Manufacturing and Design of E-Vehicle from a Scrapped Vehicle

Atharva Taware[1], GokulPadmule[2], Sanket Boramane[3], Rutvik Jaiswal[4]
[1,2,3,4] *Student, Department of Electrical Engineering, AISSMS IOIT Pune*

***Abstract*: Due to the increase in the pollution and cost of fuels, there has been a need for alternate Vehicles (electric vehicles) to conventional Internal Combustion engine (ICE) vehicles. As electric vehicles are environmentally friendly, they are considered Green Transportation. Electric vehicle technology has become increasingly significant in a society where energy conservation and environmental preservation are growing concerns. Due to growing concerns about the effects of the Air Quality Index (AQI) and the greenhouse effect, some cities have designated zero-emission zones and tightened emission limits to promote the use of electric vehicles. Researchers, environmentalists, and other groups have paid close attention to eco-friendly electric cars (EVs) in recent decades, as concerns about the detrimental impacts of greenhouse gas emissions from conventional vehicles on global warming and air pollution have increased.**

To overcome these issues an idea to reconstruct an ICE vehicle with an electric motor as the main driving utility is implemented. For the same a custom swingarm is designed that could fulfil the requirement, for the construction of the swing arm various forces acting on the vehicle are considered to ensure the durability of the vehicle.

The vehicle has been powered by a 750W BLDC motor engaged with a wheel with the help of a chain and sprocket mechanism. The rider gives input through a throttle which is sensed and then required feedback is supplied to the motor through a controller.

Testing of the vehicle has been carried out on the ground in robust conditions to get the practical range, speed, and durability values of the vehicle.

Various components, such as the controllers, battery, and motor are incorporated into an electric vehicle. Because an electric vehicle's, conventional IC engine is replaced with an electric motor, the electric motor is the first and most essential part to choose when designing an electric car. As a result, an electric vehicle's motor must provide enough power and additional motor characteristics. The most important step is to select an appropriate motor rating for the load being transported.

***Index Terms*: BLDC motor, Controller, Electric vehicle, EV, Lead acid battery.**

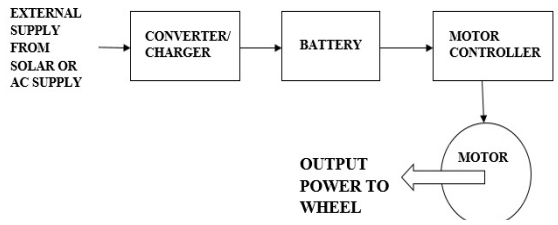
1.INTRODUCTION

The electric vehicle is one of the most promising technologies for potentially replacing fossil fuels, because of its many advantages, it also helps us to reduce the emission of harmful gases. It consists of many modules which play a vital role in EVs such as charging modules, converters, controllers, selection of batteries, and electric motor. The battery unit is used to supply electric power to the electric motor and the controller is used to control motor speed and regenerative braking. It helps in controlling the input and output parameters.

An electric car operates on a fundamental scientific principle: energy conversion. Electric energy is converted into mechanical energy. A motor in the electrical system performs this conversion duty. There are many dissimilar types of motors. The motor of an EV is similar to that of an internal combustion engine. In electric cars, the foremost source of power is motors. It is extremely significant in electric vehicles. There are many different types of electric motors, but due to significant advancements in the field of power electronics and control techniques, numerous types of electric motors can now be employed in electric vehicles. High starting torque, density, good efficiency, and high power should be features of electric motors utilized in automobile applications.

The electric car is one of the most promising future technologies for lowering fossil fuel consumption while simultaneously being ecologically benign by minimizing hazardous gas emissions. The charging module, converters, controllers, batteries, and electric motor are all components of an electric vehicle, and the block diagram of power flow in an electric vehicle is depicted in Figure.

2.BLOCK DIAGRAM



3. OBJECTIVE

- To convert an Internal combustion engine vehicle (ice/pollution causing vehicle) into electrical vehicle
- To design and develop an electric vehicle from a scrapped ICE vehicle.
- To study the working of ICE.
- To research, select and purchase appropriate motor and battery for the vehicle.
- To design a swing-arm that is able to sustain various forces that are acting upon it and is able to full-fill the requirements for the mounting of motor.
- To effectively adjust the batteries while maintaining the overall balancing of the vehicle.
- To integrate motor and battery using proper controller.

4. PROBLEM STATEMENT

The technologies for global transportation are dominated by internal combustion Engine-powered vehicles that lead to a major threat to green gas emissions, even though the global transportation technology partially moved to Hybrid fuels and battery electric vehicles. These technology improvements are not attracted global customers because of their cost and their compatibility. Our aim is to rebuild an Internal combustion engine vehicle into Electric Vehicle that would meet the requirements of one person driving the vehicle.

5. METHODOLOGY

1. Methodology Internal combustion engine vehicle analysis, including dimensions, mass, drive type, and other ICE vehicle data.
2. Motor research, selection, andpurchase: To calculate appropriate motor considering the mass, of the system and considering various resistance (rolling, gradient) and drags(aerodynamic).
3. Battery research, selection, andpurchase: To select the appropriate battery for the system considering the motor specifications, required range, and speed of the vehicle.
4. Removing of fueltank, IC engine and,Assembling of the motor, and battery to electricvehicle

6.MAIN COMPONENTS

In EV, Electrical motors are similar to IC engines in IC-engine vehicles and the vehicle's heart is the electric motor. Electric energy to mechanical energy conversion is done by using an electric motor. When a driver of an electric vehicle hits the accelerator, the car's battery sends electricity to the stator via the controller, which causes the rotor to spin, and then mechanical energy to the wheel via the shaft and chain system.

A] CONTROLLER

The controller is used to connect the E-bike and all the electrical components of the E-bike. Electric bikes have two main electrical components connected between the battery and the motor. The EV controller is connected to electrical and electronic components such as the battery and throttle Element (if any), speedometer, and motor. It also includes three Hull sensors to be the position sensors that send the position signals of the motor rotor to the LO port of the Controller

The controller transmits PWM signals and controls the output current of the motor via the duty factor of the PWM inverter, and accordingly, it will control the speed of the motor. Throttle input is analog in nature which is a sense by the controller and makes it acceptable. An e-bike controller receives information from the battery, motor, accelerator, and pedal-assist systems, and then return the correct signals to the electronic or electrical parts of a system of motor. The voltage provided to the motor can be adjusted, from 0V to the rated voltage of the entire battery pack, Responding to the user's accelerator signal, pedal sensor, and various current limits.

It is important to select a motor controller that matches the power rating of the motor used and the battery voltage. With the help of a throttle, it allows controlling the power of the motor.

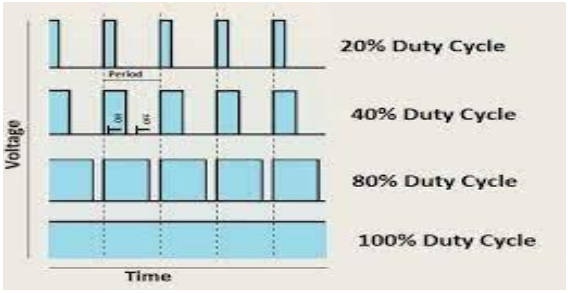


Fig. 6.1 PWM Wave

b] GEAR AND CHAIN:

Energy is required to drive the machines and equipment for a variety of applications. Available power is required to be transmitted to get the desired motion and work. When power is transmitted from the input device to the output device using mechanical elements is known as mechanical power transmission. Mechanical elements like the friction disc, various types of rope, belts, chain, gears, couplings elements, etc. Or transmission of power. In the drive, the energy is transferred by using a chain drive, where input supply is to be obtained by the BLDC motors shaft and output to the
Vehicle's sprocket.

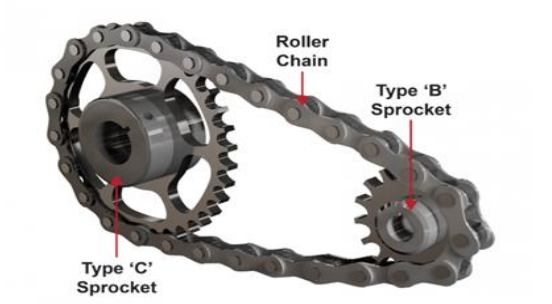


Fig. 6.2 Chain drive

Advantage of Chain Drive:

- In chain drive no slippage occurs.
- In chain drive velocity ratio remains constant. So, the chain drive is one positive drive. However, the polygonal effect can lead to non-uniformity in speed.
- The efficiency of the chain drive is more than 95 percent.
- It is generally not affected by environmental temperature and conditions.
- Regular/periodic maintenance requires in Chain drive Ex. Lubrication.

C] MOTOR

I] DC Motors in Series

Other DC motors in comparison to DC series motors have a strong starting torque, making them a good choice for traction applications. It was the most extensively utilized traction motor at the time. This motor's benefits include easy speed control via various techniques and the ability to tolerate a rapid rise in load. All of these features make it a magnificent versatile motor. Due to brushes and commutators, the fundamental disadvantage of DC series motors is their high maintenance. Railways employ these motors. This motor belongs to the DC brushed motor category.

II] BLDC

It's almost identical to permanent magnet DC motors. Because it lacks a commutator and brush arrangement, it is referred to as brushless. BLDC motors do not require any maintenance. High starting torque and efficiency are fundamental properties of BLDC motors. BLDC motors are well-suited to high-power density design. Due to their traction properties, BLDC motors are the most recommended motors for electric vehicle applications. By contrasting BLDC motors with traditional brushed motors, you can learn more about them.

D] BATTERY :

The storage battery is a battery where the energy can be stored in the form of chemical energy and then converted into electric energy at the time of discharge. The conversion of electrical energy into chemical energy by applying an external electrical source is called as charging process of the battery. Whereas conversion of chemical energy into electrical energy for providing the external load is known as discharging of the storage battery. During charging of the battery, the current is supplied to it which causes chemical reactions inside the battery. during the formation, the energy is absorbed due to chemical changes. When the battery is connected to the load, the chemical reactions take place in a reverse direction, during which the absorbed energy is discharged as electric energy and provides power to the load.

E] V2G:

The term "vehicle2grid" refers to a system that permits energy from an electric car's battery to be returned back to the grid. A car rechargeable

battery discharged based on the multiple indications, such as energy generation or consumption locally, is known as electric vehicle2grid technology.

F] THROTTLE

The electric bike's throttle is an entirely twisted throttle that must be used with one's hands. The whole end of the handlebar is occupied by the completely twisted throttle. To control the throttle, the rider just grips it and bends it back towards himself. Many people like full accelerators because they can be operated entirely with the hand's five fingers. The working principle of the accelerator depends on the Hall effect. An internal combustion engine's throttle valve is difficult to calibrate, while an electric vehicle's software may be customized in any way. The various throttle settings available for electric vehicles can assist in making the vehicle seem firm when driving.

7. FUTURE SCOPE

- Regenerative braking: we can use regenerative braking to store mechanical energy while we apply the brake. In mountainous places or where brakes are used frequently, such as on city trips, regenerative braking will be more useful. Future work needs to identify the percentage of recoverable energy, the impact of efficiency, cost, and the reduction of dependence on battery technology.
- Battery: we can upgrade the battery to the lithium-ion battery
- Solar panel: To charge the battery simultaneously we can use the solar panel to charge the battery which arise higher efficiency.
- Vehicle-to-grid: Vehicle-to-Grid is a bi-directional interaction between an electric vehicle and an energy distribution grid.

8. CONCLUSION

The working of the ICE engine is studied, based on research and calculations done the vehicle is employed with a 750W BLDC motor and a Lead-Acid battery pack with a capacity of 48V 14Ahr. A custom swing-arm with a motor mounting space is designed using tools like AutoCAD and blender and the batteries are properly placed in the vehicle. Motor and battery are interlaced through a charge controller and are calibrated. A fully functional E-Vehicle is manufactured and designed from a scrapped vehicle.

REFERENCE

[1] T. Porselvi1, Sri Hariharan. M. K 2, Ashok.J3, Ajith Kumar.S4,“Selection of Power Rating of an Electric Motor for Electric Vehicles ”International Journal of Engineering Science and Computing, April2017

[2] M. K. Loganathan, C. Ming Tan, B. Mishra, T. A. M. Msagati and L. W. Snyman, "Review and selection of advanced battery technologies for post 2020 era electric vehicles," 2019 IEEE Transportation Electrification Conference (ITEC-India), 2019, pp. 1-5, doi:10.1109/ITEC-India48457.2019.ITECINDIA2019-254.

[3] J. C. Ferreira, V. Monteiro, J. L. Afonso and A. Silva, "Smart electric vehicle charging system," 2011 IEEE Intelligent Vehicles Symposium (IV), 2011, pp. 758- 763, doi: 10.1109/IVS.2011.5940579.

[4] X. Chen, W. Shen, T. T. Vo, Z. Cao and A. Kapoor, "An overview of lithium-ion batteries for electric vehicles," 2012 10th International Power & Energy Conference (IPEC), 2012, pp. 230-235, doi: 10.1109/ASSCC.2012.6523269.