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Development of Solar Vehicle

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ABSTRACT - *In today's time where the whole world is struggling with polution and due to polution global warming is increasing as well as fuel prices are increasing and for all these problem there is only one solution for it and it is an solar bike which can be used for daily communication. Electric bike/vehicle can prove to be a milestone in this endeavor. 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. The uses of renewable energy in the place of conventional fuel are the best solution to overcome this problem. An Solar bike can be considered a good alternative for traveling within small and medium distances and solar bike is totally based on natural source with the help sunlight the vehicle is charged. The main aim of this paper is to present an idea of the design and development of the Solar bike.*
Key words- *Electric Bike, Solar panels, BLDC motor, Lithium-ion Battery, Frame, Controller and throtle.*

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I. Introduction

In this paper we will discuses about the solar bike & its status in the modern world. About the design of solar vehicle and its modern design. Here, we have focused its need in the modern world & the challenges that can be solved through a solar bike. We will also solve the heating issues of the electric vehicle produced by the battery. As per the modern genration it will aerodynamic in looks so that it will get good range.

1.1 Introduction to Solar bike

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 place in a 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 an 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

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, long lasting 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]

1.2 Motor selection

BLDC motor of 500 W 48V is selected

1.3 Battery selection

Since motor selected is of 48V hence battery voltage rating should also be 48. Therefore, we select Single Lithium-ion battery which will be of 48V and 25 Ah in series combination of we get 48 V and 25 Ah[9].

1.4 Panel selection

we use one panels of 20 W each having dimension 520mm* 350 mm* 22 mm[7]

II. CURRENT SCENARIO OF E-BIKE IN THE WORLD

In 2016, there are 210 million electric bikes worldwide used daily. It is estimated that there were roughly 120 million e-bikes in China in early 2010 & sales are expanding rapidly in India, the United States of America, Germany, the Netherlands & Switzerland. The world's fifth-largest auto market is readying for a stupendous transformation: moving completely towards electric vehicles (EVs) by 2030. It will set the standards and specifications for the vehicles and provide guidelines to incentivize their use. Summary: - From this part of paper, the solar bikes are pollution free vehicles which can be used in day-to-day life by people to reduce the dependency on fossil fuels. They are efficient, have very less running & maintenance cost compared to other vehicles. They have potential for the future mode of transportation[3].

III. FABRICATION AND DESIGNING OF SOLAR BIKE

In this part of research paper, we have discussed the components & materials required to convert any gasoline bike into a solar bike.

3.2 RAW MATERIAL

In table various raw material for discuss: -

Sr. no.	Material	Price (Rs.)
1	Motor	10000
2	Controller	7000
3	Throttle	1500
4	Wiring	5000
5	Meter & light	4000
6	Bike body & chassis	10000
7	Welding & Fabrication	10000
8	Battery	30000
9	Painting	2500
10	Solar Panal	30000
	Total	110000

Table : - Various Raw Material

IV. CONCLUSION

- Battery capacity directly affects the range of the e-bike.
- Commuting with low fatigue at a top speed of 24 kmph.
- Extends the riding range 30 kms on a single charge.
- Lesser maintenance cost.
- Detachable battery can be taken inside the house for charging.
- Design of battery with longer running hours, lighter weight with respect to its high energy density and high output voltage.[6]
- Thumb throttle - simple to operate and less strain on hands.
- No noise - no vibration - no smog - no smog checks.
- No gasoline - no oil - no tune-ups.

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