

Fabrication of Solar Powered Electric Bicycle

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ABSTRACT:The electric bicycle is an alternative to conventionally fossil fuelled vehicles which promotes clean environment. It can reduce not only the pollution but also reduce congestion. Our project focuses on solar energy. An electric bicycle developed by us is the modification of existing normal bicycle by using suitable DC motor, solar panel, lead-acid batteries, control circuitry etc. The system is modified in such a way that the rider can make choice of which mode he wants to prefer i.e. by using throttle mode, he can either choose the bicycle to be driven completely with the electric motor or by using manual mode he can choose it to be driven manually by himself. Solar panels are mounted over it to collect solar radiations. This type of bicycle is totally eco-friendly as this requires only solar energy for its working. Our model will create new market opportunities for local economy and will provide energy efficient and low cost solution to automobile industry.

KEYWORDS:Electric bicycle, dc motor, lead-acid battery, solar panel.

I. INTRODUCTION

Bicycles are widely used after it was introduced in Europe somewhere in 19th century and the main purpose for it was to provide a form of recreation. The developments of bicycle still continue until today due to the practicality and ease of use. Bicycle can be categorized into many types for function and purpose such as road bicycle, touring bicycle, downhill bike, mountain bike and electric bike. All the design and development was designated to match with its purpose to function well in that particular situation. The basic component for a bicycle consists of front and rear wheel, frame, handlebar, seat and fork.

A traditional bicycle is a two-wheel vehicle that is propelled by the rider who delivers muscle power through pedals that rotate one of the vehicle's two wheels. The rider keeps the bicycle upright by steering the front wheel to create a force that restores the vehicle to its stable zone whenever necessary to prevent tipping. An electric bicycle carries batteries or fuel cells that deliver electric power to a motor that is coupled to either wheel. In most electric bicycles the rider can choose to use muscle power to deliver all, part, or none of the propulsion power required to maintain his or her adopted travel speed. Some models even sense your pedal pressure and command the motor to deliver more power whenever you pedal hard. The innovation of bicycles brings on the creative way to improvise the use of bicycle by invention of electric bicycle or e-bike. The e-bike is basically a bicycle with an electric motor used to power the vehicle. Components for this bicycle still majorly consist of what are required to build a bicycle but with some addition like electric motor controller and battery. Electric bicycle now are rapidly increase in term of usage since 1998 and China was the leading country for most users of electric bicycle and followed by others European country.

Traditional methods of mobility depend on fuel to a great extent, which leads to a large consumption of energy and is hazardous to the environment. A promising alternative to fuel-based transport is the electric bicycle which has developed rapidly in china in recent years and exhibited huge potential for its energy-saving and environmentally friendly features. However, e-bikes have not drawn sufficient attention from academics and the government as they deserve. It is urgent to understand why and how the e-bike industry has developed in China in order to further boost its development.

1.1 LITERATURE SURVEY

This simulation study of the dynamics and electric consumption of an electric bicycle under the effects of operating conditions such as air density and slope. The simulation models including dynamic and battery models are established to describe the operation of the electric bicycle. These models are calculated and solved by a code programmed in Matlab-simulink. In addition, an experimental study is also conducted to examine the dynamic and electric consumption characteristics of the electric bicycle.

1.2 COMPONENTS :

1.2.1 BICYCLE :



Fig -1: Bicycle

We used HERCULES SPARX AX Mountain bicycle which will supports all parts required for electric bicycle, takes the load of all parts attached to it and works smoothly without providing fatigue to rider.

1.2.2 LEAD ACID BATTERY:



Fig-2 :Lead Acid Battery

Two lead acid rechargeable batteries of 12V 22.5 Amp are used which are connected in series position. It basically stores the electrical energy generated and utilizes it to run the motor. A battery has a positive terminal called cathode and negative terminal called anode. The terminal marked positive is at higher electric potential energy and the terminal marked negative is source of electrons

when connected to external circuit will flow and deliver energy to external device. These batteries can be recharged multiple times.

A lead-acid battery of 12V 22.5 Amp is having specifications:

1. Nominal voltage _____ 12V
2. Capacity _____ 22.5 Ah
3. Weight _____ 15.2Kg
4. Dimensions _____ 190 x 65 x 94
5. Case Material _____ ABS

1.2.3 CONTROLLER:



Fig - 3 :CONTROLLER

A motor controller governs the performance of an electric motor. A motor controller provide means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and faults. A motor controller is a device that acts as intermediary between batteries and motor.

The controller of an electric bike is an electronic circuit that not only controls the speed of an electric motor but also serves as a dynamic brake. This controller unit uses power from the battery and drives it to the motor connection, power lock, battery level indicator, brakes, brake light, charger and throttle.

Each plug is provided with different colored wires for easy understanding, following fig. illustrates colour code for each controller plug.

1.2.4 PERMANENT MAGNET DC MOTOR :



Fig -4 :Permanent Magnet DC Motor

A DC motor is one of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most mutual types rely on the forces created by magnetic fields. Nearly all types of DC motors have specific internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in portion of the motor. A DC motor's speed can be controlled over a extensive range, using either a variable supply voltage or by changing the strength of current in its field windings.

Permanent magnet DC motor used here is a geared motor having following specifications ----

- | | | |
|----|-----------------------|----------------|
| 1. | Source | ----- DC |
| 2. | Voltage | ----- 24 V |
| 3. | Power | ----- 250 W |
| 4. | Operating Temperature | -----20°C-45°C |
| 5. | Full Load Current | ----- 13.5 A |
| 6. | No Load Current | ----- 2.2 A |
| 7. | Stall Torque | ----- 40 Nm |
| 8. | Rated Torque | ----- 8 Nm |

1.2.5 THROTTLE:



Fig -5 :Throttle

It is required to vary the speed depending upon the road conditions and 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.

The speed control is achieved by varying armature voltage by using rheostat in series with armature. This is simplest method where better speed regulation can be possible.

1.2.6BRAKES :



Fig -6 :Brakes

Two brake leavers are provided on both sides of bicycle handle so as to stop and control the bicycle while running. These brakes serve two operations first is, During manual operation of bicycle when brakes are applied it actuates brake pads through mechanical linkages and stop the bicycle and another is, during electric assist condition when brakes are applied it send signal to controller which cut off the power supply to motor and stops the bicycle.

1.2.6 SOLAR PANEL :



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If incident light from sun reaches solar panel it produces DC current which is used to recharge batteries.

Solar panel is provided at the back of the rider on cycle carriage by means of metal frame.

Solar module has following specification -----

1. Output ----- DC
2. Capacity ----- 14 W
3. Weight -----500g
4. Dimensions ----- 4650 x 350 x 25

1.3CONCLUSIONS :

To scope with the global warming, scarcity of traditional resources and increasing demand of petroleum products it is necessary to shift our way towards alternate resources like the electric bike which can become better mode of transport. Our project may provide a solution for this existing problem in which charging of the battery is done as the vehicle is on rest. Since it is energy efficient, cheaper and affordable to anyone. It can be used for shorter distances by people of any age. The most vital feature of the electric bike is that it does not consume fossil fuels. The second most important feature is it is pollution free, eco-friendly as well as noiseless in operation. For offsetting environmental pollution using of electric bike is the most viable solution. It can be charged with the help of AC adapter if there is an emergency. The Operating cost per/km is very less since it has fewer components it can be easily dismantled to small components, thus requiring less maintenance. Apart from these features one of the important feature provided by our project is eliminating switch board charging which can save lot of energy and cost.

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