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Solar Hybrid Bicycle

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Abstract: *Fuel prices in India and around the world increases day by day, so there is a great need to look for an alternative to conserve these natural resources. Promoting the use of hybrid vehicles can reduce CO2 emissions and fuel costs. Therefore, a solar bicycle is an electric vehicle that offers an alternative to using solar energy to charge the battery, and therefore provide the voltage required to run the engine. The hybrid bike combines the use of solar energy, as well as the dynamo that runs through the pedal to charge the battery to run the bicycle. The bicycle has the most viable solar/electric power generation system mounted on the vehicle to charge the battery during all durations. This multiple-load vehicle can be loaded with both solar and mechanical energy. The solar panels can be mounted on the back of the bicycle to capture the sun's rays. When there is no sun, mechanical work acts as an auxiliary energy source [1]. To control the speed of the engine, an accelerator is provided that controls the supply. This type of technique involves reducing the operating cost and increasing the efficiency of the vehicle's operation. The speed of the hybrid solar bicycle can reach up to 10-15 km/h carrying a load of a person of average weight.*

I. Introduction

Solar energy is used to charge the battery. One or more photovoltaic cells can be used to harness solar energy to generate a voltage to charge the battery. The battery gives the required voltage to the PMDC motor mounted on the back wheel to run the bike. Solar bikes are not usually sold in our day today life but there manufacturing can be increased to prevent environmental pollution. These are mainly used as a practical project and are also sometimes sponsored by government agencies. There have been many patents in electric vehicles in different countries and therefore electric vehicles are not a very new concept. Using solar energy to charge the battery and combining this concept with the concept of electric generation. Pedaling is a new concept and there has been a lot less research in this regard. A solar bicycle uses photovoltaic cells that convert solar energy at the voltage required to charge the battery. There are two types of solar panels that are generally used that is polycrystalline panels and monocrystalline solar panels. The polycrystalline the panels have less efficiency compared to monocrystalline panels. There are different types of batteries used in Electric vehicles such as lead acid batteries, lithium ions Batteries, nickel cadmium batteries, etc. Different batteries have different advantages for different applications for solar bicycles. The lead-acid and lithium-ion batteries in question are the most commonly used. Lead acid batteries have lower cost, higher current load capacity but have less life and they are heavier. While lithium-ion batteries havehigh energy density, lower weight but has a higher cost and there are possibilities of the explosion [2].

II. Objective

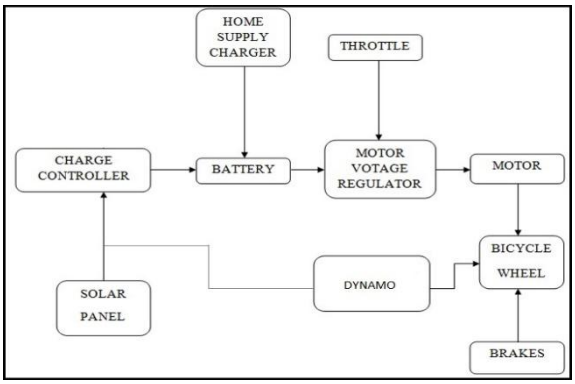
These are the lists of the objective to be made.

- To reduces pollution.
- To reduce dependence on fossil fuel.
- Easy use of renewable energies sources.
- To update a conventional electric bicycle to electric bicycle with solar energy that can be used for leisurely walks.
- To design and develop solar energy electric bicycle that obtains its supply by using solar energy from photovoltaic energy panels as well as electric supply.

III. Methodology

The methodology used in the construction of the hybrid bicycle has been illustrated as a block diagram in the figure. The main objective of the project is to guarantee the efficient operation of the hybrid bicycle complying with the management requirements [3]. Taking into account the legal limits on the speed of the electric bicycle. Since regeneration is involved, the determination of the type of components to be used, given the restrictions of weight and size, became more crucial. The main components needed for this project are listed below.

- Motor
- Battery
- Solar Panel
- Solar Charge Controller
- Throttle
- Electric Supply



(**Fig.1-** Block Diagram)

IV. Working and Specification

1. Motor

Electric motors convert electrical energy into mechanical energy. Several types of DC motor can be used in electric bicycles, such as the BLDC motor and the PMDC motor. In our project, we have used PMDC motor. A Permanent Magnet DC motor (or PMDC motor) is a type of DC motor that uses a permanent magnet to create the magnetic field required for the operation of a DC motor. The magnetic field strength of a permanent magnet is fixed it cannot be controlled externally [4].

Power	250W
Voltage	24V
RPM	3300

2. Battery

Depending upon design calculation requires voltage to drive a PMDC motor is 24Volt so we selected two 12Volt maintenance free batteries connected in series.

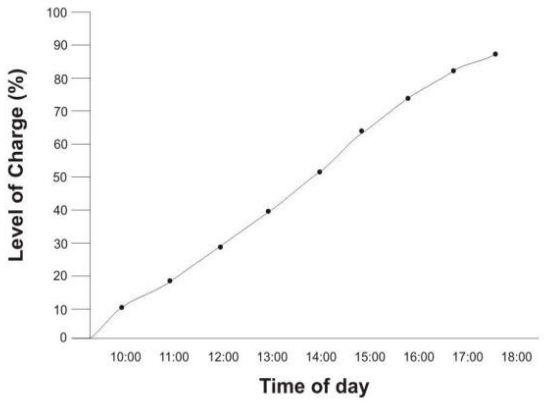
The battery also acts as a capacitor in a way that stores the electrical energy produced by the generator due to electrochemical transformation and supply on demand. Drums it is also known as an electric charge accumulator. This happens normally when starting the system.

Nominal Voltage	24
Capacity	7.2Ah

3. Solar Panel

Solar cells convert the energy of sunlight directly into electricity by using the photovoltaic effect. The photovoltaic effect involves the creation of a voltage in electromagnetic radiation. The photoelectric and photovoltaic effects are related to sunlight, but they are different in that the electrons are expelled from the surface of a material when exposed to the radiation of sufficient energy in the photoelectric, and the electrons generated are transferred to different valence bands to drive inside the material, resulting The accumulation of voltage between two electrodes in photovoltaic [5].

Power Output	25W
Dimension	740*350*25
Type	Polycrystalline



4. Voltage Controller

It is essential to regulate the voltage output of the solar panel before it is supplied to the battery. The output of the solar panel is not always stable due to change in the intensity of sunlight, angular changes with respect to the direction of sunlight, as well as other environmental factors. The output power of the voltage regulator is higher than the input power. The output of the solar panel is the input of the elevator converter, which then goes out to the battery to charge [6]. Because the output of the solar panel will vary constantly, we need a voltage regulator that takes an input of a wide range of voltages and generates a specific value of constant voltage.

5. Charge Controller

A solar charge controller manages the energy that enters the battery bank from the solar panel. Ensures that deep cycle batteries do not overload during the day, and that energy does not run back to the solar panels at night and drain the batteries. Some charge controllers are available with additional capabilities, such as lighting and charge control, but energy management is your main task.

6. Accelerator

The maximum speed of a bicycle is 15 kmph. 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 the right side of the handlebar and is connected to the controller.

V. Calculations

Weight of cycle be 30kg, and weight of person is 70kg.
Therefore, total distributed weight= (70+30)/2= 50kg.
Now, normal reaction= 50*9.81= 490.5N
Frictional force acting on each tire will be,
For static friction,
$F=\mu*N= 0.03*490.5=14.715N$
For dynamic friction,
$F=\mu*N= 0.004*490.5= 1.962N$
Torque,
For static friction, $T=F*R=14.175*0.30=4.4145Nm$
For dynamic friction, $T=F*R=1.962*0.30=0.5886Nm$
Angular Speed=
$\omega= (V/R)=(15000/(3600*0.3))=13.88$ rad/sec
Power for static friction = $T\ \omega= 4.4145*13.88= 61.2732W$
Power for dynamic friction = $T\ \omega= 13.88*0.5886= 8.169W$
Total Power= 61.2732+8.169=69.44W
Therefore, Power on both the tire will be around 140W [7].

VI. Conclusion

The bicycle assisted by solar energy is a modification of the existing bicycle and is powered by solar energy. This bicycle has a cheaper cost of 15000 rupees and is simpler in construction, and can be widely used for short trips of approximately 10 to 15 km, especially by schoolchildren, university students, office workers, villagers, postmen, etc. It is very suitable for young people, elderly people, with physical disabilities and meets the need of the economic class of society. It can be operated throughout the year at no cost. The most important feature of this bicycle is that it does not consume valuable fossil fuels, thus saving money. It is ecological and pollution-free since it has no emissions. In addition, it does not make noise and can be recharged with the AC adapter in case of emergency and cloudy weather. The cost of operation per kilometer is minimal. It can be operated by manual pedaling in case of any problem with the solar system. It has fewer components, can be assembled or disassembled easily, so it needs less maintenance. One of the biggest disadvantages of the project is its speed cannot be increased by more than 15 kmph. The speed of a bicycle can be increased by using the motor of more power.

A section of conclusions should be included that clearly indicates the advantages, limitations and possible applications of the document. Although a conclusion may review the main points of the document, do not repeat the summary as a conclusion. A conclusion could explain the importance of the work or suggest applications and extensions.

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