Solar Powered Electric Vehicle Charging Station

Prutha G[1], Prajwal L[2], Chidananda Swami[3], Chandana N[4], Thejaswini N[5]
[1]*Assistant Professor, Prutha G, VTU, Rajarajeswari College of Engineering #14, Ramohalli Cross, Mysore Road Kumbalagudu, Bengaluru-560074, India*
[2,3,4,5] *VTU, Rajarajeswari College of Engineering #14, Ramohalli Cross, Mysore Road Kumbalagudu, Bengaluru-560074, India*

***Abstract*—The use of electric vehicles (EVs) as a reliable substitute for gas-powered automobiles is growing in popularity. Batteries are necessary for these vehicles to function. Innovative charging infrastructure has been developed as a result of the growing need for sustainable energy solutions and the increasing popularity of electric vehicles. The goal of this project is to be the first to design and build a cutting-edge solar-powered electric vehicle charging station. The station's main goal is to use solar energy to charge electric vehicles in an economical and sustainable manner. Among the most important aspects of this project are the integration of solar panels, energy storage systems, charging infrastructure design, and smart grid connectivity.**

The system incorporates smart grid integration for effective energy distribution and energy storage options like batteries, guaranteeing power availability even in the absence of sunlight. Because of its emphasis on cost-effectiveness, scalability, and ease of implementation, the design can be employed in both urban and rural settings. This creative strategy supports the use of renewable energy in transportation and offers EV consumers a sustainable energy option, supporting international efforts to tackle climate change. To maximize performance and improve user experience, the station is outfitted with features including real-time monitoring systems, user-friendly interfaces, and quick charging capabilities. This project helps to realize a greener, more sustainable transportation future by integrating solar energy with EV charging infrastructure.

***Index Terms*—Electric Vehicles (EVs), Batteries, Solar powered.**

1.INTRODUCTION

The supply of fossil fuels, including coal, natural gas, and oil, is limited, according to numerous research. Our modern way of life is heavily reliant on the rapid consumption of energy produced primarily by fossil fuels. With the world's population growing and the economies of many emerging and developed nations expanding, there is a growing demand for energy. In the near future, the energy problem is foreseeable. The effects of using fossil fuels on climate change have also been found by researchers.

These fossil fuels are consumed in the engine of fuel-powered cars, producing toxic substances that pollute the environment and endanger all living things. A lot of attention is being paid to renewable energy in an effort to stop these negative effects. Alternative energy, or renewable energy, should be actively investigated sooner rather than later as a substitute for fossil fuels. One long-term answer to environmental degradation is renewable energy, such solar electricity.

The transportation sector uses a significant amount of these non-renewable fuels. Many adjustments must be made to the existing transportation system, and creative new initiatives are being developed to modernize it. Vehicle technology will need to be upgraded concurrently with the transition to renewable energy. One real-world example of sustainability is the construction of solar charging stations for electric bikes and motorcycles. Solar photovoltaic (PV) modules are used in the solar charging stations' concept to transform solar energy into direct current power. A battery bank can be used to store the DC energy.

2.METHODOLOGY

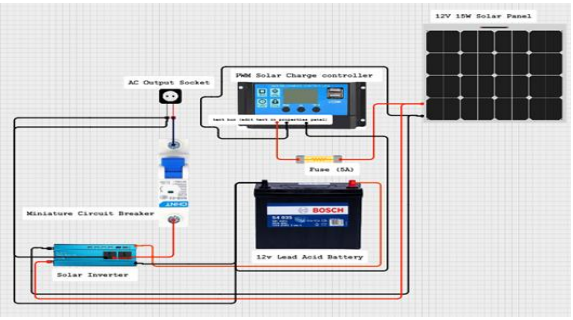
Designing and deploying an autonomous solar power system that can provide clean energy for charging electric vehicles is the first step in the methodology. Installed and angled to optimize sunshine capture throughout the day is a 12V, 15W solar panel. A PWM solar charge controller, which is connected to

the panel, effectively controls the power flow to guarantee ideal battery charging while guarding against reverse polarity, overcharging, and overdischarging.

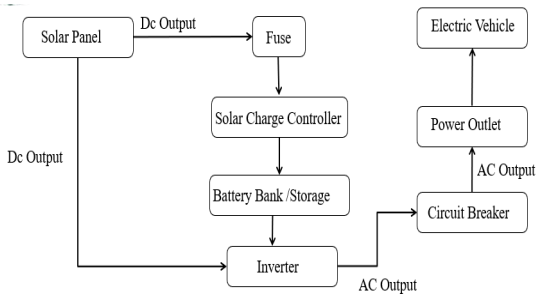
Due to its high energy density and recharge efficiency, a 12V lithium-polymer battery is used to store the energy collected by the solar panel. Based on real-time solar input, the PWM charge controller maintains the battery's charge level through direct interface. The battery ensures continuous EV charging operation by providing the remainder of the system with power even in overcast or dark conditions. Supply variations that could harm the inverter or connected load are avoided via the system's voltage regulation.

In order to deliver AC output, the system uses a small solar inverter that transforms the battery's 12V DC into 230V AC, which is compatible with standard AC appliances and EV chargers. The inverter is attached downstream of the battery unit and charge controller. To guard against electrical problems, overloads, and short circuits, safety features including a 5A fuse and a micro circuit breaker (MCB) are incorporated into the circuit to safeguard the inverter and the AC output socket.Electric cars or low-wattage AC devices can be directly connected thanks to the fixed 3-pin connector that makes the AC output available. To guarantee clear layout visibility, safe component positioning, and well-organized wire paths, the entire setup is put together on a hardwood test board. Scalability is made possible by the system's modular design, which allows for the installation of more panels or batteries in response to changing power needs. Independent of grid infrastructure, our approach guarantees eco-friendly EV charging capability, safe operation, and effective energy use.

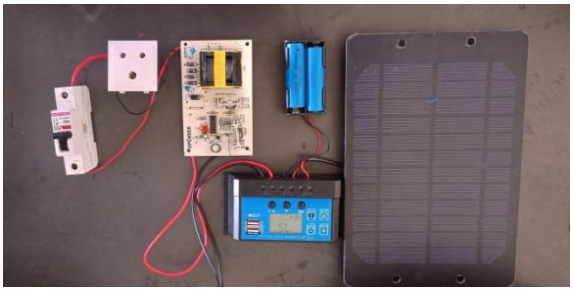
CIRCUIT DIAGRAM



BLOCK DIAGRAM



RESULT



Outcome of a Project

3.RESULTS AND DISCUSSION

3.1Results

vThe project's end product is a fully operational solar-powered EV charging station that can provide dependable, clean energy for EV charging. Through the use of a PWM charge controller, the system effectively captures solar energy from a 12V, 15W solar panel and stores it in a 12V Lithium-Polymer battery. The method effectively charges the battery during daylight hours, and a solar converter subsequently transforms the stored energy into 230V AC output. For charging, the user can connect electric cars or other AC-compatible equipment to the AC output plug. By stopping overcurrent or malfunctioning circumstances, protective devices such as fuses and micro circuit breakers (MCBs) guarantee operational safety. It is perfect for distant or power-poor areas because the complete setup runs without relying on grid electricity. In order to facilitate continuous EV charging, the system maintains a steady output during the day and guarantees battery backup support in low light. All things considered, the project shows a viable, affordable, and expandable solution that fits in with

the worldwide trend toward energy efficiency and electric vehicles.isolated or areas without electricity.

Discussion

This project's solar-powered electric vehicle (EV) charging system efficiently integrates safe energy distribution, intelligent power management, and renewable energy generation to produce a dependable and environmentally responsible charging infrastructure. Even when there is no sunlight, the system's 12V, 15W solar panel and lead-acid battery guarantee constant power supply. By adding a PWM charge controller, the battery may be charged safely and regulated, increasing its longevity and preserving system stability. By lowering reliance on fossil fuels and the conventional electrical grid—which is frequently constrained or costly in rural or isolated areas—this arrangement encourages sustainable habits.

4. CONCLUSION

As a result of this initiative, solar EV charging stations will be widely used, showcasing the possibility of integrating renewable energy sources into mobility. Its modular architecture makes upgrades simple, whether they involve MPPT controllers, Internet of Things energy monitoring, or fast-changing technology compatibility. The system can be used in a variety of settings, including houses, public parking lots, and school campuses. Such solutions are crucial to promoting clean mobility as climate change awareness and the shift to electric vehicles grow. In conclusion, this project not only offers an affordable and useful EV charging solution, but it also demonstrates how important sustainable technologies are to creating a more resilient and environmentally friendly future.

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