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Charging Station for E-Vehicle using Renewable Source

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Abstract: *Globally, there is a growing demand for electric vehicles, but the electricity used to power them is primarily generated from conventional sources, which results in a significant consumption of fossil fuels. This has led to numerous issues, including heightened levels of pollution and global warming, as well as economic problems due to the cost of fossil fuels. To address these concerns, this paper proposes the promotion of renewable energy sources specifically solar-based charging systems for electric bicycles. Electric bicycles, which can be powered through pedalling and electricity, are more cost-effective than other types of electric vehicles, making them a more accessible option for consumers. The paper outlines the development of a solar-based charging station for electric bicycles, incorporating a solar-based controller. The proposed system aims to reduce electricity costs, charging time, and CO2 emissions, while also contributing to the creation of a more sustainable and eco-friendly transportation system..*

Keywords: Solar PV Module, PWM Charge Controller, Battery, E-Bicycle

I. INTRODUCTION

Currently, the energy crisis represents a crucial and intractable dilemma. The principal cause for excessive utilization of conventional resources lies in the unsustainable excavation practices employed, coupled with the population's steady increase, thereby boosting vehicle demand. However, fossil fuels have their limitations, including pollution and economic challenges due to their exorbitant costs. Environmental apprehensions persistently grow, primarily regarding greenhouse gas emissions, which are causing global warming, a significant issue in the current climate. Consequently, people are striving to transition to clean energy sources, and with the added benefit of its non-renewable nature, this has fostered a mounting demand for e-bikes. The transportation sector ranks as a primary contributor to pollution and global warming, as vehicles rely on fossil fuels, specifically gasoline or diesel, which emit harmful gases when burned, further compounding pollution. Given the attendant health benefits, cost-effectiveness, environmental-friendliness, and proximity travel, the demand for e-bikes continues to surge.

However, as is commonly known, the present electricity grid remains predominantly fuelled by fossil fuels, leading to indirect emissions at power plants. To mitigate this issue, we have leveraged the sun's energy as a power source, which generates electricity from solar power, effectively charging e-bikes. Solar energy, a renewable energy source, represents a viable alternative concerning its wide availability and inherent advantages, such as its low cost and environmental-friendliness. The focus of this project is to utilize solar power to power E-vehicles.

II. METHODOLOGY

The diagram presented illustrates the block diagram of the project titled "Charging Station For E-Vehicle Using Renewable Source".

The block diagram is comprised of several components, including a solar module, a solar charge controller, a battery, an AC to DC charger, a controller, and a motor. The initial component is comprised of three polycrystalline PV modules, each with a 12V, 50W rating, series connected, to maximize output. The LifePO4 battery with a rating of 36V, 10AH is utilized and an AC to DC charger is employed for backup purposes.

The subsequent component, the controller, is responsible for managing the motor and energy-saving device. The primary function of the electric bike controller is to receive inputs from all electrical components, such as the throttle,

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speed, sensor, battery, and motor, and then determine the appropriate signals to send in return to each component, such as motor, battery, or display. The controller is situated between the battery and the motor, receiving power from the former and delivering it to the latter. The BLDC motor is rated at 36V, 250W.

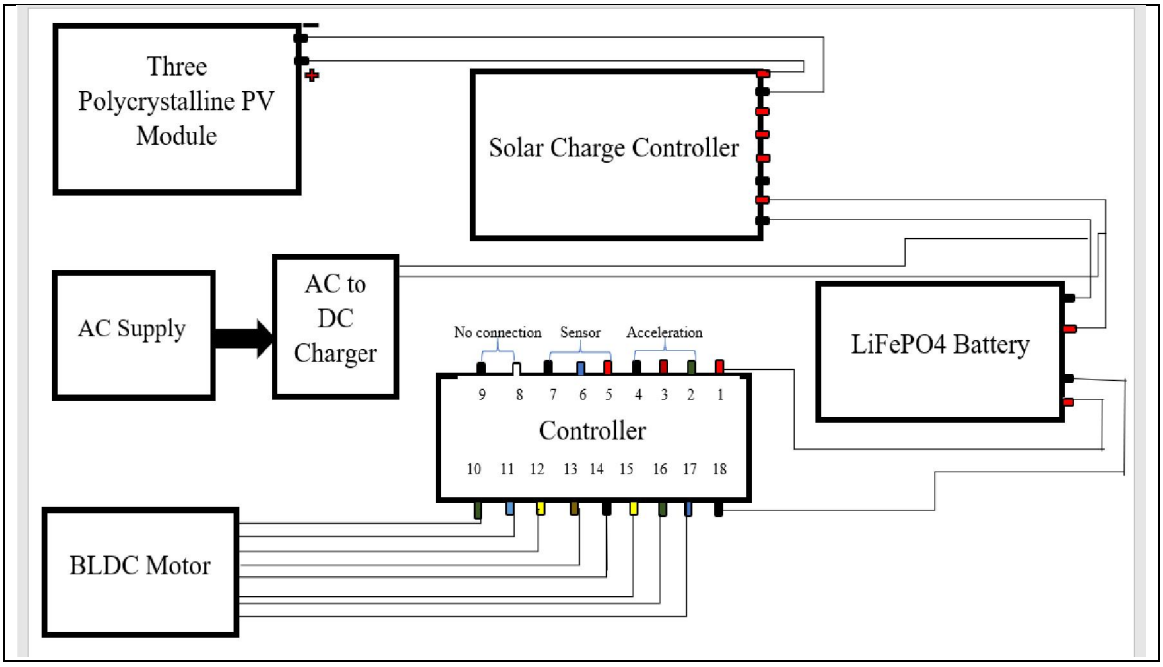

Fig.1

2.1 Solar PV Module

Solar PV modules are a key component in solar energy systems, and are used to capture sunlight and convert it into usable electrical energy. Among these, Monocrystalline and Polycrystalline solar PV panels are the most widely used. Each type has its own set of benefits and drawbacks. Consequently, depending on the specifics of a given project, a Polycrystalline solar module may be deemed the most appropriate choice.

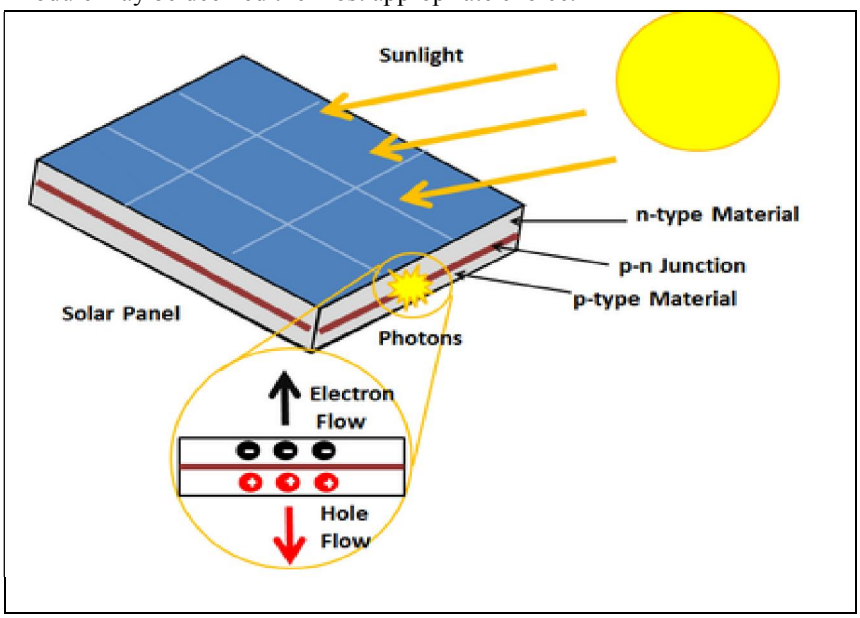

Fig.2

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This is a 50W, 12V Polycrystalline Solar PV module, which is manufactured by interconnecting individual Photovoltaic (PV) cells. These cells are composed of semiconductor materials such as crystalline silicon and are capable of converting light energy from the sun into electrical energy. Solar PV modules typically range in power output from 50W to 350W, and are employed to enhance the overall power output of PV cells through interconnection.

2.2 PWM Charge Controller

Charging of battery can be done in effective way with the help of Pulse width modulation. PWM helps for constant voltage battery charging.

Features of PWM-

Protects the battery (12V) from overcharging.

Reduces system maintenance and increases battery lifetime.

Auto charged indication.

Reliability is high.

10amp to 40amp of charging current.

Monitors the reverse current flow.

The Fig.3 shows the internal structure of PWM solar charge controller

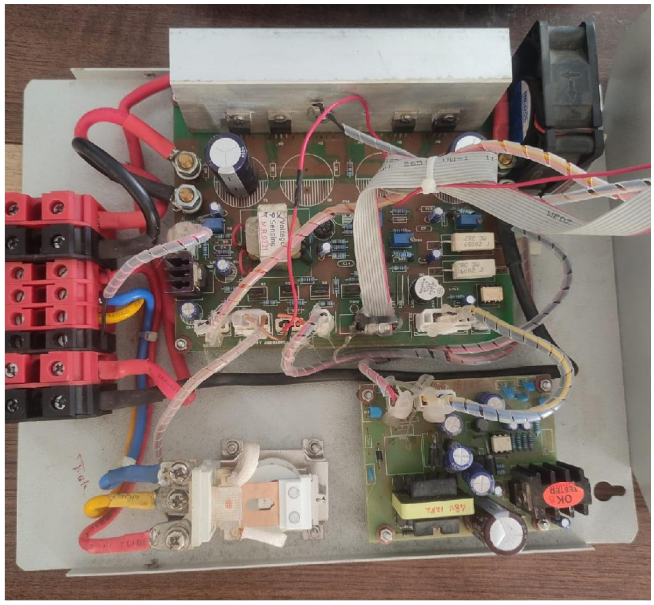

Fig. 3. PWM

2.3 Lithium Iron Phosphate Battery

Lithium iron phosphate represents a type of battery that can be recharged. Each individual cell of the LFP battery operates at a nominal voltage of 3.2V. By connecting four LFP battery cells in a series arrangement, a 12-volt battery is formed, which can serve as a superior substitute for various 12-volt lead-acid batteries.12V LFP batteries have four cells connecting in series, thus for a 36V LFP battery, 12 cell are connected in series.

Fig. 4. 36V, 10 Ah LFP Battery

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III. RESULT

3.1 Observation

Date	Time	Solar Voltage	S C
10/02/23	1:28 pm	40.1 V	3
10/02/23	2:28 pm	41.4 V	3
10/02/23	2:58 pm	41.4 V	3
11/02/23	9:23 am	41.0 V	1
11/02/23	9:53 am	41.4 V	2
11/02/23	10:23 am	41.9 V	2
11/02/23	10:53 am	41.9 V	2
11/02/23	11:23 am	42.3 V	3

3.2 Experimental Result

Solar Charging Time: 4 hrs
AC Charging Time: 4:30 hrs
Distance covered after full charged: 40-45 km
Experimental Speed: 21.6 kmph
Time required to charge E-bicycle from solar charging is less than time required by AC charging.

IV. PROJECT SETUP

Fig. 5 shows the actual module of the solar based charging station. In this project PWM solar charge controller is a very good mean to charge battery of the E-bicycle from the three polycrystalline solar panels of 50-Watt, 12 Volt each.

Fig. 5

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V. CONCLUSION

It is observed that the demand of E-vehicle is increasing day by day and E-bicycle is becoming more popular among them. E-bicycle can replace the both normal operated bike and a simple bicycle. While driving E-bicycle if we lost electric supply to motor then it can be driven by using pedals as a normal bicycle. As in this project as we are proposing to charge E-bicycle with the energy generated from non-renewable source of energy, it minimizes the dependence on fossil fuels like petrol and diesel. If number of such type of charging station get increased in our country, then itmay decrease demand of electricity from power system network. Ultimately it will reduce carbon emission and help in reducing the environmental pollution.It will lead to provide electricity to each and everyone. If number of such type of charging station got increases Electric vehicle demand will increased which will create various job opportunities and help in strengthen the economy. Apart from charging the E-bicycle with renewable energy-based charging station we can also move towards self-generating E-bicycle, means charging the battery while riding the bicycle by pedal.

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