SAE NITK
SOCIETY OF AUTOMOTIVE ENGINEERS

TECHBUZZ
TECHBUZZ
TECHBUZZ

SAE NITK
ANNUAL MAGAZINE

MARCH 2023, VOL 4.0

AUTONOMOUS VEHICLES

Foreword

I am contented to state that our club SAE-NITK has been one of the most active clubs over the past few years till today and has been doing incredible work. Our institution is very proud of the club.

I would like to take this opportunity to express my gratitude to Prof. Prasad Krishna (Director Additional-charge NITK Surathkal), Prof. Narendranath S (Dean Student Welfare) and Prof. Ravikiran Kadoli (HOD - Mechanical Engineering) for their unending support in conducting our club activities of SAE NITK .

I am pleased to write this foreword for the 2023 edition of SAE NITK Annual Magazine Vol.4. SAE NITK has consistently improved the quality of it's articles on the magazine and on weekly blog articles.

I am glad that the SAE - NITK club remains committed to producing an annual college magazine. This year, the club is bringing out the annual magazine TechBuzz Vol 4.0, which aims to shed light on some of the recent trends of the automobile industry. I heartily congratulate every member of the club and the editorial team's utmost effort to make this magazine. I thank the convenor, Patrike Vedika Rajkumar and the chief editor, Jishnu Das. All the members and coordinators deserve a massive acknowledgement for all the hard work they have been doing to make this club one of the most active clubs in NITK Surathkal.

SAE NITK has improved in its strength over the years and I hope to see the same in coming years. I firmly believe that our club SAE NITK will reach several milestones in the years to come. SAE NITK should continue its great work, and I wish them a huge success in all its undertakings.

Regards
Dr. Poornesh Kumar K
Faculty Advisor
SAE NITK

Message from the Editorial Team

We at SAE NITK are exultant and exuberant to publish the fourth issue of our annual magazine Techbuzz. As the saying goes: “The mind, like a parachute, works best when opened”. This initiative sets the budding minds free, allowing them to roam free in the realm of imagination and make magic out of the term ***"Autonomous Vehicles"***. The ambitious write-ups of our writers are indisputably ample to maintain the curiosity and admiration of the readers. We believe that our success depends upon our endowment to perceive, the capacity to discern and the power to traverse.

'Alone we can do so little; together we can do so much.' - Helen Keller. The above quote is the core of our magazine. Like a team, we all have contributed to developing the articles present within our latest attempt. This strenuous task of editing the magazine would not have been possible without the sincere support of the media team members. They painstakingly edited all the articles given and presented them in the best way possible.

Not to forget, we are obliged to our **Faculty Advisor**, **Dr. Poornesh Kumar Koorata**, who helped steer our boat from the ocean of instability to the shores of steadfast progress. We are indebted to our **Convenor** of 2022-23, **Patrike Vedika Rajkumar**, for guiding us throughout the making of the magazine and giving her solid support. Lastly, we wish all the readers prosperity and pray for their well-being. We hope they are ever enthusiastic and always endeavour to learn and explore new things with aplomb.

Stay safe and Keep learning!

SAE NITK Editorial Team

Lucky Prameeth Rayi	Jishnu Das	Nimesh Bhagat
Pradeep Singh Solanki	Jatin Kaushal	Deshik Narasimha
Likhita J	Kavin Kabilan	Sharan Venkatesh

IN THIS ISSUE

AUTONOMOUS VEHICLES

by Samyak Meshram and Tehsin Khan

The age of independent vehicles is upon us. Driverless vehicles are formally operating and are right around the corner at best, a time or two down.

Autonomy (independence) refers to where the vehicle gets its source of information. What information is that vehicle using to make driving opinions? Autonomous implies that the vehicle is obtaining information from its own sensors. An independent vehicle has its own sensors which help it to obtain information and make decisions.

In order for AVs to become fully functional in society, a complex ecosystem working both independently and cooperatively needs to be created. Collaborative technologies will need to live within a vast range of specialized areas.

Autonomous driving is anticipated to revise road business, cheapening current externalities, especially accidents, and business. The performance of an independent driving vehicle encompasses not only complex automotive technology but also mortal behavior, ethics, business operation strategies, programs, liability, etc. Still, it plays out; these vehicles are coming and presto.

Their full acceptance will take decades, but their convenience, cost, safety, and other factors will make them ubiquitous and necessary. Similar to any technological revolution, the companies that plan ahead, acclimate the fastest and imagine the biggest will survive and thrive. Companies invested in old technology and practices will need to evolve or risk dying.

"Tata Power is the biggest CPO of EV charging infrastructure in the country. Tata Power is almost single-handedly addressing range anxiety for EV owners through a pan-India EV charging infrastructure setup!"

Source: weka.io

ELECTRIFICATION

by Saif Akram and Nitish Kumar

Source: reddit.com/r/wallpapers

Electrification is the process of powering by electricity and, in many contexts, introducing such power by changing over from an earlier power source. The benefits of electrification start with sustainability and greenhouse gas reduction. Replacing electricity generated by fossil fuels with power generated by renewable sources, coupled with the electrification of final uses, reduces pollution.

Electric vehicles are actually older than combustion engine ones. After a few marginally successful attempts that ultimately did not stick, Tesla, pushed by innovation and new environmental restrictions to ICEs, established the electric vehicle globally. From there, other players, new or already well-established, set off in pursuit of the American firm as it continued growing in popularity and appeal to the new generations.

Five main interlocking benefits of electrification are:

- Decarbonization
- Innovation
- Digitalization
- Efficiency
- Air quality

VEHICLE CONNECTIVITY

by Anil Gedila and Fajal

Source: peigerfabrics.com

Vehicle connectivity refers to the integration of advanced technologies in vehicles, enabling communication and data transfer between the vehicle and other devices, such as smartphones, laptops, or the internet. The integration of these technologies has the potential to revolutionize how we interact with our vehicles, leading to improved safety, comfort, and efficiency.

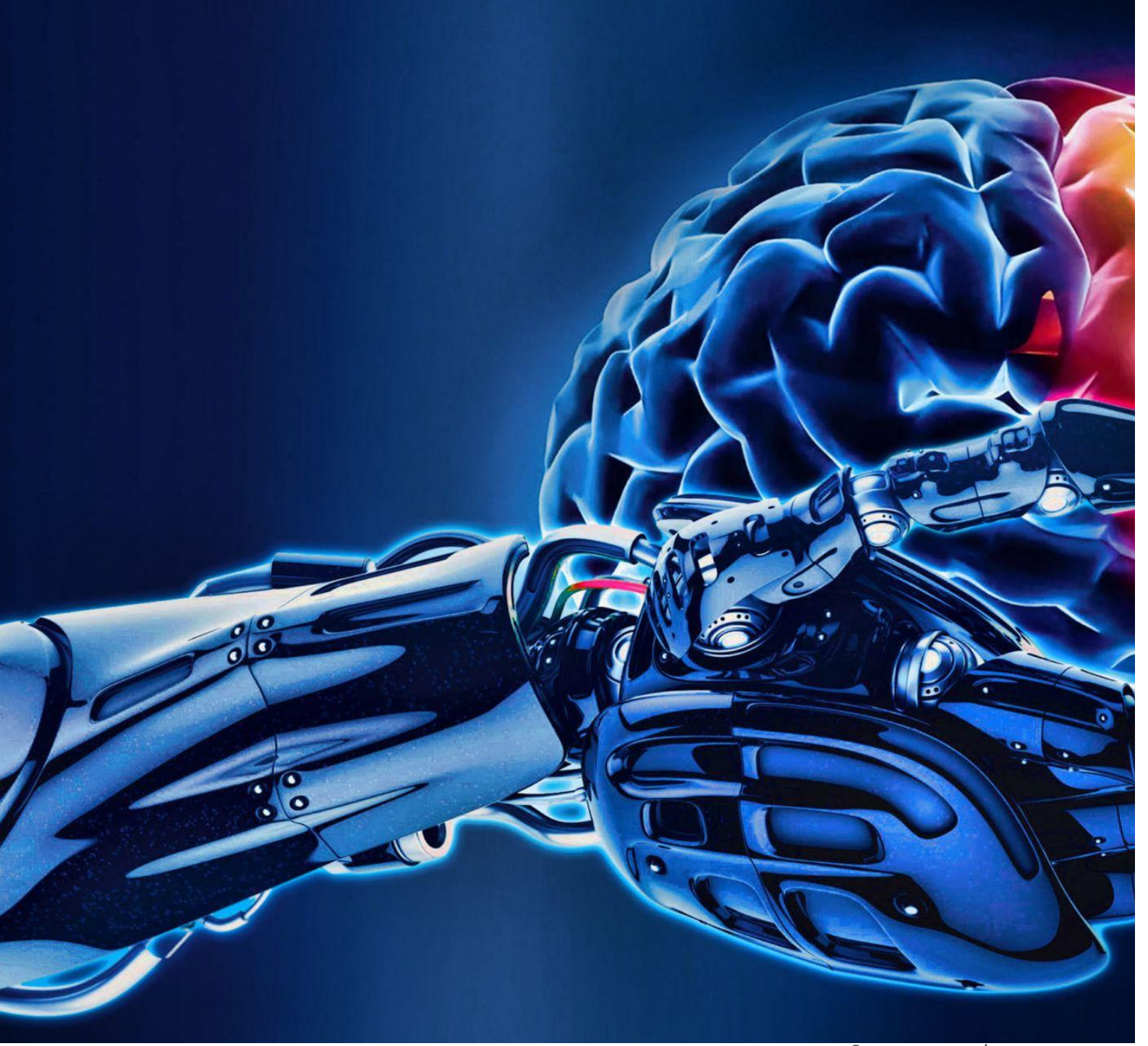
One of the critical benefits of vehicle connectivity is improved safety. Vehicles can be equipped with various safety systems to alert drivers of potential hazards, such as collision or lane departure warnings. Integrating cameras and sensors into vehicles can also help drivers avoid accidents, making the roads safer. Additionally, vehicles can communicate with other vehicles on the road, sharing information on traffic conditions, road hazards, or other vital data.

Another significant advantage of vehicle connectivity is enhanced comfort. Drivers and passengers can now enjoy the latest entertainment, navigation,and communication systems from their vehicles. They can stream music, access real-time traffic updates, or send emails without ever having to leave their cars. Vehicle connectivity also enables remote monitoring of the vehicle, so drivers can check its status or start the engine from a smartphone app.

Vehicle connectivity has also changed how we interact with our vehicles, making them more efficient and environmentally friendly. For example, connected vehicles can optimize fuel consumption by using data from sensors and other devices to decide the most efficient driving route or speed which can result in significant fuel savings and reduced emissions, positively impacting the environment.

In conclusion, vehicle connectivity has opened up new avenues for innovation and has the potential to transform the way we use our vehicles. It has already improved safety, comfort, and efficiency and it will continue to do so as technology continues to evolve. However, there are also challenges associated with vehicle connectivity, such as privacy concerns, cybersecurity threats, and the need for universal standards. Addressing these challenges is crucial for the continued growth and development of the industry.

"Many vehicles these days are connected vehicles, equipped with Android Auto and Apple Carplay. They also come with calling abilities and remote access to air conditioning, headlamps and internal features."

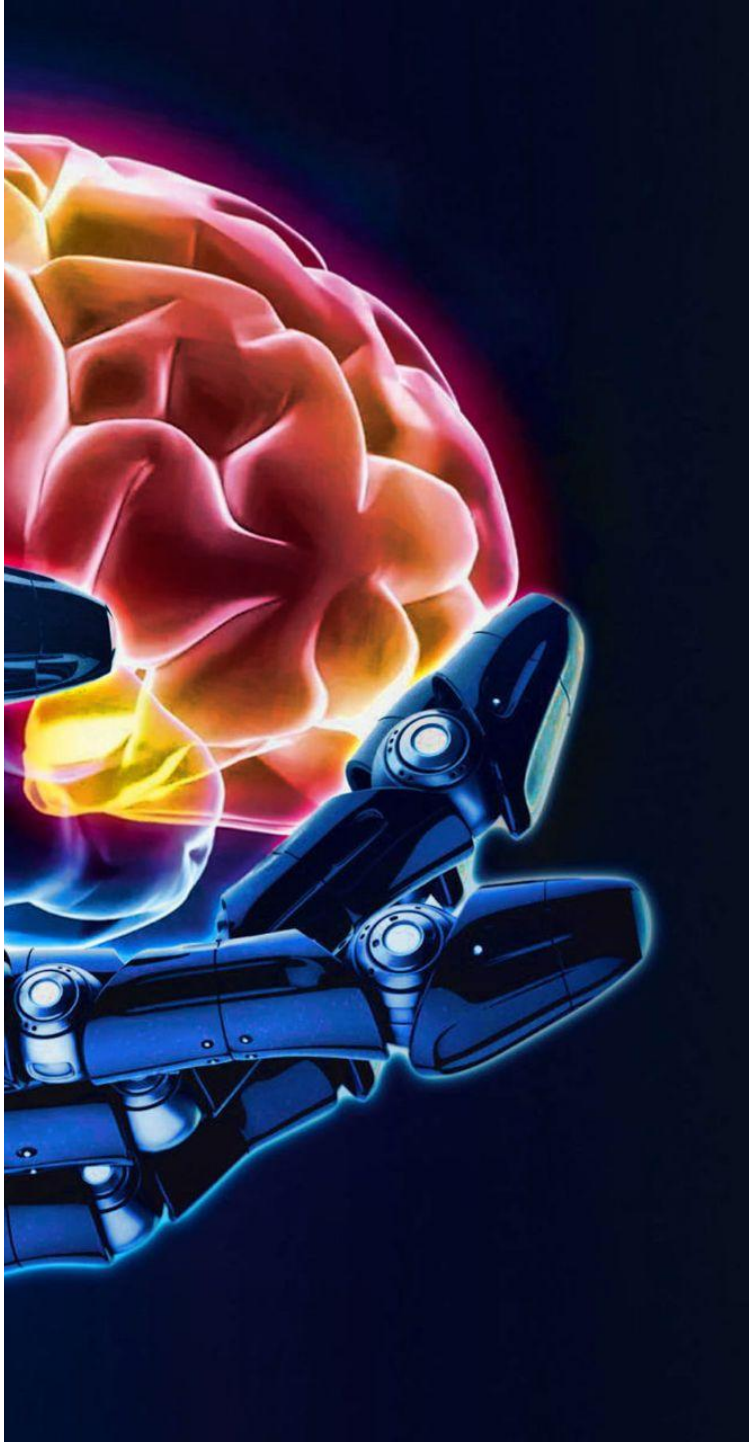


Source: peakpx.com

ARTIFICIAL INTELLIGENCE

by Nimesh Bhagat and Deshik Narasimha

Artificial intelligence refers to a set of generalities, technologies, and styles that aim to make computers suppose and learn like humans. It is a new field of study that concentrates on making computers "smart", performing tasks without any human guidance or intervention. Artificial intelligence can be used in videotape games,



mobile phones, buses, surveillance, etc. Numerous well-known social media platforms like Google and Facebook use AI. The concept of artificial intelligence was introduced as early as 1950. Alan Turing, a mathematician and computer scientist, designed a machine named "Turing Machine". This machine can test whether computers can form opinions or not. The test can test the capability of machines to respond like humans.

Artificial intelligence is generally divided into four types:

• Reactive Machines: This type of AI has a short memory. They do not store former recollections. IBM's chess program is a perfect illustration of reactive machines.

•Limited Memory Artificial Intelligence: As the name suggests, it has limited memory. Tone-driving buses are an example of limited memory AI.

•Proposition of Mind Artificial Intelligence: These types of artificial intelligence are reused. The aim is to make machines that can perceive people as feelings and studies.

•Tone-apprehensive AI: These are advanced performances of AI. They are supposed to be more intelligent than humans.

Impacts of artificial intelligence

Artificial intelligence can have both positive and negative effects on society. Artificial intelligence operations make human tasks much easier. This could lead to the loss of jobs. The cost of enforcing artificial intelligence is relatively high, and skillful workers are demanded to develop it.

ARTIFICIAL INTELLIGENCE IN THE AUTOMOTIVE INDUSTRY

Auto manufacturers use artificial intelligence in just about every hand of the auto-making process.

Examples of AI in the automotive industry include artificial robots constructing a vehicle and independent buses navigating business with machine literacy and vision.

What is a tone-driving auto?

A tone-driving auto (occasionally called an independent auto) is a vehicle that uses a combination of detectors, cameras, radar, and artificial intelligence (AI) to travel between destinations without a human driver. To qualify as completely independent, a vehicle must be suitable to navigate without human intervention to a destined destination over roads that have not been acclimated for its use.

Features of buses with tone - Driving Google's Waymo design is an illustration of a tone-driving auto that's nearly entirely independent. It still requires a human motorist to be present but only to stamp the system when necessary. It is not tone-driving in the purest sense, but it can drive itself in ideal conditions

Hands-free steering

Adaptive voyage control (ACC) down to a stop

Lane-centering steering

Path to the unborn

In the crypto world, blockchain technology makes use of fine sense and algorithms to produce an independent system that is both transparent and inflexible. Then in the automotive world, it is anticipated that the combination of blockchain technology and tone-driving buses will produce a far better independent system that would increase the translucency and delicacy of opinions made by these buses.

"By 2030, AI is expected to add 15.7 trillion USD to the world's GDP, which corresponds to a rise of 14 percent."

SHARED MOBILITY

by Om Palwe and Shyam Pratap Singh

Shared mobility means using a vehicle collectively by straphanger for transportation without owning it. The vehicles used for shared mobility include cars, vans, e-bikes, motorcycles, and scooters.

Shared mobility is expected to generate three business models. Some companies have already started working on some models, while others are still in progress

Three key models which are expected to emerge globally are:
• Purpose-built vehicles for mobility on demand are expected to gain popularity
• Vehicle-as-a-service is likely to be more prominent
• Contract manufacturing may pick up pace

Some of the benefits of shared mobility are given below.
o Productive travel
o Reduction in travelling costs (comparing private vehicles)
o Rise in employment
o Reduced fuel consumption
o Reduced emissions of greenhouse gases.

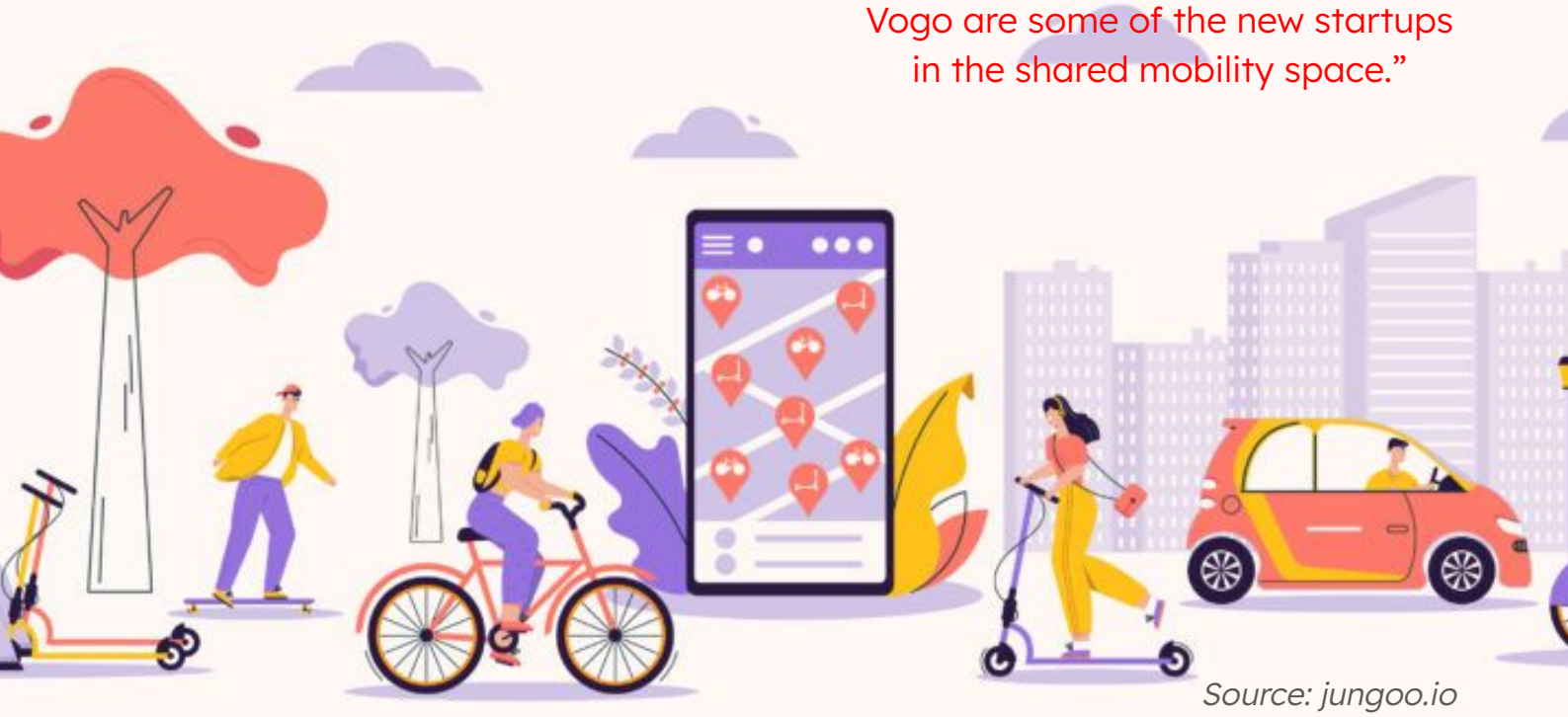
Lakhs of people in large metropolitan or urban cities are taking advantage of car sharing.

Private vehicle in most cities isn't very practical for many consumers (e.g., Tokyo), and they are turning to car-sharing platforms as a means of financial savings, more productive use of vehicles, and personal ease.

Globally, Asia is one of the largest markets for shared mobility. Within Asia, China and India will be the most promising market due to its large population. The Indian shared mobility market was valued at $1,025.8 million in 2019 and is expected to grow at a CAGR of 56.8% during the forecast period (2020–2025).

In conclusion, it is clear that shared mobility has a bright future and need, not only in India but globally in the coming years, as rapid increase in population and inflation all around the world takes place.

"Companies like Yulu, Bounce and Vogo are some of the new startups in the shared mobility space."



Source: jungoo.io

INTERNET OF THINGS

by Harshit Madival and Syed Ameen

IoT devices can gather and share data by integrating electronic components, software, sensors, and network connections. IoT permits actual items to be detected and controlled from a distance across existing organisation foundations, opening doors for a more straightforward mix of the real world into PC-based frameworks and bringing about superior proficiency, precision, and monetary advantage. In this issue of our magazine, we will try to comprehend on Internet of Things and how IoT is integrated with autonomous vehicles.

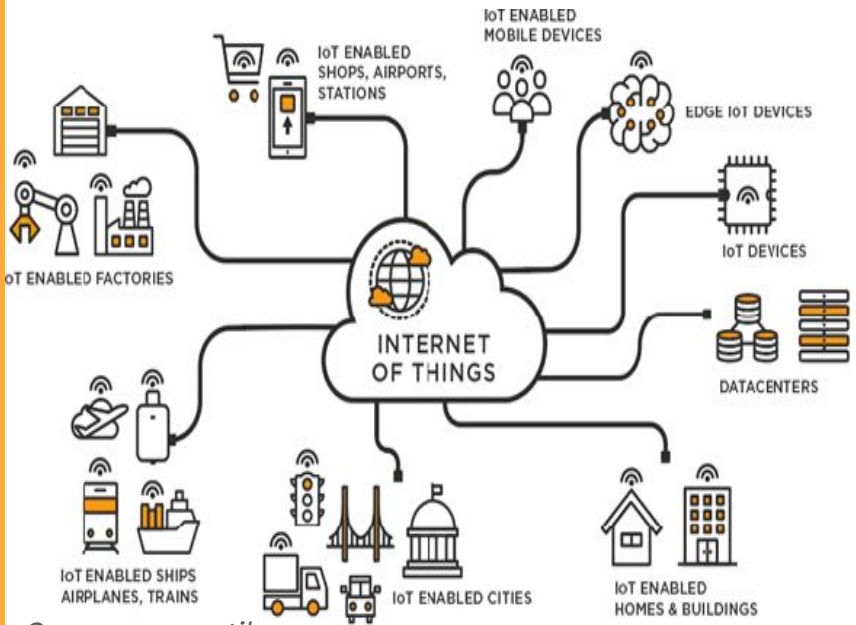
"The first IoT device was a soda machine at Carnegie Mellon University, which led to the development of the first widely used IoT device—ATMs."

The Internet of Things (IoT) has transformed the way we live and work by connecting everyday objects to the Internet. From smart homes to connected cars, the IoT is making our lives more convenient, efficient, and safe. A network of internet-connected devices, vehicles, and buildings that can collect, exchange, and act on data is known as the Internet of Things (IoT).

IoT has become an integral part of modern life and is making inroads into multiple industries, including the automotive industry. Autonomous vehicles, or self-driving cars, are an exciting development in the world of transportation, and they are set to revolutionise how we move from one place to another.The integration of IoT in autonomous vehicles is a significant step towards achieving this goal.

IoT-enabled autonomous vehicles have the potential to collect data from various sources, including traffic signals,weather sensors, GPS, and other cars on the road. This information can be used to build an extremely precise and up-to-date map of the road, which can assist the vehicle in making decisions in real-time. For instance, the car can adjust its speed or route to avoid accidents, traffic congestion, or other obstacles on the road.

IoT technology can also enable autonomous vehicles to communicate with each other, creating a network of cars that can share information and coordinate their movements. This can help in the development of platooning, where a group of cars travel in a convoy with a single lead car, increasing efficiency and reducing fuel consumption.



Source: www.tibco.com

The Internet of Things is changing the way we live and work in countless ways, and we are excited to see where this technology will take us in the future. Thank you for joining us as we explored the world of the IoT in this issue of our magazine.

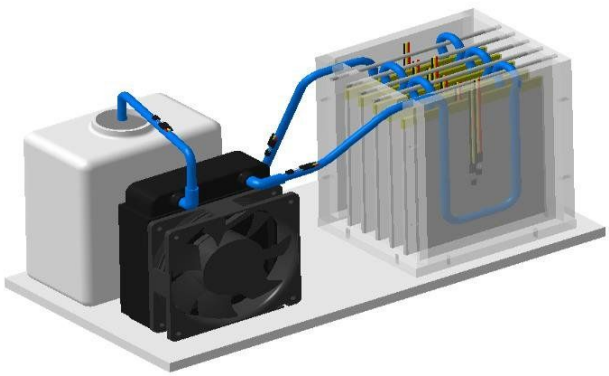
"The first IoT device was a soda machine at Carnegie Mellon University, which led to the development of the first widely used IoT device—ATMs."

BATTERY THERMAL MANAGEMENT SYSTEM

by Mayur and Kethan Ajmeera

Batteries are essential to many devices and systems, from electric vehicles and grid energy storage to portable electronic devices.
However, batteries can suffer from several temperature-related issues, including reduced efficiency, decreased lifespan, and even safety hazards like overheating or fire. Battery thermal management systems (BTMS) are used to regulate the temperature of batteries during operation. These systems typically consist of a combination of passive and active cooling mechanisms, including air or liquid cooling, and thermal insulation..

There are various types of BTMS, including passive and active cooling systems. Passive systems are typically used in smaller battery packs and rely on natural convection to transfer heat away from the cells. In contrast, active systems use fans, pumps, and refrigerant fluids to regulate the battery pack's temperature actively.



Source: researchgate.net

One common type of BTMS is liquid cooling, where a liquid coolant is circulated through the battery pack to regulate its temperature. This type of BTMS can effectively regulate temperature and is commonly used in electric vehicles. However, implementing it can be complex and costly, requiring additional components like pumps, tubing, and heat exchangers.

Another type of BTMS is air cooling, where fans or other mechanisms are used to circulate air over the battery pack to dissipate heat. This type of system is more straightforward and less expensive than liquid cooling but may not be as effective at regulating temperature in extreme conditions. In addition to active cooling mechanisms, passive thermal management techniques can also be used to regulate the temperature of batteries. These can include the use of insulation to reduce heat transfer and the strategic placement of batteries within a device or system to avoid hot spots.

Proper battery thermal management is critical for maintaining battery performance and safety. Without an effective BTMS, batteries can suffer from reduced capacity, shortened lifespan, and increased risk of failure. Developing effective and efficient BTMS technology is critical for the widespread adoption of battery-powered devices and systems.

As the demand for electric vehicles (EVs) continues to grow, so does the importance of battery thermal management systems (BTMS). BTMS are crucial for maintaining the optimal operating temperature range of the battery cells, as they can experience significant heating and cooling during charging and discharging cycles.

The specific type of BTMS used in an EV will depend on several factors, including the battery chemistry, the size and configuration of the battery pack, and the operating conditions of the vehicle. For example, lithium-ion battery packs may require more active cooling due to their higher energy density and a greater propensity for thermal runaway. Overall, a well-designed BTMS is critical for the reliable and safe operation of EVs.

GUIDANCE AND SELF DRIVING

by Shannon Carlo and Khushi Rathod

Self-driving technology refers to the system that drives the vehicle in the absence of human assistance. The notion of self-driving has evolved over the last decade tremendously, but the

vision existed before the decade too. There are six levels of automation, according to SAE. Self-driving cars, a combination of various systems, are the embodiment of human drivers that comprehends the complex scenarios around and manoeuvres the vehicle.

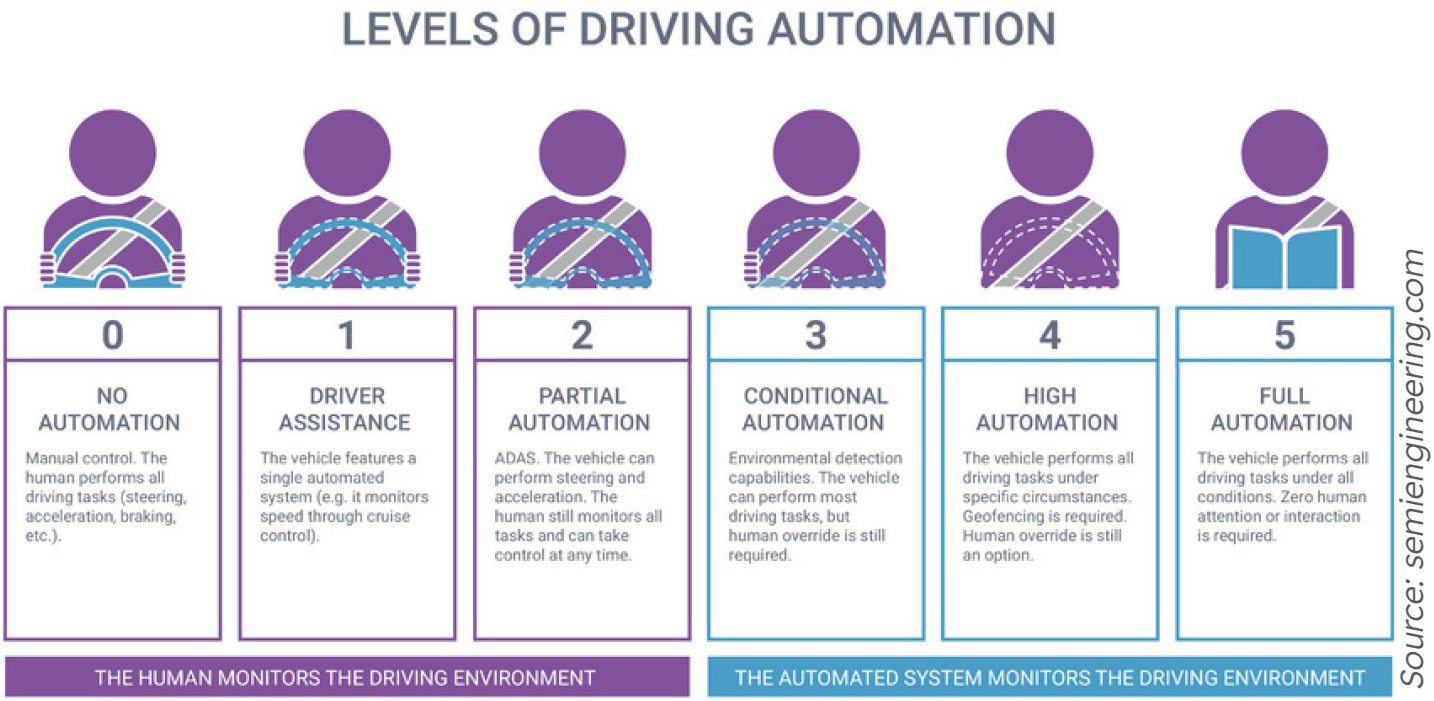


Figure 1: Levels of Automation as per SAE (as adopted by US Department of Transportation)

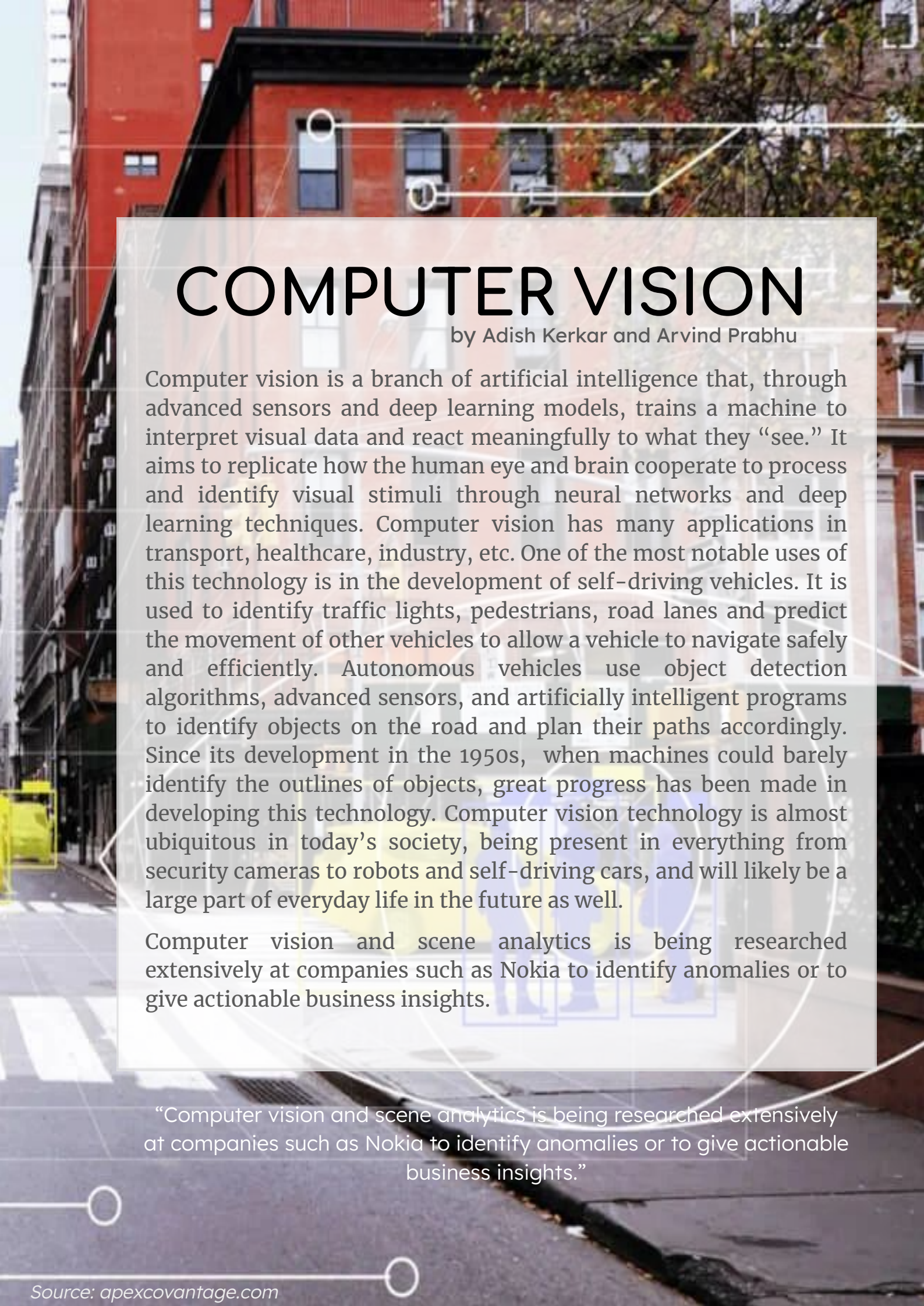
LiDAR is Light Detection And Ranging that uses infrared waves to detect the position of obstacles. The emitter, receiver, and processor components of LiDAR are integrated onto the chip, i.e., compact for applications. It is installed on the top of the car that continuously emits infrared radiations in 360 degrees. These radiations collide with the obstacles in the path, and rays are reflected back. Waymo's car, formerly called Google's self-driving car, uses a lidar fixed on its top that sends an array of 64 laser beams to create a 3-D image using a camera.

The distance of the obstacles from the car is calculated using the reflected wave. This

technology can create images and calculate distances in the range of 200 metres. LiDAR, along with RADAR and ADAS systems, is being extensively studied, and research is being done to apply these to autonomous technology. The optimal path for the car to traverse is determined using GPS satellites and matched with maps of the locality, and also, 3-D images are used to determine the obstacles and define the path. Very few car companies like Tesla have tested Level 5 cars. Volkswagen Group SeDriC and the Audi AIcon are also included

as Level 5 cars.

"38,824 people were killed in motor crashes in 2020, in the US alone. This number can be drastically reduced with a full implementation of AVs."



COMPUTER VISION

by Adish Kerkar and Arvind Prabhu

Computer vision is a branch of artificial intelligence that, through advanced sensors and deep learning models, trains a machine to interpret visual data and react meaningfully to what they "see." It aims to replicate how the human eye and brain cooperate to process and identify visual stimuli through neural networks and deep learning techniques. Computer vision has many applications in transport, healthcare, industry, etc. One of the most notable uses of this technology is in the development of self-driving vehicles. It is used to identify traffic lights, pedestrians, road lanes and predict the movement of other vehicles to allow a vehicle to navigate safely and efficiently. Autonomous vehicles use object detection algorithms, advanced sensors, and artificially intelligent programs to identify objects on the road and plan their paths accordingly. Since its development in the 1950s, when machines could barely identify the outlines of objects, great progress has been made in developing this technology. Computer vision technology is almost ubiquitous in today's society, being present in everything from security cameras to robots and self-driving cars, and will likely be a large part of everyday life in the future as well.

Computer vision and scene analytics is being researched extensively at companies such as Nokia to identify anomalies or to give actionable business insights.

"Computer vision and scene analytics is being researched extensively at companies such as Nokia to identify anomalies or to give actionable business insights."

Source: apexcovantage.com

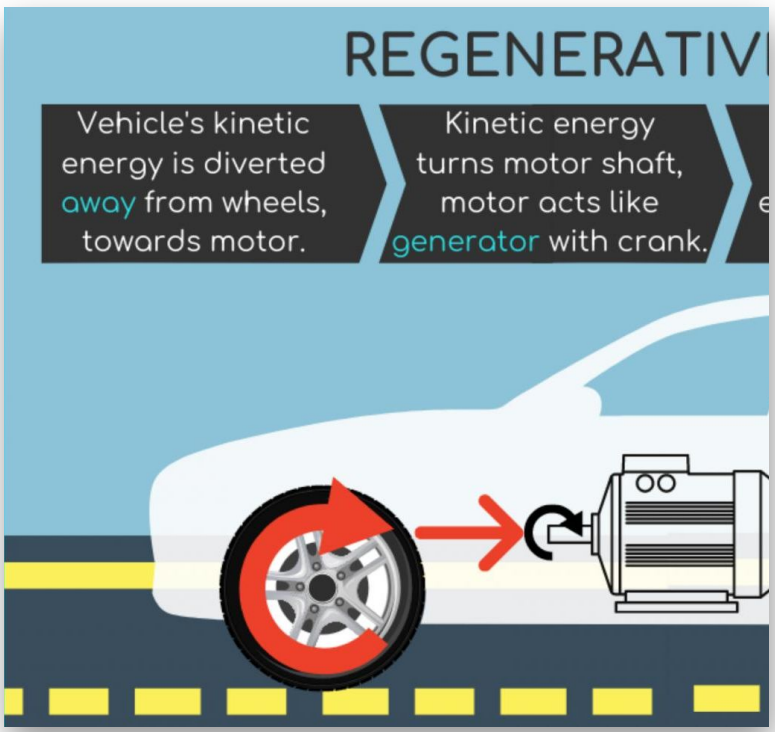
REGENERATIVE BRAKING

by Samyak Jain and Urvesh Parmar

Regenerative braking is a technology that relies on the principles of electromagnetic induction and the conservation of energy. When a vehicle equipped with regenerative braking is in motion, it has kinetic energy, which is a form of energy associated with the motion of an object. When the driver applies the brakes, the kinetic energy is transformed into other forms of energy, such as heat and sound, due to friction.

However, with regenerative braking, the vehicle's kinetic energy is converted into electrical energy instead of being dissipated as heat and sound. The conversion of kinetic energy into electrical energy is made possible by using an electric motor acting as a generator.

The process of electromagnetic induction is used to generate electrical energy. Electromagnetic induction is a phenomenon discovered by Michael Faraday in the early 19th century, which refers to the generation of an electrical current in a conductor when it is placed in a changing magnetic field. In the case of regenerative braking, the electric motor's rotor is driven by the kinetic energy of the vehicle when the brakes are applied. The rotor's motion creates a changing magnetic field, which induces an electrical current in the motor's stator windings. The electrical energy generated in the motor is then fed back into the vehicle's battery, where it is stored as potential energy.

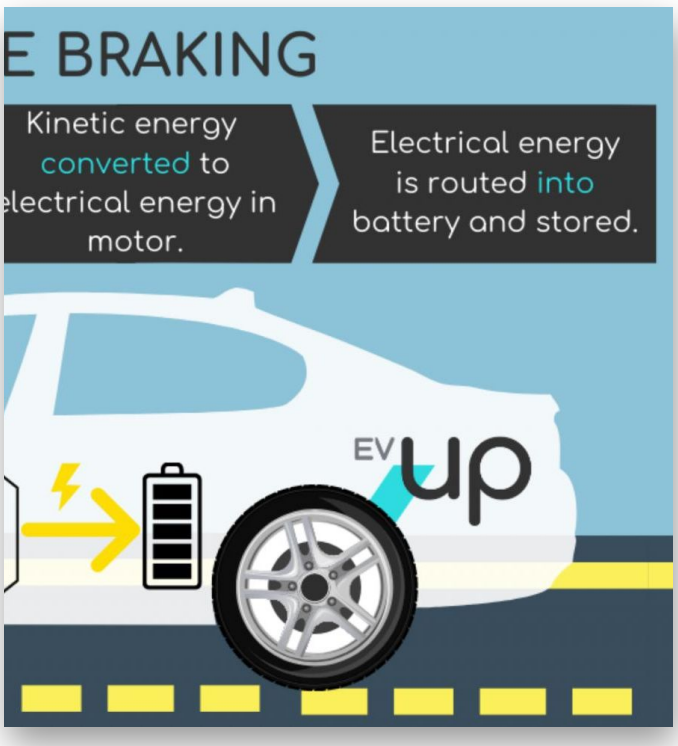


Source: evup.com.au

The rotor's motion creates a changing magnetic field, which induces an electrical current in the motor's stator windings. The electrical energy generated in the motor is then fed back into the vehicle's battery, where it is stored as potential energy.

The conservation of energy principle is also relevant to regenerative braking. The law of conservation of energy states that energy cannot be created or destroyed but only transformed from one form to another. In the case of regenerative braking, the kinetic energy of the vehicle is transformed into electrical energy instead of being lost as heat and sound. The electrical energy stored in the battery is then transformed back into kinetic energy when the driver accelerates the vehicle. This energy transformation process ensures that the total amount of energy in the system remains constant while improving the efficiency of the vehicle.

In summary, regenerative braking is a technology that relies on electromagnetic induction principles and energy conservation.The process of converting kinetic energy into electrical energy through regenerative braking is made possible by an electric motor acting as a generator. The electrical energy generated is then fed back into the vehicle's battery, where it is stored as potential energy. This process results in improved energy efficiency and helps reduce the amount of energy wasted during braking.



"Regenerative braking is used to utilize wasted energy during braking to recharge batteries in EVs."

"Most EVs these days come equipped with regenerative braking technology."

COMPOSITE MATERIALS

by Kavin Kabilan and Sharan Venkatesh

WHAT ARE THEY?

Composite materials are materials made of two or more materials having different properties that do not blend or dissolve with each other. Metal matrix composites are prevalent in aerospace industries to make the mobility vehicle lighter, agile, and environmentally stable, improving fuel efficiency and performance. Recent advancements in material engineering introduced advanced composites containing fibers in the matrix of other materials. These are called fiber composites. Fiber composites have a high strength-to-weight ratio and resist fatigue. Some commonly used fiber composites are fiberglass and carbon fiber.

ABOUT THEM

Composite materials have been vital in the development of human technology. Its robust properties, such as durability, strength, and low weight, make it highly desired and established in today's market.

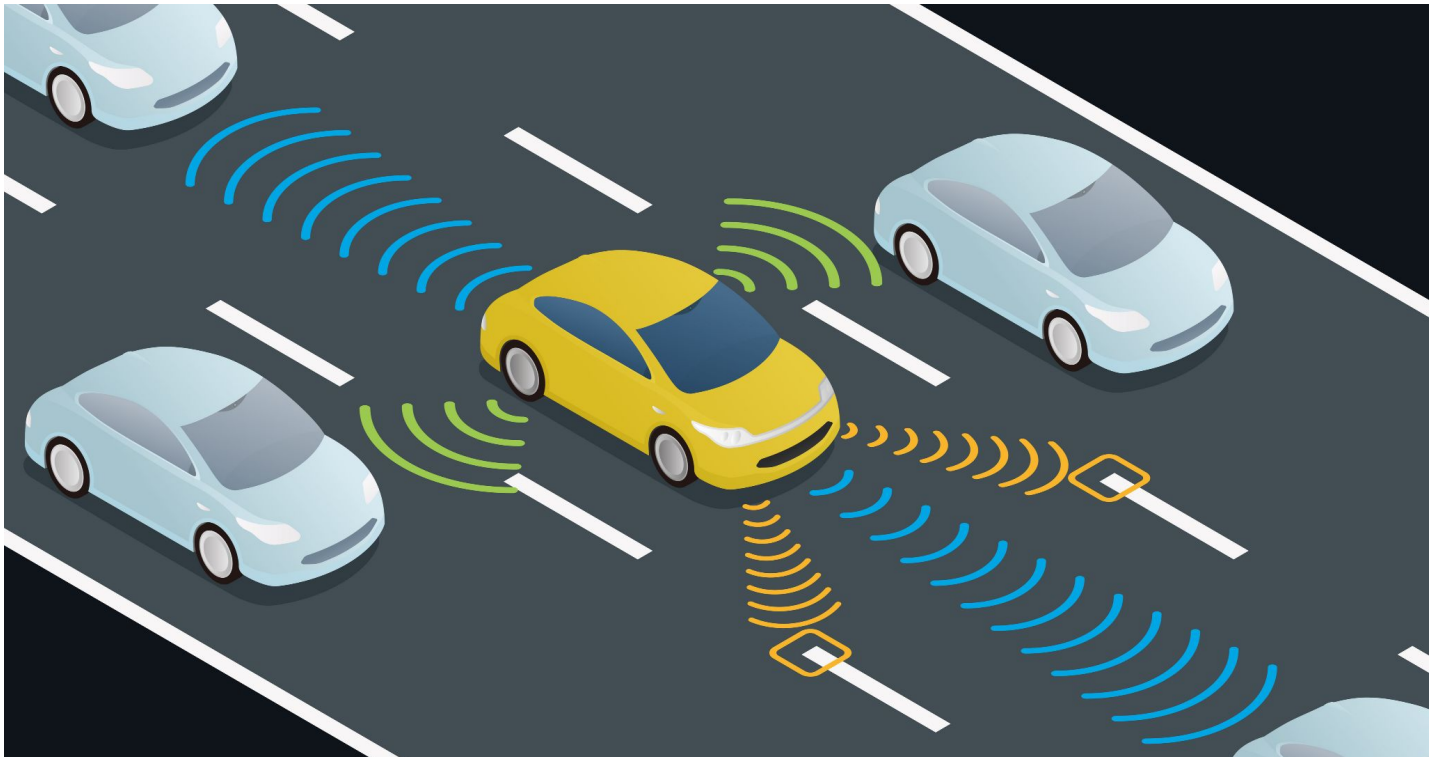
CARBON FIBER

Carbon fiber composites are among the most sought-after composite materials in the present age. This composite, like others, consists of a matrix phase and a reinforcement phase. The matrix phase is usually a polymer resin like epoxy; the reinforcement is carbon fiber. Reinforcement using carbon fiber gives CFRP added strength and rigidity.

CFRP has extensive applications spanning aerospace, automobile, and even civil engineering! For example, the Airbus A350 consists of 52% CFRP, the highest weight ratio of CFRP in any airliner ever produced. Moreover, GE manufactures its GE90 and GEnx engines using carbon fiber composite fan blades.

"Composite materials are resistant to weather, elevated temperatures as well as chemical agents which makes them suitable from a degradation/corrosion standpoint."

Source: linkedin.com



Source: tatacapital.com

SAFETY OF AUTONOMOUS VEHICLES

by Anandita Tiwari and Harish B

Self-driving cars will reshape the modern transportation industry, but having autonomous vehicles on the road is safer or more dangerous? A driverless car cannot be safer than a human driving a car, probably because, intuitively, a machine cannot beat the years of experience a human has. However, contrary to what it seems like, humans are quite terrible at not getting into accidents; even if we can establish that self-driving car are safer, in other words, they can get into fewer accidents, there is still the tricky question of who is to blame when they do get into accidents.

Research published by the US Department of Transportation NHTSA (National highway safety administration) found that 94% of all car crashes that occurred between 2005 and 2007 were the results of errors by drivers, that is to say, due to one or all drivers not being attentive enough and therefore, not reacting accordingly. The goal for autonomous vehicles is not to avoid accidents altogether but to cause fewer accidents than humans do.

"Autonomous vehicles are safer on roads compared to human drivers, to an extent that in the future, no human may even be allowed to drive!"

When Google's autonomous car hit a bus, marking one of the dozen crashes since their project began, Google's project turned to development. However, any self-driving car crash causes concern among the general public. Despite all the accidents, autonomous vehicles remain safer than humans. One of the main concerns about autonomous vehicles is the potential of getting hacked and the reliability of the sensors and AI systems that power autonomous vehicles. These vehicles rely on complex networks of sensors and computers to function; if these systems were compromised, it could lead to serious accidents. Manufacturers of autonomous vehicles are taking steps to secure their systems and make them resistant to hacking; they are working These systems to improve the accuracy and reliability of these systems and are also developing backup systems to take over if the primary systems fail.

Tesla is making great headway as they are making autonomous driving more prominent. Elon Musk has opined that one of the talking points in a future dominated by autonomous vehicles will be whether or not to ban manual driving (by regulators). Google's self-driving car project had only 12 fender bender events in a total of 1.8 million miles driven.

FUTURE OF EVs IN INDIA

by Madhan Mohan Reddy and Santosh Kumar C

The race for India's EV space is heating up. Every automobile industry wants to take advantage of the opportunity of acquiring this industry. Companies are partnering to build better EV technology and infrastructure for EV charging.

India's auto industry is the fourth largest in the entire world. India's automobile industry is expected to become the third largest by the end of 2021. Besides, this industry contributes 7.1% to India's total GDP. Currently, two-wheelers dominate India's automotive industry. This has a 75% contribution to the total volume. Also, it is considered that passenger vehicles dominate India's car market. According to this report, people's incomes are rising, and the demand for passenger cars is expected to increase.

Let us talk about electric vehicles. The sale of electric vehicles is less than 1% of the total sales of the automobile sector. However, some experts believe this number will rise from 1% to 5% in the coming years. However, this is an expectation. It is not a fact yet.

"As of 2022, the Tata Nexon EV is the best-selling EV car in India, followed by the Tata Tigor EV."

In the coming times, we will know how this percentage will improve further. 5 lakh two-wheelers currently operate in India in the EV category. Nevertheless, the number of electric cars has yet to reach lakhs. Their number is in the thousands. The challenges of the Electric vehicle segment that it can hope to overcome in the future.

The first challenge for this industry is that of charging infrastructure. Cars will be manufactured, and people will buy them also, but with non-EV cars, one stops at a petrol pump to add fuel.

But the charging infrastructure needs to develop sufficiently in the case of electric vehicles. This is a challenge for this industry. Tata Power and NTPC are working on this problem. The second challenge for this industry is the upfront cost.

Assume that you go to buy a car. You get a diesel/petrol car for five lakhs. But the same car in the electric segment will be for ten lakhs. Over here, the customer will take into concern his/her money involved. This is a challenge for the electric vehicle segment. The upfront cost in terms of battery is quite high. Hence any electric vehicle increases the upfront cost for the buyer. The government can support organizations in different ways that are developing charging infrastructure. Tata Motors, Mahindra Motors, MG Motor, Ashok Leyland Electric, and Ola Electric are some leading EV manufacturing companies.

If electric vehicles operate well in the future, then Tata Power will take the lead in developing charging infrastructure. This largest integrated power company runs a power generation and transmission business. In recent times this company has been shifting its focus toward charging infrastructure.

PROJECTS

As a club, we at SAE-NITK have undertaken many projects where we learn and research and understand different topics of various domains of engineering like mechanical, electronics, aeronautics, data science, etc. Here is a brief summary of some of the projects done by the batch of 2021-22!

F1 Tubercles Biomimicry

Planning for 6 DOF Robot Manipulator

Solar based Wireless Power Transmission

Active Suspension Using Matlab

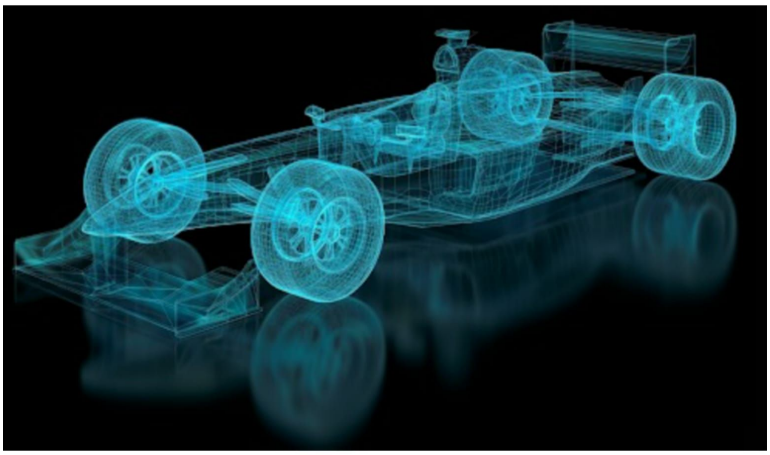
Velocity prediction and Road Lane Detection with Python

Source: app.flipsnack.com

01

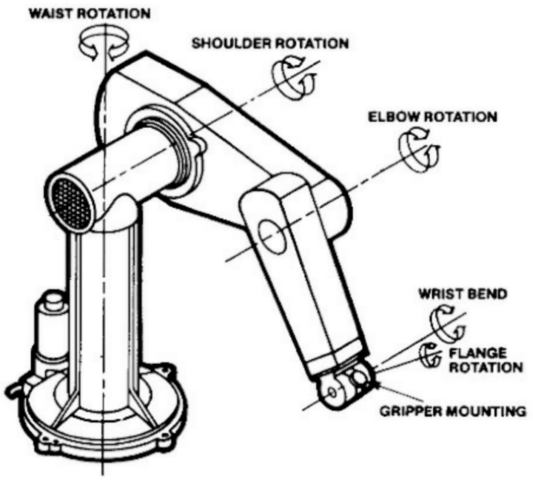
F1 Tubercles Biomimicry

Raghav Ganesh, Lucky Prameeth Rayi,
Shaik Dilshad Begum



Source: azom.com/article.aspx

This project compares the aerodynamic characteristics of the actual rear wing of an F1 car and a tubercle leading edge on the rear wing. This project is inspired by nature humpback whales which exhibit excellent aerodynamic abilities underwater despite being one of the heaviest beings on the planet. The optimum airfoil is found using XFLR5, designed in Fusion 360, and analyzed using ANSYS.



Source: researchgate.net

Planning for 6 DOF Robot Manipulator

Pradeep Singh Solanki, Sumanth N Hegde, Nischayi Vabilisetti

In the era of 4.0 technology, robotic arms are becoming more and more popular in modern industries. Today, every small and large industry uses the robotic manipulator to complete various tasks like picking and placing, welding process, painting, and material handling. Therefore, the research and simulation of robotic arms significantly improve the efficiency of using this tool in all sectors. The Unimation PUMA 560 serially linked robot manipulator was used as a basis because this robot manipulator is widely used in industry and academia. It has nonlinear and uncertain dynamic parameters serial link 6 degrees of freedom robot manipulator. The position and orientation of the robotic arm end-effector are generated by the Denavit Hartenburg method, and the inverse kinematics equations have been derived using the analytical method. Cubic and quintic polynomial interpolations have been used to study trajectory planning, and the Monte Carlo method is proposed to analyze the robotic arm's workspace.

02

03

Solar based Wireless Power Transmission

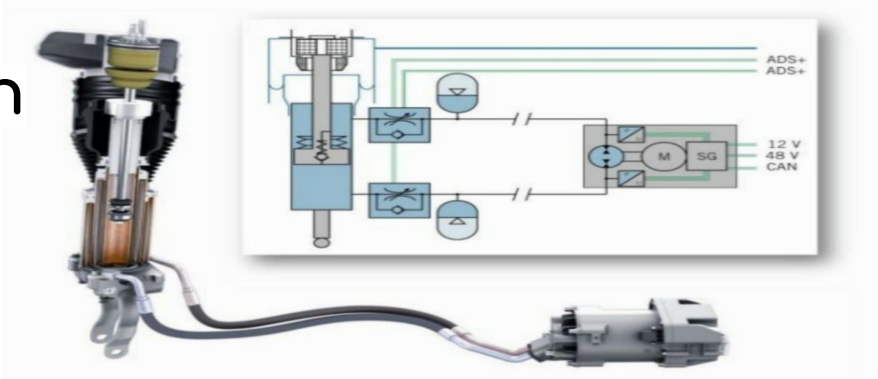
Navya Kollipara, Likhita J, P Yogesh, Ajmeera Kethan

Source:smartmot.com/brakes

A literature survey is done on wireless power transmission. Simulations were done to study the power transmitted using different coil distances and materials. Solar power is studied in detail. A detailed study of how solar energy which is DC can be made useful for wireless power transfer using converters. The point of maximum power is drawn from the graphs. Future development of the project would be a detailed analysis of load requirements, solar panel modeling, and dc to WPT for electric vehicle charging.

Active Suspension Using MATLAB

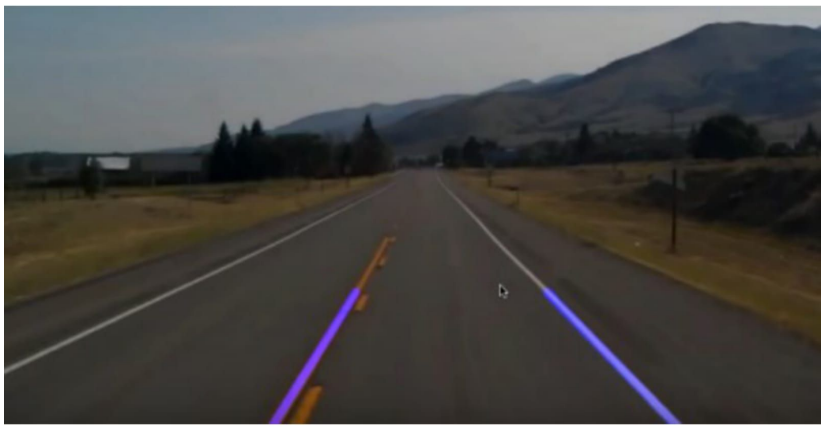
Sumit Sagar, Shunu PS, Manoj GS, Mudavath Puja Chauhan



Source :shopmax2ooo.com

04 Vehicle suspension systems are typically rated by their ability to provide good road handling and better ride comfort. Current automobile suspension systems use passive components only by utilizing spring and damping coefficients with fixed rates. This system only offers a compromise between these two conflicting criteria. Spring and damper are used between the vehicle body and the wheel assembly in conventional passive suspensions. The parameters of the spring-damper are chosen to emphasize one of several conflicting interests, like passenger comfort, road handling, and suspension deflection. Using a feedback-controller hydraulic actuator between the body and wheel assembly, active suspensions allow the designer to balance these requirements. Active suspension controls the vertical wheel movement with an onboard system rather than determined only by the road profile. Team members were able to gain valuable experience in applying various concepts such as mathematical modeling, PID controllers, and the basics of H- infinity synthesis and MATLAB. However, the project still has a lot of scope for improvement in terms of improving the efficiency of the system and introducing various other aspects such as different control modes, etc.

05



Source:madrasresearch.org

Velocity Prediction and Road Lane Detection with Python

Yash Kundale, Mihir Mali,
Ashish Prateek, Shannon Carlo

This project has 2 modules. Road curvature module: In this module, we first developed a module to detect lanes in a road using AI & ML. Using this data we then calculate the radius of the curvature of the road at each point of the frame. This data is then sent to the next module. Velocity prediction module: In this module, we take the given radius of curvature of the road. Other factors such as slip angle steering angle calculated. Combining the calculated radius of curvature and the maximum speed for a safe turn is calculated The maximum speed is displayed on the screen for assisting drivers or for calculating the safe speed for self-driving vehicles.

REFERENCES

Autonomous Vehicles
https://www.sciencedirect.com/science/article/pii/S2352146518302606
https://theconversation.com/global/topics/autonomous-vehicles-1007/

Electrification
https://corporate.enelx.com/en/question-and-answers/what-is-electrification#:~:text=Cutting%20greenhouse%20gas%20emissions%20must,met%20by%20other%20energy%20sources
https://en.wikipedia.org/wiki/Electrification

Vehicle Connectivity
https://www.nhtsa.gov/technology-innovation/vehicle-vehicle-communication
https://blog.rgbsi.com/7-types-of-vehicle-connectivity

Artificial Intelligence
https://www.workana.com/job/future-of-artificail-intelligence-1?ref=projects_1
https://www.essaybanyan.com/essay/essay-on-artificial-intelligence/

Shared Mobility
https://www.futurelearn.com/info/courses/sustainable-transport-and-shared-mobility/0/steps/279379
https://www.swarco.com/mobility-future/sustainable-mobility-examples-definition/shared-mobility

Internet Of Things
https://en.wikipedia.org/wiki/Internet_of_things
https://www.oracle.com/in/internet-of-things/what-is-iot/
https://www.drishtiias.com/daily-news-analysis/securing-internet-of-things/print_manually

Battery Thermal Management System
https://cicenergigune.com/en/blog/battery-thermal-management-system-btms-electric-vehicle#:~:text=The%20Battery%20Thermal%20Management%20System,to%20operate%20safely%20and%20efficiently.
https://www.sciencedirect.com/topics/chemistry/battery-thermal-management-system
https://www.sciencedirect.com/science/article/pii/S2352152X21000232

Guidance and Self Driving
https://www.national.co.uk/tech-powers-google-car/
https://www.techtarget.com/searchenterpriseai/definition/driverless-car
https://www.techtarget.com/searchenterpriseai/definition/driverless-car

Computer Vision
https://reader.elsevier.com/reader/
https://www.sas.com/en_in/insights/analytics/

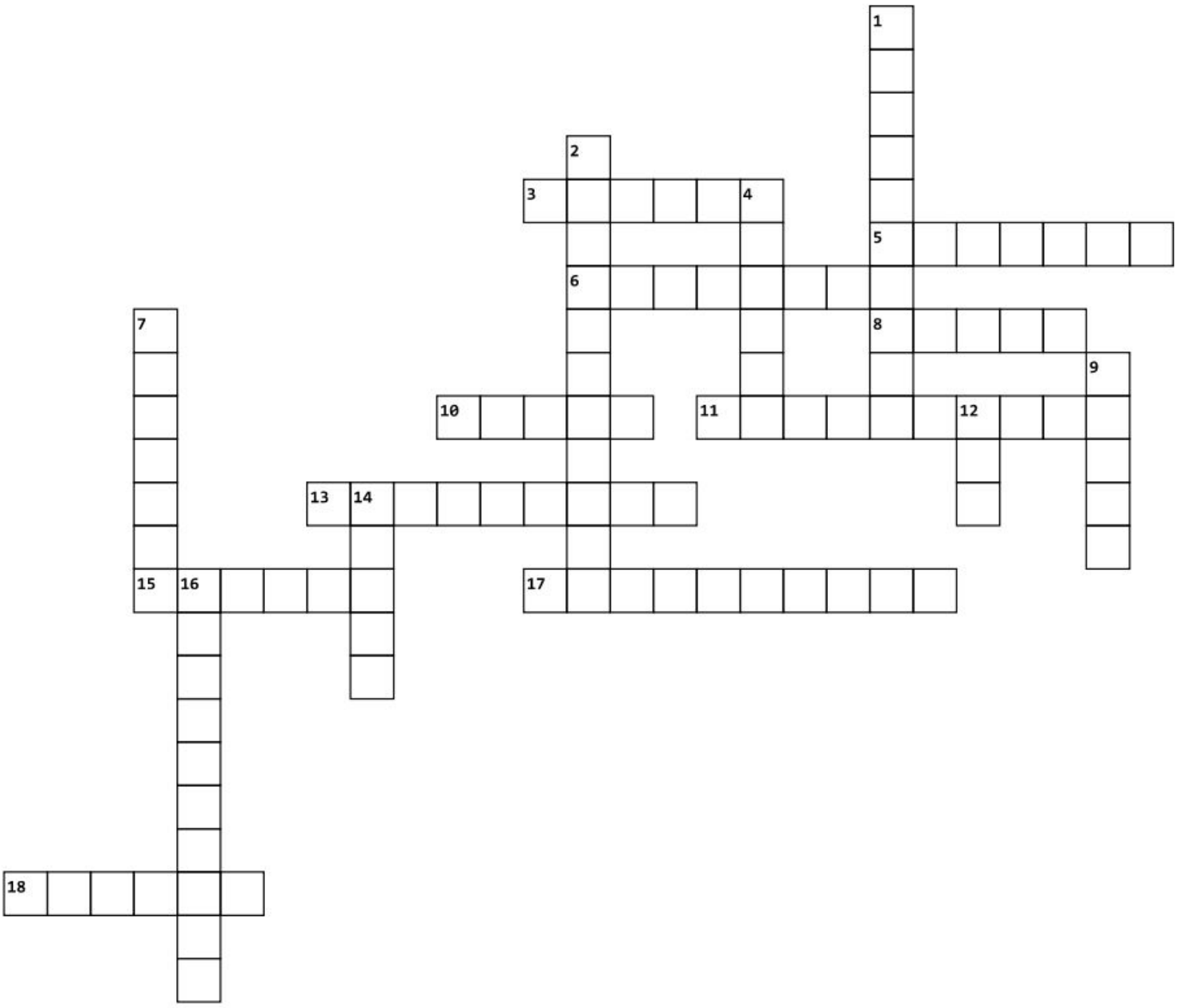
Regenerative Braking
https://e-vehicleinfo.com/regenerative-braking-system-in-electric-vehicles/
https://iopscience.iop.org/article/10.1088/1757-899X/1271/1/012025/pdf

Composite Materials
https://en.wikipedia.org/wiki/Carbon-fiber-reinforced_polymers
https://www.ge.com/news/reports/the-art-of-engineering-the-worlds-largest-jet-engine-shows-off-composite-curves

Safety of Autonomous Vehicles
https://thegradient.pub/are-self-driving-cars-really-safer-than-human-drivers/
https://www.pnas.org/doi/10.1073/pnas.1805770115
https://vtechworks.lib.vt.edu/bitstream/handle/10919/55090/DriverInattention.pdf
https://www.vox.com/recode/22425169/autonomous-features-cars-elon-musk-autopilot

Future of EVs in India
https://www.investindia.gov.in/team-india-blogs/electric-vehicle-ev-sector-india-boost-both-economy-and-environment
https://www.india-briefing.com/news/electric-vehicle-industry-in-india-why-foreign-investors-should-pay-attention-21872.html/

CROSSWORD PUZZLE



Across

3. One of the major commercial aircraft manufacturers
5. One of the different matrix composite types
6. A favourable property of composites
8. An Indian two-wheeler EV Startup
10. Infrared waves used for detection
11. How plants get heat in cold regions
13. Principle behind regenerative braking
15. The basic phase in composites
17. Way of preventing heat influx or outflux
18. A human sense that even computers are slowly obtaining

Down

1. Secure database for maintaining transaction information
2. Removal of heat where it is unwanted
4. Hardware to detect or measure properties
7. Main element in modern batteries
9. Elon Musk
12. Taxis and EVs
14. Best-selling EV in India
16. Makes decisions by oneself or itself

Hints: 1.Blockchain 2.Dissipation 3.Airbus 4.Sensor 5.Ceramic 6.Strength 7.Lithium 8.Ather 9.Tesla 10.Lidar 11.Greenhouse 12.Ola 13.Induction 14.Nexon 15.Matrix 16.Autonomous 17.Insulation 18.Vision

MEET OUR CORE

Patrike Vedika Rajkumar
Convenor

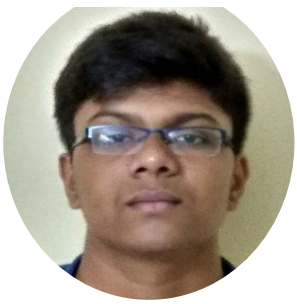
Lucky Prameeth Rayi
President

Mihir S Mali
Secretary

Prasanthi Bolimera
Webmaster

Pradeep Singh Solanki
Treasurer

Sumanth N Hegde
Technical Head



Shrivatsa Hegde
Technical Head

Aashish Prateek
Project Head

Sumit Sagar
Project Head

Navya Kollipara
Project Head

SAE NITK
ANNUAL MAGAZINE
TECHBUZZ VOL 4.0

SAE NITK
SOCIETY OF AUTOMOTIVE ENGINEERS