



Design of Electrical Bicycle Using Solar Panel

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Abstract:- In present scenario a Solar Hybrid Bicycle system will help to solve the major problems of fuel and pollution. There is no doubt that the emission of carbon-dioxide from an automobile exhaust is a concern for the increasing rate of global warming. The fuel prices in India and around the world is increasing day by day thus there is a tremendous need to search for an alternative to conserve these natural resources. Promoting use of hybrid vehicles can reduce CO₂ emission and the fuel costs. Thus a solar bicycle is an electric vehicle which provides alternative by utilising solar energy to charge the battery and thus provide required voltage to run the motor. India is blessed with nine months of sunny climate thus concept of solar bicycle will be very useful in India. So we have built a Hybrid bicycle which combines the use of solar energy as well as the dynamo that runs through pedal to charge the battery to run the bicycle. The bicycle has the most feasible solar/electric power generation system mounted on the backside of bicycle to capture the sun rays to charge the battery during all durations. When there is no presence of sun, the bicycle work on the battery. For controlling speed of the motor, an accelerator is given which controls the supply. This technique reduces the running cost and increases the running efficiency. The speed of this Solar Hybrid Bicycle goes up to 25-30 km/hr carrying a load of a person of average weight. Thus solar hybrid bicycle can become a cheap alternative against the use of automobile and thus its manufacturing is essential.

Keywords: Solar, Bicycles, hub motor.

I. Introduction

The solar hybrid bicycle is used to reduces the use of fossil fuel and also reduce the pollution .As we know that the natural resources is reduced day by day so it is necessary to reserve that natural resources.

To overcome the use of fossil fuel we are using the solar energy to drive our bicycle. Here we are using 4 solar panels of 12 volts each and solar energy is stored using lead acid battery. Also this bicycle is charged with the help of battery charger.

But as we know that electricity is not available in some village so with storing the solar energy and use it for driving is one solution for many problems. This helps in conserving natural resources, reducing pollution and making effective use of solar energy.

During night time, this bicycle is driven by stored energy in the battery which is charged by solar panels so bicycle is continue in use .This is the idea used in this work.

II. Block Diagram of Electrical Bicycle using solar Panel.

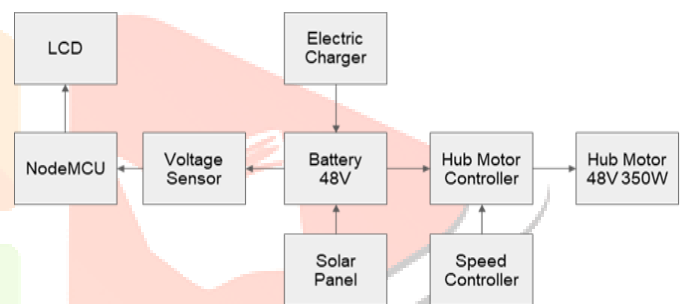


Fig 1 Block diagram

III. Details of Components

A. Hub motor

The hub motor is a conventional Dc motor. The rotor is outside the stator with the permanent magnets mounted on inside. The stator is mounted and fixed onto the axle and the hub will be made to rotate by alternating currents supplied through batteries. Hub motor generates high torque at low speed, which is highly efficient and which does not need sprockets, brackets and drive chains. This means they are very reliable and have a long life. The main characteristic of Brushless DC Machines is that they may be controlled to give wide constant power speed ranges.



Fig 2: Hub Motor Rotor



Specifications of Hub Motor used in our project work is given below in table 1:

Table 1. specification of hub motor

Rated Voltage	48V
No load current	1AMP
Rated current	14AMP
Rated power	350W
Speed(RPM)	328
Rated torque(kg-cm)	61
Compatible wheel size	20to28inch

B. Hub Motor Controller



Fig 3 Hub motor controller

C. Throttle/Accelerator



Fig 5 Throttle

Throttle is 10 kilo ohm potentiometer. It is required to vary the speed depending upon the road conditions & traffic. Therefore an accelerator or a throttle is necessary. Throttle allows us to drive the motor from zero speed to full speed. The throttle is fitted on right side of the handle bar and is connected to controller. This throttle is technically referred to as a Hall Effect type. The throttle has three wires contains a black, red, and green. The supply voltage is via red and black wires and is usually around 4 volts. Green wire voltage increases as the throttle is turned.

D. Battery (48v, 5amp)



Fig. 6 Battery

Lead acid batteries are one of the most popular types of battery in electronics. Although slightly lower in energy density than lithium metal, lead acid is safe, provided certain precautions are met when charging and discharging. This have a many advantages over other conventional types of batteries, the lead acid battery is the optimum choice for a solar assisted bicycle.

This work revolves around supplying and utilizing energy within a high voltage battery. It demands for a battery with longer running hours, lighter weight with respect to its high output voltage and higher energy density. Among all the existing rechargeable battery systems, the lead acid cell technology is the most efficient and practical choice for the desired application. The battery chosen for this project is a high capacity lead acid battery pack designed specifically for vehicles. Plastic casing is provided to house the internal components of the battery.

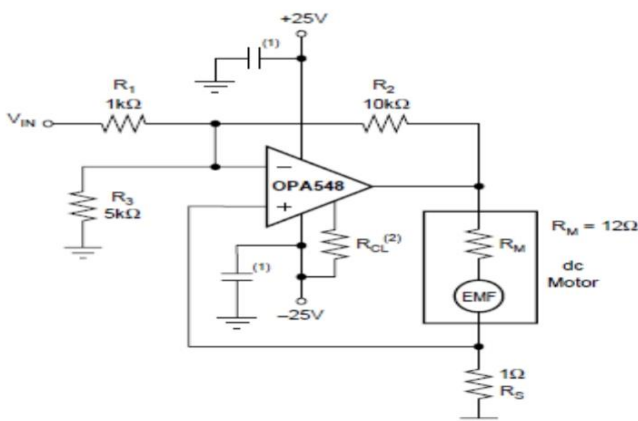


Fig 4 Hub motor controller circuit

E. NodeMCU (ESP12)



Fig.7 NodeMCU

It is a wi-fi module which is used to indicate the status of battery voltage in our mobile or web page through the IP address. Out of nine digital pin we are using only two pins D0 and D1 for display of battery voltage.

F.LCD Display



Fig8. LCD Display

It is basically 16*2 LCD display 16 characters per line and there are 2 such lines. This is I2C 16*2 Arduino LCD screen is using an I2C communication interface. The LCD screen is used to display the battery voltage.

G .Solar Panel



Fig.9 Solar panel

Table 2 specification of solar panel

Voltage	12V
Power	10W
Current	200AMP
Size	24*24inch
Weight	2kg

The bicycle is operated by solar energy. The lead acid battery is charged with solar energy with the help of a solar cell. Solar cells convert the energy of sunlight directly into electricity through the use of the photovoltaic effect. The photovoltaic effect involves the creation of a voltage into an electromagnetic radiation.

Solar cells are electrically connected and fabricated as a module with a sheet of glass on top to allow light to pass and protect the semiconductor from the weather. To obtain a desired peak DC voltage solar cells are connected in series and to get desired peak current, solar cells are connected in parallel. Here in our work, we are using 4 solar cells each of 12 volts and we have connected all 4 solar cells in series so total DC voltage obtained is 48 volts.

H. Software

Arduino software is used to program the nodeMCU. With the help of arduino software the status of the battery voltage is shown on the LCD screen.

Also with the help of this we program the nodeMCU to show the battery voltage on LCD.

IV. Circuit Diagram and Working

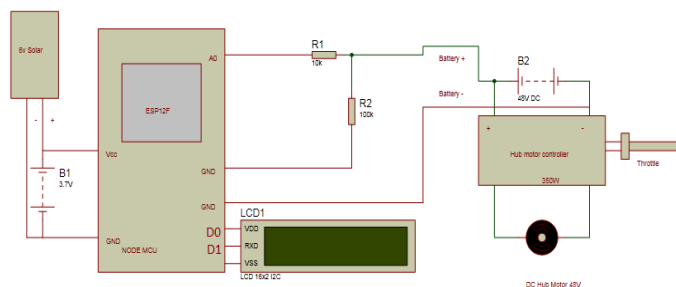


Fig. 10 Circuit diagram

In this project we are using hub motor, hub motor controller, solar panel, throttle, LCD display, and battery. The battery is of 48V lead acid battery. When accelerator is started, then the battery power starts going towards hub motor controller. The hub motor controller converts the DC voltage to the AC voltage with the variable frequency, amplitude that runs the hub motor in different speed. Then the hub motor controller gives the required voltage to the hub motor. When the hub motor receives the required voltage, it starts running. The throttle which is nothing but a potentiometer which is of 10kilo ohm is used for acceleration which is used for the speed control of the cycle. The battery is charged using two methods:

In first method battery is charged using solar panels. There are 4 solar panels each of 12 volts 10 watt. These solar panels are connected in series to get total voltage of 48 volts. The solar panel is directly connected to the battery to charge the battery.

In the second method, battery is charged using charger via power supply directly.

Total weight of model is 20 kg it is able to carry the person weight of 60 kg to 65 kg and can run with the speed of 25-30 km/hr.

V. Result and Discussion

Speed of bicycle depends on the battery voltage. So to check this, we have measured RPM of Hub Motor with varying voltage. The readings are shown in table 3.

Table 3 RPM of Motor

RPM of Rotor	Voltage
300	48v
280	47v
240	46v
200	45v
Stop	43v

The Table 3 shows that as voltage decreases the rpm of Hub Motor decreases and voltage is in dc regulated form. The maximum voltage is 48V and the speed obtained is 300 rpm of rotor due to pedalling.

VI. Conclusion

We have designed a solar operated electric bicycle which runs on Hub Motor. The model of Solar panels and battery used in this electric bicycle has total weight of around 20 kg. It can carry person weight up to 65 kg and runs with the maximum speed of 30 km/hr. Battery percentage is displayed on LCD display to indicate battery status. This same information is sent on user mobile with the help of NodeMCU. The solar panel system takes 5-6 hours to charge the battery fully and can run the bicycle

automatically for approximately 12 hours. Thus our solar operated bicycle is a cheap alternative against the use of automobile.

VII. References

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