA Tube (Metal coil), 60Rs/Kg Cost: Cost of both pipes Rs. 90
Function: The inner fixed pipe acts as a supporting pillar to the outer pipe and is also an important part of the mechanism. The outer movable pipe is where the base of the sanitizer bottle is attached. The outer movable pipe follows a linear up and down motion.

Features: As the outer pipe moves in a linear motion, precautions should be taken so that forming of friction between the inner pipe and outer pipe does not occur.
4.Sanitizer bottle base Dimensions: 100 x 90mm. The wall base is raised to 25mm, it is bent by forming.
Material: Metal sheet Cost: Rs. 10
Function: This base holds the sanitizer bottle. Features: Base should be adjustable by height.
5.Top constraint part Dimensions: Lower Circular Part diameter- 22mm, thickness- 5mm, length- 25mm; Extended Par- 135 x 30 mm, thickness-3mm
Material: Metal Sheet Cost: Rs. 6
Function: Lower Circular Part- This part restricts the motion of the outer movable pipe. Extended Part-
It acts as a constraint for the upward motion of the sanitizer bottle.

Features: Lower Circular Part-Diameter of this part should almost be equal to or greater than the outer pipe so as to restrict its motion. Extended Part- This Part must be welded to the lower circular base with utmost precision.

6. Spring Dimensions: diameter- 12mm, length- 35mm Material: Steel

Cost: Rs. 10

Function: function of the spring is to bring back the outer pipe to original position

Features: the length of the spring should be chosen carefully according to the mounting points.

7.Clips Dimensions: Per clip: Length- 70mm, Width- 15mm, thickness- 2mm. It is bent by forming processes.

Material: CRCA Metal Sheet Cost: Rs 2

Function: Clips are bent by forming a process to use them as a connecting link between the pedal and the inner fixed pipe. Features: The final distance between the clips, after it is bent by forming, should not be more than the diameter of outer movable pipe.

Working:

1. On pressing the pedal, the clips attached to the pedal and inner fixed pipe make similar movements as the pedal.
2. The outer movable pipe, which was earlier resting on these clips, shoots upward due to the movements generated by the pedal and the clips.
3. As the outer movable pipe moves upwards, the sanitizer bottle, placed inside the sanitizer bottle base, reciprocates with the outer movable pipe.
4. This upward movement of the outer movable pipe is terminated by the top constrained part.
5. The lower circular base prevents the ascending movement of the outer movable pipe; also, at the same time the extended part of the lower circular base clashes with the sanitizer bottle pump.
6. Hence, pressure is applied on the pump and the bottle starts dispensing sanitizer.
7. The dispensing action of the sanitizer bottle comes to an end when the pump is brought back to its original position by removing the pressure applied.
8. For this action to take place, the outer movable pipe should move downwards, thwarting the collision between the bottle and the extended part of the lower circular part.
9. When the pressure from the pedal is lifted, the pedal returns to its original position, so does the clips and outer movable pipe. Thus, the pump returns to its initial position and stops dispensing sanitizer.
10. However, in certain cases, the pedal remains in a neutral position on the removal of pressure.
11. In order to bring the outer movable pipe downwards, and to stop the dispensing action, the spring mechanism takes place.
12. When the outer movable pipe shoots upwards, the spring attached to the outer movable pipe and inner fixed pipe gets extended / elongated.
13. As the collision between the outer movable pipe and the top constraint occurs and there is no scope for the pipe to move further upwards, the extended spring pulls the pipe back to its initial position, so that it can return back to its compressed state.
14. Hence, the dispensing action stops.

Specifications:

Characteristics of model	Value
Total weight	3.80 kg
Total height	970 mm
Total estimated cost	Rs. 350

Durability 10 years
Cost of powder coating Rs. 55
Time required for manufacturing 4 hours

Advantages:

1. The spreading of germs / viruses by means of touching the pump or sanitizer bottle by a large number of people is almost reduced to zero by means of this dispensing machine.
2. This machine is user-friendly. This machine does not require any high-end skills nor does it require a massive amount of strength for operation purposes.
3. Almost all parts required for the manufacturing of this dispenser can be obtained from the industrial waste discarded by fabrication, construction, production, manufacturing factories.
4. This machine entirely works on mechanical mechanisms. It does not require any power source or battery cells for operation.

Disadvantages:

1. The use of pure sheet metal for manufacturing this product can sometimes lead to corrosion of certain parts after some time of usage.
2. In certain cases, on failure of the spring mechanism, the pedal will remain in a neutral position, resulting in failure in the purpose of the machine.
3. This foot-operated sanitizer dispenser cannot accommodate a taller-sized sanitizer bottle than usual.
4. This machine can be only used for sanitizer bottles with a push-down mechanism.

Applications:

The applications of the foot-operated sanitizer dispensers are so vast that they can be placed upon any place with a heavy traffic of people. Some of the places which require immediate installation of these dispensers are:

1. Hospitals:
2. Restaurants
3. Offices
4. Schools / Colleges
5. Religious places
6. Industries

The basic mechanism used in these dispensers can be also applied to various other products so as to simplify their operation and production. Foot-operated taps, foot-operated fans, etc. are some of the example products using the foot- activated lever mechanism.

Conclusion:

This foot-operated sanitizer dispenser is slowly but surely gaining popularity all over the world. This machine boosts up the process of sanitization. It is a frontline fighter against COVID-19. Also, due to the low manufacturing and production cost of this product, It is easily affordable by owners of huge industries as well as by small shopkeepers. This dispenser has seen a great market share these days. Many manufacturing factories have started producing these machines as they can be completely constructed from other industrial wastes, benefitting the factories. These dispensers increase the awareness about hand hygiene among people and also contribute in creating a healthy environment for all. The use of these foot-operated sanitizer dispensers will surely help in reducing the number of COVID-19 positive patients.

Anushka Moharir
T.E. MECH A

Vansh Porwal
B.E. MECH B

COMPETITIONS

TEAM MAVERICKS RACING

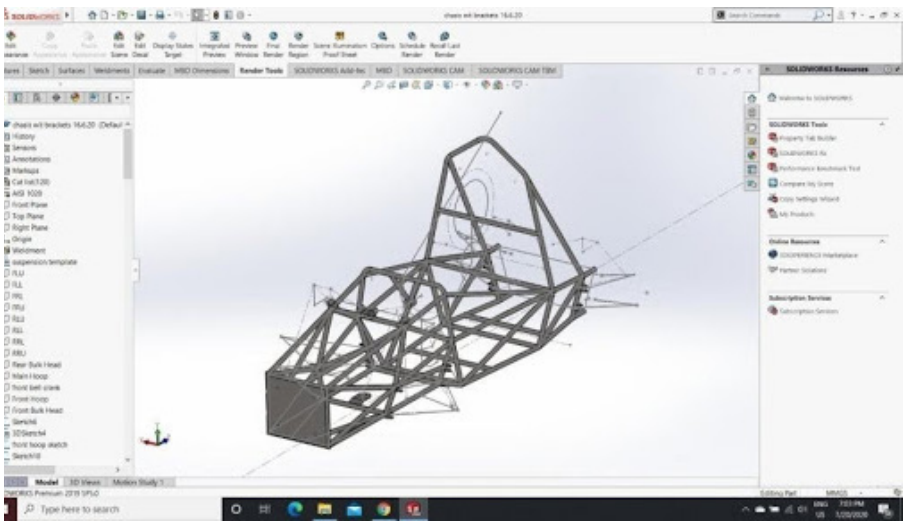
The whole world is switching to electric vehicles, so as a part of such a great team we decided to manufacture an Electric Autonomous vehicle. To serve the purpose of eco-friendly sustainable Vehicles and to bring the vehicle running on mainstream electric, the team is developing an Electric Student Formula Style Vehicle which is charged from an electric source and is set in motion by electric drive only.

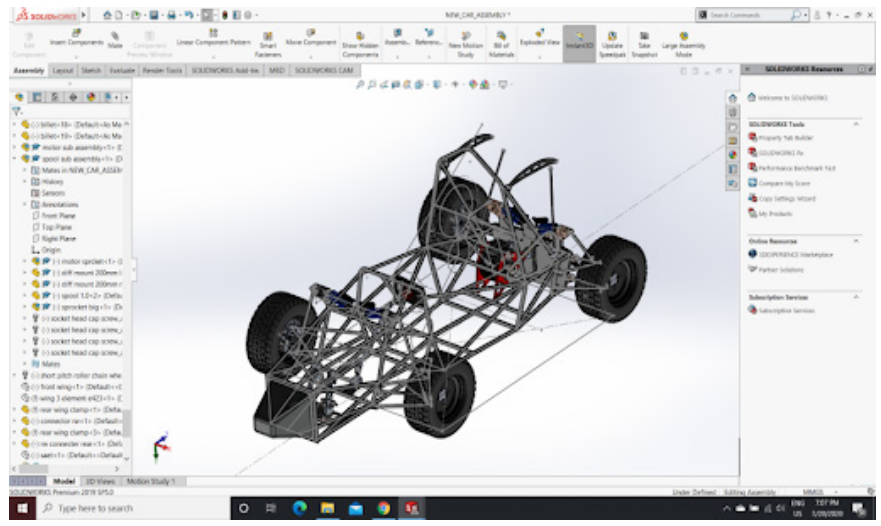
Formula Imperial is a student formula style vehicle design and manufacturing event. The event formerly known as Hybrid Vehicle Challenge-HVC. The event is organized by Omnes inter VSMEX the Imperial Society of Innovative Engineers, India (ISIE INDIA, An ISO 9001:2008). ISIE is an Associate Member of FMSCI & SFI, Recommended by Ministry of New & Renewable Energy (Govt of India), Supported by Ministry of Forest & Climate Change (Govt of India).

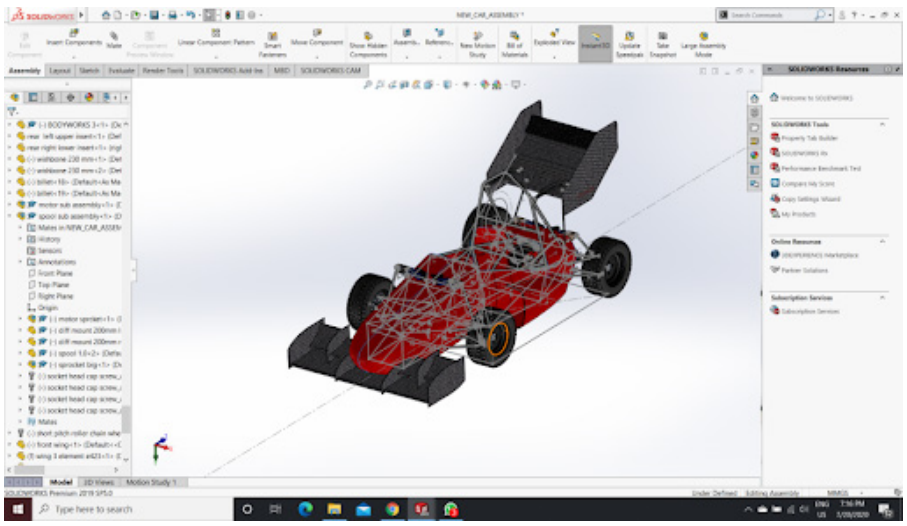
Team Mavericks Racing, the official Student Formula Team of TCET, Mumbai that designs and manufactures Student Formula Style Vehicle and Represents TCET, Mumbai in Formula Imperial Event which is organized by ISIE India.

Team Mavericks Racing is participating for the 3rd time in Formula Imperial 2021 with improved design in order to improve performance. The main aim of the team is to design and fabricate the more efficient and economical student formula vehicle which also runs on New / Renewable Energy.

CAD MODELS







Technical Specification of Vehicle:

Motor	BLDC 10KW
Top Speed	80-90 kmph
Suspension	Push Rod Type with DNM Burner RCP 2S Dampers
Chassis	Made of Hollow Seamless pipes (ASI 1080)
Brakes	180mm Disc (Front Rear)

Past Achievements:

- **2th ALL INDIA RANK**
- **1st RUNNER UP in INNOVATION**
- **2nd RUNNER UP in DESIGN**
- **4th in COST**
- **5rd in BUSINESS PLAN**

Team Captain: Bhavesh Chaudhary
Team Mentor: Prof. Mahendra Shelar

TEAM ECLIPSE RACING

About the Team :

Eclipse Racing is a group of young automotive enthusiasts who have a common goal of designing and developing an ergonomically optimum and mechanically refined single-seat Formula Race Car while competing in various Formula Student Competition around the World.

Eclipse Racing is the Formula Student Combustion team of Thakur College of Engineering and Technology. Eclipse Racing was established in the year 2018 by our Former Team Captain . Mr. Nrutesh Haldankar and former Team Manager Mr. Ankit Gupta. The team was formed to provide students a platform for gaining practical knowledge and skill which are otherwise absent in the curriculum.

Formula SAE is a platform created for engineering students to showcase their skills and advance knowledge practically by designing and manufacturing an FS styled Racecar. The competition is not won solely by the team with the fastest car, but rather by the team with the best overall package of design, performance, finances and sales planning.

Committee :

Eclipse Racing started its journey by first participating in Supra SAE-INDIA in 2019. SAE-INDIA or Society of Automotive Engineers India is a premiere Automotive committee formed for arranging such Technical Competitions and seminars. Eclipse Racing works under the guidance of Mr. Sachin Oak being a designated SAE Faculty Advisor for the team.

Competition :

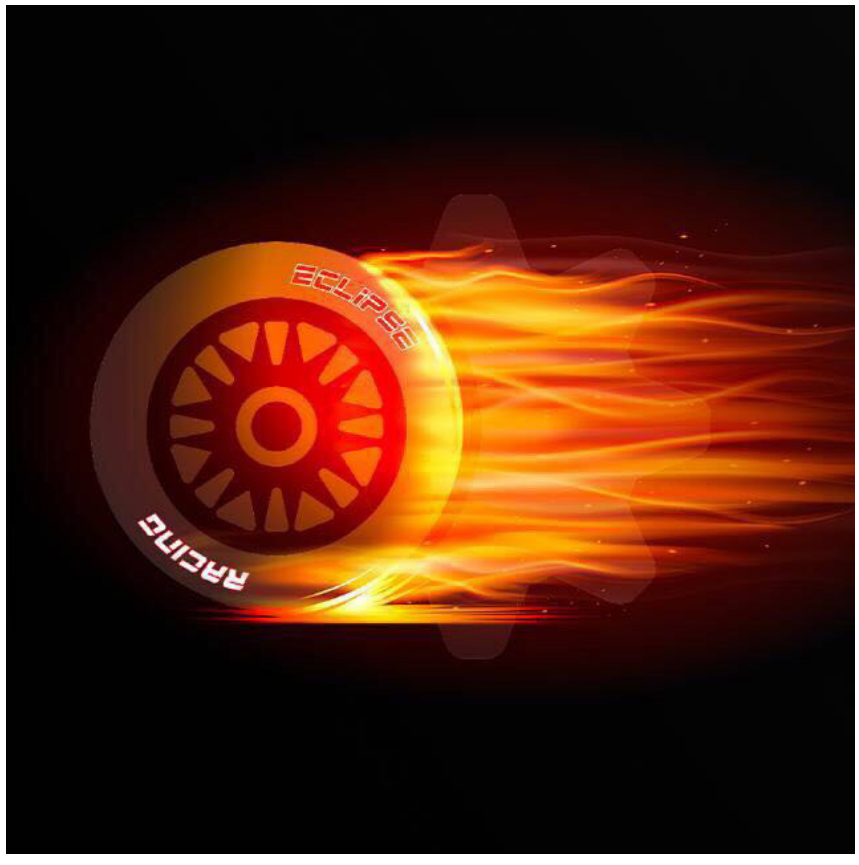
Eclipse Racing has participated in Supra SAE-INDIA in 2019 and 2020, the latter being cancelled due to the ongoing Covid-19 global pandemic. SUPRA SAE-INDIA is an engineering design competition of skill, speed and spirit. A jury of experts from the motorsports and automobile industry judge the car based on multiple factors. Supra SAE-INDIA is held at Buddh International Circuit, Greater Noida – India's only Formula 1 Racing Track.

Teams Achievements :

With over 130+ teams at SUPRA SAE-INDIA 2019 and Eclipse Racing being a first year team we have been able to achieve great enough ranks.

19th in Business Plan :

We placed 19th amongst 130+ Teams for Business Plan in SUPRA SAE-INDIA 2019. It consisted of formulating and delivering a business model to sell our vehicle to a target audience of weekend racing enthusiasts.



97th Overall All India rank :

Despite being a small team of 13 Automotive Enthusiasts without any prior experience designing and manufacturing Formula Student Vehicles, we managed to secure the 97th rank amongst 130+ Teams from across the country.

Future Plans :

Eclipse racing will be participating in Supra SAE-India 2021 and Formula Bharat 2022.

What do you learn?

We provide an opportunity for all the members to learn various skills and get a hand on experience to manufacture a racecar while learning the skills required. Designing a FS style racecar requires advanced knowledge about various subsystems of a vehicle. Softwares like Solidworks, Ansys, Optimum G are used to design, simulate and finalise all the designed parts necessary for building a racecar. Apart from the technical aspect, sub-events like Business Plan Presentation, Cost event help the students to understand different factors affecting the Non-Technical aspects of making a racecar.

Message from our Founders

"The moment when you are on Drivers Brief going around the track while witnessing the Excellence of the Buddh International Circuit, thought of driving the self-built vehicle on the track, trust me that's the best feeling of my life till date"--- Ankit Gupta

Team Captain: Aakash Patel
Team Mentor: Prof. Sachin Oak

TEAM TECHNOCRATS

Team Technocrats is a student ATV design and fabrication team participating in the ISNEE Quad Torc. “Indian Society of New Era Engineers” is an organization focusing on the technical and managerial development of future engineers. The organising committee gives opportunity to the undergraduate and diploma engineers to research and develop innovative projects. Design challenges organised by ISNEE provide students a panorama to work as a team and allows them to commit and dedicate to demonstrate and prove their creativity to resolve real life problems. The aim of Team Technocrats is to design and engineer an All-Terrain Vehicle with structural superiority, dynamic stability and manoeuvrability through rough terrains.

Quad-Torc is a four-day competition which involves many events which are planned each day. The competition embarks with a drop test event which is mandatory for all the teams to surpass, where the vehicle is dropped from a height of 7 feet. Many other events such as the DisAsm, Suspension test, Manoeuvrability, Kill the Hill and other documentation events such as the Design Validation, Evaluation and Business plan presentation are planned accordingly.

This year the uncertainties regarding the event kept on rising as the world is facing a deadly pandemic. The on-ground event was cancelled, lockdown was enforced and the team faced a plethora of problems. Despite the given conditions, the team did not drop the bundle. College meet turned into countless zoom meets and utmost dedication of the members led to a successful design of a Quad bike. The team participated in QUAD TORC CONCEPT 2020 which is a concept category introduced by ISNEE Motorsports under Quad-TORC Design Challenge. To meet the guidelines of Quad-Torc Concept the team was divided into two with the sister team being – TEAM KRATOS

Reasons to participate in this competition:

- To showcase our skills at a national level.
- To build a bridge between imagination and real engineering through designing and manufacturing.
- To create a change in the society with our knowledge of engineering. isnee quad - torc 2019

Our experience while:

1. Designing the vehicle:

All domains worked with one prime goal – to design a reliable and robust high speed

ATV. The work initiated with hundreds of iterations for suspension and steering mechanism to choose the best design and reliability for our vehicle. The parts designed by various domains namely chassis, suspension, steering, brakes and powertrain were simulated under various testing aspects to analyse their performance.

2. Deciding the material and budget: The most significant and challenging part as a team is to build a vehicle with high quality components and also to maintain the budget. The ultimate objective was to design the elements which are capable to bear all loads in static and dynamic conditions is achieved. Mechanical properties of diverse materials suitable for fabricating a component were studied, testing was done and the one which met the criteria were selected. Vendors and dealers were contacted to find the best possible market price for the raw materials required.

Experience of the competition:
Various teams from all over the nation participated in this competition. Every team and their vehicle were unique in its own way and surprised everyone with their skills. The technical inspectors helped and guided each team throughout the competition. The competition was well organised and the team members presented their designs and efforts flawlessly. In spite of being stuck amidst a pandemic the team members did not lose hopes, kept their spirits high and cohesively achieved an unbeatable feat.

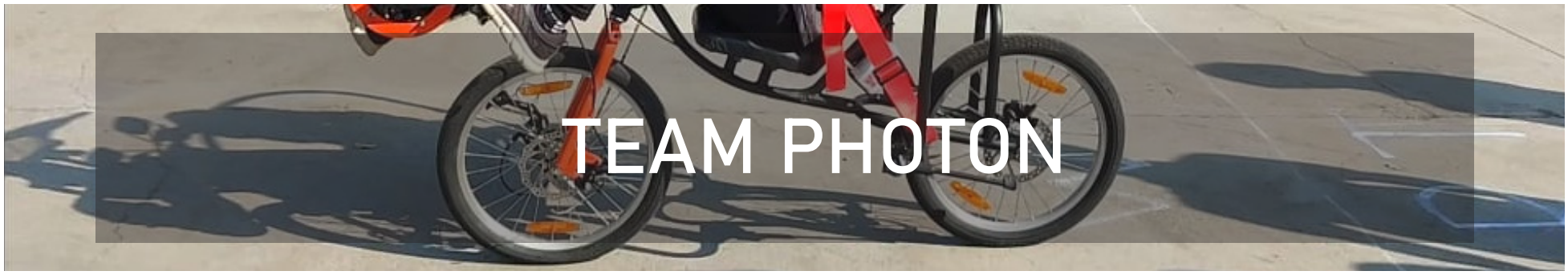
Our way ahead:
Team Technocrats plans to participate in Quad TORC 2021 which is expected to be held in September 2021 and also other Quad Bike challenges like FMAE's QBDC.

ISNEE QUAD - TORC CONCEPT 2020:

TEAM TECHNOCRATS
- AIR 1 – Overall Champion
- Best Design
- Best Business Plan
- Judgers choice Award (Best tech savvy: Mr. Balaji Murthy)

TEAM KRATOS
- AIR 3
- Judgers choice Award (Best female participant: Ms. Anushka Moharir)

Team Captain: Hardik Padia
Team Mentor: Prof. Sachin Oak



TEAM PHOTON

About E-FEST:

E-FEST, organised by American Society of Mechanical Engineers (ASME), is a technical festival that takes place all across the globe in continents like North America, South America, Europe and Asia, of which Team Photon participates in the Asia-Pacific level. The E-FEST houses various competitions like Human Powered Vehicle Challenge (HPVC), Student Design Competition (SDC), Innovative Additive Manufacturing 3D Challenge (IAM3D™), New Elevator Pitch Competition, Oral Competition. Out of the aforementioned, HPVC is the highlight of the technical fest and invites majority of the footfalls. In these competition students from different colleges engineer human powered vehicles like bike, trike and quad-bike. The motto is to encourage the ideas, innovations and skills of the students and inspire them to co-create eco-friendly technologies. This year the E-FEST was held at Marwardi University, Rajkot (Gujarat) from 27th February to 1st March. Many teams that took part in the enthralling competition included IIT – Roorke, VIT – Vellore, IIT – Patna, Delhi Technical University, NMIMS (Shirpur) and many more.

About Team Photon:

Team Photon, by representing TCET, has been actively participating in E-FEST: HPVC since 2017 and has always aimed at ameliorating itself. Each year the team has showcased a better version of itself taking into account the experience and knowledge gained. This year we fabricated Phoenix, a vehicle catering to the urban settings and changing lifestyles. In doing so, comfort was the key criteria and thereby a detailed research was undertaken on the subject of biomechanics to deduce and derive the optimum lengths of various components of our vehicle. We aspired to develop a proficient vehicle that would pose as a preferential choice in upcoming era of green vehicles.

Experience:

The preparations for the competition commenced in the month of June 2019. As the members of a team are the cornerstone for subsequent success we started by recruiting new members. The new members were trained in handling some of the basic power tools and were made aware of some terminologies and

practices that would be implemented upon for the days to come. Design reports, an eminent part of the competition, were closely scrutinized so as to look for the scopes of improvements. Soon after the team had a fair idea about the type of vehicle that was to be developed, that is a semi-recumbent front wheel driven bike, the process of designing followed. The team continued to improvise as and when faced with hurdles during designing process. Simultaneously the process of sourcing was under way so as to ease out the manufacturing phase.

After completing a fair 3D model, the manufacturing of the vehicle begun. Various raw materials and components were procured from various places spread across Mumbai. The team simultaneously worked on the fabrication of the vehicle and formulation of the design report. This year, as planned, we were able to spend more time on the riders practice for the Sprint Race and Endurance Race. As any vehicle is as good as its driver, similarly the physical fitness of the riders played a very crucial role. The days spent in the competition gave the team members the first-hand experience of the competitive nature of the world outside the bounds of the classroom. Just like every other team, Team Photon competed with vigour and the rest is history.

3-Days of the competition:

After an overnight journey in Saurashtra Mail we reached Rajkot in morning around 10. Due to the immediate threat of Covid-19; we were provided with basic precautionary sanitation needs. As we reached our pit area, we started unpacking our prudent packing. Till afternoon, we had almost assembled whole vehicle. After having lunch we completed whole assembly. We 51 competitions wanted to complete static testing on the very same day itself but due to time constraints we were sent back from inspection areas. Our aim for the next day was to successfully complete static inspection in the first-go. After again going through whole vehicle we successfully completed inspection by lunch. After having lunch, we went to look over other teams' vehicle and learn from the same. Some team members went for design presentation. A power-point presentation needs to be presented to panel of judges. Aaron Weinerman (ASME Global Representative and Manager of Public Affairs) along with many other delegates was on round to study every vehicle in the competition. He was in awe with our vehicle and even rode it. Probably Phoenix was the only vehicle he rode out of all the 50 vehicles present in the competition.

Coming on to next day, we had Men's sprint and Female's sprint scheduled for the day. A 100 metres track was set-up with sufficient run-up track. Sprint time was to be recorded and displayed on the screen present. After various checks by our team on vehicle regarding transmission, safety, ease of riding, etc. we moved for racing in our allotted timing slots. All the rigorous riding practice done by our riders yielded in successful results. We stood at 3th position in Women's sprint and 17th in Men's sprint.

Third day was one of most challenging part of the competition. Endurance race was to be conducted on that day. In Endurance Race, the team has to collectively ride the vehicle for 2.5 hours passing various obstacles and completing a few tasks simultaneously. The track was of 1.25 km, and every rider was required to complete 5 complete laps as per rule-book. Almost all the qualities of rider and team were tested. There were many teeth biting moments when and where the integrity of team was checked.

After having our lunch we proceeded to awards ceremony. After long wait, when finally the judges started announcing HPVC awards we were on edge of our seats. We were stunned, astonished and pleased when we heard, 'The overall first prize of HPVC 2019 goes to Team No.: 12', we still become emotionally dehydrated when we recall that wonderful moment. Many memories were made; lessons were learnt for such a magnifying and amazing experience. As it is rightly said, "A dream doesn't become reality through magic; it takes sweat, determination and hard work."

Learning Outcomes:

Apart from the tangible trophies there were a lot of takeaways from this competition. Students involved as members of the team enhanced their skills of Time Management, Resource Management, negotiations, planning and procurement. Some of the technical skills that were picked up are Designing, Technical Writing, Manufacturing and Fabrication processes. While experiencing a few moments of despair, we were compelled to learn the skills of problem solving and team spirit.

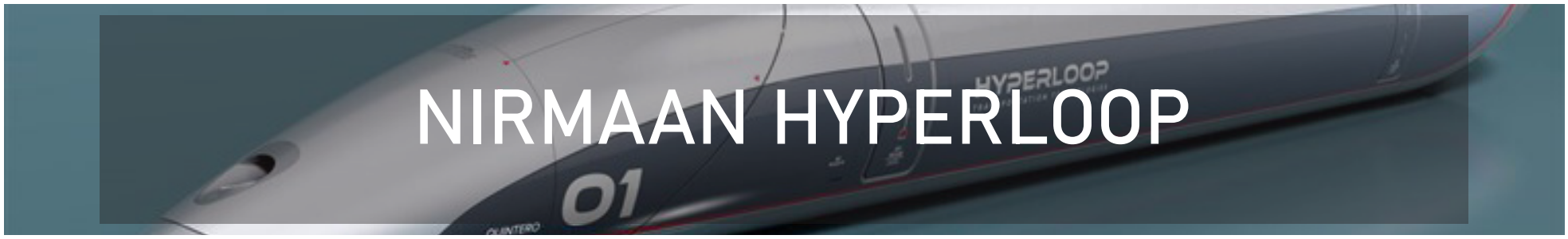
Way Forward:

In spite of the conditions that have risen due the COVID-19 pandemic, lockdown being enforced; the challenges that are faced arising from the same, the Team has geared up to compete in HPVC 2021 in Chandigarh University. With online recruitment under way and support of our professors and mentors we are hopeful of achieving new heights.

Achievements :

- 1st Prize in Overall Competition
- 3rd Prize in Endurance Event
- 3rd Prize in Women's Speed Event
- 4th Place in Design Event
- 17th Place in Men's Speed Event

Team Captain: Sujit Poojari
Team Mentor: Prof. Mahendra Shelar



NIRMAAN HYPERLOOP

Hyperloop is an idea given by Elon Musk, CEO of SpaceX. Mr. Musk has open sourced his idea of a pod that will travel at the speed of sound in a vacuum tube with low pressure, depriving air resistance and friction. Hyperloop is basically a passenger carriage (dubbed "pod") which is propelled inside a tube that is at near vacuum pressures, hovering on a track by magnetic or air bearings. This pod is propelled inside the tube to super high speeds due to the elimination of drag. This fifth mode of transport can cut travel time to a fraction of what is present today. A journey from Mumbai to Delhi could last a mere 70 minutes as opposed to the current 140 minutes possible via airplanes. That is half of what people have to wait before getting to their destination and as an added bonus, Hyperloop does that with minimum use of natural resources and damage to the environment. The whole system is energy efficient and very nature friendly as the pollution by this will be non-existential, where the pollution by the trains and airplanes are a big concern till date.

The Competition :

The SpaceX organization had taken up the initiative to organize and hold the Hyperloop Pod Competition, which provides a platform to student teams across the Globe to test and display their abilities to improve on the system and show their mantle. The Competition is held in Hawthorne, California, USA, where the elite few get an opportunity to run their test pods in the SpaceX test tunnel, where they get to experience real scenarios and test their pods feasibility. After open sourcing the idea of such a powerful system the SpaceX organization has held four competitions till now to see how enthusiastically the engineers all around the world can take up this opportunity to innovate something new in it. The only criteria to win the competition – come up with the fastest pod. And so, they did. Students from over 1500 universities across the world applied, out of which about 30 teams got selected to present their pod to the man himself, Elon Musk and race for the coveted prize of global domination. The competition was able to produce pods that ran over 480 kmph which is the highest ever achieved by any hyperloop test project.

The Team :

So, the students of Thakur college of engineering and technology join forces across all branches to take an initiative to spend our time in learning, designing and constructing a pod for any competition across the globe. We are also thrilled to announce

that we will be participating in the first of its kind competition organized by The Boring Company, another branch of the Elon Musk companies. We aim to participate in competitions that attempt to bring in innovative solutions to crucial life problems and aim to implement science to its fullest.

The team "NIRMAAN HYPERLOOP" which has taken interest in the space technologies and innovations for a new better and brighter tomorrow could not step down from the opportunity to indulge in this one of a kind competition for the implementation of constructing a pod successfully and generate hope for the future of the technology by fulfilling all the necessary criteria required to win any competition, around the globe. We have had the opportunity to communicate with competition winners as well as industry leaders in the field of Hyperloop to get a better understanding of the systems.

Our Aim Implement The Future :

The organization was formed with Nirmaan Hyperloop being one branch of an entire pool of innovative endeavors. We aim to participate in various up and coming competitions which try to break stereotypes and bring about change that is required in the society. We aim to expose members to learning on a global scale which is rarely offered by any university less than the world leaders. This helps them gain practical knowledge which can be correlated with academics to create more substantial impact.

Our Journey Ahead :

During the first half of 2020, we were hit with an unforeseen circumstance which brought not only our work but the entire world to a halt. But we didn't let that stop us. We, as our unofficial motto says, worked around it. We held online recruitment programs for new member admits, started with the brainstorming phase online as well. We aim to come out stronger and put our best effort in every new endeavor that we pursue. We vouch for innovation and strive to discover new paths to knowledge.

Tejas Sharma
Team Lead

Kedar Shinde
Mechanical Lead

Harsh Kudtarkar
Electronics Lead

Snehal Raj Verma
Manager

THE STUDENT EDITORIAL COMMITTEE

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PUBLICATION HEAD

SIMRAN NAIR
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