DEVELOPMENT OF SOLAR BASED ELECTRIC VEHICLE CHARGING STATION

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Abstract: **India's urban population is expected to jump from 480 million in 2022 to 730 million by 2030. As a result, we must boost productivity, enhance quality of life, make cities sustainable, and transition to renewable energy sources in urban areas where demand is still low. Future metropolitan areas will also require an expansion of the transport system to connect various regions. Additionally, this raises the number of available automobiles and further stresses the environment. To combat pollution, we need to take steps to introduce and produce electric automobiles. Unfortunately, many consumers in India are turned off by the lack of EV charging infrastructure.**

In light of the aforementioned difficulties and possibilities, we put forth a suggestion for bridging the supply and demand imbalance, which is frequently perceived as an issue in the energy sectors. The charging of E-buses and Electric vehicles will be supported by a distributed energy resources system for a community area's solar energy system coupled to a battery energy storages system simultaneously, eliminating the dependence on electricity produced by fossil fuels. The framework and schematics for this system were created for a trial run to charge electric automobiles in India utilizing the solar power recharge idea.

Key words: EV, solar power charging, mobile vehicles to car etc.

I. INTRODUCTION

In India, individuals most frequently and affordably travel by road. Recently we are facing more problems due to dependence of crude oils and reliability low efficiency. This has been opened doors for electric vehicles industries for reduction of dependence of fossil fuels. And India has been witnessed for acceptability of electric vehicles.

India sought to increase the sustainability of electrical vehicles and reduce its carbon footprint. According to estimates, the Indian EV industry will grow by almost 44% year between 2020 and 27. In order to combat climate change and minimize pollution, India must stop importing crude oil. This has been discussed and taken into consideration. India is entering the electric vehicle market, and it has established international competitors. Moreover, a new mobile technology has been used to implement the charging station for electric vehicles. India nearly generated electricity 51.6% from thermal power plant, 11.8% from hydropower, 10.2% from wind energy, 6.3% from natural gas, 12.8% from solar and 1.7% from nuclear energy.

India is a country with plenty of sunshine and has ambitious plans to use solar energy to generate electricity. Electricity is used to power the majority of our energy needs, with solar photovoltaics (PV) being applied on a global scale. The flexibility of solar PV as standalone systems with battery backup makes for faraway cities. Renewable energy sources like solar are climate-dependent, and the climate in India varies with geography.

The primary provides so far are EV. The vans operated by store about 200kwh for vehicle charging, and it carries both AC and DC connections [1].

Because now a days it's on trend to generated electricity through solar based. Mainly it is all depended on Electric items such as EV vehicles, solar heater, solar cooker, solar water heater etc. Now it's on demand for the use of solar based items for saving electricity dependence of fossil fuels etc.

By installing solar panels on our home or business, we can be generated for our own clean and renewable energy to power our EV vehicles. They can help reduce the reliance on fossil fuels and reduce our carbon footprints.

There are only a few things that require emphasis while using solar panels to charge EVs. To make sure that our solar panels are receiving the ideal quantity of sunlight, they need constantly take into account where to install the station and their orientation.

The charging station uses an off-grid PV system. The necessary load is set. The battery ban is intended to withstand peak load for off-grid system requirements. The assumption is that the consumption will remain constant at 2.5 kw per hour, or an equivalent load of 60 kwh per day. Figure 4 depicts how the off-grid PV system operates. After meeting the load, the PV array creates electricity during the hours of the sun, and the leftover energy is stored in batteries.

I. Electric vehicle charging station:

Electric vehicles chargers currently in different models: like Level 1, Level 2, Level 3 are the direct current fast charging (DCFC) system. In level1 and level2, EV is connected to AC power, 120v or 240v, and a battery charger in the EV converts the AC power supply to DC needed to charger the battery requirement. The combine of EV and photovoltaic generation was developed. A linear model is used to access its impacts on the energy system. The operation of EV using renewable energy sources is an environmentally friendly technology. A smart charging station was developed for hybrid EV or PHEs based on DC voltage sensing.

II. Levels of charging stations:

EV charging station can be classified into three following categories level:

1. Level 1EV charging station:

Use a 120v AC plugged into a standard wall outlet. Do not require any additional equipment. These are often used at home appliance. And these are the cheapest amongst all the available charging stations. These chargers can be delivered 7-8 miles of i3 ranges per hour charging. 1.4kw power delivery.

2. Level 2 EV charging station:

The commercial chargers uses a 280v AC plugged while the residential chargers use a 240v AC plugged. Can be installed as a part of a solar panel system.

These chargers are can be delivered 10-60 miles of i3 range per hour of charging. It takes 2 hours to fully charge a car battery. 3.8-7.8kw power delivery.

3. Level 3 EV charging station:

Basically it is also known as DC fast charger. It is usually used only in industry and commercial applications. DC charging stations requires high-powered, highly specialized equipment to installed and maintained.. All electric car do not support charging with these level 3 chargers. And it uses ultra-high power of 480v circuit at public charging stations. Up to 80% of range in just 30 mints charging. Up to 50kw power delivery [2].

III. Problem Statement:

- **A LP method for allocating solar charges**

To address the offline allocation problem, we provide a framework for linear programming (LP). By taking into account the solar energy generated, the energy consumption of each car, the availability, and the battery level of each vehicle, the linear programme determines an equitable distribution while optimising the total solar energy delivered to the vehicles.

- **Vehicle planning drawback (VSP) with recharge:**

VSP models and optimizes vehicle-to-trip assignment drawbacks with work unit battery capability constraints. The objectives embrace maximizing the number of tasks that are completed, attenuating the number of vehicles used and total distance traveled, or attenuating the prices through a time charging designing [4].

- **Charging scheduling with limited space:**

Charging periods or begin times are allotted via planning to EVs beneath time constraints and therefore the restricted variety of chargers.

- **Routing and charging station selection:**

Charging routing drawback with energy constraints is to search out the foremost economical route or charging places with the minimum energy consumption, considering traffic conditions and offered resources at the charging stations.

- **Multi-aggregator collaboration:**

The charging of logistic EVs at the central depot should be particularly well scheduled because of its serious burden over the native load.

- **Analysis of Energy Transfer:**

That for the aim of the mentioned dynamic infrastructure, the answer with a separate metameric transmitter coil array was elite. the most advantage is that it's appropriate for dynamic and conjointly static EV charging, which was associated with important demand per Fic project.

IV. Methodology:

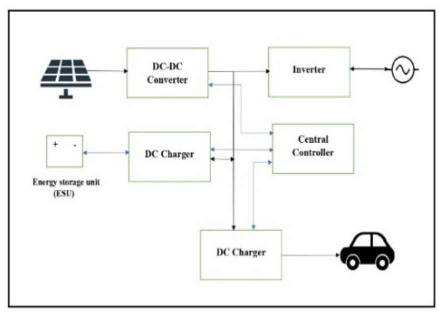


Figure1: Block diagram of the charger

Solar-powered EV chargers like EV arc run only on solar energy. In these cases, the solar-generated power restricts how rapidly EV batteries can be charged. Furthermore, if a charging station has a large number of EVs connected to it and solar electricity is scarce, it must decide how to divide solar energy among the cars. In autos, heterogeneity and various charge levels are both conceivable. A car-sharing company's primary goal is to maximize customer pleasure, therefore a plain best effort billing strategy that fairly distributes energy may not be the best course of action. The algorithm ensures that charging stations provide the most solar energy possible while minimizing waste by maximizing solar utilization. Fairness makes sure that energy is distributed fairly at charging stations so that customers can leave their automobiles with fully charged batteries. The size of the solar panel required to cover a single automobile in a parking lot is first calculated.

A single parking space in the US is approximately 9 feet by 18 feet, or 162 square feet. A typical solar panel with a surface area of 17.57 square feet produces 345 watts. As a consequence, a parking lot with only one car may generate around 3.2 kW of solar energy, while a parking lot with five automobiles can generate about 18 kW. We assess an 18 kW PV system using the dataset, unless otherwise stated. From the Data Port dataset, we pick an 18 kW rooftop solar power system for homes. The true solar energy generated is measured against this. We use the approach described in that uses the solar panel's characteristics and day-ahead weather forecasts to estimate expected solar output.[5]

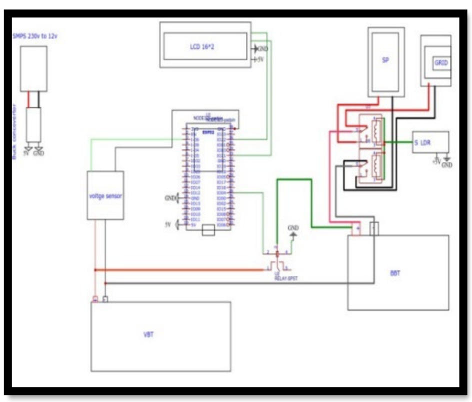


Figure2: Schematic diagram

Below is a quick explanation of the functions and characteristics of the EV charger solution for the 12V/5A specification. The ESP32 MCU is used in this EV charger design to accomplish the battery charging control function. The MCU has a battery charging module that can be used for constant voltage and constant current closed-loop charging control to efficiently charge a battery. MCU ESP32 internal block diagram.

4.1 Battery Charging Process:

Figure 1 depicts visually how the charging voltage and current fluctuate during the charging process. A low charging current, or trickle charge (TC), will be initially set if the battery voltage is too low when the charging cable is attached. Constant voltage and constant current (CV) are applied for charging, which continues until the battery is fully charged after the battery voltage reaches a pre-defined level (Vu). When the voltage hits VOFF, the battery is deemed to have been completely charged. The final voltage (FV) is established when the charging current decreases to 0.[4].

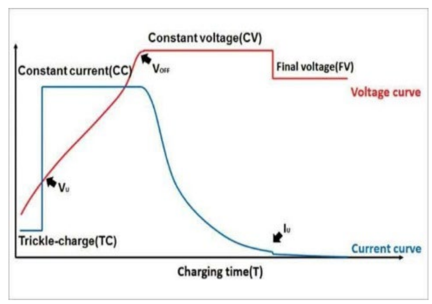
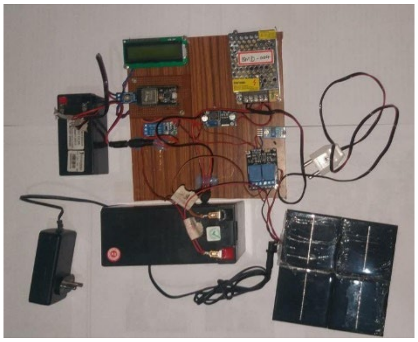


Figure3: Battery Current Curve

Typically, electrical energy is transferred from a power source to a battery during the charging process, generating chemical processes inside the battery that store the energy for eventual use. It is significant to note that different battery types may necessitate different charging techniques and that the intricacies of the charging process might change based on the type of battery being used. To avoid damaging the battery or posing a safety risk, it's also crucial to adhere to the manufacturer's instructions for charging your battery.

V. RESULTS & DISCUSSION:



The project's objectives—PEV Smart Charging and Storage in Supporting Grid Operational Needs—have been effectively created and proven through the present initiative. This section discusses the project's findings, the lessons discovered, and the main roadblocks encountered. The availability of charging infrastructure is a significant and complicated issue, and it would be prohibitively expensive to build a full charging network. Furthermore, given how rapidly the industry is developing, existing beliefs about technology and driver preferences may not be accurate in the future. It is generally acknowledged that the market for charging infrastructure will eventually move to the private sector as the demand for charge stations and the profitability of their operation rise with the sales of electric vehicles.

CONCLUSION

The Electric Vehicle Charging kit with efficient charging capability has been constructed with cost efficiency the electrical vehicle will be the replacement for the present non-renewable energy sources vehicle. The electrical vehicle emits zero emission and run in very less cost and maintains is less compare to IC engines. The electrical vehicle charging station requires more space compare to fuel stations but it doesn't require any storge tank and is less dangerous compare to normal fuel stations. The EV Charging station runs from electricity which can be produce using renewable sources which emits zero emission.

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