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### SOLAR ELECTRIC BICYCLE

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**ABSTRACT:** The fuel price is rising steadily day by day. The pollution due to vehicles in metro cities & urban areas is increasing continuously. It causes to increase in the temperature of the earth. To overcome this problem we need to find another way to protect the earth from being heated. It is also not affordable to purchase vehicles for all classes of society. Keeping this in mind, a search for some way to cater to these economically poor people as well as to provide a solution for environmental pollution was in progress. The solar-assisted bicycle developed is driven by a DC motor fitted in front or rear axle housing & operated by solar energy. Solar energy is energy in the form of rays and heat from the sun. This energy can be harnessed by using a series of technologies such as solar panels. Solar panels are devices that consist of solar cells that convert light into electrical energy. The solar panels mounted on the carriage will charge the battery & which in turn drives the BLDC motor. When the bicycle is idle, the solar panel will charge the battery. This arrangement will replace the petrol engine, the gearbox & the fuel tank in the case of a two-wheeler or a chain sprocket, chain & gear shifting arrangement of a conventional bicycle being used by the most common man.

As a part of the dissertation work, the solar-assisted bicycle is fitted with a BLDC motor on the Back axle of a bicycle with a power rating of 250W and with a traveling speed of around 25-30 km. It is provided with a pair of lead acid batteries of 35 Ah each, a photovoltaic solar panel with a capacity of 20 watts, a voltage regulator of 24V, 10 Amp, an accelerator, and a motor controller of 24V, 25Amp. There is also a provision for charging of the battery with 220-240V, AC wall outlet supply, in case of poor solar supply due to cloudy weather.

KEYWORDS: Solar Powered Bicycle, BLDC Motor, Solar Panel, Voltage Regulator.

#### I. INTRODUCTION

Solar-powered bicycle is a very vital alternative to the fueled automobile. Cities around the world are undergoing rapid urbanization. Mobility in urban areas is one of the challenges that must be addressed and improved to get a better quality of life for the community [1]. Urban mobility is a prevalent problem in many cities around the world. Issues on urban mobility affect the quality of life and environmental sustainability are gaining importance in the world [2]. The world population has been progressively concentrating in the cities, by using solar bicycles except for fueled automobiles we can able to save nature and control the traffic as well as reach our destination faster. A solar bicycle is a bicycle that runs using the electrical energy of a battery to run the BLDC motor which runs the bicycle. Solar energy is used to charge the battery. Photovoltaic cells use solar energy to generate voltage to charge the battery. The battery gives the required voltage to the BLDC motor mounted on the Back wheel to run the bicycle. Solar bicycle is not sold generally in our everyday life but their manufacturing can be increased to prevent environmental pollution [2].

These are primarily used as practical projects and are also sometimes sponsored by government agencies. There have been many patents on electrical vehicles in different countries and thus electric vehicles are not a very new concept. Utilizing solar energy to charge the battery and combining this concept with the concept of electricity generation pedaling is a new concept and there has been very less research in this regard. The solar bicycle uses photovoltaic cells that convert solar energy into the required voltage to charge the battery and runs the bicycle.

#### **II. LITERATURE REVIEW**

The user will surely be tired after using the bicycle. This will not suitable for students to use to go to the class because they will be tired when they are in the class and will lose their concentration while hearing the lecture. Next motorized bicycles that used fuel as their prime mover. The bicycle uses fuel that is costly. As students, their allowance is limited and only can be used for their study material and for their food to survive on campus. Besides that, the motorized bicycle will make pollution that can be very bad for our environment, especially in this period that global warming



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happened on earth. Lastly, electric bicycles that generate by battery can only be sufficient for about an hour. The user needs to find a power supply too.

A solar bicycle is a modification of a conventional bicycle and is driven by electrical energy. It can run on any type of either cemented or asphalt road or it can also run on a muddy road. Solar bicycles is having very less initial and maintenance costs and hence can be used for short-distance travel by students, and office people. It is suitable for young, aged, and handicapped people and completes the need of an economically poor class society. It can be used throughout the year free of cost. The most important merit of this bicycle is that it does not consume the necessary fossil fuel which is required in day-to-day life and thus prevents the environment from pollution and also helps conserve natural resources.

**III. PROJECT METHODOLOGY** 



- ii. Solar panel
- iii. Batterv
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- Battery Charger v
- Throttle vi.
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#### i. **BLDC Motor**

A DC Motor is an electrical machine that converts electrical energy into mechanical energy. We are using a BLDC motor to run the Bi-cycle. 24V Li-ion battery has been given to it. Generally, the average person in an efficiently designed e-bike provided more than enough overhead 500W. BLDC motors are the most popular among all the configurations or widely used in bicycles. An electric motor generates torque that is been soft that connected to a chainring. BLDC MOTOR Features are selected high-quality raw material good gloss simple and generosity, the motor is made of metal gear resisting so with a long serving life, this motor is capable of rotation in either the clockwise direction. There are many advantages of BLDC motors such as better speed versus torque characteristics, high dynamic response, long operating life, noiseless operation, and 80% High efficiency.



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S.N.	PARAMETERS	DETAILS
1.	Power Rating	500w
2.	Ampere	26.7A
3.	Rated Voltage	24V DC
4.	Weight	5 kg
5.	RPM	500 RPM
6.	Torque	12 N-m



Fig.2 BLDC Motor

#### ii. Solar Panel

A solar panel is an electronic device that is used to absorb the sun's energy and convert the sun's light energy into electricity. A solar panel can be used to generate electricity through the photovoltaic set of 24W, the solar panel is used in this project which converts solar energy into electrical energy. solar panel fitted on the career of the bicycle so that the solar panel is safe or absorption energy easily. This project is an SPV controller used for overcharge protection of batteries from the solar panel. Well, solar panel efficiency is generally 15 to 20%. Solar panel charge time depends on the weather condition.



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S.N.	Parameters	Details
1.	Maximum power(Pmax)	2W
2.	Maximum power current	1.5 A
3.	Open circuit Voltage	21.4 V
4.	Short circuit current	1.4 A
5.	Maximum voltage (VPM)	17.7 V



#### iii. Battery

Fig.3 Solar Panel

Li-ion battery is one of the most popular or latest types of battery in electronics. Li-ion battery is an advanced technology that uses lithium-ion as a key component of its electrochemistry. Li-ion batteries or small to be able to move through a micro permeable separator between the anode and cathode the typical estimated life of a Li-ion battery is about 400 to 500 charge cycles. Li-ion battery is fully charged in 3 hours the Li-ion battery is the optimum choice for solar assist bicycles, this battery charges the home supply and solar energy. The 24 V battery supplies voltages to the Motor. These projects demand a battery with longer running hours lightweight, High output voltage, and higher energy density. Battery cost is High but some advantages of this battery are safe and the Life cycle is better as compared to other batteries [4].



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PARAMETER	CORRESPONDING FACTOR/VALUE
ТҮРЕ	Li-ion
NUMBER	Two Batteries
VOLTAGE	12 V
EXPECTED CYCLE LIFE	2000 times
MAX. CONTINUOUS DISCHARGE CURRENT	15A
MAX CHARGE VOLTAGE	14.6 V
CONNECTION	in series
AMP-HOUR RATING	20 Ah
DISCHARGE CUTOFF VOLTAGE	10 V



**Fig.4 Battery** 

#### iv. Motor Controller

The Motor Controller for controlling motor regulation is a very important controller. it is an important element of our project. we used a Motor controller in the bicycle for controlling the amount of power supplied to the wheel of the Bicycle. A motor controller is fitted between the Battery and Motor to control the amount of power supplied to the Motor and also in other accessories which are used if required [3]. The motor controller performs the function of conversion of the DC voltage from the battery to an alternating voltage with variable amplitude and frequency that drive the motor at different speeds. It basically consists of MOSFET transistors and a small microprocessor that vary from detecting any malfunctions with the motor hall sensors, and the throttle, to protect functions against excessive current and under-voltage [3].



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**Fig.5 Motor Controller** 

#### v. Battery Charger

In this bicycle, there are two types of battery chargers required which are solar battery chargers and another one is from the home supply. Solar battery chargers are an inexpensive, environmentally friendly, and convenient way to make sure your batteries are always fully charged and ready to go all the time. The problem with charging a battery from a solar panel is the SUN. It does not shine all the time and clouds get in the way. Our eyes adjust to the variations in the strength of the sun but a solar panel behaves differently. Many of the solar panels drop to below the 13.6v needed to charge a 12v battery and as soon as this occurs, the charging current drops to ZERO. This means they become useless as soon as the brightness of the sun goes away [4].

#### vi. Throttle

It is required to vary the speed depending on the road conditions & traffic. Thus throttle is necessary. The throttle allows us to drive the motor from low speed to full speed. The throttle is fitted on the right side of the handlebar and is connected to the controller. It consists of MOSFET transistors and a small microprocessor. This throttle is technically referred to as a Hall Effect type. The throttle has three wires containing black, red, and green [4]. The supply voltage is via red and black wires and is usually around 4 volts. Green wire voltage increases as the throttle is turned.



**Fig.6 Throttle** 



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#### vii. Switch

A switch is used just below the throttle for the safety purposes of the vehicle. It gives the option of starting and stopping the vehicle. it uses a key for the operation of on and off. so that its owner keeps it use personalized.



**Fig.7 Start Switch** 

#### **V. CONCLUSION**

It is very much suitable for young, aged, and handicapped people and caters to society. It's cleaner and you never have to buy gas or change the oil. Thus leading to a pollution-free environment. This bicycle Is cheaper, simpler in construction & can be widely used for shortdistance travel. The most important feature of this bicycle is that it does not consume valuable fossil fuels thereby saving crores of foreign currencies. It is eco-friendly & pollution free, as it does not have any emission. It is suitable for both city and country roads, that are made of cement, asphalt, or mud. This bicycle is cheaper, simpler in construction & can be widely used for short-distance traveling especially by school children, college students, office goers, villagers, postmen, etc. It is very much suitable for young, aged, and handicapped people and caters to the need of the economically poor class of society. It can be operated throughout the year free of cost. The most important feature of this bicycle is that it does not consume valuable fossil fuels thereby saving crores of foreign currencies. It is eco-friendly & pollution free, as it does not consume valuable fossil fuels thereby saving crores of foreign currencies. It is eco-friendly & pollution free, as it does not consume valuable fossil fuels thereby saving crores of foreign currencies. It is eco-friendly & pollution free, as it does not have any emissions. Moreover, it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather. The operating cost per kilometer is minimal, around Rs.0.70/km. It can be driven by manual pedaling in case of any problem with the solar system. It has fewer components and can be easily mounted or dismounted, thus needing less maintenance. From a future energy system perspective, it is important to identify new ways of transporting and generating of electricity [4].

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