

# Development of Series Hybrid Electric Scooter

Tanaji Balawant Shinde

Assistant Professor, Department of Mechanical Engineering, Sanjay Ghodawat University, Kolhapur, Maharashtra-

**Abstract** - The BS-VI standard is now used in new vehicles. Because existing two - wheeler emissions are more harmful than BS-VI, top brand scooters such as Activa, Jupiter, and Accesses will be developed under these standards. The government is promoting electric scooters in order to reduce ICE-based vehicle emissions. The advantage of an electric scooter is that it emits no harmful emissions and has a high torque at low speeds. However, converting ICE-powered vehicles to pure electric vehicles incurs higher production costs. As a result, in our project work, we chose an existing ICE-powered Activa scooter to convert to electric. To take the benefits of a hybrid power source, two power sources are used for vehicle propulsion in series and Series Hybrid electric scooter is developed.

**Key Words:** ICE powered scooter, EV conversion kit, Series Hybrid electric scooter

## 1. INTRODUCTION

In our project work we mainly focused on the development of Hybrid scooter with help of EV conversion kit. Existing ICE powered scooters can be converted to electric without much modification to save money on manufacturing new scooters and to reduce emission. Conversion kits used for retrofitting can solve range, battery charging, and new scooter manufacturing issues. Only a few parts are changed during the conversion. As a result of this advancement, hybrid scooters can save money on fuel and manufacturing as well as emission can be significantly reduced.

## 2. LITERATURE SURVEY

**Abdulhasnain Murtaza Akodiyawala and others** stated in their project work that, Fuel consumption has been uncontrolled for the past 50 years, and reserves of such fuel are now completely depleted. [01]

**Haroon Rayyan Harris<sup>1</sup>, Ajay G Dev, Joel Jose, Ganesh Jithamanyu DV, Vishnu Sankar, Jibin Noble** stated that, The Indian government has focused on delivering a fully functional infrastructure for EVs by 2030, effectively trying to ban ICE vehicles. [02]

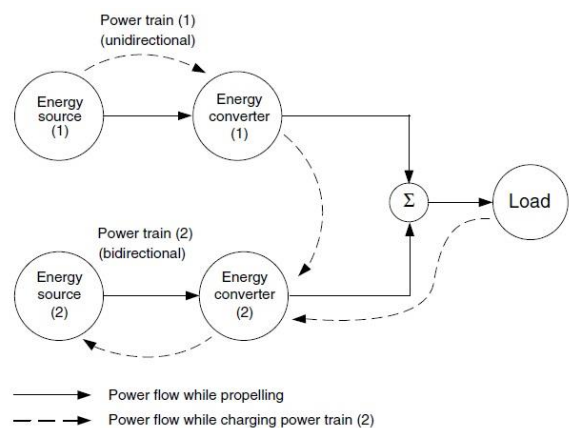
**Rishabh Kedar and others** stated in their research work Companies in India such as Bajaj, Yamaha, Revolt, and Hero are introducing new electric scooters to the market. As it is a new and rapidly growing market, new manufacturers such as

Ather, Ola, Simple One, Pure EV, and others are rapidly emerging. [03]

**Shrinit R. Lambodari and others** stated that Electric conversion of an IC-powered vehicle that was about to be scrapped, i.e. vehicles whose manufactured dates have passed, could be reused. [04]

**Prof. Sachin Tayade and others stated that** Many ICE automakers, including TESLA, NISSAN, CHEVROLET, BMW, and HONDA, have invested heavily in the design and development of electric vehicles that are more efficient in minimizing the previous drawbacks of higher cost, less drive per charge, and lower top speed. [05]

**MEHRDAD EHSANI, YIMIN GAO, SEBASTIEN E. GAY, ALI EMADI** described in their book on modern electric, hybrid electric, and fuel cell vehicles that, There are many available patterns of combining the power flows to meet load requirements as described below:

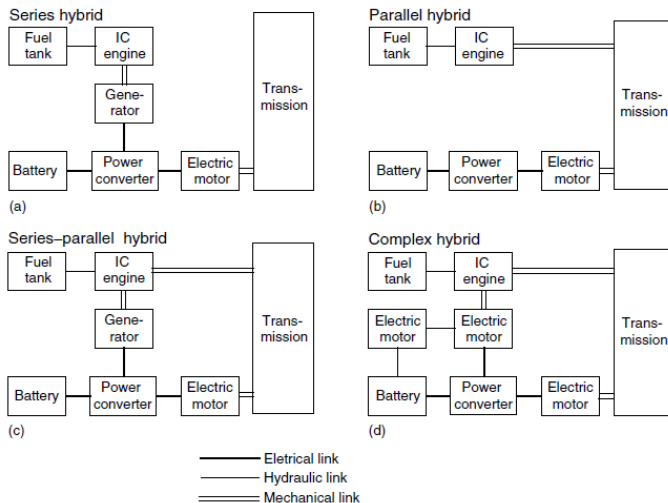


1. Power train 1 alone delivers power to the load
2. Power train 2 alone delivers power to the load
3. Both power train 1 and 2 deliver power to load at the same time
4. Power train 2 obtains power from load (regenerative braking)
5. Power train 2 obtains power from power train 1
6. Power train 2 obtains power from power train 1 and load at the same time
7. Power train 1 delivers power to load and to power train 2 at the same time
8. Power train 1 delivers power to power train 2, and power train 2 delivers power to load
9. Power train 1 delivers power to load, and load delivers power to power train 2.

- Pattern (1) is the engine-alone propelling mode. Pattern (2) is the pure electric propelling mode, in which the engine is shut off. Pattern (3) is the hybrid traction mode. [06]

## Architectures of Hybrid Electric Drive Trains

MEHRDAD EHSANI, YIMIN GAO, SEBASTIEN E. GAY, ALI EMADI described in their book on modern electric, hybrid electric, and fuel cell vehicles that, a hybrid vehicle's architecture is loosely defined as the connection between the components that define energy flow routes and control ports. [06]



## 3. SELECTION OF COMPONENTS

### EV Conversion Kit



Components:

#### 1. Motor (1500w/60v)

Brushless DC electric motors also known as electronically commutated motors (ECMs, EC motors). Primary efficiency is a most important feature for BLDC motors. Because the rotor is the sole bearer of the magnets and it doesn't require any power. i.e. no connections, no commutator and no brushes. In place of these, the motor employs control circuitry. To detect where the rotor is at certain times, BLDC motors employ along with controllers, rotary encoders or a Hall sensor.

Specifications of Motor:

Power =1500w

Type= BLDC

Size =10 inch

Torque= 30 n.m

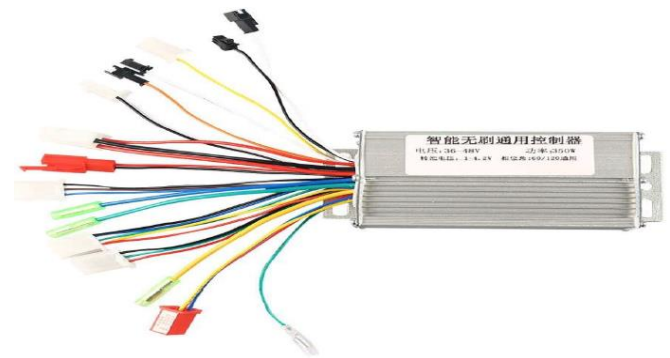
Waterproof= ip54 grade

Max temp.= 80 degree

Weight =8 kg

Efficiency =85%

#### 2. Controller (35a/60v)



The controller varies the speed and torque of the motor. Any vehicle without control is useless, without the control the vehicle will ruin itself and also dangerous for the human being driving that vehicle. So, in order to avoid that it is very necessary that control system should be installed. The appropriate controller connects the power source- fuel cell or battery - to the actual motor. It controls speed and direction, and optimizes energy conversion. While batteries produce fairly constant voltages which decrease as they are used up, the voltage output by fuel cells varies as a function of power. The table below provides the specification. It has extended fault detection and protection. Monitoring battery voltage, it will stop driving if battery voltage is too high. It will cut back then stop driving if voltage is going too low. It has built in current loop and over current protection. The controller has thermal enhanced rugged aluminum housing. For thermal protection Current is cut back on low temperature and high temperature to protect battery and controller from being damaged.

Specification:

Compatible Voltage= 48/60V

Rated Current =35A

Peak Current= 65A

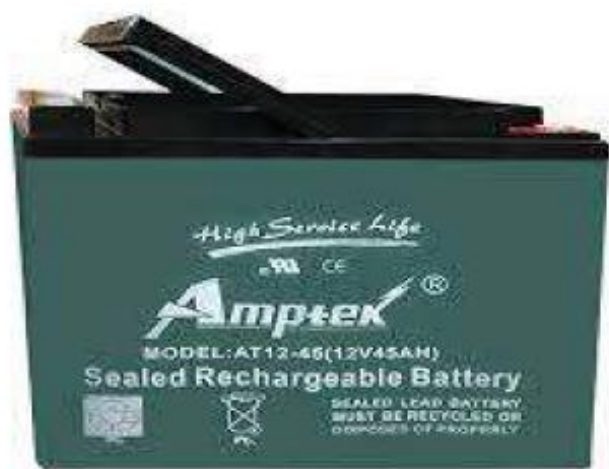
Water Proof =IP64 Grade

Regeneration= Yes

Type =Sine Wave

### 3. Battery (60v/25a) Specification:

Rechargeable Batteries: Battery is like a fuel tank for the electric system and requires refilling by the means of charging. The table below provides the specification.



### Specifications:

Voltage 60v

Capacity 25ah

Range 45-55 km

Max. Discharge 30a

Max. Temperature 60c

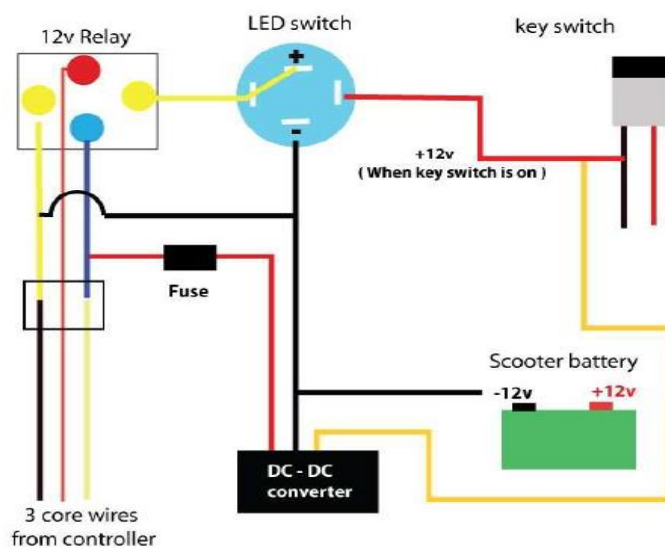
Charging time 2.5 hours

Weight 8.5 kg

Dimensions 230\*160\*170 mm

### 4. Charger (60v/10a)

Charging Current= 10A



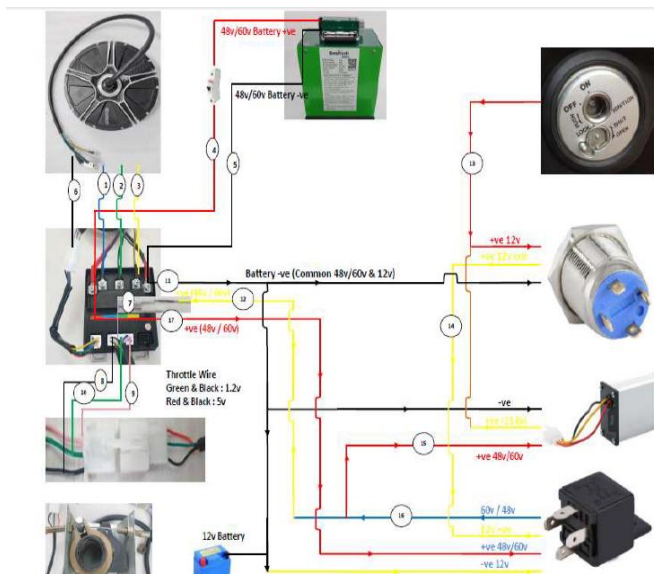
### 5. MCB:



MCB stands for miniature circuit breaker. A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and by interrupting continuity, to immediately discontinue flow of electricity.

## Connection Diagram

[12] *Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification*, IEEE Std. 802.11, 1997.



## 4. CONCLUSIONS

A petrol-electric hybrid vehicle system has been successfully developed, which is both economical and environmentally friendly because the electric system can travel half the distance. This vehicle uses half the amount of fuel that other vehicles do because it is powered by an electric system. This vehicle will be very useful in remote areas because fuel is not easily available at remote places, and it can run efficiently even with a small amount of fuel. In remote areas, we can also use solar energy to charge batteries. This technology can also be used in four-wheeled vehicles with two motors.

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