Maratha Vidya Prasarak Samaj's
Karmaveer Adv. Baburao Ganapatrao Thakare College Of Engineering
Nashik-13.
(NAAC ACCREDITED INSTITUTE WITH 'A' GRADE)

DEPARTMENT OF ELECTRONICS &TELECOMMUNICATION ENGG.

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Department Vision:-

To be recognized as an excellent department offering competent technical education to create competent electronics & telecommunication engineers for the benefit of the common masses.

Department Mission:-

Committed to serve the needs of society through innovative teaching learning processes, promoting industry- institute interaction to provide competent and cultured electronics and telecommunication engineers.

Greeting,

The Department of Electronics and Telecommunication is celebrating "Engineer's day" by unveiling technical newsletter "TeChronicle" VOL-2, ISSUE-3 on 15th September 2020. Every year this day is celebrated to appreciate the exceptional contributions of Sir Mokshagundam Visvesvaraya.

Understanding Autonomous and E Vehicle with Dr. Sagar Behere (Director, Aurora Innovation Inc. Palo Alto, USA.)

[Team Editorial]

An architect and systems integrator for complex, safety critical systems. PhD in architectures for highly automated driving. Skilled in software and firmware development, control systems design, functional safety, cyber security, embedded hardware, computer networking, and systems engineering. We are talking about **Dr. Sagar Behere** is the Director of Systems and Safety Engineering at Aurora Innovation Inc.USA He has worked with autonomous driving projects at Toyota, Zoox, Volvo, and other organizations in Europe and North America. He has been awarded a doctorate in reference architectures for autonomous driving from the Royal Institute of Technology in Stockholm, Sweden. Dr. Behere is passionate about combining research from the domains of industrial mechatronics, artificial intelligence, and machine consciousness to create architectures for applied machine intelligence. He currently a guide Researcher at KTH the Royal Institute of Technology in Stockholm, Sweden and Director, Systems and Safety Engineering at Aurora Innovation Inc., Palo Alto, USA. He completed his Bachelor in Mechanical Engineering from University of Pune in 2003. Then he completed his masters in Systems, Control and Robotics from KTH, Sweden in 2010. Then he completed a Licentiate in Machine Design from KTH, Sweden in 2013. Then he completed his PhD in Machine Design from KTH, Sweden in 2015.

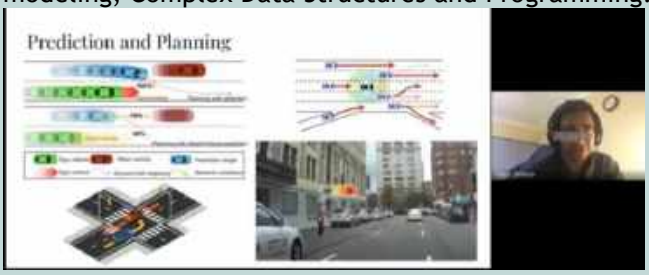
We had a cheer full interactive session glimpse of our conversation with Dr. Behere Sir:

Student: What is the actual technology which helps to operate autonomous cars? Is this technology reliable?

Answer: The key technology required to drive an autonomous car is sensing, perception, prediction, control and vehicle platform. self-driving cars combine a variety of sensors to perceive their surroundings such as RADAR, LIDAR and SONAR. autonomous vehicles are able to be more transformative and is further agile to possible changes.

Student: What Sort of Engineering skills we should acquire to work on an autonomous vehicle?

Answer: Extremely diverse sets of skills are needed to build an autonomous vehicle. Mathematics is the common foundation. Students require deep familiarity with subjects like Machine Learning, computer vision, Discrete mathematics, Estimation and Bayesian modeling, Complex Data Structures and Programming.



Student: As we do in our day to day life, have nonverbal communications with the foremost driver and drive accordingly. Will it be possible for self-driving cars to replicate those movements?

Answer: It is one of the biggest challenges in the autonomous industry. Autonomous industries are trying to resolve this issue very soon. We have an external user interface similar to the internal user interface which is used to communicate like vulnerable road users. This problem has not been solved yet. Machine Learning is advancing day by day. We surely come up with the solution.

ELECTRIC VEHICLE [Ms. Sarika Jagtap]

How does the electric engine work?

Electric cars function by plugging into a charge point and taking electricity from the grid. They store the electricity in rechargeable batteries that power an electric motor, which turns the wheels. Electric cars accelerate faster than vehicles with traditional fuel engines – so they feel lighter to drive.

What's their range like?

How far you can travel on a full charge depends on the vehicle. Each model has a different range, battery size and efficiency. The perfect electric car for you will be the one you can use for your normal journeys without having to stop and charge up halfway through.

What types of electric cars are there?

There are a few different types of electric vehicle (EV). Some run purely on electricity, these are called pure electric vehicles. And some can also be run on petrol or diesel, these are called hybrid electric vehicles.

1.Plug-in electric - This means the car runs purely on electricity and gets all their power when they're plugged in to charge. They don't need petrol or diesel to run so don't produce any emissions like traditional cars.

2.Plug-in hybrid - These mainly run on electricity but also have a traditional fuel engine so you can use petrol or diesel too. If you run out of charge, the car will switch to using fuel. When it's running on fuel, these cars will produce emissions but when they're running on electricity, they won't. Plug-in hybrids can be plugged in to an electricity source to recharge their battery.

3.Hybrid-electric - These run mainly on fuel like petrol or diesel but also have an electric battery too, which is recharged through regenerative braking. These let you switch between using your fuel engine and using 'EV' mode at the touch of a button. These cars cannot be plugged in to an electricity source and rely on petrol or diesel for energy.

What are the inner parts of an EV?

EVs have 90% less moving parts than an ICE (Internal Combustion Engine) car. Here's a breakdown of the parts that keep an EV moving:

1.Electric Engine/Motor - Provides power to rotate the wheels. It can be DC/AC type, however, AC motors are more common.

2.Inverter - Converts the electric current in the form of Direct Current (DC) into Alternating Current (AC).

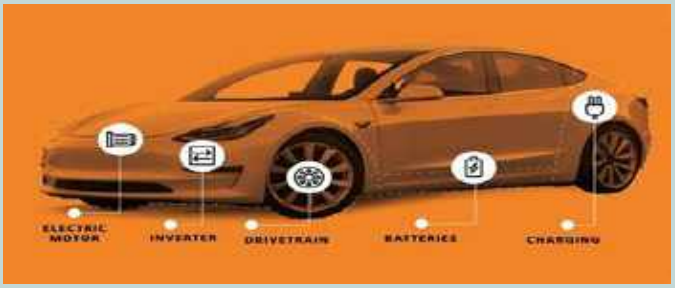
3.Drivetrain - EVs have a single-speed transmission which sends power from the motor to the wheels.

4.Batteries - Store the electricity required to run an EV. The higher the kW of the battery, the higher the range.

5.Charging - Plug into an outlet or EV charging point to charge your battery.

Discussion

The use of fully electric vehicles does make a significant impact in reducing greenhouse gas emissions. Even with the energy production in the United States being two thirds nonrenewable energy, electric vehicles still produce less than half the amount of CO2 as conventional gasoline cars do annually. The purpose of the study was to bring all the pieces of information together that create a full picture of the potential significance of this technology. While electric vehicles may be making a difference now, their impact could be increased if a substantial effort is made by the government and lobbying parties to encourage more policy change, research, and production of more electric vehicles. One of the limits of this study was the limited research done on cradle-to-grave emissions of the production of lithium-ion batteries. Since this is a relatively new field and each battery has its own chemical background, emissions of production were not found. This is an important component of the electric vehicle discussion because the production of these batteries is not only the most expensive part of the car, it may also be the most energy consuming part of production. More research needs to be conducted on electric vehicles, renewable energy, and lithium-ion batteries, especially the various chemical make-ups of the batteries on the market. The country is on the right track to start making a significant reduction in greenhouse gasses, and with these reductions the planet should remain livable for centuries to come.



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1.Schmid, Ashley. 2017. "An Analysis of the Environmental Impact of Electric Vehicles." Missouri S&T's Peer to Peer 1, (2). https://scholarsmine.mst.edu/peer2peer/vol1/iss2/2.

2.https://www.edfenergy.com/for-home/energywise/how-do-electric-cars-work

E-VEHICLES AND INDUSTRIAL OPPORTUNITIES [Himanshu Bhamare, TE ETC]

The Indian Automobile Industry is currently ranked 5th largest in the world and is set to be the 3rd largest by 2030. The requirement of mobility in India is set to change dramatically in the near future to cater to the requirement of 1.30 billion+ population. The past modes of transport and infrastructure will not suffice in coming years. Recognizing this aspect, the Government of India, is working towards developing a mobility option which is "Shared, Connected and Electric". There is an increased need to prepare for a green future for Indian mobility and reduce dependence on imported crude oil. The Indian EV Industry is in its nascent stages with only 2 electric car manufacturers, about 10+ players in 2 Wheelers and 3-4 OEM's in Electric buses. Most other auto OEMs are now looking at introducing EV models in India. While there is a vision for 100% electric vehicles by 2030, most industry experts indicate that around 40-45% EV conversion by 2030 is a realistic expectation. A major push towards EVs will be led by the public transportation requirements in India – Fleet cars, E-Buses, 3 wheelers and 2 wheelers. India offers huge opportunities for Norwegian companies in every aspect of the EV ecosystem. This is a market in developmental stages and Norwegian firms could identify and position themselves to cater to this growing market in the long run.

The Government of India has declared public charging stations and EV charging businesses as a de-licensed activity. There have been initiatives to set up community charging stations, as in the case of Plugin India facilitated charging stations. News reports have indicated plans to provide solar-powered charging points at the existing fuel stations of the country. There are companies like Tata Power, Fortum and others which are engaged in the business of electric vehicle charging. They have already installed all varieties of chargers - rapid DC chargers and level 2 AC chargers for all kinds of applications - public access, workplace charging, fleet charging, residential communities, malls, highways etc and have large plans to scale up. On 22 May 2018 Ather Energy launched its charging infrastructure service in Bangalore called Aether Grid, with each charging station called 'Point'. The service is open to all electric vehicles but has been deployed where Other plans to launch its own electric scooter.

Key Opportunities For firms lie in relatively unexplored businesses in India.

1 OF 3EV Charging spaces:

•EV Chargers,Smart Chargers (equipment / technology)
• Charging Infrastructure Services
• Smart Charging networks
• Cloud based solutions for Charging Apart from a few local firms in power electronics, EV Charging sector remains an uncharted territory for India. This offers excellent opportunities .

2 OF 3 EV Mobility Services:

• Cloud based mobility / fleet services
• Technology for such services.
• Smart Networks Ola and Uber are 2 national fleet operators, there is scope to introduce new solutions and enter this space of shared mobility in India.

3 OF 3 Vehicle to Grid / Storage / Battery:

• Vehicle to Grid solutions.
• RE integration with EV charging and Storage.
• Lithium Battery Solutions and BMS Currently, there is little awareness of the scope and extent of impact on the grid. Norwegian firms could bring in global experiences to India.

E-vehicles industry electric mobility mission create 10 million jobs in future:

India has chalked a plan to aid its electric mobility mission by creating a specialized workforce. The blueprint aims at generating 10 million jobs.

The Ministry of Skill Development and Entrepreneurship is in the process of preparing the programme to provide adequate manpower to the electric mobility industry.

The strategy includes creating a skilled and trained workforce which has an expertise in design and testing, battery manufacturing and management, sales, services and infrastructure of electric vehicles.

Reference :-

https://scholar.google.co.in/scholar?q=e+vehicles+towards+electronic+industry nhl=en&as_sdt=0&as_vis=1&oi=scholar

EV CHARGERS [Ms. Shweta Bagade, TE ETC]

Here electric fuel is nothing but the charge which is required to run the car hence we can call it as electric fuel. Important component in an EV which requires advancement is the Chargers. An average E-Car takes a minimum of 5 hours to get a charge that combined with its very low mileage becomes a disaster It gets plugged into the AC mains and converts the AC to DC to charge the batteries. But there are more to add to it. Charging is a process in which the batteries and charger should coexist; you cannot push current inside a battery if the battery is not ready to accept it. There are many types of chargers; the most common types are discussed below.

Level 1 Charger: These are the most basic chargers and it is probably the one that you get along with your car. They take a long time to charge the batteries since they operate in 120V AC, They convert this 120V AC to DC and use it to charge the batteries. The current rating of the charger will also be low somewhere near 8-10 A, this means you will be sending less current and thus taking a long time to charge your batteries overnight. On the positive side, this method improves the life cycle of the battery since our charging current is less.

Level 2 Charger: These are a bit faster than Level 1 charger, it depends on the manufacturer to provide you with Level 1 or Level 2 charger. Level 2 chargers operate on higher voltages like 240V or above and also have high current ratings near 40A to 50A. This makes the car charge faster.

Level 3 chargers: Level 3 chargers are the game changers, these are also called as the super chargers or fast chargers. They can charge your car to 60% of its total capacity within 30 minutes. The downside is that since it is pushing a lot of current inside your battery like 100A for a Tesla (insane! Yes) the batteries inside would feel like taking a crash course all year. So eventually the life of the battery is reduced. Also most superchargers do not charge the batteries till 100% since more time will be required to charge the battery from 80% to 100%. A supercharger station of Tesla is shown below.

Reference :-

1.https://www.circuitdigest.com

HEART OF E-VEHICLES [Mr. Shivam Jungare]

E-Vehicles are in huge demand due to their advantages like very few moving parts, no balancing issues, good speed control, high acceleration, self-started and high starting torque, on the traditional combustion engine based vehicles. The heart on which all these e-vehicles work is the battery of these vehicles. Many companies have developed vehicles running entirely on electricity, but the name which always tops the list is 'Tesla'.

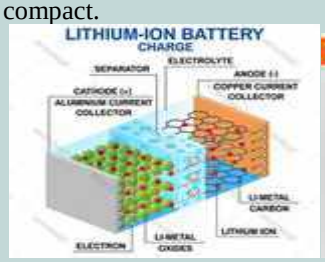
So, what makes Tesla stand out from others?

Tesla uses the lithium ion cells. Electrochemical potential is the tendency of metals to lose electrons.

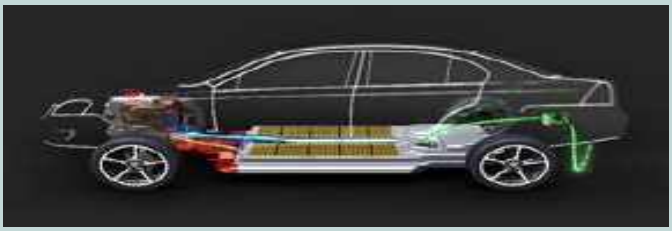
Lithium has the highest tendency to lose electrons. It has only one electron in its outer shell and always wants to lose it. In its pure form Lithium is highly reactive while in metal oxides it is somewhat stable.

Charging: As shown below, lithium metal oxides are placed at one end having the Aluminium at its side. And the graphite structure on the other side has a copper plate. These graphite layers are loosely bonded so that the separated lithium ions can be easily stored there. In between these, an electrolyte with a separator is placed. This electrolyte acts as a guard which allows only the lithium ions to pass through it. The positive terminal of the power source is attached to the Aluminum plate having the Lithium metal oxides and the negative terminal is attached to the Carbon sheet. When the power supply is turned on, the Aluminum plate being positive attracts the negative valence electrons present on the Lithium atoms. These electrons travel through the external circuitry and reach the graphite layer. In the meantime positively charged Lithium ions would be attracted towards the negative copper plate and flow through the electrolyte and get trapped there. When the lithium ions reach the graphite sheet, the cell is fully charged. This state is unstable.

Discharging: When the power source is removed and a load is connected across the circuitry, the exact opposite of charging takes place. The Lithium ions want to go back to their stable state through the electrolyte. And the electrons move back towards the metal oxide through the load causing an electric current flowing through the load. In practical cells, the graphite and metal oxide are coated on copper and aluminum foils. These foils are called current collectors. An organic salt of Lithium acts as an electrolyte and it is coated on to the separator sheet. All these sheets are wound on a cylinder around a central steel core, thus making the cell more compact.



A standard Tesla cell has a voltage between 3 and 4.2 volts. Many such Tesla cells are connected in series and a parallel fashion to form a module. 16 such modules are connected in series to form a battery pack in a Tesla car.



Lithium ion cells produce a lot of heat during the operation and a high temperature will decay the cell's performance. A battery management system is used to manage the temperature, state of charge, voltage protection and cell health monitoring of such a huge number of cells. Glycol based cooling technology is used in a Tesla battery pack. The BMS also uses something called cell balancing in which the cells charge and discharge equally. Thus, many small cylindrical cells divide the discharge strain equally during high power demands. This could not be achieved using a single large cell. This is why Tesla cars perform better than other brands.

Reference :-

1.https://www.youtube.com/watch?v=VxMM4g2Sk8U

AUTONOMOUS VEHICLES
[Ms. Esha Chokhar, TE ETC]

Autonomous vehicles are well on their way to being a reality. Improving the efficiency of internal combustion engines is one of the most promising and cost-effective near- to mid-term approaches to increasing highway vehicles' fuel economy. The Vehicle Technologies Office's research and development activities address critical barriers to commercializing higher efficiency, very low emissions advanced internal combustion engines for passenger and commercial vehicles. This technology has great potential to reduce U.S. petroleum consumption, resulting in greater economic, environmental, and energy security.

Already offering outstanding drivability and reliability to over 230 million passenger vehicles, internal combustion engines have the potential to become substantially more efficient. Initial results from laboratory engine tests indicate that passenger vehicle fuel economy can be improved by more than up to 50 percent, and some vehicle simulation models estimate potential improvements of up to 75 percent. Engineers are working to improve internal combustion engines to utilize renewable fuels, to combine with hybrid electric powertrains, and improve overall engine performance.

Power Electronics and Electric Machines

Advanced electric drive vehicles (EVs) such as hybrid-electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEV), fuel cell electric vehicles (FCVs), and battery electric vehicles (BEVs) require power electronics and electrical machines (PEEM) to function. The term electric vehicles (EVs) may be used which includes both FCVs and BEVs, these devices allow the vehicle to use energy from the battery to assist in the propulsion of the vehicle, either on their own or in combination with an engine. The electric system drives, where the inverter (power electronic) takes direct current (DC) electricity from the battery and converts it to alternating current (AC) electricity and sends it to the motor. The electric motor (electric machine) uses the AC current to create torque (mechanical power) to power the wheels for propulsion. To further visualize the way an EV drivetrain works

Advanced Driver Assistance Systems :-

Blind Spot Detection - Detects other vehicles located to the driver's side and rear. Warnings can be visual, audible, vibrating or tactile. Can also alert drivers backing out of a parking space when traffic is approaching from the sides.

Local Hazard Information- There are many times when knowing what is around the corner could be useful. But for drivers that knowledge could be critical.

Cross Traffic Alert Systems– Uses radar or other technology to detect approaching objects that you cannot see. Sensors are mounted on the rear bumper so they have a better vantage point to detect cross traffic than the driver.

Adaptive Headlights- Headlights can now respond to your surroundings, changing from high to low beam, and changing direction depending on traffic and terrain.

Automatic Sensing Gadgets-Our cars can now sense much of the environment around them, along with the adaptive headlights and steering, and automatic drivetrains mentioned above, our cars can now provide:

Rain-sensing Wipers- Rain-sensing wipers are designed to clear the windshield of rain, snow, and debris without driver intervention. They automatically activate and alter speed and rate to keep outward visibility unobstructed at all times.

Cabin Climate Control- With automatic climate control vehicle occupants can set their preferred temperature and the system will manage the heating, air conditioning, and vents to maintain that temperature independently of other occupants.

Distracted Driver Detection- This system monitors the driver's head and eyes to ensure they are up and facing forward, that the eyes are open, and monitors steering patterns and lane keeping. The system gives an alert if it detects drowsing or distraction.

Tire Pressure Monitor -With this system, a warning light on the dashboard will light up if your tire pressure is low. You no longer have to get out of the car, crouch down, and struggle with the tire pressure gauge to check your tire pressure.

Reference :-

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2.http://autocaat.org/Technologies/Power_Electronics_and_Electric_Machines/

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