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HYBRID CHARGING STATION

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Abstract - In an attempt to decarbonize the transportation sector, among many countries, is option for emobility as an optimal solution, to create a greener, cleaner, and more affordable future for everyone. However, it is missing a crucial prerequisite, which is a strong EV charging infrastructure. The various EVCS types, technologies, techniques, and equipment. It also includes the design of a charging station for small EVs for on campus use, with a solar energy system input. Next, a mechanical 3D design for the final product. As well as a proof-of- concept implementation. Lastly, some conclusions, limitations, and recommendations for further research. Creating a sustainable future through e-mobility is indeed a crucial step in combatting climate change. However, the success of this transition heavily relies on the development of a robust EV charging infrastructure. This infrastructure encompasses various types, technologies, techniques, and equipment to support the growing fleet of electric vehicles (EVs). To address the need for a charging station on campus, especially for small EVs, integrating solar energy systems can significantly enhance sustainability. Designing such a station involves careful consideration of factors like location, power capacity, and user accessibility. Mechanical 3D design plays a pivotal role in visualizing the final product, ensuring optimal functionality and integration with existing infrastructure. Proof-of-concept implementation is essential to validate the feasibility and effectiveness of the proposed charging station. This involves testing the charging process, efficiency of solar energy utilization, and user experience. Through this phase, potential challenges can be identified and addressed, paving the way for broader deployment.

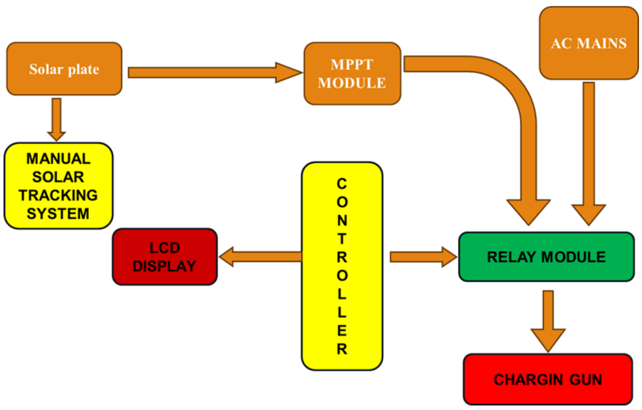
Key Words: Sunlight, Solar Panel, Charging Station, EV charging etc.

1.INTRODUCTION

In an attempt to decarbonize the transportation sector, among many countries, is option for e-mobility as an optimal solution, to create a greener, cleaner, and more affordable future for everyone. However, it is missing a crucial prerequisite, which is a strong EV charging infrastructure. The various EVCS types, technologies, techniques, and equipment. It also includes the design of a charging station for small EVs for on campus use, with a solar energy system input. Next, a mechanical 3D design for the final product. As well as a proof-of-concept implementation. Lastly, some conclusions, limitations, and recommendations for further research. Inverters are widely used in the domestic as well as industrial environments to serve as second line of source in case of power cut form the electricity utility grids. However, due to low capacity of the battery the inverter dies out with the use of heavy load appliances. This project is designed in such a way that it overcomes this limitation by the use of solar energy. Hybrid Inverter with Solar Battery Charging System consists of an inverter powered by a 12V Battery. This inverter generates up to 110V AC with the help of driver circuitry and a heavy load transformer. This battery gets charged from two sources, first being the mains power supply itself. If the mains power supply is available, the relay switches to the connection using mains power supply to supply to the load. This power supply also charges the battery for using it as back up the next time there is power outage.

2. SYSTEM DEVELOPMENT

Block Diagram



Block Diagram Of Hybrid Charging Station.

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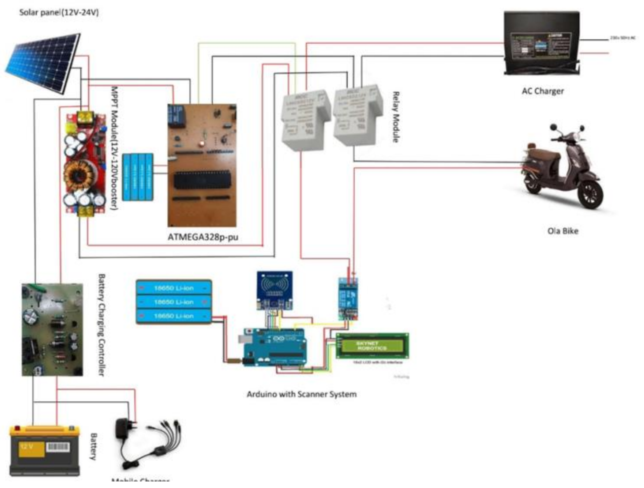
Circuit Diagram



Circuit Diagram Of Hybrid Charging Station

Working

Here in this project, we are going to make Ev charging station. Which powered by solar power. Solar power is arranged in such a way that it will collect maximum power. We make manual arrangement of solar plate adjustment in both axis. Power From solar plate coming at input of MPPT module. Here the power is boosted as per required voltage. The input come over here is feed to controller compare it with rated voltage and switches relay either side as per coding. When solar input is below rated voltage, it will shift automatically towards AC mains solar provision.At the charging end we put battery level indicator to show battery status. Also, in future we work for how much power consumed in charging and its tariff visually.

3.HARDWARE COMPONENTS

1. MPPT Module
2. Relay
3. ATMEGA328p-pu controller
4. Crystal Oscillator
5. Solar plate
6. E-Bike charger
7. Voltage Indicator
8. LCD display
9. Mobile Charger
10. Cables & Connectors
11. Arduino Uno With Scanner System
12. LED's
13. MS square pipe
14. MS round pipe

Mppt 90 Volt

Fig 3.3 MPPT

The major principle of MPPT is to extract the maximum available power from PV module by making them operate at the most efficient voltage (maximum power point). 1500W DC-DC 12-48V to 24-72V Boost Step-Up Converter For Car Laptop Solar Battery is a non-isolated DC power converter module. With high power and stable output, it converts 10-60VDC to 12-97V DC. High-quality components ensure high conversion efficiency, up to 97%. Designed with a smart temperature control fan, which will automatically work when the temperature reaches about 60%, and stop when the temperature drops below 60%. Widely used for high power solar street lamp driving, various LED lighting CV driving, vehicle-mounted and mobile device power supply, DIY adjustable CV CC power supply, solar power charging, and various battery charging.

Relay

Fig. RCC Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.
Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The traditional electromechanical form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts.

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ATMEGA328P-PU Controller

Fig. Atmega328p-Pu Controller

This is original version of ATmega328P-PU IC which also known as ATmega328P-U. So you may receive IC with printed name ATmega328P-U. The ATMEGA328P- U is a low-power CMOS 8-bit micro-controller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328P-PU achieves through puts approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughput's up to ten times faster than conventional CISC micro-controllers. The ATmega328P-PU AVR is supported with a full suite of program and system development tools including C Compilers, Macro Assemblers, Program Debugger/Simulators, In-Circuit Emulators, and Evaluation Kits.

Crystal Oscillator

Fig. Crystal Oscillator

A crystal oscillator is an electronic oscillator circuit that uses a piezoelectric crystal as a frequency-selective element. The oscillator frequency is often used to keep track of time, as in quartz wristwatches, to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is a quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators. However, other piezoelectricity materials including polycrystalline ceramics are used in similar circuits. A crystal oscillator relies on the slight change in shape of a quartz crystal under an electric field, a property known as inverse piezoelectricity. A voltage applied to the electrodes on the crystal causes it to change shape; when the voltage is removed, the crystal generates a small voltage as it elastically returns to its original shape. The quartz oscillates at a stable resonant frequency, behaving like an RLC circuit, but with a much higher Q factor (less energy loss on each cycle of oscillation). Once a quartz crystal is adjusted to a particular frequency (which is affected by the mass of electrodes attached to the crystal, the orientation of the crystal, temperature and other factors), it maintains that frequency with high stability

Solar Plate

Fig. 3.8 Solar Plate

A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.

Solar panels are usually arranged in groups called arrays or systems. A photovoltaic system consists of one or more solar panels, an inverter that converts DC electricity to alternating current (AC) electricity, and sometimes other components such as controllers, meters, and trackers. A photovoltaic system can be used to provide electricity for off-grid applications, such as remote homes or cabins, or to feed electricity into the grid and earn credits or payments from the utility company. This is called a grid-connected photovoltaic system.

E-Bike Charger

Fig. Ev Bike Charger

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A battery charger, recharger, or simply charger, is a device that stores energy in a battery by running an electric current through it. The charging protocol (how much voltage or current for how long, and what to do when charging is complete) depends on the size and type of the battery being charged. Some battery types have high tolerance for overcharging (i.e., continued charging after the battery has been fully charged) and can be recharged by connection to a constant voltage source or a constant current source, depending on battery type. Simple chargers of this type must be manually disconnected at the end of the charge cycle. Other battery types use a timer to cut off when charging should be complete. Other battery types cannot withstand over-charging, becoming damaged (reduced capacity, reduced lifetime), over heating or even exploding. The charger may have temperature or voltage sensing circuits and a microprocessor controller to safely adjust the charging current and voltage, determine the state of charge, and cut off at the end of charge. Chargers may elevate the output voltage proportionally with current to compensate for impedance in the wires.

Voltage Indicator

Fig. Voltage Indicator

Voltage indicators essentially work with the same principles as voltmeters. They are connected in parallel to the desired point and the voltage at the connected point will be the same between the terminals of the voltage indicator device. In Medium-Voltage and High-Voltage systems voltage indicator devices has vital importance. Thus, International standard on Voltage Detecting System (VDS) IEC 612435 clearly explains the structure of a voltage indicator. According to the standard, A VDS is a single-pole and capacitevely coupled device that is used for detecting absence or presence of operating voltage on AC Medium Voltage electrical systems for frequencies between 10.6 Hz to 60 Hz. This devices should also permit that any other electrical tests to be performed.

LCD Display

Fig. LCD Display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden: preset words, digits, and seven-segment displays (as in a digital clock) are all examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight.

Mobile Charger

Fig. Mobile Charger

A mobile battery charger circuit is a device that can automatically recharge a mobile phone’s battery when the power in it gets low. Nowadays mobile phones have become an integral part of everyone’s life and hence require frequent charging of battery owing to longer duration usage. Battery chargers come as simple, trickle, timer-based, intelligent, universal battery charger-analyzers, fast, pulse, inductive, USB based, solar chargers, and motion powered chargers. These battery chargers also vary depending on the applications like a mobile phone charger, battery charger for vehicles, electric vehicle batteries chargers and charge stations. Charging methods are classified into two categories: fast charge method and slow charge method. Fast charge is a system used to recharge a battery in about two hours or less than this, and the slow charge is a system used to recharge a battery throughout the night. Slow charging is advantageous as it does not require any charge detection circuit. Moreover, it is cheap as well. The only drawback of this charging system is that it takes maximum time to recharge a battery.

4. SOFTWARE COMPONENTS

Arduino Uno With Scanner System

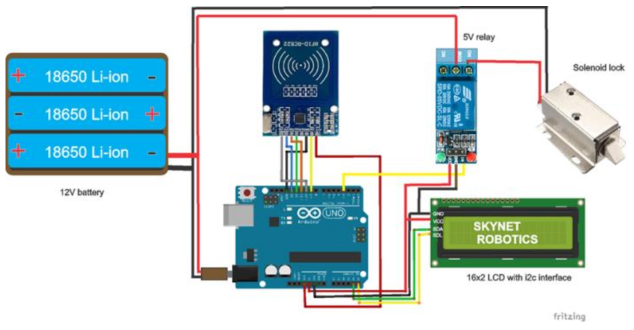

Fig. Arduino Uno With Scanner System

5. PRFORMACE ANALYSIS RESULT

In this project we get 12V from Solar Panel and by using MPPT Module its boosted 12V into 120V required for E-bike. Solar Panel also provide 12V to battery charging circuit which provide supply for mobile charging unit.

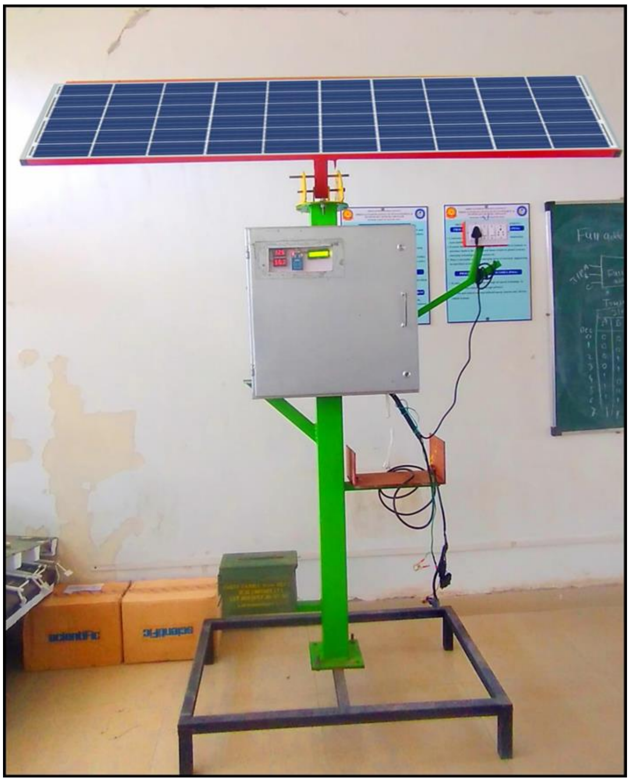

Fig. Project

6. Advantages, Disadvantages And Applications

Advantages

1. Use Of free Energy.
2. Getting power source with no cost.
3. Simple Installation.
4. Low Maintenance service.
5. Easily repairable.
6. Used for different bikes

Disadvantages

1. During rainy season solar panel does not operate at full efficiency.

Applications

1. School/College campus
2. Marriage halls
3. Garden parking
4. Playing ground parking
5. Hospital parking
6. Food court parkin

7. CONCLUSIONS

The main aim behind this capstone project was to design a charging station for small EVs for on-campus use.This report includes on the state-of-the-art review of electric vehicles and EV charging. It also focuses on the system design and theoretical calculations. Namely, for the Solar energy input and the requirements of our chosen EV, the analysis and design of a DC-DC converter with isolation and a DC-AC Inverter. Furthermore, on the control aspect, it includes both a PWM Control and an Access control using Arduino and RFID. It also contains a 3D design of our final product and a small) scale implementation to concretely apply the design and theory.

8.FUTURE SCOPE

It is undeniable that there is still work to be done and further research to be made. The largest challenge or limitation that we faced during this project was the unavailability of some important equipment. In the future, this project can be developed further at a larger scale with the availability of all necessary parts. That being said, this capstone project was an amazing and fun experience overall, it allowed me to put to practice a large array of concepts that I have learnt throughout my degree, as well as to discover some new ones and apply them.

9. ACKNOWLEDGEMENT

The acknowledgment section for a solar charging station project typically includes recognition of those who contributed to the project's success, such as financial supporters, technical advisors, and research participants. This section may also express gratitude to institutions that provided resources or facilities for the project. Research papers often include this section to give credit to individuals, organizations, or agencies. It is an important part of scholarly writing, highlighting the collaborative nature of scientific work.

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