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Electric Vehicle Operating on Solar Energy

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Abstract: ***In the current automotive market, the demand for electric vehicles has skyrocketed due to factors including rising fuel prices, pollution, and their enhanced efficiency. Yet, we cannot claim that electric vehicles are completely environmentally benign when taking into account about our major energy source, which is thermal energy. The above mentioned problems will be mitigated by electric vehicles if they are powered by a renewable energy source. Our paper is to make a prototype of an electric vehicle which is powered by solar energy. We use a 17V solar panel with a 12V charge controller to charge a 12Vbattery. It also has a provision to charge the battery from AC supply. Our suggested design will guarantee excellent efficiency, no fuel expense, and minimal contribution towards pollution. The circuit is designed in such a way that it can charge the vehicle only when the vehicle is in a standstill condition and the operating speed of the vehicle is low which can be rectified in future.***

Keywords: electric vehicle, charge controller, solar

1. Introduction

As modern society and technology advances, more and more people around the world are becoming concerned about the effects of global warming and irreversible climate change. Worldwide efforts are being made to significantly reduce CO2 emissions as well as other dangerous environmental pollutants. Automobiles, which are almost exclusively powered by internal combustion engines and emit harmful pollutants, are among the most famous producers of these pollutants. According to various reports, cars and trucks are said to be responsible for around 25% of CO2 emissions, with other significant modes of transportation making up the remaining12%.

Pure combustion engines are increasingly being held responsible for global warming due to the huge number of cars on the road today. Electric vehicles are considered to be a potential remedy for this. In India, conventional (thermal, nuclear, and hydro) and renewable sources are used to produce electricity (Wind, Solar, Biomass etc.). Still, the majority of electricity is produced by coal-fired thermal power plants, which accumulate to 75% of overall electricity. Acid rain, smog, ground-level ozone, and particle emissions are all effects of utilizing coal as a source of electricity. Burning coal and petroleum products releases fly ash particles into the atmosphere, adding to the problem of air pollution. Due to the operation of coal mining, both ground water and surface water becomes polluted. The quality of surface water of the mining zones is first being polluted by the emission of unsavory substances like ash, oil, phosphorus, ammonia, urea, and acids.

It is not possible to classify an electric car as eco-friendly if its battery got charged using grid electricity or any other non-renewable energy source. This issue can be resolved by adopting a renewable energy source to power the electric vehicle's battery. Eco-friendly vehicles are presently experiencing global opportunities due to the rapid technological advancement in the fields of electric vehicles and renewable energy.

Many researchers have suggested various ways to charge an electric vehicle with solar energy. Solar energy is regarded as the best renewable energy source available in the country. As an alternative, it can be used to charge the battery. This work proposes a way to use solar energy to power an electric vehicle.

2. Literature Study

Fred Chiou (2015) proposed design of solar charging station. Two solar charging stations with various capacities were designed by him. Electric motorbikes can be charged at one station, and electric bikes at the other. Compared to electric bikes, electric motorcycles have a bigger carrying capacity. The concept is that solar PV module is used in the charging stations to convert solar energy to DC electricity. A charge controller can be used to store this energy in a battery bank. The DC voltage from the battery bank is converted via an inverter to110voltsAC at 60Hz, which is of the same frequency as the power coming from a wall outlet [1].

Zhou Qing (2014) proposed a vehicle solar battery charging. In order to provide electricity for battery charging in an effective manner for along time with mobile electric vehicles, it is necessary to track the maximum output power of the photovoltaic cells. This resolves them is match between the battery charging time and charging state [2].

Yogesh Sunil Wamborikar and Abhay Sinha(2010) developed a solar powered vehicle. All current electric vehicles use motors that are powered by AC power. An inverter set connected to a battery is necessary for the configuration in order to convert DC electricity to AC power. Many losses occur during this conversion; as a result, the net output is relatively low and has a short lifespan. While being less expensive, an AC drive requires substantially more complex circuits and maintenance than a DC drive. Here the system is controlled by electrical means and not by electronic means [3].

Yu Z. H, and Zeng J proposed a DC-DC converter with ultra-high voltage gain for roof-mounted solar cell electric vehicle. They suggested a few changes to the roof-mounted

solar array-based electric vehicle's current electrical network. It is suggested to use a switched Z-source DC-DC converter combined with switched mode –inductor network to change the DC-link's low voltage to a higher one. By switching off the inductor in the front end's switched-inductor network and adding an additional diode and to the output of the conventional Z-source DC-DC converter, the voltage gain is enhanced. The suggested SZSIC achieves better voltage gain when compared to the current DC-DC step-up network [4].

Tejas Sonawane, and Shambhavi Bade, proposed an electric vehicle charging station based on solar energy. Their suggested system involves charging stations with independent, grid-connected solar power, EVSE, and external battery component. They offer intelligent billing, which accepts card payments. The amount of energy utilized to charge a customers's car completely determines the payment or costs. Fully automated charging is proposed here [5].

Hardware

Solar Panel: Using the photovoltaic effect, solar panels produce power. The phenomenon known as the photovoltaic effect occurs when an object produces an electromotive force as a result of absorbing photons. When sunlight or other light strikes a semiconductor's PN junction, the photovoltaic effect takes place. A polycrystalline solar panel of 17V 10A is used to produce power. Several sources of silicon are used to create polycrystalline solar cells. In comparison to monocrystalline solar panels, their price is lower.

RS570 DC Motor: The vehicle is driven by two 1A RS570 DC motors which can produce high torque. One is on the back wheel, while the other is in the steering. The two motors are attached to a drive. The servo's internal gears, convert the output while rotating slowly and with greater torque. This generates a great deal of force for a little period of time.

Battery: The motor is powered by a 12V15.6watt rechargeable lead acid battery.

Drive: The drive is connected to the battery and two motors for control. Drive is an electronic device that captures and regulates the electrical energy sent to the motor. The drive modifies the amount and frequency of energy fed to the motor, which in directly controls the motor's speed and torque.

Gearbox: Two JRR 570 gear boxes are provided for power transmission.

Remote Controller: Vehicle can be controlled by HH670K Bluetooth remote controller

Charge Controller: A solar charge controller controls the voltage and current output from the solar panel and stops the battery from over charging. Succinctly summarized, a solar charge controller control show much energy is transmitted from a solar panel to a battery. The power from the 17V solar panel is controlled by a PWM charge controller of12V.

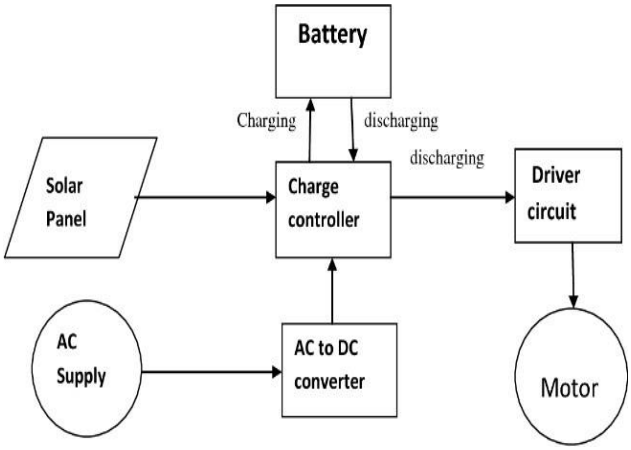

Figure 1: Block diagram of proposed design

In Fig.1 two DC motors are fixed to the front and rear wheels, respectively. While the back wheel motor only needs to run in accordance with the front wheel the front wheel motor's primary responsibility is to drive and steer the vehicle. The Drive which includes the remote sensing unit for vehicle remote control, is coupled to the front wheel motor. This remote sensing device is connected to a switch that starts the car in run mode. To discharge the battery and start the motors, a connection is made from this remote sensing device to the battery. Additionally, another switch is provided to link the charge controlling device to the drive and battery. This switch alternates between the battery and charge controller depending on whether it is at stand still or driving mode. The car is switched to charging mode when it is at rest. When in run mode, the drive is attached to the battery and powers the vehicle while the charging controller charges the battery. Also it has an additional port to charge the battery from an AC supply. The AC supply is converted to DC and stored in the battery. Photograph of our proposed model is shown in Fig.2.

Figure 2: Solar Panel assembly of the Vehicle

3. Future Development

Electric vehicle and renewable energy are field having lots of scope in future. Our proposed system can be considered for future development. As of now simultaneous charging and discharging of our battery is not possible and hope future designs will overcome this constraint. Also installing solar panel on the doors of the car can be considered for

further development.

This system was proposed by considering many advantages of using an electric vehicle which is powered by a renewable energy source. This system offers a quiet and eco- friendly operation. Since it's a solar powered car, it is free from fuel cost and will not contribute towards atmospheric pollution. It needs low maintenance compared to other conventional vehicle. Also it is provided with a port to charge the battery from an AC source. High initial cost of the vehicle can be compensated from fuel free operation.

The proposed system has limitations such as vehicle offers limited speed range and can be powered only when vehicle is in standstill condition. Moreover the availability of sun light is essential factor for running of the vehicle. India being a neighbor to the equator, is lucky enough to get equal amount of day and night. But there are countries which has short day time, Solar powered vehicle is not practically possible in those regions.

4. Conclusion

In this work, we have developed an electric vehicle operating on solar energy using a 17V solar panel to charge a 12V battery. This will, to some extent, provide solution to existing pollution issues. This prototype's limitations can be rectified in the future, making it a fully ecologically responsible vehicle. By improving this design to a socially economically and environmentally viable one will make the world a better place to leave.

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