iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.43584

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Study of Electric Vehicle

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Abstract: ***Main objective of this paper is to describe the study of design theory and recent development in Electric Vehicle (EV) also provides a summary of various important parts and components of EV to understand Design Process. To enhance the fuel efficiency and reduce emissions in air the employment of conventional vehicles needs to be reduced and also the implementation of electrical vehicles should be promoted, the most aim of this paper is to clarify the importance of EV for avoids the greenhouse gasses emissions from transportation which is major environmental issue and it's increasing day by day. This issue is avoided by use of EV. Therefore EV Design in such way that it's light in weight, more efficient, and simply controllable.***
Keywords: EV, Design of Electric Vehicle

I. INTRODUCTION

Electric vehicles are utilized within the 1990s, their dispersion into the vehicle market has not been up to the mark due to the rationale that it's not cost effective and these vehicles must recharge once in 60 to 70 km drive. The hybrid vehicles play a significant role within the present market and it obtains their energy from the combustion engine. In an exceedingly new technological era the demand for electric vehicles around the world is continuously increasing very rapidly.

As the awareness of environmental protection and energy saving continues to rise, only the electrical vehicle can realize real zero oil consumption and 0 pollution. The internal-combustion engine and also the diesel (no matter what proportion their efficiency is improved) further as hybrid vehicles all consume fuel, so there's still a way to travel in realizing real zero emissions. Therefore, the electrical vehicle with zero emission will undoubtedly become the mainstream means of personal transportation within the future. The governments of every country and their societies have outlined large scale plans to market battery powered electric vehicles and are vying for considerable opportunities to vary the character of personal vehicles.

It is incontrovertible fact that electric vehicles are in our lives for an extended time, but within the last two years there are tremendous increases in electric vehicle sales and production. Additionally to the widespread environmentalist approach and sounding by the broader masses, factors like warming and depletion of fossil fuels are the most important supporters of electrical vehicles in search of recent technology. As a results of the demand created by this supply, major automobile manufacturers began to announce their future plans to develop and expand electric vehicles one by one.

II. ELECTRIC VEHICLE

The electric vehicles are of four types -

1) Battery Electric Vehicle (BEV) / All-Electric Vehicles (AEV).
2) Hybrid Electric Vehicle (HEV).
3) Plug-in Hybrid Electric Vehicle (PHEV)
4) Fuel Cell Electric Vehicle (FCEV).

The electric energy stored within the battery is provided to the electrical motor by which the electrical motor is run. Since electric vehicle doesn't have any combustion engine, there's no chance of emission of exhaust gases within the air. Therefore it doesn't cause any harm to the environment making the vehicle more eco-friendly. For propelling the vehicle, the battery has to be sufficiently charged. The current for charging the vehicle is obtained from the renewable energy sources like solar, wind, hydroelectric, etc. the foremost popular and efficient renewable energy source used for charging the battery is by using solar power. The most advantage of using solar power is that we will implement the solar panels on the body of the vehicle. The panels will be used per our needs. The panels may be fixed on the roof, front and rear side of the vehicle. When the pedal of EV is press, the controller gains energy from the battery. This electrical energy is supplied to the motor where it's converted into mechanical energy. This activates the motor, this motor thereby rotates the wheel which successively moves the vehicle.

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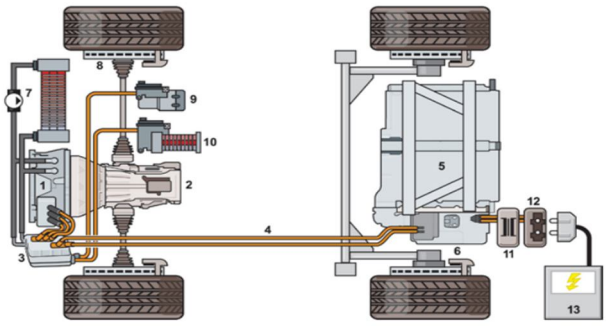
III. THE MAIN COMPONENTS OF AN ELECTRIC VEHICLE

The electric vehicle driveline system includes:

1) High-voltage battery with control unit for battery regulation and charger
2) Electric motor/generator with electronic control (power electronics) and cooling system
3) Transmission including the differential
4) Brake system
5) High-voltage air conditioning for vehicle interior climate control



a) Electric motor/generator
b) Transmission with differential
c) Power electronics
d) High-voltage lines
e) High-voltage batter
f) Electronics box and control unit for battery regulation
g) Cooling system
h) Brake system
i) High-voltage air conditioner compressor
j) High-voltage heating
k) Battery charger
l) Charging contact for external charging
m) External charging source

IV. ELECTRIC MOTOR/GENERATOR

In general, motors for EVs work by converting electricity into energy through the creation of a magnetic flux at the fixed a part of the machine (the "stator", which is static), whose displacement puts a rotating part (the "rotor") in motion. EVs use both electricity (AC) and electrical energy (DC) motors, and there are several variations of every. EV batteries stores energy in direct current, EVs having AC motors needs an inverter to convert the DC to AC by which the energy that's generated can power the car's motor.

1) *DC Motor:* It's also called as "brushed DC motor", the advantage of DC motor is ability to supply high initial torque, while also offering easy speed control. A drawback, however, are the aforementioned brushes and also the motor's commutators, both of which require the next degree of maintenance in comparison to other motors. Another fun fact: forklift motors are DC and are usually the identical because the ones you'd find in an electrical car.
2) *Brushless DC Motor (BLDC):* As you'd probably guess, these do away with the brushes, furthermore because the commutators, making them more technologically advanced and far lower maintenance. They are highly efficient and offer high initial torque, and are mostly used as wheel motors or "hub motors", meaning they're fixed into the hub of a wheel, which it drives the power directly to the wheel
3) *Permanent Magnet electric motor (PMSM):* Similar to a BLDC, but the PMSM has – as you'd guess from the name – permanent magnets embedded within the rotor to form a relentless magnetic flux. They need a high power rating and may be employed in high-performance applications like sports cars. These are the motors you'll find within the Tesla Model 3 (although Tesla uses AC motors in other models, just like the Tesla Model S).

4) *AC Motors:* There are two sorts of AC motors employed in EVs: synchronous and asynchronous. Both types can add reverse and convert energy into electricity which will be stored within the EV's battery during deceleration, a nifty process commonly called "regenerative braking". In an asynchronous motor, also called an induction motor, the electric-powered stator generates a rotating field. In a very electric motor, the rotor acts as an electromagnet itself.

Induction motors don't have a high starting torque, but are efficient and cheaper compared to other options. In terms of use, an electric motor is seen because the better option for urban driving where there may be lots of starting and stopping at low speeds, whereas an asynchronous motor is preferable for driving at high speeds for long periods of your time.
AC motors are more widely used than DC motors thanks to the very fact they're cheaper and more efficient, and are the selection of most major EV manufacturers, including Tesla and China's largest automaker, Chinese Wall Motors.

V. DESIGN SPECIFICATIONS

1) *Ground Clearance:* The fully-laden solar car must have a minimum of 6 inches of ground clearance which will be measured between the bottom and the lowermost a part of the vehicle.
2) *Weight of EV:* The burden of the vehicle shouldn't exceed the limit of 180 kg, without the driving force.
3) *Wheel Size:* The wheel diameter should be minimum of 12 inches or maximum of 14 inches.

a) *Tyre Size:* Tires employed by teams should have the subsequent specification.
b) *Tread Width:* Maximum 6.5 inches (165.1mm) and minimum 3.54 inches (90 mm)
c) *Load Rating:* Greater than the load on wheels.
d) *Speed Rating:* Greater than the most speed of the vehicle.

4) *Chassis Material:* The tube/rectangular pipe used in the fabrication of the chassis or the opposite frames/supports maybe seam or seamless.
5) *Steering System:* Determining the length and position of all the elements is perhaps best determined by trial and error, so integrate as many extra mounting holes as you can. Allowable total mechanism free play (inclusive of play all told the steering linkages) is limited to 10 degrees, measured at the steering wheel.
6) *Braking System:* Regenerative braking system is mostly used in EVs in combination with any time of brakes. Disk brakes are most effective brakes for a car.

VI. TRANSMISSION

Pure electric vehicles (BEV) don't require the standard transmission with several speeds. The polarity of the electric motor is solely reversed once you want to reverse the vehicle. This implies that the direction of rotation of the electrical motor changes. This is often finished a gear selector lever, which simply has the positions "Neutral", "Forward" and "Reverse". The speed may be regulated infinitely with the gas. Full hybrid vehicles (HEV) and plug-in hybrid vehicles (PHEV) still have a standard transmission. As a rule, these aren't manual transmissions, but automatic or dual clutch transmissions.

VII. BRAKE SYSTEM

An electric vehicle has two independent brake systems. One system is that the traditional mechanical/ hydraulic brakes system. The second brake is made by the electrical drive motor as an "engine brake". The advantage of this "engine brake" in comparison with the combustion engine is that the energy released by the electrical motor/generator during braking and deceleration is recovered and fed into the high-voltage battery. This regenerative braking contributes to the high efficiency of the electric vehicles particularly in heavy city traffic where brakes are used often. Additionally, the wear and tear of the vehicle brakes is reduced using regenerative braking system.

VIII. BATTERY

A. *Types of Rechargeable Battery*

The different forms of rechargeable batteries are differentiated by the materials used for the electrodes and electrolytes. The foremost common rechargeable batteries are lead-acid, nickel-cadmium, nickel metal hydride and lithium-ion batteries.

B. *Lead-Acid Battery*

The traditional 12 V vehicle electrical system battery has plates made up of lead and lead/lead oxide and are used as electrodes. Vitriol is the electrolyte.

1) Requires maintenance (distilled water must be added to confirm the desired electrolyte liquid level)
2) Not similar temperament for powering electric vehicles because they're very heavy and enormous, reducing the load capacity
3) Can lose an outsized a part of its capacity after just six years
4) If damaged, electrolyte (acid) can leak

C. *Nickel-Metal Hydride Battery*

These batteries use a nickel compound and a compound of another metal for the electrodes. Potassium hydroxide is that the electrolyte. They need the next energy density than Ni-Cd batteries and are relatively proof against damage.

Even if a memory effect doesn't occur to the extent of the Ni-Cd batteries, these batteries also lose efficiency over the course of their life. To a specific extent, this loss in efficiency is reversible. Nickel metal hydride batteries do not have any contains of poisonous heavy metals like lead or cadmium. The electrolyte is stored within the battery in solid form. If the housing is broken, only some droplets will escape.

D. *Nickel-Cadmium Battery*

Cadmium (Cd) and a nickel compound are used for the electrodes in these batteries. Potash is used because the electrolyte.

1) Also called an alkaline battery
2) contains a higher energy density than lead acid batteries
3) Less vulnerable to damage and electrolyte leaks
4) Subject to a memory effect. This sort of battery can tolerate deep-discharging or overcharging only to a particular extent without becoming less efficient
5) Cadmium and cadmium compounds are poisonous

E. *Lithium-Ion Battery*

Structure of this battery uses lithium metal oxides and graphite for electrodes. Different solvents for lithium salts form the electrolyte. Lithium ion batteries contain only a little amount of water and don't have a memory effect. Compared with the nickel cadmium batteries, they need quite twice the maximum amount energy density. This means that this battery type requires less space in an electrical vehicle leaving more room for the occupants and also the luggage compartment.

IX. CONCLUSION

The design process of the electric drive train, which involves calculation of the required battery capacity and motor power to give maximum efficiency, is defined. It is estimated that 700 W motor is enough to generate the power to drive the car while 48 V batteries with capacity 40 Ah is required. Thus by using such technologies as presented in this paper will helpful to individual or automotive industry towards understanding electric vehicles and its design process.

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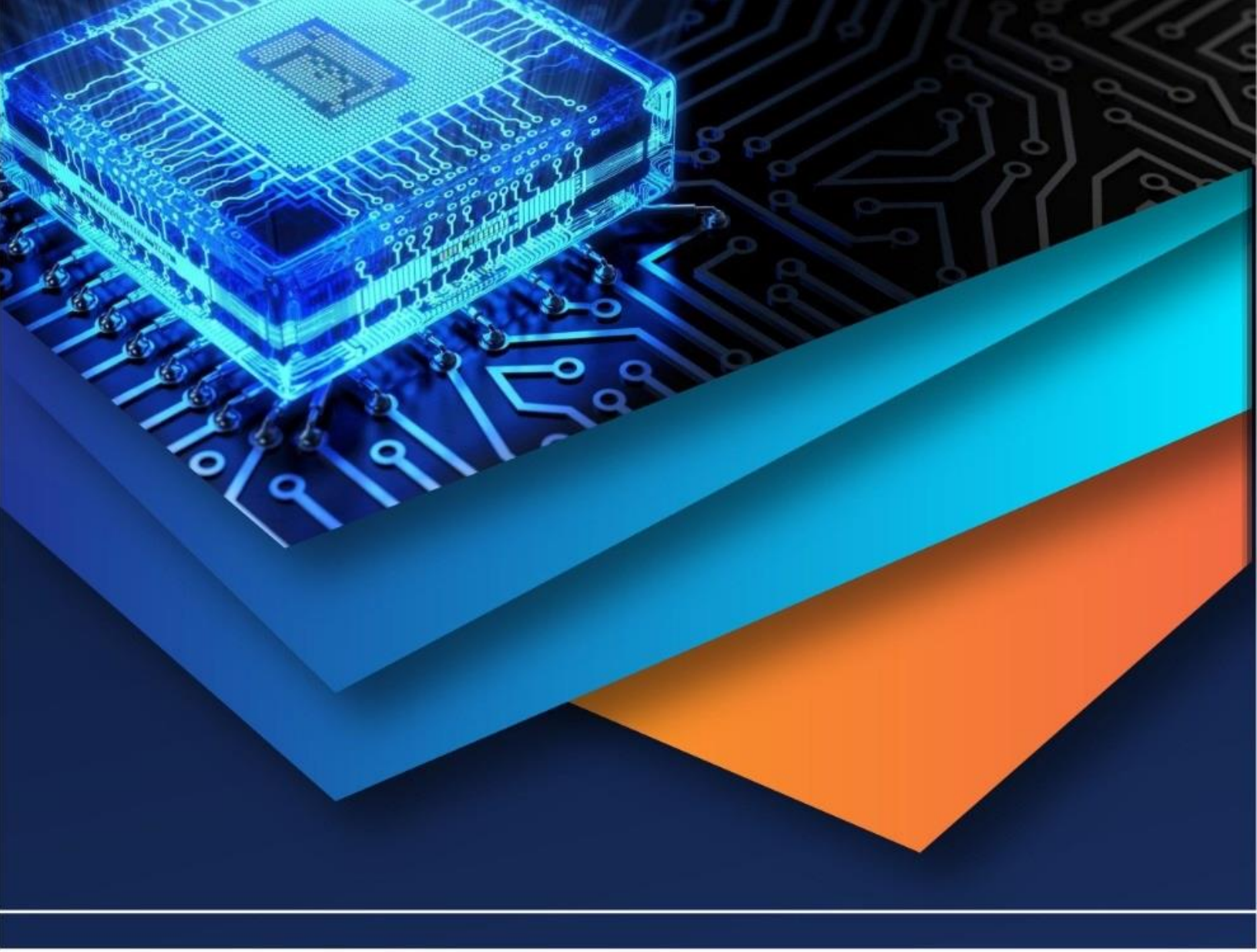

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