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PETRO ELECTRIC BIKE

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ABSTRACT:

A petro electric bike or hybrid bike is a proposed vehicle that can operates not only on IC engine but also on batteries which drives a motor to provide electricity and may also drive a wheel. It has great advantages over the previously used battery system that drives the power from charged battery. IC engine is a major source of air pollution. The objective is to design and fabricate a two wheeler hybrid electric vehicle powered by both battery and IC engine. The combination of both powers makes the vehicle dynamic in nature. It provides its owner with advantages in fuel economy and environmental impact over conventional automobiles. Hybrid electric vehicle combine an electric motor, battery and power system with an internal combustion engine to achieve better fuel economy. In PEV, the battery alone provides power for low-speed driving conditions where internal combustion engines are least efficient. In accelerating, long highways, or hill climbing the electric motor provides additional power to assist the engine. Theallows a smaller, more efficient engine to be used. Besides it also utilizes the concept of regenerative braking for optimized utilization of energy. Thus vehicle is best suited for the growing urban areas with high traffic. Equipment and their cost analysis are done. It deals with fabrication of vehicle. This includes assembly of IC engine and it components. The next phase consists of implementing the electric bike and designing the fork. The final stages would consist of increasing the efficiency of the vehicle in economy ways.

KEYWORDS: Internal Combustion engine, Hub motor, Fuel economy, Fuel Optional Technology.

INTRODUCTION:

The project discloses a hybrid system consisting of an Electric and Internal Combustion(IC) based power drives. The front wheel is being propelled by battery and the rear wheel is powered by gasoline, which means it includes a single cylinder, air cooled internal combustion engine and a BLDC motor based electric power drive used for hybrid powering of the vehicle. The system we implemented is a petro electric bike. The project has a number of benefits to both the team members as well as external benefits through increasing awareness of alternative transportation modes. Despite the environmental friendliness of the project or the projected benefits of more people relying on non-polluting modes of transport, the main reason we selected the project was for the level of interaction between us, the engineers, and our product. Designing a transportation vehicle requires consideration of mechanical objectives, electrical objectives, safety criteria, comfort, user

friendliness as well as an array of other objectives which may conflict under various circumstances. We hoped that through navigating our way through this vast set of criteria the satisfaction of completingthe project would be much greater than other projects we could have selected.

MATERIALS AND METHODS:

Table 1: Components and Mechanism used for Proposed Petro-Electric Bike	
SL.NO	**MATERIALS**
1.	IC ENGINE(BIKE)
2.	BLDC MOTOR(HUB MOTOR)
3.	MOTOR CONTROLLER KIT
4.	BATTERY SYSTEM
5.	BATTERY CHARGER

1. IC ENGINE:

Scooty ES is the motor-vehicle usedhas run by a 59cc, 2 stroke, singlecylinder and forced air-cooled engine. It produces maximum power of 3.5bhp @ 5500 rpm which ismore sufficient than by charging the batteries through the external charging circuit.

Figure 1: Pictorial Representation Internal Combustion Engine

Table 2: Specifications of the Internal Combustion Engine used		
SL.NO.	**DESCRIPTION**	**SPECIFICATIONS**
1.	Type	TVS Scooty ES
2.	Engine displacement	59cc
3.	Engine type	Single cylinder,2 stroke, forced air cooled
4.	Engine starting	Electric and kick
5.	Maximum power	3.5bhp @ 5500rpm
6.	Maximum torque	4.5Nm @ 5000rpm
7.	Top speed	75kmph
8.	Overall mileage	45kmpl
9.	Front brake	110 mm diameter
10.	Rear brake	130 mm diameter
11.	Front suspension	Telescopic suspensions at front

12.	Rear suspension	Helical spring and hydraulic damper
13.	Front and rear tires	2.75 x 10
14.	Length x width x height	1685x1220x1060mm
15.	Wheelbase	120mm
16.	Weight	79.5Kg

2. BLDC MOTOR(HUB MOTOR):

Brushless DC electric motor (BLDC motors) also known as electronically commutated motors (ECMs, EC motors) are synchronous motors that are powered by a DC source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. In this context, AC, alternating current, does not imply a sinusoidal waveform, but rather a bi-directional current with no restriction on waveform. Additional sensors and electronics control the inverter output amplitude and waveform (and percent of DC bus usage/efficiency) and frequency (i.e. rotor speed). The rotor part of a brushless motor is often a permanent magnet synchronous motor, but can also be a switched reluctance motor, or induction motor. Brushless motors may be described as stepper motors; however, the term stepper motor tends to be used for motors that are designed specifically to be operated in a mode where they are frequently stopped with the rotor in a defined angular position.Hub motors are an interesting development which could offer benefits such ascompactness, noiseless operation and high efficiency for electric vehicles. These motorshave stators fixed at the axle, with the permanent magnet rotor embedded in the wheel.The traditional "exterior rotor" design has the hollow cylindrical rotor spinning around astator axle. There is a "radial air gap" between the stator and rotor. The stator consists ofstacked laminated steel plates with wound coils. Pulse width modulated current is used tosupply current to the stator. Hub motors must run at relatively low speed equal to theactual rotation of wheel if there is no final gearing stage. The benefit is about a 10% increase in efficiency due to the lack of transmission. The main reason for choosing a hub motor is that it does not require a transmission system which helps in reducing the transmission losses. Since it has no brushes to wear out the life of motor is increased. It has a greater traction control. The back electro motive force created by BLDC motor can easily be stored in the batteries.

Figure 2: Image for the hub motor internal arrangement

Table 3: Specifications of the Hub Motor used

SL.NO.	DESCRIPTION	FEATURES
1.	Rated voltage(V	48V DC
2.	Rated power (W)	500
3.	Constant current at idea load (A)	5-15
4.	No load speed (rpm)	300rpm

5.	Rated torque (N-m)	5-15Nm
6.	Max. Power (W)	>500
7.	Max. efficiency	>85%

3. MOTOR CONTROLLER KIT:

The controller connects the power source to the motor. It controls speed, direction of rotation, and optimizes energy conversion. While batteries produce constant voltages which decrease as they are used up, some controllers require a DC to DC converter to step down this changeable voltage to the motor's expected constant operating voltage, but other controllers incorporate a DC-to-DC converter and can accept a varying voltage. Converter efficiencies are typically greater than 90%. The voltage control is achieved by "chopping" the source current - the voltage is switched on and off, with the ratio of on to off determining the average voltage. Chopping is performed by power electronic circuitry such as diodes and thyristors and silicon control rectifiers (SCR). Controllers also effect regenerative braking, by which the motor is acted as a generator to recharge the batteries. The controller for the motor is being interfaced with the motor speed regulation. The speed controlling throttle is being interfaced through the motor controller circuit. The motor used here is 48V, 500W, Ampere made hub motor. The controller for the motor is also Ampere made suitable for controlling the specified motor. The throttle is an ampere made throttle for speed regulation of the specified motor. The input to the motor is supplied by four Amptek made Electra lead-acid batteries each of 12V, 24Ah through controller for testing purpose. Two independent propelling sources are being employed for obtaining total propulsion of the vehicle.

The Functions of DC Controller are listed below:

- Super low noise when starting up
- Speed limit/3 speed
- Under-voltage protection
- Under-current protection
- Cruising control
- Water proof

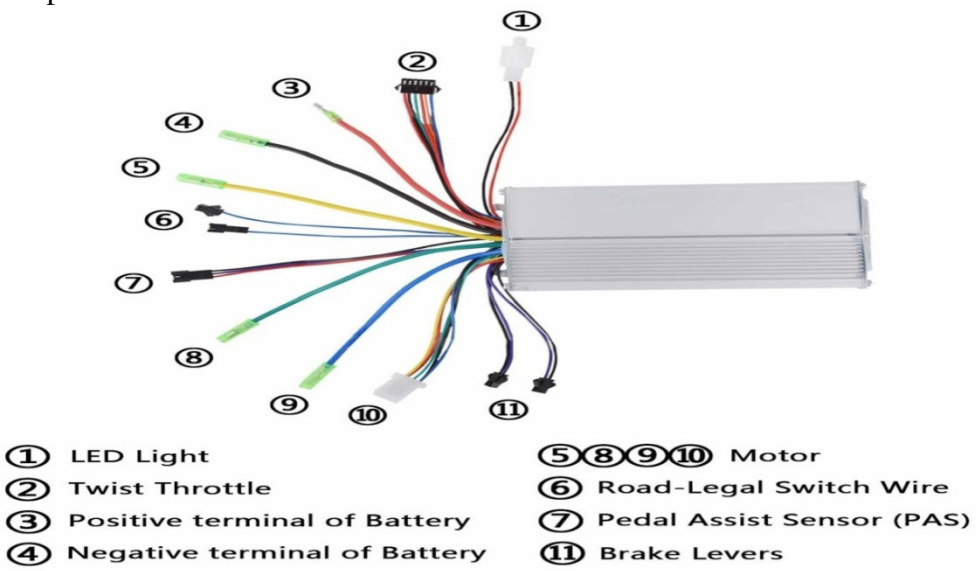

Figure 3: Image for the controller kit

Table 4: Motor Controller kit Specifications	
Description	**Specifications**
Rate voltage	DC 48V
Rated power	500W
Rated current	30A
Under-voltage protection	DC41.5V+-0.5V
Current limited	30A±0.5A
Efficiency	≥83%

4 .BATTERY SYSTEM:

LEAD ACID BATTERY:

The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the oldest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features along with their low cost, makes it attractive for use in motor vehicles to provide the high current required by automobile starter motors. As they are inexpensive compared to newer technologies, lead-acid batteries are widely used even when surge current is not important and other designs could provide higher energy densities. Large format lead-acid designs are widely used for storage in backup power supplies in cell phone towers, high-availability settings like hospitals, and stand-alone power systems. For these roles, modified versions of the standard cell may be used to improve storage times and reduce maintenance requirements. Gel-cells and absorbed glass-mat batteries are common in these roles, collectively known as VRLA (valve-regulated lead-acid) batteries.Due to the freezing-point depression of the electrolyte, as the battery discharges and the concentration of sulfuric acid decreases, the electrolyte is more likely to freeze during winter weather when discharged. During discharge, H+ produced at the negative plates and from the electrolyte solution moves to the positive plates where it is consumed, while HSO−4 is consumed at both plates. The reverse occurs during charge. This motion can beby diffusion through the medium or by flow of a liquid electrolyte medium. Since the density is greater when the sulfuric acid concentration is higher, the liquid will tend to circulate by convection. Therefore a liquid-medium cell tends to rapidly discharge and rapidly charge more efficiently than an otherwise similar gel cell.

Figure : Battery used for this project

In this project, 48V (12*4) V sealed batteries are used. Each battery is of 12 V and 24 Ah capacity. Sealed battery has a good Energy density and power density ratio. It has about 80% of charge /discharge efficiency. Lead acid batteries, used currently in many electric vehicles, are potentially usable in hybrid applications. Lead acid batteries are inexpensive, safe, and reliable. But cold temperature performance, short calendar and cycle life are still impediments to their use. Advanced lead acid batteries are being developed for hybrid electric vehicle applications. They are wide used for large amounts of storage are needed at a lower cost than lead acid batteries.

BATTERY CHARGER:

Electric Bike Chargers are designed to fulfill all kind of power requirements of Electric Bike. Battery charging operationhas wide AC input range (170 - 300VAC) and to withstand the adverse Indian power conditions. These are designed with high frequency switching technology that makes product highly reliable, cost effective, compact size and light weight. When the charge level in the charge indicator shows less, then the Engine is switched on mechanically. The power developed from the engine generates electricity through the PMDC motor and charges the batteries through the Charging Circuit.

CIRCUIT DIAGRAM:

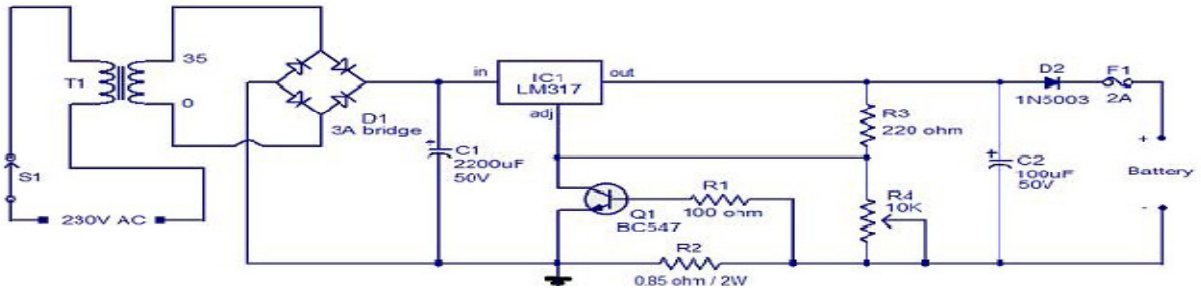

Figure : Basic circuit diagram for the charger

Table 5: Specifications for the Battery		
SL.NO	**DETAILS**	**RANGE**
1.	Nominal voltage(V)	59
2.	Capacity (Ah)	24
3.	Battery type	Lead acid
4.	Dimensions	L*W*H (187*77*170)mm
5.	Color	Green

4. METHODOLOGY:

Mounting IC engine (petrol run, 5000rpm, and TVS SCOOTY ES) on the chassis of the bike provides suitable adjustments.To design front wheel of IC engine is modified and attached with a pulley and is connected toa HUB motor (48V, 15 amps @300 RPM) mounted in line with controller kitdrive and connections are made to the batteries through a charging circuit.To fit the three battery in dickey and last one in foot space.(all batteries are in series connection) Testing the connections(motor to controller kit) and run battery mode to verify the motor is running condition.When the charge indicator shows charge is less, IC engine will be turned ONmechanically and HUB Motor will produce electricity to maintain the battery level untilfinding a plug in source.To

design the accelerator in IC engine throttle near to fit the controller kit throttle and charging port to design in below seat. After thetesting of scooty for mileage, Procurement of petro electric bike, IC engine and Hub motor in workingcondition.

BLOCK DIAGRAM WITH EXPLANATION:

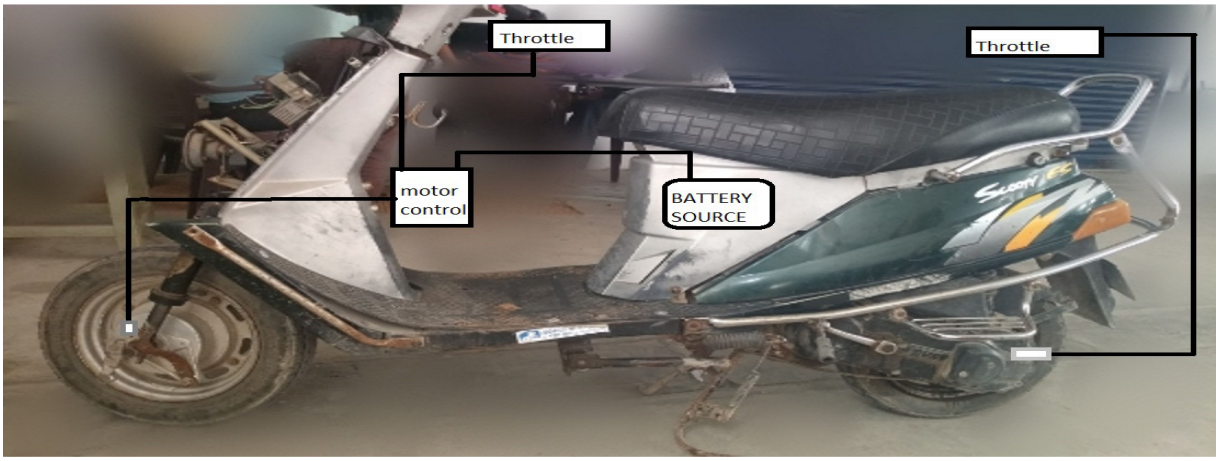

Figure 4: Block diagram for petro electric bike

Front wheel of IC engine is connected to a HUB Motor (48V, 15 amps @300RPM) through controller kit and the whole setup is mounted on the floorboard and dickey. The power developed at the front wheel was coupled to the HUB Motor (48V, 15 amps at 300 RPM) through the controller kit and a rated power output of 500 W (48V, 15amps). The connections were given to the batteries through a charging circuit which helps in developing the required current levels. Here there is a need to charge 4 x 12V series connected batteries which require 1.2 x 48 which is equal to 57.6V and hence we made use of 48V HIB Motor. Andthis is because of voltage drop on application of load. When the charge level comes down to a moderate level, then it is indicated by the speed meter. Then, the engine is switched on mechanically.

Table 4: Comparison between IC Engine and Electric and Hybrid Bikes

PETROL BIKE	ELECTRIC BIKE	PETRO ELECTRIC BIKE
Single source of energy	Low efficiency	Dual source of energy
High pollution	Lower power	High efficiency
High fuel cost	Pollution free	Less pollution
High torque	Noise free	Less energy consumption

FUTURE ENHANCEMENT:

In Future, the proposed Petro-Electric Bike may plays an important role in the eco-friendly and sustainable Environment by enhancing Solar power to charge the battery not by external battery. From the implementation of this work, the cost of the external battery reduces and the battery gets charging while the vehicle running with fuel. Batteries are the removable one after the discharge occurrence and so the solar panel may overcome this by providing them as stationary.

CONCLUSION:

The hybrid bike can be powered by fuel optional such as IC engine and Battery. Compared to ordinary bikes this Petro electric bike is more efficient and economic. This petro electric bike will be a new innovation in automotive era, it is more eco friendly because it cause less pollution. The Petro electric bike is a better solution for hiking fuel cost day to day.

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