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CONVERSION OF IC ENGINE VEHICLE TO ELECTRIC VEHICLE

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Abstract - *An electric vehicle is a type of alternative fuel vehicle that uses electric motors and motor controllers instead of an internal combustion engine. Power is derived from battery-packs rather than a carbon based fuel. This saves not only money, but has much smaller impact on the environment. It also offers a number of advantageous over conventional internal combustion engines, especially In terms of lower local emissions, higher energy efficiency. There are certain barriers for the rapid adoption of electric vehicles, including the limitations of battery technology, high purchase costs and the lack of recharging infrastructure. In our project we are going to fabricate an electric vehicle using lithium ion battery and with BLDC motor.*

Key Words*: *electric vehicle; internal combustion engine; environment.

1. INTRODUCTION

While using the electric vehicles the operating cost of the vehicle can be reduced. It can be made as cost effective. Due to the impact of increase in the fuel price, it is difficult among the public to use internal combustion engine vehicles. The future of automobile is going to be the era of electric vehicles. Thus the existing internal combustion vehicles cannot be demolished. The pollution emitted by the automobiles is increasing rapidly nearly about 73% of total pollution due to the usage of internal combustion engines. The newly manufactured electric bikes are higher in cost. The main advantage of the electric vehicles is reducing emissions. Electric vehicles use large battery packs for the energy which are higher in cost. They use lithium-ion batteries which prices around thousands. Obviously, everyone is looking for ways to make electric vehicles less costly. One way of doing this is to consider converting an internal combustion engine (ICE) vehicle into a new electric one. There are a number of kits on the market that can be utilized to do this conversion, but these kits costs higher. Electric vehicles consist of batteries for energy, an electric motor for power, a controller to control the flow of energy to the motor, and a potentiometer to allow accelerator pedal to provide input to the controller. The vehicle's gasoline engine, exhaust system, petrol tank, and clutch assembly will no longer be needed. Electric vehicle conversion is the replacement of a vehicle's combustion engine and connected components with an electric motor and batteries, to create an all-electric vehicle. Another option is to replace a large combustion engine with an electric motor (for power) and a small combustion engine (for speed), creating a hybrid electric vehicle or a plug-in hybrid electric vehicle .Commercially-manufactured electric vehicles are inhibited by the limited range per charge of batteries (up to 379 km, 236 miles), battery charge times that are slower than gasoline filling times, apparent greater initial cost over combustion engines, and potentially high service costs for used or worn-out batteries. Short range electric bike is claimed to travel 90-100kms if once charged. Most of the electric bikes offer low level of performance with longer range distance and high level of performance with low range distance. The experimental setup of our project consists of an ordinary bike, lithium ion battery, a BLDC motor and a controller. A new and improved design for the conversion of IC engine vehicle to electric vehicle was developed based on the literature review and the problem identification. The proposed design consists of electric rear wheel-drive with a BLDC motor, battery and chain drive.

2. METHODOLOGY

As the future is in the hands of electric vehicles, the existing IC engine vehicles cannot be completely demolished if we are changing into electric vehicles and this is the problem identified in the problem identification stage. Then in literature review stage, the patents, journals, online references were collected, studied in detail and the literature review was summarized. Based on the problem identification and literature review the conversion of IC engine vehicles to electric vehicles was designed. Then the calculations were made to select the required components. After the fabrication work of our vehicle with propose design the performance, efficiency, speed of the vehicle and also the load carrying capacity of the vehicle will be tested.

3. COMPONENTS USED

SL.NO.	COMPONENTS
1.	Bike
2.	Lithium Ion battery
3.	BLDC motor
4.	Controller

3.1 BIKE

For our project we had selected a four-stroke gasoline powered bike, and then we removed the engine and its

components as we are replacing the engine and its components with battery and BLDC motor.

SELECTED VEHICLE

3.2 LITHIUM ION BATTERY

The battery is the main source of power to the BLDC motor. The battery to be used is selected based on the operating parameters of the vehicle, the lithium ion battery is selected. The lithium ion battery is less in weight when compared to lead acid battery and has high energy density, low self-discharge, and low maintenance. Thus the efficient battery that is required for driving the motor is to be used. The battery used should be fast charging, efficient and long lasting. Major consideration is weight of the battery and its power output for the rated speed. It takes only short period of time to get charged it is also one of the consideration to choose this battery. Lithium ion battery is the battery that we have selected for our project. For getting more distance we have preferred 48V 10Ah battery. So that it can move for a longer distance.

LITHIUM ION BATTERY

3.3 BLDC MOTOR

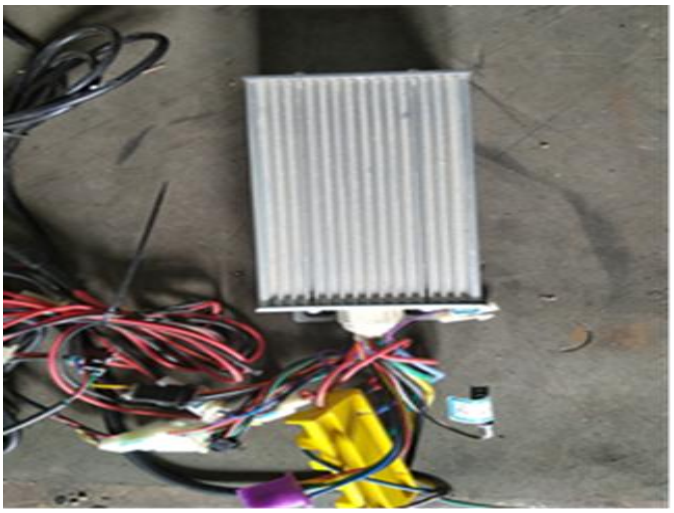
For attaining high speed and initial torque, brushless dc motor is preferred as it has the following advantage.

BLDC MOTOR

For the load carrying capacity, on considering the gross vehicle weight and the passenger weight the motor with following specifications are selected. The brushless DC motor is powered by battery source and is controlled by the driving controller. The brushless DC motor is powered by battery source and is controlled by the driving controller. To change the rotation speed, you change the voltage for the coils. The voltage to the BLDC motor is controlled by the driving controller circuit.

3.4 CONTROLLER

While BLDC motors are mechanically relatively simple, they do require sophisticated control electronics and regulated power supplies. Thus a drive controller is selected which is required to control the BLDC motor. The controller choosing for the project must match up with the battery specifications as well as with the motor specifications.



CONTROLLER

4. CALCULATIONS

Load calculation

The total load applied to the BLDC motor is calculated based on the following weight of the vehicle and its accessories.

Vehicle weight = 70kg
Motor weight = 10kg
Battery weight = 8kg
Rider and accessories = 90 kg
Total load = 178 kg

Force calculation:

The force required to pull the calculated load is based on the total load of the vehicle. The force required is given by the formula

$$F = Crr * M * g$$

Where,
F= force in newton
Crr= co efficient of rolling resistance
= 0.01
g= acceleration due to gravity
= 9.81 m/s^2
M= mass of the vehicle (total load)
F = 0.01* 178 * 9.81
F = 17.46 N

Power calculation:

Assuming the maximum velocity of 30km/hr the power required to pull the rated load is calculated by using the formula

$$P=F*(V/(3600))$$

Where,
P= Power in watts
V= Velocity
30 Km/h = 30000 m/h
P =17.46 *(30000/3600)
P =145.5 watts

Battery selection:

The watt hour of the battery is given by

$$Ah \times V = wh$$

Where
Ah = Ampere hour
V = Voltage
Wh = Watt hour

(i) 48V 10Ah battery
=48 X 10
=480wh

Since the battery produces 480watts, which is higher than our required voltage we can use this battery.

DISTANCE CALCULATION

The distance that can be travelled using this battery is given by

d=wh/F
=480/17.46
d=28 kms

The road conditions may not be same during the whole journey so we can calculate the distance that can be travelled for double the actual load.

d=wh/F
=480/20
=24kms

CHARGING TIME CALCULATION

The charging time of a Lithium ion battery varies depending upon the charger used for it. The charging time of the lead acid battery is given by

$$T=Ah/A$$

Where
Ah = Ampere hour rating of battery
A = Current in amps (charger)

T=10/5
=2 hours

Also fast charging method can be used in future, so that the battery charges faster.

REQURIED UNITS OF CURRENT NEEDED FOR FULL CHARGE

We, are using 48v 10ah lithium ion battery thus the watt hour is calculated below.

48×10 = 480wh
1amps = 1.4 kvah
10amps=10/1.4
10amps=7.1428 kvah
Kw= kvah × Pf ∴(powerfactor)
Kw=7.1428×0.174
Kw =1.24 units is required.

5. ASSEMBLING OF COMPONENTS

The battery, lithium ion battery and the BLDC motor has been assembled in the selected vehicle. The components are assembled in the vehicle without affecting the center of gravity. The motor is made to be fitted on the place at where engine is placed. The motor should not get protruded out of the vehicle. The battery is placed above the motor. The controller had been placed under the seat for protection. By arranging the components at their desired locations the vehicle can able to produce required distance and speed. The

charger unit has also been attached with the selected vehicle for charging.

MOTOR AND CONTROLLER ASSEMBLY

6. WORKING

The vehicle driven electrically with the help of a lithium ion battery and a BLDC motor. The motor is made to run with the help of lithium ion battery. The specification of lithium ion battery is about 48V 10Ah battery. A pinion is made to fit on the motor. The 600W motor is used for our project. The electric current from the battery is passed to the controller then the required amount of current will be flown into the motor. The voltage of the controller must match with the battery pack. The sinewave controller to be used for the project. The motor drives the rear wheel of the vehicle with the help of a chain drive. Then the vehicle is set to move. The speed and range of the vehicle can be increased by increasing the battery capacity and then the motor specifications. The battery is charged with the help of charger. The battery charger must be used as it should match up with the battery. As lithium ion battery is used for the project the battery gets charged in a short period of time and it is also long lasting. The charging time of a Lithium ion battery varies depending upon the charger used for it. The charging time of the lead acid battery is given by,

$$T = Ah / A$$

The above figure shows the electrical connections that were made to the vehicle. The accelerator, brake and lightning switches. The controller is placed under the seat so that the wiring connections can be made easily with battery and motor.

7. TEST REPORT

Mileage test had been taken for our project. From this test we have calculated the range and speed of the vehicle. The range and speed of the vehicle can be improved by increasing the capacity of the battery. The components specifications and the test report outcome is shown in the table.

TABLE 1.2

BATTERY	48V 10Ah
MOTOR	600W
CONTROLLER	SINEWAVE
CHARGER	3A
CHARGING TIME	2 hrs
MILEAGE	25-30 km/hrs.
SPEED	25

8. RESULTS AND DISCUSSION

By choosing the components with these specifications, the vehicle will travel at a speed of 30 km/hrs for single charge of the battery. It also travels for a longer distance. As 600W motor is used for our project it gives more initial torque. The speed and distance of the vehicle can be increased by increasing the battery capacity and the motor specifications. On board charging can be also implemented to increase the operating range of the vehicle. As lithium ion battery is used it has less weight, long life span and fast charging.

9. CONCLUSION

In the existing electric vehicles, there are many disadvantages. The hub motored electric vehicles does not provide more initial torque and then the vehicle will not provide more speed as given by the BLDC motor. By implementation of this project it reduces the cost of an electric vehicle and with these components the speed and range for the vehicle can be achieved.

10. CONTRIBUTION TO THE SOCIETY

By this project idea we can save the energy used for recycling old vehicle frames and also we can protect the environment by reducing the usage of petrol.

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