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Solar EV Charger for E-Bikes (Cycle)

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ABSTRACT.
This paper proposes the development of E-Bike (Cycle) Battery Charging System. The E-bike (Cycle) Prototype is a single speed single seater Cycle Which runs on DC Geared Motor and is equipped with a Battery in Series. This Prototype is used as safe and efficient and is used to conserve natural resources. Therefore E-Bike is used where we can chargethebattery with the help of solar energy (Polycrystalline Solar Plates). Out of 12 monthsin a year at least 8 months is sunny weather and which will be more beneficial for our topic. We have studied this for Battery charging Controller with MPPT (Maximum Power Point Tracking) to charge the batteries of E-bike (Cycle). In this study, the Battery Charging Controller can be called as Current Controller, MPPT, Polycrystalline Solar panel, Geared DC Motor and Batteries are used for Battery Charging System. As per our findings we have noticed that MPPT is more efficient with respect to PWM (Pulse Width Modulation) type at optimising the Battery Charging System. MPPT will increase performance by 10-15% as compared to other modules. We will increase the efficiency of E-Bike (Cycle) by the use of Solar EV Charger.
Keywords: Polycrystalline Solar Panel, MPPT, Current Controller, Battery, Geared DC Motor.

I. INTRODUCTION.

Electrical Vehicles (EVs) are the cleanest and safest way of mode of transportation. The idea of using solar energy to recharge electric vehicles is one that is developing and has gained traction in recent years. In India there are many Solar Charging Stations but comparatively Solar Charger are not in the scope till date. For EV vehicles we have proposed this project where Solar EV charger for E-Bikes (Cycle) is made. E-Bikes (Cycle) can be charged by domestic electricity as well but most of the electricity generated is by the use of fossil fuels, so for conserving the natural resources there is an alternative. As an alternative we have used Polycrystalline Solar Panel which make use of solar energy. For efficiency with solar panel we have made use of MPPT (Maximum Power Point Tracking), this makes system more efficient and helps in obtaining maximum output. This system requires no maintenance and is easy to install. This project helps in optimising Battery Charging System (BCS). Solar Panel using Solar Energy is the most affordable way to generate electricity which can be used remotely and that is why we have made the system feasible and is attached to the E-Bike (Cycle) systematically. This method is used for increasing the efficiency by at least 10%. [1]

1 Basic Approach for Solar EV Charger for E-Bike (Cycle).

-To design and develop Solar EV charger which is very user friendly.
-To make a design which will be user efficient.
-To make use of most appropriate module which is more effective.
-To make this model more refine in terms of energy efficiency.

2 Modules used.

1) Block Diagram
2) 100 w 12 v solar panel
3) MPPT solar charger controller (12v 8amp 100 Wp)
4) Current Controller 12v 10amp 100w
5) 25Ah to 28Ah 12V Lead Acid Battery
6) 12V 250W Geared DC motor

Block Diagram

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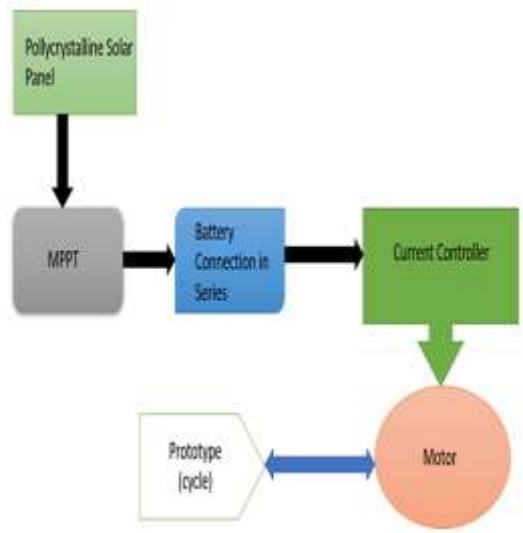

Polycrystalline Solar Panel.

They are made of individual Polycrystalline cell. In a Power Case Study it was found that 6.65% and 5.38% efficiency was daily average of photovoltaic cell for monocrystalline and polycrystalline respectively[]. Since Polycrystalline is less Efficient as compared to Monocrystalline Solar panel, We prefer Polycrystalline just because to make E-bike more economical. [2]

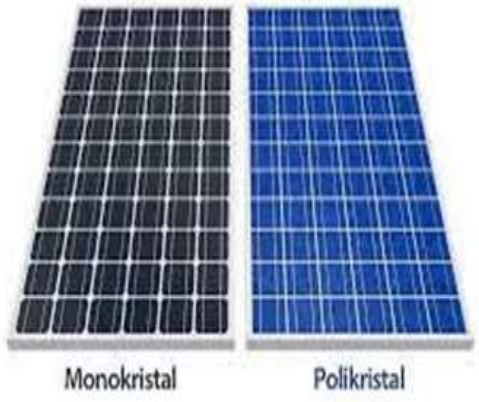

Fig 1 : Polycrystalline Solar Panel.

(https://www.aydinlatma.org/en/what-is-the-difference-between-monocrystalline-and-polycrystalline-solar- panels.html)
Rating.
Open Circuit Voltage (Voc) 21.90 V
Short Circuit Current (Isc) 6.12 A
Nominal Maximum Power (Pm) 100 W/12 V
Voltage at Maximum Power (Vmp) 17.96 V Current at Maximum Power (Imp) 5.57 A
Maximum System Voltage 1000 V

MPPT.

This makes allowances for a solar cell's fluctuating Voltage Current property. The MPPT makes the solar ce **l** believe the load is changing even when you are unable to adjust the load, tricking the panels into producing a different voltage and current that allows more power to go into the battery or batteries. MPPT is required to monitor current and voltage from solar panel. MPPT tracks Changing operating point when the power is at its maximum and this will increase efficiency of Solar Cell. As MPPT is capable of such things that is why we have used MPPT over PWM also MPPT is Affordable. [3]

Fig 2: MPPT

(https://5.imimg.com/data5/DU/VL/CO/SELLER-4156670/mppt-solar-charge-controller-12v-8a-100wp-- 500x500.png)
Rating.
Rated Power 100 Wp Rated Voltage 12 V

Motor Current Controller.

It is component where all Electrical Parts of E-Bike (Cycle) are connected together. Various sensors are connected together in Current Controller, as well as Motor, Battery, Display, Lights, Brake indicators, etc. It is a processing unit which controls the flow of current which leads to managing the overall function of our prototype i.e. E-Bike (Cycle). It also worksas protection such as Low Voltage Protection, Over Voltage Protection, Over Temperature, Over Current and Brake Protection. It controls the Speed of Motor which will make throttle run according to us. Controlling current means for example it takes 30 amp from the battery and give output of 80 amp. [4]

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Fig 3 : Current Controller (https://robu.in/wp-content/uploads/2020/01/8-3.jpg)

Rating,
Rated Voltage 12V Rated Power 250W

Lead Acid Battery.

Lead Acid Battery gives High Performance and is maintenance free battery which helps in constant discharge. Size of batter is also compact so it will be easy to install in small Bicycles as well. We have made use of 9Ah * 3 Batteries in Series which will give output of 28 Ah Approximately. This Battery is connected to Current Controller of E-Bike (Cycle).

Fig 4: Lead Acid Battery

(https://sp-ao.shortpixel.ai/client/q_glossy,ret_img,w_554/https://bijleebike.com/wp-content/uploads/2022/06/lead-acid-removebg-preview.jpg)
Rating.
12 volt 28 Ah in total Charging time: 5-6 Hours

Geared DC Motor.

Geared DC motor is also called as DC gear motor or Gear head Motor. This increases DC motor Torque but decreases the speed of the motor, also controlling the speed of motor is more efficient in DC Gear Motor. It has gear assembly connected with motor. [5]

Fig 5 : Geared DC Motor

(https://5.imimg.com/data5/OW/ND/MY-8716310/250-w-my1016z2-dc-geared-motor-for-ebike-500x500.jpg)
Rating.
12 Volts 250 Watts DC Geared Motor

II. RESULTS AND DISCUSSION.

At first the prototype was able to run at 8 kmph. About 70 minutes was the run time of fully charged Lead Acid Battery. After the prototype was ready along with the Solar Panel Battery Charging System (BCS) It was Observed that the E-Bike (Cycle) was able to attain the speed at 10 kmph on average, also the efficiency of prototype was increased and we were able to run the motor for more than 80 minutes. Some things were rearranged again for the best balance of weight of E-Bike (Cycle). After the desiredresults were obtained, we have made a decision to add Dynamo system as well for the purpose of increasing the Mileage of our Protype i.e. E-Bike (Cycle). Also we intend to decrease the time for charging the battery or we will make backup for the same.

III. CONCLUSION.

The main objective of this project is to increase the efficiency of E-Bike (Cycle). This system is successfu **l**y implemented by the use of MPPT and Polycrystalline Solar Panel. We have made use of this to decrease the use of natural resources as well as alternative to pollution emitting vehicles. This project ensures safe and efficient use

of E-Bike (Cycle). Also this Projects saves Fuel cost and is more friendly with nature.

IV. FUTURE SCOPE.

There are basically some points we have considered to add Like we will increase the battery pack which wi **l** increase the run time of our prototype. Things other than increasing battery pack is that we will increase the capacity of Solar Panel, Motor and Controller to increase the speed of E-Bike (Cycle). Also we will make attempt to Collaborate with some E-Bike manufacturers for higher models and for proper Workshop. We will try to simplify the complex structure of our prototype.

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