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Electrifying the Future: The Rise of Electric Vehicles

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Abstract- The detrimental effects of gasoline-powered vehicles on both the environment and human health have prompted the automotive industry to shift towards electric vehicles (EVs). This report aims to explain the functioning of an electric vehicle and compare it to both internal combustion engines (ICEs) and hybrid vehicles. Additionally, it explores the advantages and disadvantages of EVs, along with a glimpse into the future of this technology. EVs are significantly more efficient than ICEs, converting a higher percentage of energy from the grid to power the wheels. They also offer instant torque, providing quick acceleration and a smoother driving experience. While they may have limitations such as limited range and higher upfront costs, the numerous benefits they provide in terms of sustainability, efficiency, and reduced emissions make them a viable alternative to conventional gasoline-powered vehicles.

I. INTRODUCTION

India's automotive market has witnessed significant growth due to a rising middle-class population and steady economic development. However, the soaring petrol prices, increasing environmental concerns, and the need for sustainable transportation solutions have sparked a growing interest in electric vehicles (EVs) in India. This report aims to describe the technology behind EVs, highlight the advantages of electric engines over internal combustion engines (ICEs), and discuss the reasons behind the rapid growth of EVs as a necessity for a better world. Electric vehicles have a rich history, dating back to the mid-19th century when they emerged as a preferred method of propulsion due to their comfort and ease of operation. While internal combustion engines dominated the automotive industry for nearly a century, electric power remained prevalent in other vehicle types such as trains and smaller vehicles. Electric vehicles, also known as electric drive vehicles, utilize one or more electric motors or traction motors for propulsion. They can be powered by electricity from off-vehicle sources or self-contained with a battery or generator that converts fuel to electricity. This section provides an overview of the essential components of an electric vehicle, their functions, and the theory of operation. A Bridge to Electrification Hybrid vehicles serve as an intermediate step towards full electrification. This section explains the concept of hybrid cars, their components, functions, and the theory of operation. By combining an internal combustion engine with an electric motor, hybrid vehicles offer improved fuel efficiency and reduced emissions compared to conventional gasoline-powered vehicles.It highlights the advantages of electric vehicles in terms of energy efficiency, instant torque delivery, and lower maintenance costs. Electric vehicles have a significantly lower environmental impact compared to gasoline-powered vehicles. By producing zero tailpipe emissions, EVs contribute to cleaner air quality and reduced health risks associated with particulate matter and carcinogens emitted by ICE vehicles. This section discusses the environmental advantages of EVs and their positive impact on public health.

While EVs offer numerous benefits such as reduced emissions, quieter operation, and potential cost savings in the long run, challenges such as limited charging infrastructure and higher initial costs are also discussed. It discusses government initiatives, incentives, and policies aimed at promoting EV adoption, as well as the expected growth of charging infrastructure. Additionally, it touches upon emerging technologies, such as solid-state batteries and increased range capabilities that will shape the future of electric mobility in India. Electric vehicles have emerged as a viable and sustainable alternative to traditional internal combustion engines. In the context of India's automotive market, EVs offer a solution to rising petrol prices, environmental concerns, and the need for a cleaner and greener transportation system. While the initial investment for an electric vehicle may be higher, the long-term benefits in terms of reduced emissions, improved air quality, and potential cost savings make EVs an indispensable part of the automotive industry's future.

II. BASIC SCHEME

1. The proposed idea of electric vehicle is suitable for the location where price of petrol and diesel are high and the rate emission of flue gas is high
2. This scheme has generate electricity through dynamo.

III. WORKING OPERATION

In an electric vehicle (EV), the key components responsible for its operation include an electric motor, a controller, and a rechargeable battery pack. The electric motor is the primary source of propulsion in an EV and converts electrical energy into mechanical energy to drive the wheels of the vehicle.

The controller plays a crucial role in managing the power flow between the battery pack and the electric motor. It receives power from the battery pack and regulates the amount of current and voltage delivered to the motor based on various factors such as the position of the accelerator pedal and the vehicle's speed.

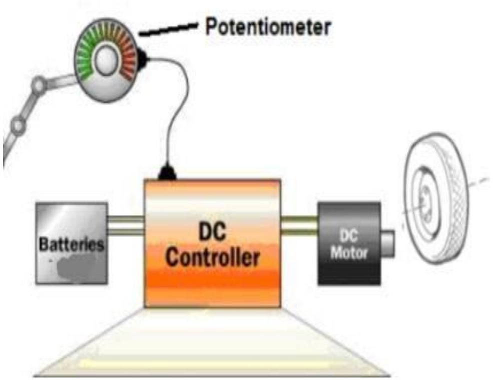

Fig:1 Basic block diagram

Fig:2 Chassis of vehicle

The rechargeable battery pack is the energy storage system of the EV. It stores electrical energy, typically in the form of lithium-ion batteries, and provides power to the electric motor through the controller. The capacity and performance of the battery pack affect the driving range and overall efficiency of the electric vehicle.

To control the speed and power output of the electric motor, variable potentiometers (commonly connected to the accelerator pedal) are used. These potentiometers send signals to the controller, indicating the desired power level or speed requested by the driver. By adjusting the position of the accelerator pedal, the driver can control the amount of power delivered to the motor.

The conversion of electrical energy to mechanical energy in the electric motor allows the vehicle to move without relying on a traditional gasoline engine. This results in reduced emissions and a quieter operation compared to internal combustion engine vehicles.

IV DESCRIPTION OF PARTS AND THEIR FUNCTIONS

a) Potentiometer. It is circular in shape and it is hooked to the accelerator pedal. The potentiometer, also called the variable resistor, provides the signal that tells the controller how much power is it supposed to deliver.

TABLE I. ACCELERATOR / THROTTLE-

Supply Voltage (V)	48
Return Voltage (V)	4
Max. Load output current (A)	15.625
Handle Bar Diameter (mm)	22
Three wires red, green, black	May differ from works Fit for 48 v supply

b) Batteries. The batteries provide power for the controller. Three types of batteries: lead-acid, lithium ion, and nickel-metal hydride batteries. Batteries range in voltage (power).

c) Battery specification- Power = Voltage x Current P = V. I

750 = 48 x I

I = 15.625 Ah

Hence according to the above calculations, to drive motor of 750 W, 48 V capacity; we select 4 batteries of 12V 33Ah. We connect these batteries in series to achieve a voltage of 48 V as required by the motor

d) Electrical charging-

Time required to fully charging the battery is calculated.

Power Supplied to Battery during AC Charging: AC Adapter Specification: 48 V, 5 A

P = V. I

P = 48 x 5

P = 240

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Therefore the time required to charge the battery completely is:
t = 720 ÷ 240
t = 3 hours
Hence, it is found that, the time required to charge the batteries completely is 3 hours

IV. DC CONTROLLER.

The controller plays a crucial role in the electric vehicle's powertrain system. It serves as the intermediary between the batteries and the motor, enabling precise power delivery. The controller's capabilities are versatile, allowing it to supply varying power levels based on the driver's input. When the car is stationary, the controller delivers zero power, while pushing the accelerator pedal to its maximum activates full power output. For any position in between, such as when the pedal is pressed 25 percent of the way down, the controller employs a technique called pulse modulation. In this mode, the power is cycled on and off, with a 25 percent on-time and 75 percent off-time ratio. However, it's important to note that the controller's operation relies on the signals received from the two potentiometers connected to the accelerator pedal. To ensure safety and prevent potential issues, the controller compares the signals from both potentiometers, and if they are not equal, it inhibits motor operation. Once the controller supplies power to the motor, the motor, in turn, drives a transmission. Finally, the transmission transmits the rotational force to the wheels, allowing the vehicle to move forward.

Fig:2 DC Motor Controller

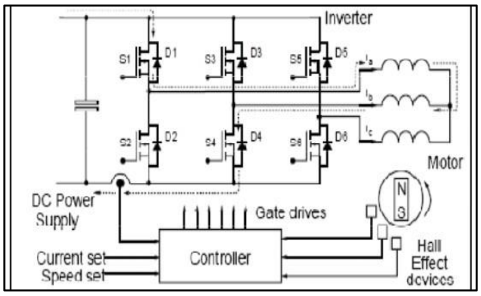


Fig: 3 Controller

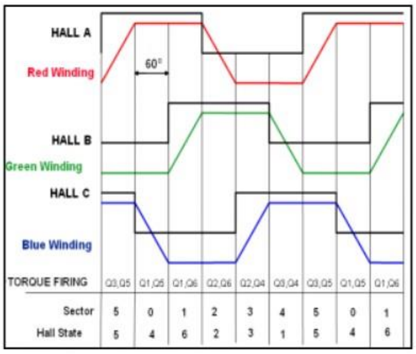


Fig: 4 Output voltage pattern

Motor. The motor receives power from the controller and turns a transmission. The transmission then turns the wheels, causing the vehicle to run.

Motor calculations-

Since the total Solar EV weight is equal to 174 kg the Normal reaction acting on each tyre is equal to (87 x 9.81) Newton each.

Friction force acting on the tire- F = μ N1
F = 0.3 x 853 F = 255 N

Torque required-
T = F x r
T = 255 x 0.19 T = 49 Nm

Speed calculation-
ω = v ÷ r, ω = (10 x 1000) ÷ (0.19 x 3600)
ω = 14.61 rad /sec ω = (2 π N) ÷ 60
N = (60 x 14.61) ÷ (2π) = 140 rpm

Power calculations-
P = (2 π N T) ÷ 60
P = (2 π x 140 x 49) ÷ 60
P= 720 Watt (Approx)

The solar power is used as a supplementary energy to ride the Solar EV . A motor with power of 750 W is selected [2]

Fig:5 Hub Motor

V. SOLAR PANEL

The solar panel is photovoltaic converter which works only in bright sunlight. If cloud blocks the sun rays or during night the solar panel does not work. To make the solar energy available throughout the day, a solar charger is incorporated.

Maximum Power (Watt)	75 W
Charging current (Amp)	4.16
Open Circuit Voltage (V)	25
Max Power Voltage (V)	18 V
Short Circuit Current	**8.31**
Power Measured at Standard Test Condition	1000 W per m2 at 25° C
Lifespan	25 years

VI. SEQUENTIAL SWITCHING CIRCUIT

It will work as a switching between solar panel and battery. Battery will connected to solar panel for 10 Min alternately.

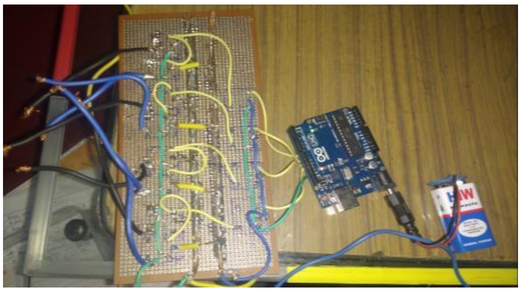
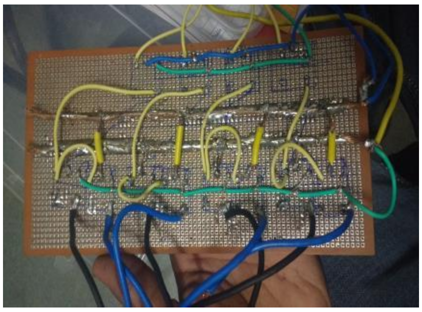


Fig:6 Sequential switching circuit



Fig;7 Sequential switching circuit

VII. EMISSIONS

Electric vehicles (EVs) are widely recognized as being significantly cleaner than gasoline-powered vehicles, with estimates suggesting they are approximately ninety-seven percent cleaner. One of the main reasons for this is that EVs produce zero tailpipe emissions, unlike their gasoline counterparts. Tailpipe emissions from gasoline vehicles contribute to air pollution and can release particulate matter into the atmosphere, which has detrimental effects on human health. Additionally, the process of burning fossil fuels in gasoline vehicles emits carbon dioxide (CO_2), a greenhouse gas responsible for global warming. The impact of global warming includes the depletion of the Earth's ozone layer. By opting for EVs, which do not emit CO_2 during operation, we can help mitigate global warming and indirectly contribute to preserving the ozone layer. Another advantage of EVs is their simplified design, which requires fewer parts compared to gasoline vehicles. This means reduced consumption of resources like gasoline and oil, further enhancing their environmental cleanliness. As we continue to transition towards electric vehicles and cleaner energy sources, we can significantly reduce our environmental footprint and work towards a more sustainable future.

VIII. CONCLUSION

As seen in this report, the electric vehicle has many advantages and benefits over the internal combustion engine. It is cleaner and much more efficient; however, it also has disadvantages. It is heavier, limited to the distance it can travel before recharge, and costs more. The future of the EV relies on its battery. If researchers can produce or
find the “super battery”, the EV's future is promising. As of today, each vehicle has its own characteristic that makes it better than the other. Only time and technological improvements will tell which vehicle will excel in the future. The above proposed project named “ ELECTRIC VEHICLE” will be designed on the objective of providing an alternative source of transportation as well as an economical we believe this project, if effectively used may be considered as an innovative and a good solution for the large emission of CO_2 as far as a developing nation like India is concerned.

Fig:-8 Final Image of vehicle

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