Solar PV Charging Station For Electrical Vehicles With EV Technologies

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***Abstract*- Nowadays the consumption of EV vehicles is getting more due to reducing the pollution in the environment and to reduce their maintenance costs on vehicles (regarding fuel costs). So, the future is going to be with EV's only and to reserve our fossil fuels for future generations.So, basically the people facing the problem with EV's that they are not efficient for to travel long distances, because the mileage of the EV's are less compared to fossil vehicles, and the availability of the charge stations are very less. To overcome this problem we are going to introduce this Solar PV charging station with EV technologies.The main concept of this charge station is to charge the EV's with the help of renewable Solar resource and with a backup facility of Grid connection too. Whenever we have availability of the solar at that time the charge stations batteries will charge through the relays.Whenever the solar energy is not available at that time according to the amount charge in station the relays will switch from solar to Grid connection (G2V), and when the solar is available at that time the relays again switch to solar with the help of the Arduino.Other than this operation we are performing the Vehicle to Grid operation (V2G) too. To decrease the load disturbances in transmission lines or grid. With the help of this charge station,we can increase the use of EV's for long distances too and can preserve fossil fuels for future generations. By using this we can make the world pollution free by the use of EV's all over the world.**

Keywords: Electric Vehicles, Solar Power, Charging station, AC-DC converters,DC-AC Inverter,Voltage Sensors(DC and AC),EV Technologies(G2V and V2G),Arduino Uno.

1. INTRODUCTION

The combination of solar photovoltaic (PV) technology with infrastructure for electric vehicle (EV) charging signals a paradigm change in sustainable energy and mobility. In an era marked by escalating climate concerns and the urgent need for decarbonization, the marriage of solar power and electric mobility emerges as a beacon of innovation and progress[1]. The embarks on an in-depth exploration of this transformative synergy, navigating through the intricate landscape of renewable energy adoption and transportation electrification. By examining the evolution of solar PV charging stations and their role in reshaping the urban fabric, energy consumption patterns, and environmental stewardship, this study endeavors to unravel the multifaceted implications of this emerging technology[2].This explores the concept of solar PV charging stations for electric vehicles, delving into the synergy between renewable energy generation and electric mobility. By leveraging solar energy, these charging stations provide a sustainable and eco-friendly alternative to conventional fuel-based transportation. Additionally, advancements in EV technologies further enhance the efficiency and viability of solar PV charging stations, addressing challenges such as range anxiety and grid integration. Beyond environmental benefits, the adoption of solar PV charging stations carries economic and societal significance[3]. As the cost of solar PV technology continues to decline and electric vehicle adoption rises, these stations offer opportunities for cost savings, job creation, and local economic development. Moreover, by decentralizing energy production and fostering community engagement, make the shift to sustainable energy in the future[4].

Through a comprehensive examination of existing research, case studies, and technological innovations, this paper aims to elucidate the design, implementation, and potential impact of solar PV charging stations for electric vehicles[5]. By providing insights into the benefits, challenges, and opportunities associated with this emerging technology, it seeks to inform stakeholders and policymakers about the transformative potential of solar PV charging stations in shaping the future of transportation and energy[6][7][8].

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2. LITERATURE REVIEW

SOLAR PV CHARGING STATION
The solar PVpanel(Photovoltaic) converts the sunlight into DC electrical energy from that we are connecting to the boost converter which setup the DC Voltage from that we are giving the connection to the EV's with the help of the station batteries which stories the solar energy in the form of DC and here we used the DC-Dc fast charger for charging the Electrical Vehicles[9] .

In this we also added the EV Technologies which means grid to vehicle and vehicle to grid so here we are using the grid to vehicle system as a backup for our charge station, whenever solar energy is not available due to some climatic conditions[10]. At that time we didn't get the sufficient energy to charge the EV's so to overcome this disadvantage we took this G2V system .With the help of AC-DC Converter we convert the AC supply which is coming from the grid to DC supply which we give the charging source for EV's through charge station batteries[11].

However we are placing vehicle to grid technology too for this charge station, from the solar charge station battery or through EV batteries we convert the DC supply to AC supply with the help of the inverter from this we can give the supply to our charge station as well as grid too which helps us in electrical cost benefits and to reduce the voltage drop in the transmission lines[12] .

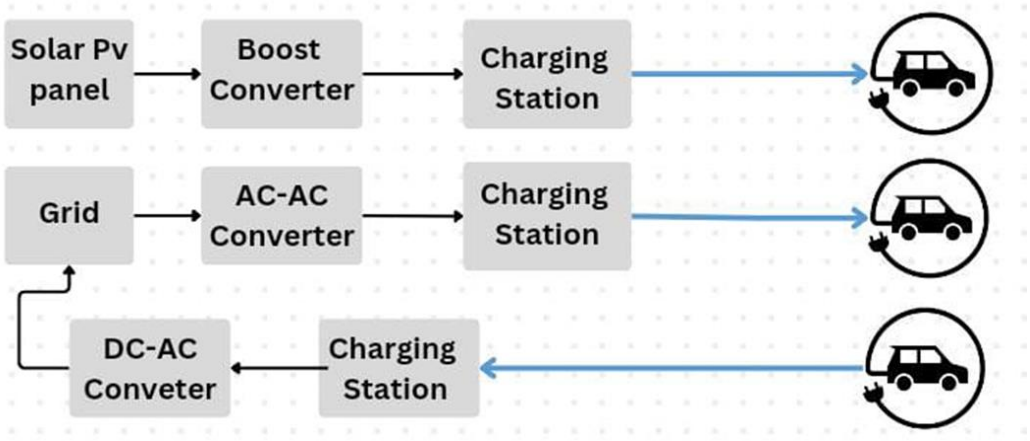
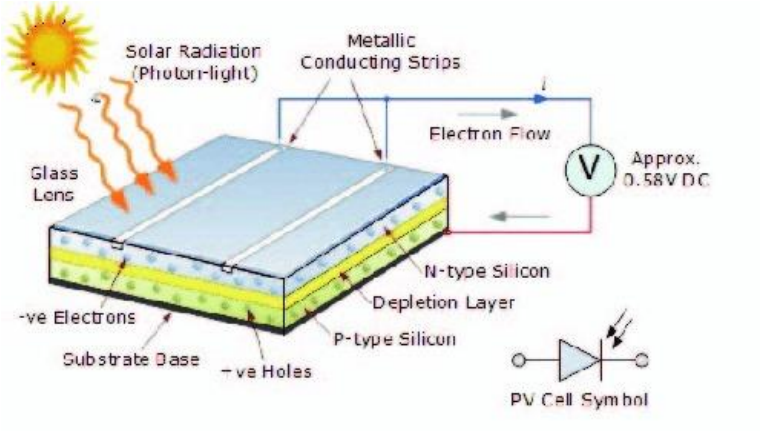


Fig 1: Block Diagram of Solar PV Charge Station with EV technologies.

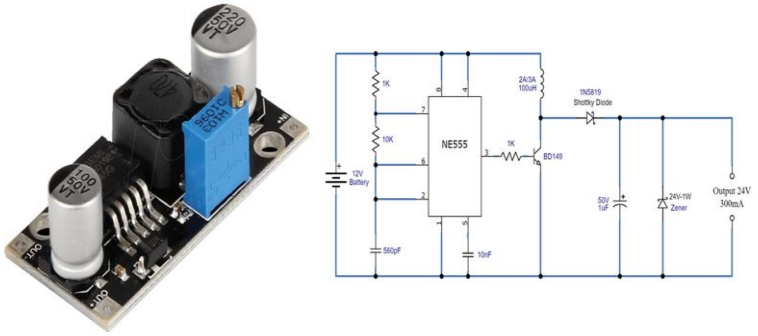
3. SOLAR EV CHARGING STATION DESIGN

Now we are going to explain each part of our block diagram in details
A. Solar PV panel In our solution, the solar PV panel serves the dual purpose of enabling batteries to be charged using solar energy and supplying electricity to the grid during peak demand periods. The ranges that we are going to use is 10V Solar Panel



B. Boost converter (DC-DC)

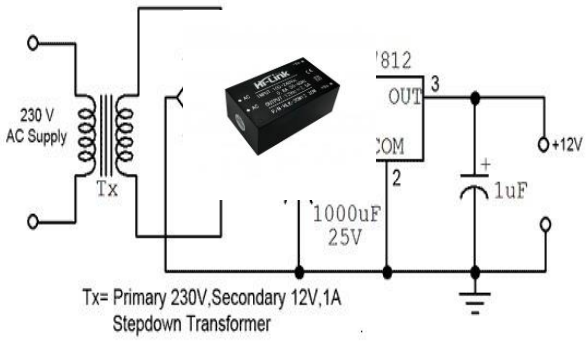
The second-to-last part we will affix to the solar panel is a boost converter. Through the use of a switch, the solar voltage is increased and sent to the battery, allowing energy to be stored in the system batteries.The range that we are going to use is a 12-24V Boost Converter.The potentiometer contained within this boost converter allows us to modify the output voltage of the device.



C. AC-DC Converter

The primary purpose of the converter is to change the grid's AC input into a DC output that can be used to charge a battery. As a result, this is one of the G2V technologies we'll use in the project as a backup for EV charging in times when solar power is scarce due to weather conditions.

The range that we are going to use is a 200-240 v ac = 12 v dc.



D. DC-AC Inverter

As part of the V2G technology, the inverter's job is to convert the DC voltage from the station battery to the grid.This technique is employed when there is a high demand for electricity from the grid and when we have a reliable solar power source. It also helps us manage voltage dips in transmission lines by supplying power from the charging station to the grid. We are also able to deliver this electricity to our charging station.

The ranges for the DC-AC Inverter is a 12v dc to 230v ac

E.Arduino UNO

The main purpose of using the Arduino UNO is to read the voltage Sensors which are connected to Batteries which are coming from the solar and another battery that is connected across the G2V Technology and V2G Technology.

By reading the values from the Voltage sensor that will be displayed using the display module for the testing purpose.

We are going to display the code that we use in the Arduino to sense the voltages .

4. PROTOTYPE IMPLEMENTATION AND RESULTS

Here we prepared a manual working prototype of this project with the help of the above mentioned components assembled in a uniform manner to show that we are giving charge to EV's for that we place a LED strip to show the charge output of the charge station. And for the V2G connection also we placed an inverter to get AC supply which we can give to the grid so for that we placed a LED lamp.

The storage of the charge station batteries will be displayed on the display channel with the help of voltage sensors and Arduino UNO.

The assembled figure of the prototype is shown below with their output:

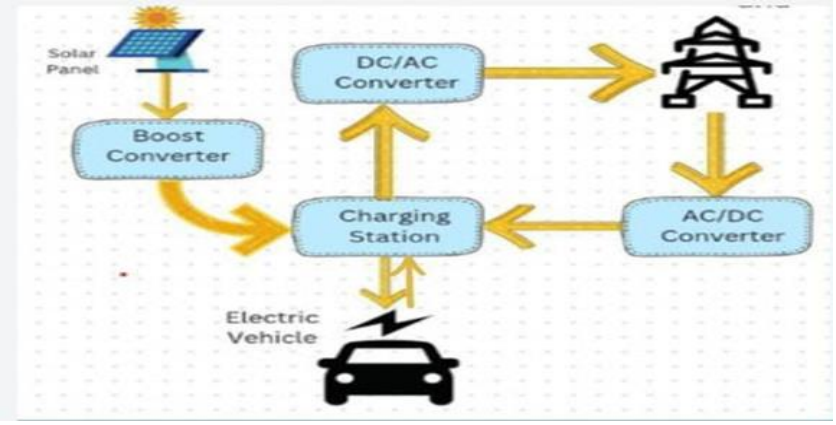


Fig 2. Proposed system simulation

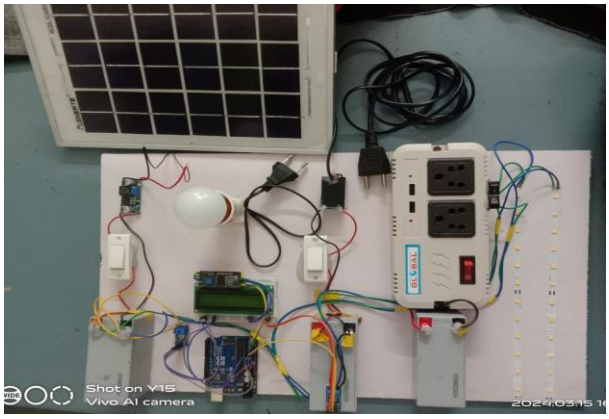


Fig 3: Prototype assembled

Fig 4: Displaying the battery storage output.

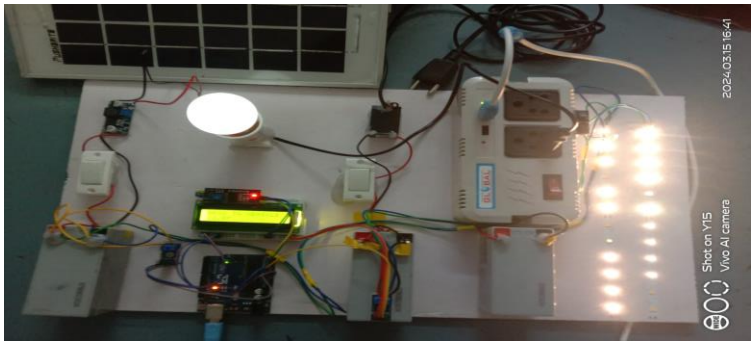


Fig 5 : Displaying the prototype output

5. CONCLUSION

Nowadays the Consumption of EV's is increasing to decrease pollution and global warming. However, there are far fewer charging stations than EVs are being used, thus in order to address this issue, we created this initiative. This charge station will help us in both ways like consuming and distributing purposes for either Grid or charge station with the EV technologies we used like G2V and V2G.

With the help of this charge station we can make EVs more efficient in everyday life and we can make EVs travel long distances by placing these charge stations beside roadways with a respective distance.

Future Scope:

In this project we make the project in manual but further we can make it automatic by using programmable logic circuits(PLC) and with Internet of things(IOT) and relays, to reduce the maintenance costs. And in this project we used Lead acid batteries for the station batteries with that we will get low efficiency and less reliability to overcome that we can place Lithium ion batteries to get more Efficiency and Durability of the station.

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