Modifying an IC Two-Wheeler Engine into a Battery-Powered Two-Wheeler Vehicle

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Abstract- The shift to electric vehicles (EVs) is a good remedy to help curb urban air quality degradation and eliminate dependence on fossil fuels. This paper looks at the prospect and design potential for reengineering the primary mechanism of propulsion such as internal combustion engines as well as two-wheeled vehicles.
The retrofit process includes dismantling the ICE system and integrating the electric motor–battery, motor controller including all the connecting wires, and computer-controlled electrical systems. Key areas include the selection of the components, installation problems, and safety measures and precautions. The initial tests have demonstrated that the engineering changes made to the two-wheeler enable it to meet the same performance parameters of the factory-manufactured electric vehicles but at a relatively higher efficiency while maintaining lower operational costs. Although there are still worries about the first cycle cost and the technical reliability, it is very well accepted by the users because of such factors as environmental protection and savings. In this work, renewable energy is exemplified as a reasonable and green approach to electrifying the conventional two-wheeler, which prepares the ground for further improvement and development of the technology.

Keywords: Component selection, Installation issues, and Safety considerations.

I. INTRODUCTION

In most cases, global warming is bound with mobility expansion, for example, an increase in the number of vehicles and emissions alike.
For the emissions from electric vehicles to be reduced, efficient and less harmful to the environment mode of traveling is worked on and offered. This project investigates one of the modification methods of changing some internal combustion engine vehicles into electric vehicles.
Instead of developing a new electric car, old gasoline cars are made into electric cars. We utilize vehicle chassis, motors, batteries, and BLDC controllers. This switch is powered by batteries.
A lot of Carbon dioxide is released when a Vehicle IC engine expires and continues in use causing Global warming and pollution.
They would systematically fail until finally the engine stops working and the vehicle is rendered inactive. But with the replacement of engine through retrofitting, the vehicle chassis can be used for electric vehicles.
Conversion of gasoline operated vehicle to battery operated vehicle is called as conversion. The brushless DC (BLDC) motors are used to remove internal induction motors system, as it delivers rotation without the requirement of a separate gear box and is eco-friendly. Improvement of something includes the concept of upgrading when new technologies or new capabilities are provided to already existing systems with a goal of improving efficiency, enhancing performance as well as the compliance of more stringent environmental regulations.
This method substitutes the original engine and related parts for a complete power plant, rendering the vehicle emission, pollution, noise and noise-free.
Remanufacturing decreases the level of recycling because it cut down pollution by using old vehicle chassis rather than disposing them a scrap for recycling. We are dealing with the project that is aimed at converting petrol vehicles into electric vehicles by way of retrofitting. Take the vehicle chassis and attach the motor, battery and BLDC controller to it. The battery packs in an electric vehicle acts as the source of energy required to drive the electric motors.
Batteries have components which allow insertion of electric current from power sources. It also has a power plug, and a battery charger which can either be portable or plugged in at the entrance of the electrified basin. The controller provides the energy that is supplied for the motor which then is initiated and is used to regulate the motion of the vehicle in either forward direction or backward.
Electric vehicles are an excellent choice for drivers who want to save on fuel costs without compromising on performance.

II. LITERATURE REVIEW

Available literature considers the surge of interest towards electric two wheelers, their transition to cleaner fuel, and their technical aspects. It includes including the history of electric vehicle, the conversion of IC engines to electric vehicles, the scope of work involved in conversion, tests, the issues and ways for improvement. The summary also highlights the significance of overcoming legislative barriers as well as having the relevant knowledge and skills.

The results of this study support the hypothesis that the conversion of the internal combustion engine installations into electric drivetrains for two-wheeled vehicles can help reduce urban emission and promote environmentally friendly transport. But it requires quite a detailed analysis in terms of technical, economic and user acceptance.

III. PROPOSE METHODOLOGY

In the last few years, electric scooters have become quite common especially because of their simplicity and usefulness regarding cities. These new generation vehicles have a powerful motor and gearbox system fitted inside that runs on a lithium-ion battery. The benefits and importance of this battery are that it converts electrical energy to mechanical energy and moves the scooter in the right direction. When the rider rotates the ATP (Accelerator Throttle Pedal), it controls the supply of electrical energy to the motor which helps in moving the scooter forward and managing its speed better.

One of the most important components of such vehicles is a motor. It may define the final velocity achievable, but it is also the torque which determines how quick the device can start up or climb a hill. Among the most effective types are brushless motors since they are more energy-efficient and long-lasting than the, say, brushed type of motors. This means that more improved as well as less servicing is needed, making them preferred in the market strategy. The other modernization feature involved in electric scooters is the regenerative braking system. This system recycles energy used in braking and converts that kinetic energy into electrical energy that can be stored back in the battery.

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To provide a safe and dependable journey, many of these systems have monitoring features like battery charge indicators along with overcharge, overheat, and overcurrent protective devices. The ease of design and how simple they are to use are major reasons why so many people are turning to electric scooters in such a big way. Vehicles use a battery for running the motor transforming electrical energy into mechanical energy, which ultimately turns the wheels through a gear system. The throttle is the primary control taken by the rider for the purpose of modifying acceleration. Since most scooter models are equipped with rechargeable lithium-ion batteries, all parts of the vehicle need to be connected and coordinated by this controller.

The quality of the motor is a component that drastically influences the scooter's climbing ability, speed, and torque. Brushless motors run at a high rate, usually at 85 to 90 percent, which equates to a much higher efficiency than brushed motors, normally running between 75 to 80 percent. When the brakes of an electric scooter are applied, its regenerative braking systems convert kinetic energy to electrical energy.

Electric scooters equipped with regenerative braking devices are perfectly capable of operating in reverse and being used as generators, where kinetic energy is converted back into electrical energy. The device

can also display the battery charge levels and safety measures in the event of overcharging, overheating, or overcurrent.

A converted electric scooter should be charged by a standard electrical outlet and an included charger as part of the conversion kit. There are many factors that determine the performance and range of modified electric scooters, such as but not limited to weight, operating conditions, capacity of the battery, and power of the engine. The distinctive characteristic of an electric scooter includes smooth acceleration, low maintenance needs, and an emission-free ride. With these combined elements, it happens to be the most cost-effective and ecologically friendly alternative to a traditional gas-powered system.

IV. SELECTION OF BATTERY

The appropriate type of battery must be selected based on various factors, such as energy density, power density, cost, lifecycle durability, and safety. Important benefits of lithium-ion batteries include a high power-to-weight ratio, good energy efficiency, long lifespan, and high-performance capabilities at high temperatures with low self-discharge rates. For the industry at large, a problem is still the fact that most of the components can be recycled due to material recovery expenses. The primary energy sources for both the modern PHEV and fully electric automobile are special variants of these "consumer battery" chemistries, but their chemical structures often differ from those in consumer electronics. There has recently been much interest in accelerating cost reductions, increasing the useful life of these batteries, and improving their safety.

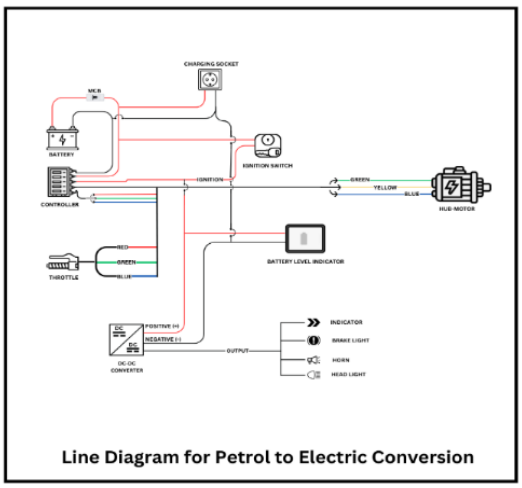


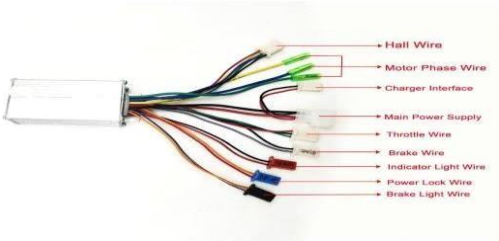
Figure 01: Line Diagram for Petrol to Electric Conversion

V. COMPONENT DESCRIPTION

1 BLDC MOTOR

The 48V BLDC hub motor is the replacement for the internal combustion engine that enables quick acceleration in the mechanical transmission system. The motor shaft is designed to become one with the rear wheel and is capable of working by immediately transferring the rear when turned on. The acceleration process may be rather silky smooth given the possibility of having speed control from the motor itself. This brushless e-bike hub motor can fit a 10-inch diameter wheel and can work optimally in temperatures ranging between -20℃ to 45℃.

2 BLDC CONTROLLER



It acts as the central nervous system in an electric vehicle for carrying out tasks to direct the movement of the motor and management of energy transfer from the battery. In addition, it reverses the rotation of the motor and allows for reverse motion of the vehicle. Presently, modern controllers utilize the principle of pulse width modulation in speed and acceleration control by periodically switching off and then switching on electricity supplies to the motor. The power source has 48/60V installed with a 1000W BLDC motor; therefore, it employs a Brushless DC controller. Higher interruption in length leads to increased power, but the longer interruptions will decrease power output.

3 LITHIUM-ION BATTERY

The lightweight, durable, and environmentally sustainable characteristics of lithium-ion batteries make them the essence of modern electronic applications. These rechargeable batteries can go through numerous cycles of charging and discharging and offer high energy density, fast charging, and low maintenance. Our system is implemented using a 48V 24Ah Lithium Ion Battery, superseding the traditional four 12V lead acid batteries. In Eco mode, this configuration allows the one-seater cars to travel between 30 to 40 kilometers with a top speed of 25 km/h, according to several users.

4 LITHIUM-ION BATTERY CHARGER

A lithium-ion battery charger is especially designed for recharging lithium-ion batteries for all electrical devices, such as cell phones and laptops, cameras, or electrical cars. Lithium-ion chargers offer superior voltage, as well as an ideal amount of current to charge, which makes them both efficient and safe to use. Such chargers use advanced technologies in the form of voltage regulation, current monitoring, and protective systems to prevent overcharging, overheating, and short circuits. Some are integrated into electronic devices while other types are specifically made with portability and compactness in mind. The importance of lithium-ion battery chargers is grounded in their function in terms of prolonging battery life and preserving such sources of energy. The charger in question is an electromobility converter designed for a 48-volt battery, with a maximum charging voltage of 54.6 volts.

5 DC-DC CONVERTER

The DC-DC converter within electric vehicles is an essential module that enables a variety of electronic circuits to work on various voltage levels. It regulates DC voltages with some demand levels in numerous applications and can be utilized in many applications, such as battery management and high voltage applications, including HV power transmission. In more detail, in two-wheeler electric vehicles, transform the high DC voltage from the main battery into a lower voltage level that would be suitable for auxiliary systems and components. The design of this converter is aimed for operation at voltage levels of 48/60/70 volts down to 12 volts DC

6 SWING ARM

The swingarm is a vital mechanical motorcycle and ATV component that links the rear wheel to the vehicle's chassis. It absorbs shocks and suspension forces through actions caused by the rider's accelerations, braking, and movements. In general, it's made from aluminum, carbon fiber, and steel attached to a pivot bolt in the motorcycle frame. This component enables the back wheel to move up and down while coupling the rear suspension system, either of the twin or monotype, to the motorcycle frame. There are two common swing arm configurations: single-sided and double-sided swingarms. The double-sided swingarms protrude from both wings of the wheel, making it stronger and stiffer. But single-sided swing arms are easier to take off the wheel, and this gives it another feature.

7 CHARGING CONNECTORS

The charging connectors for two-wheeler electric vehicles (EVs) are uniquely designed interfaces that facilitate the charging of electric motorcycles, scooters, and other similar vehicles. Unlike the connectors used for larger electric vehicles, these are tailored to accommodate the specific power requirements and battery configurations of two-wheeled vehicles. Additionally, the variety of connectors, sockets, and plugs employed in EVs and charging stations can differ significantly based on regional standards and the type of charging infrastructure, leading to the lack of a single universal EV connector suitable for every scenario.

8 BATTERY LEVEL INDICATOR

A mechanism showing the current charge available in a battery via a visual mechanism is called a battery level indicator or battery gauge. This function can be very important for battery electric vehicles in order to give it an opportunity to run efficiently and to provide support in route planning.

9 SHOCK ABSORBER

The heavy dependence of the suspension system of a vehicle on shock absorbers, which are inalienable parts, enables them to absorb and reduce the shock produced by springs and dynamics of suspension. Its operation enhances appreciably the steering precision, and increases the grip of road and the effectiveness of braking, thereby promoting road safety through continuous tyre contact with the road.

ADVANTAGES

- Compared to traditional vehicles, electric vehicles (EVs) offer a cleaner and more environmentally responsible choice.
- The absence of tailpipe emissions from these vehicles leads to a reduction in air pollution and a decrease in greenhouse gas emissions.
- Typically, electric vehicles offer lower operating costs than traditional vehicles, which can be attributed to their diminished fuel and maintenance expenses.
- Electric motors are more efficient, with a higher percentage of the energy in the battery to be turned directly into propulsions, thus reducing the amount of energy being consumed and boosting the length of distance traveled per charge.
- EVs are also said to make much less noise than internal combustion engines, and thus reduce noise pollution within metropolises. The instant torque that they can produce enables them to accelerate much faster and provide faster responses.
- Electric cars reduce dependence on fossil fuel, hence there is an improvement in energy independence and security. Conversion offers the options for the customization of a car to the owner's preference.
- Electric drivetrains consist of fewer components, resulting in reduced wear and tear, which may contribute to an extended operational lifespan.
- There are incentives, subsidies, and tax cuts from various governments for the use of electric cars.

DISADVANTAGES

- In such cases, retrofitting electric vehicles will be very costly, often expensive, and certainly so when quality parts are required.
  However, the initial costs may be recovered by savings in fuel and maintenance over time. The range of retrofitted EVs tends to be lesser than that of specially designed electric vehicles due to the likely under-optimization of its battery capacity and efficiency for long-distance travel.
- Undertaking retrofitting may result in the nullification of the original vehicle's warranty, placing the burden of repairs and maintenance on the owner.
- Furthermore, retrofit kits may lack the extensive support networks that established manufacturers provide, making it difficult to locate qualified technicians or replacement parts, while inadequate charging infrastructure for EVs, particularly two-wheelers, can also present obstacles.

CONCLUSION

Population is growing with greater numbers now, which calls for the immediate inclusion of electric vehicles, such as e-scooters, to serve as healthy substitutes in a country that uses gasoline engines. E-scooters do not emit any form of environmental pollutants, whether it is sound or air pollution. However, they are extremely convenient around rural areas where petrol or diesel cannot easily be accessed. With fuel prices continually skyrocketing, the future of electric vehicles is more promising. This e-scooter integrates the use of a 48v, 50Ah

Lithium-Ion battery, which can be charged within 5 hours and offers a max capacity of 2200 W.hr with a maximum speed that goes as high as 60 Km/h. Electric vehicles do look very bright in the future, especially with the continuously growing fuel prices.

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