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A Review Paper on Designing Electric Bicycle

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Abstract : *This project deals with the design and fabrication of a Solar Powered Bicycle which makes use of solar energy as the major source of power. The complete design of the charging system of battery, transmission of power and salient features of the bicycle are dealt with. Provision is made in the design to charge the battery from electrical source also so that the usage of the cycle is extended in places and time where solar power is not available. The transmission drive used in our project is chain drive and motor is BLDC gear motor. The whole assembly is modified on the existing bicycle without implement new design making this project cost efficient and easily available.*

Keywords: *Solar panel, BLDC Motor, Solar Powered Vehicle, Electricity, E-Bike*

I. INTRODUCTION

In present scenario, owing to the increasing number of automobiles the need for petroleum products is reaching its peak point. Petroleum products are non-renewable and may possibly get exhausted in future, so it is better to move to alternate energy sources. Crude oil prices have increased significantly over the past few years and there seems to be no turning back. Currently, there has also been a focus on the environment and it seems that the demand for cleaner alternatives for fuel has become critical. The increasing demand for pollution-free transportation has boosted the use of electric power for transportation thereby reducing the reliance on automobiles.

An Electric Bicycle is a low cost alternative to an automobile. Although the concept of electric bicycle is not new [it has not been completely explored. This project focuses on the design and testing of an electric bicycle. The project is challenging with respect to the conversion of the existing mechanical system to the one that incorporates both human pedaling and utilization of solar energy. "Electric and solar hybrid" usually indicates the use of multiple energy sources to provide power to a vehicle. Energy from ac wall outlet, solar power as well as from human pedaling is utilized in this project to charge a battery. Solar power is not only used to charge the battery, but may also be used for powering communications, controls and other auxiliary functions. The hub motor attached to the front wheel of the bicycle is charged from the battery. The project on electric bicycle promotes cleaner technology as well as a lesser reliance on petroleum product.

The depleting reserves of fossil fuels made the engineers and scientists to look for renewable energy sources. In addition, the environmental decay due to the combustion of fuel is alarming and justifies the design of eco-friendly system. India is spending large amount of foreign exchange to import crude oil even though we have abundant resource of solar energy. If we utilize solar power for local conveyance, a large amount of currency can be saved and we can also ensure pollution free environment and contribute to nation's economy.

The general mode of transportation for local trip (with in a range of 5 km) is a bicycle, motor cycle or electrical bicycle. Bicycles are the cheapest, healthiest and eco-friendly but poses problem in climbing slopes. Motor cycles are not affordable to poor people and with the rising fuel price.

II. METHODOLOGY

The methodology used in constructing the Electric Bicycle has been illustrated as a block diagram in figure 1. The main aim of the project was to ensure efficient operation of the Electric Bicycle by meeting the drive requirements. Considering legal limits on the speed of electric bicycles, the maximum speed of the Electric Bicycle was considered to be 28kmph. Since regeneration is involved, determining the type of components to be used, given the constraints of weight and size became more crucial. The main components required for this project are listed below.

Motor

Battery

Solar Cell

Throttle

Frame

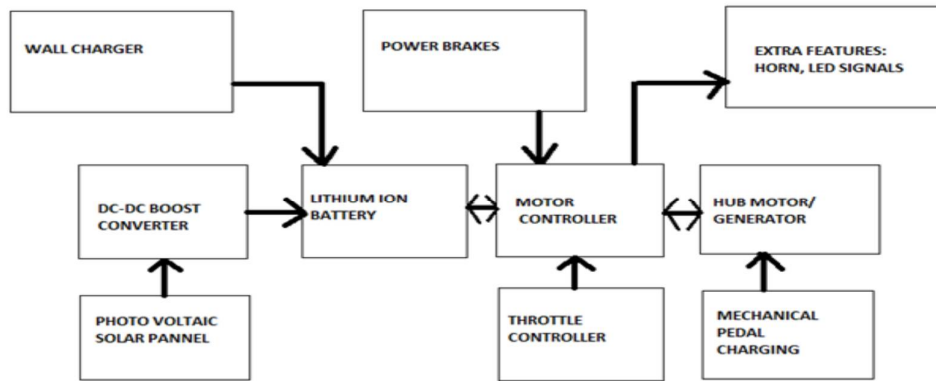


Fig 2.1: Block diagram for Electric Bicycle

Block Diagram The battery and motor required for electric Bicycle has been chosen assuming that the external forces such as wind drag, rolling resistance of tyres, etc. has been neglected. The focus is more on energy conversion between kinetic/potential and electrical energy. To accelerate the Electric Bicycle from cold start, sufficient torque needs to be provided and hence a sufficient amount of current needs to be drawn by the motor. If the terrain is flat, there is no potential energy which would have caused the motor to deliver a counter torque to oppose the force of gravity. We therefore look at only the kinetic energy required for acceleration. The energy relationships have been provided by equations.

$$\text{Kinetic Energy} = \frac{1}{2} m\Delta V^2$$

$$\text{Electrical Energy} = V \times I \times T$$

$$\text{K.E.} = \text{voltage rating motor} \times \text{current required} \times \text{time to accelerate}$$

III. EXPECTED RESULT

The solar powered bicycle has the following salient features. A cycle can run at an average speed of 15 kmph. The standard torque generated on wheel is 1.92Nm and from calculation we can determine the slope can easily climb by our electric bicycle. The battery can be charged in dual mode, Solar or Electrical supply. The battery can be charged in rainy season or at nights also. The cost is less (Rs 13000/-) compared to Luna (Rs 30000 /-) or E – Bike (Rs 25000 and above). Eco - friendly, No Pollution. The battery is being charged while riding in sun. Hence charging and usage takes place simultaneously. No running cost. It can be easily recommended as a local vehicle.

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