

Review Paper of Solar Bike

Prof. Marnish Modi, Dhairya Parikh, Harsh Patel, Jeet Patel, Khelan Patel,
Hardeepsinh Vaghela
Indus University

Abstract – Nowadays, fuel prices are increasing and also there is an increase in the pollution level and due to pollution the whole world is struggling with global warming and to get rid of it, it is talking about carbon neutrality[1]. There are many more problems with the gasoline engine but there is only one solution for every problem is electric vehicle. Electric vehicle is a new revolutionary and need of the world. In electric vehicle there are minor issues like charging time, range of the vehicle, speed, and there are solutions for it. We can use natural resources for electric vehicle issues. An electric bike is also necessary because as we know that fossil fuel sources are limited and they are depleting continuously. Keeping all these things into consideration there is a need to find a solution for conventional fuel-powered vehicles also the people's vigorous awareness of environmental problems also leads to research towards the alternate solution for the automotive vehicle[1]. The uses of renewable energy in the place of conventional fuel are the best solution to overcome this problem. The main aim of this paper is to present an idea of the design and development of the electric bike.

Key words- Electric Bike, Solar panels, BLDC motor, Lithium-ion Battery, Frame, Controller and throttle, Advantages, Challenges, Conclusion and etc.

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I. Introduction

Electric bike means a vehicle which is simply operated by an electric motor and the motor is powered by the rechargeable battery and battery can be charged by two methods first will be solar power and another will be the auxiliary port attached to battery through the controller and controller is used at two places in an electric vehicle the first controller is used between motor and battery to control the power and second controller is used between solar plate and battery to control the voltage generated by the solar plate. This paper focuses on the design and development of the electric bike, constructional parts, advantages, problems, future scope etc. The main components of a solar bike are solar plate, BLDC motor, Lithium-ion Battery, Controller, Throttle, Wiring harness and etc[2].

i. Solar Panel

A solar cell panel, solar electric panel, photo-voltaic (PV) module or solar panel is an assembly of photo-voltaic cells mounted in a framework for installation.[8]



Fig. 1 Solar panel

Solar panels use sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.[8]

ii. BLDC Motor

A brushless DC electric motor (BLDC motor or BL motor), also known as an electronically commutated motor (ECM or EC motor) or synchronous DC motor, is a synchronous motor using a direct current (DC) electric power supply. It uses an electronic closed loop controller to switch DC currents to the motor windings producing magnetic fields which effectively rotate in space and which the permanent magnet rotor follows. The controller adjusts the phase and amplitude of the DC current pulses to control the speed and torque of the motor. This control system is an alternative to the mechanical commutator (brushes) used in many conventional electric motors.[8]



Fig. 2 BLDC Motor

Power rating: 500W,
Rated voltage: 48V,
Weight: 5Kg,
Efficiency (%):80,
Torque: 12 N-m
Speed (rpm):300 [3]

The construction of a brushless motor system is typically similar to a permanent magnet synchronous motor (PMSM), but can also be a switched reluctance motor, or an induction (asynchronous) motor. They may also use neodymium magnets and be outrunners (the stator is surrounded by the rotor), inrunners (the rotor is surrounded by the stator), or axial (the rotor and stator are flat and parallel).

The advantages of a brushless motor over brushed motors are high power-to-weight ratio, high speed, nearly instantaneous control of speed (rpm) and torque, high efficiency, and low maintenance. Brushless motors find applications in such places as computer peripherals (disk drives, printers), hand-held power tools, and vehicles ranging from model aircraft to automobiles. In modern washing machines, brushless DC motors have allowed replacement of rubber belts and gearboxes by a direct-drive design.

iii. Lithium-ion Battery

A lithium-ion battery or Li-ion battery is a type of rechargeable battery composed of cells in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging.[8]

Li-ion cells use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode.[8]



Fig. 3 Lithium-ion Battery

Li-ion batteries have a high energy density, no memory effect (other than LFP cells) and low self-discharge. Cells can be manufactured to either prioritize energy or power density. They can however be a safety hazard since they contain flammable electrolytes and if damaged or incorrectly charged can lead to explosions and fires.[8]

iv. Controller and Throttle

Controller and throttle allows the driver to drive the motor linearly from zero speed to high speed Throttle which is attached to your right handle on the handle bar and it is connected to the controller. Controller is nothing but variable speed drive that converts constant DC voltage from battery to an alternating voltage with variable amplitude and frequency that will drive the motor at different speeds. It is mainly consist of Power Electronic MOSFET transistors and a small microprocessor. Insulated Gate Bipolar Transistors (IGBTs) are the most suited power semiconductor devices for AC drive converters at present stage[4]. Controller monitors the amount of voltage required by motor and also supply to head light is given through it.[5]

v. Frame

Frame skeleton of the E-bike which acts as back bone of the bike and it is designed in such way that it can sustain the weight driver, weight of load to be conveyed and also capable to hold the accessories like motor. It is designed in such way that it should bear and overcome the stresses which may arise due to different driving and braking torques and impact loading across the obstacles. Support plates are holded by drilling and tapping. M.S. along with some additional light weight components are used to build the frame[2]. Frame of e-bike should be light in weight and it must accommodate battery pack[5].

vi. Chain Drive

Chain drive is used to transmit rotary motion from one gear to another. Chain is nothing but an array of links held together with each-other with the help of steel pins. This arrangement helps to make chain more enduring, longlasting and better way of transmitting rotary motion from one gear to another.[2]

vii. Braking System

It is convenient to use braking system which consists of spring loaded friction-shoe mechanism, which is driven with the help of hand lever.[1]

II. Advantages

- Good efficiency: BLDC motors in e-bikes are above 90% efficient than IC engines which are nearby 40% efficient.[6]
- It will be charged solar energy so, it will save the electricity production.
- Eco-friendly: Electric bikes are eco-friendly if required power to charge the batteries is derived from non-conventional sources.[6]

- Cheaper: Running cost of e-bike is less as compared to conventional bikes.[6]
- Quiet journey: E-bikes are quietest of all transportation.[6]

III. Challenges

- Light Weight[1]
- Proper alignment of solar panel
- Low-Speed[6]
- Longer charging time[6]
- More weight of battery[6]
- Balance the vehicle[1]
- Short-range vehicle[1]
- Poor acceleration[4]
- Development of economical drives with high efficiency, high reliability, high power density, good controllability, good dynamic performance.[1]
- Charging output of solar panels
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IV. Conclusion

Change is a part of life and to get solution of a pollution in this world due to gasoline engine we need to replace the gasoline engine with the electric vehicle. Electric vehicle is a new future of our world.

V. Future Scope

Electric bike necessitate more advanced technology to improve its performance as well as cost effective. Electric bike project will be successful with more research work in following area:

- Fast power charging as well as wireless power charging system for electric battery
- Design of motors with high efficiency, high torque at low speed
- Design of battery with longer running hours, lighter weight with respect to its high energy density and high output voltage.[7]
- Design of intelligent controller
- Cost reduction
- Remove drawback of poor acceleration

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