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SOLAR BASED WIRELESS EV CHARGING STATION

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Abstract:

A Solar Based wireless Electric Vehicle (EV) Charging Station is an eco-friendly solution to meet the growing demand for electric vehicle charging. This project uses solar energy as a renewable source to generate electricity through solar panels. The generated power is stored in batteries and used to charge electric vehicles when needed. The system reduces dependence on conventional fossil fuels and helps in minimizing environmental pollution. It consists of key components like solar panels, charge controller, battery storage, inverter, and EV charging unit. The use of solar energy makes the system cost-effective and sustainable in the long run. It can be installed in remote areas where grid electricity is not available. The project promotes green energy and supports the concept of clean transportation. It also reduces electricity costs and carbon emissions. Overall, the solar-based EV charging station is a smart and efficient solution for future energy needs and contributes to a cleaner and greener environment.

I INTRODUCTION

1.1 ELECTRIC VEHICLE

An electric vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Modern internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types. Commonly, the term EV is used to refer to an electric car. In the 21st century, EVs have seen a resurgence due to technological developments, and an increased focus on renewable energy and the potential reduction of transportation's impact on climate change and other environmental issues. Project Drawdown describes electric vehicles as one of the 100 best contemporary solutions for addressing climate change. Government incentives to increase adoption were first introduced in the late2000s, including in the United States and the European Union, leading to a growing market for the vehicles in the 2010s. And increasing consumer interest and awareness and structural incentives, such as those being built into the green recovery from the COVID-19 pandemic, is expected to greatly increase the

electric vehicle market. A pre-COVID 2019 analysis, projected that Electric vehicles are expected to increase from 2% of global share in 2016 to 22% in 2030. Much of this market growth is expected in markets like North America and Europe; a 2020 literature review, suggested that growth in use of electric vehicles, especially electric personal vehicles, currently appears economically unlikely in developing economic.

Fig-1 solar based EV wireless station

OBJECTIVES:

The objective of a solar-based EV charging station is to use renewable solar energy to charge electric vehicles in an efficient and eco-friendly way. It helps reduce pollution, dependency on fossil fuels, and electricity costs. The system also promotes sustainable energy usage and supports green transportation.

II. BLOCK DIAGRAM:

3.1 Simple writing diagram of electric vehicle:-

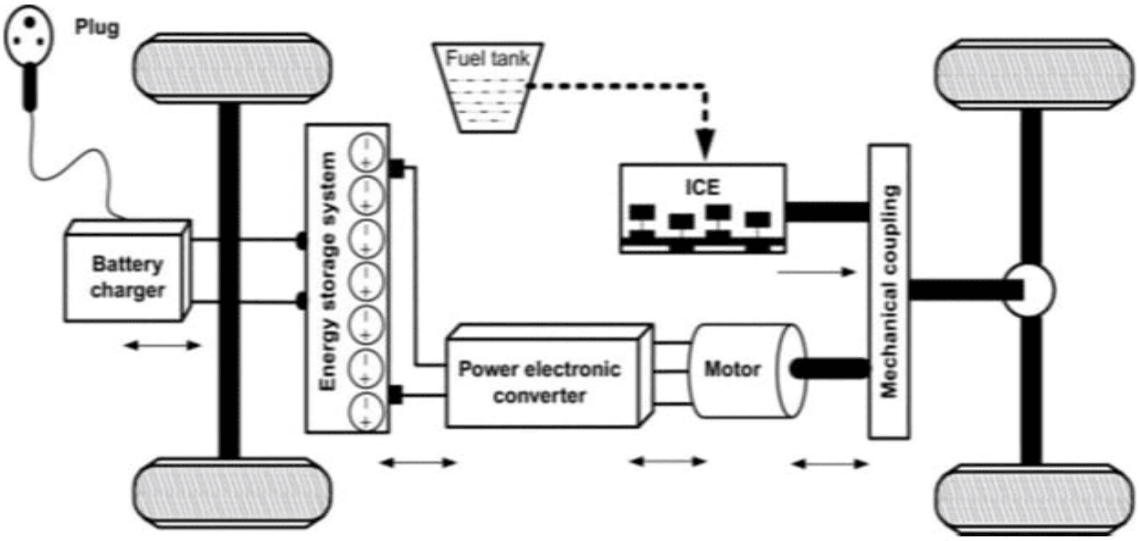

Fig-4.1 Simple writing diagram of electric vehicle:-

3.2 Power source

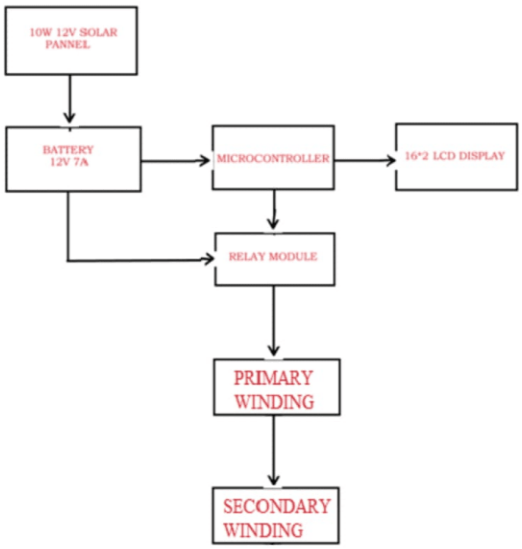

Fig-4.2 Vehicle unit

3.3 Block diagram description :

1.Solar Panel (10W, 12V)
The solar panel converts sunlight into electrical energy. It is the main renewable energy source used in the system.

2.Battery (12V, 7Ah)
The battery stores the energy produced by the solar panel. It supplies power to the system even when sunlight is not available (night or cloudy weather).

3.Microcontroller
The microcontroller acts as the brain of the system. It controls all operations like switching, monitoring battery status, and managing power flow.

4.16×2 LCD Display
This display shows important information such as battery voltage, charging status, and system condition.

5.Relay Module
The relay works as an automatic switch. It is controlled by the microcontroller to turn ON/OFF the power supply to the charging system.

6.Primary Winding
The primary coil generates a magnetic field when current flows through it. This is the first stage of wireless power transfer.

7.Secondary Winding
The secondary coil receives energy from the primary coil through electromagnetic induction. This transferred energy is used to charge the EV battery wirelessly.

IV. LITERATUE SURVEY:

1.Solar energy is widely used as a renewable source for EV charging to reduce pollution and carbon emissions.

2.Many studies show that solar-based EV charging stations decrease dependency on fossil fuels and grid electricity.

3.Researchers have used battery storage systems to store excess solar energy for use during night or low sunlight conditions.

4.Microcontroller-based systems are commonly used for monitoring and controlling charging operations efficiently.

5.Wireless power transfer technology (using inductive coils) is being developed for safe and convenient EV charging.

6.Use of relay modules and sensors helps in automatic switching and protection of the system.

7.LCD displays are used in many designs to show real-time data like voltage, current, and charging status.

8.Some research focuses on improving efficiency using MPPT (Maximum Power Point Tracking) techniques.

9.Hybrid systems combining solar with grid power are also studied for continuous charging availability.

10.Overall, studies conclude that solar EV charging is cost-effective, eco-friendly, and suitable for future smart transportation systems.

v. REQUIREMENT SPECIFICATION:

5.1- 10 Watts Solar Panel:

A solar cell is a key device that converts light energy into electrical energy in photovoltaic energy conversion. Solar cells are generally classified into four generations depending on time and categories of materials that are used for their fabrication. Sharvielectronics Tags, 12V 10 watt solar panel. Like any other solar panel, 10 watt solar panels also collect the energy from the sunlight and then convert it to electrical electricity. However, the only difference is that they can generate around 12v power while the other solar panels can create more power, and they are more efficient.

FEATURES

- Voltage Rating: 12V
- Max Power Rating: 10 watt
- Open Circuit Voltage: 21V
- Short Circuit Current: 0.61A
- Voltage At Maximum Power: 18V
- Dimension In: mm
- Length: 355mm
- Width: 265mm
- Height: 25mm
- Approx. Weight: 1.5kg

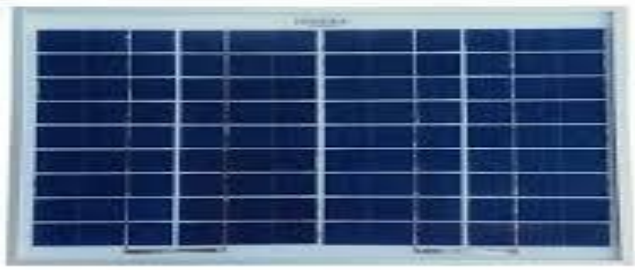

Fig- Solar Panel (10)

- These solar panels can easily operate in rural as well as urban areas.
- Also, due to their rigid composition, the 10 watt solar panel provide high efficiency.
- Plus, they are small, so you can carry them anywhere without inconvenience.
- Moreover, due to their small size, they are quite light weight.
- You can install these solar panels on motorhomes, solar gardens, and boat, too.

A 10W solar panel can easily generate approx. 0.8 amp. However, it is insufficient to charge a 12V battery efficiently. Users can use a 10w solar panel as a backup source for power outages or emergencies.
Also, it can be used for charging a battery or low-power appliances such as fans and lights.

5.2- Solar Charge Controller:

A solar charge controller is an electronic device used in off-grid and hybrid off-grid applications to regulate current and voltage input from PV arrays to batteries and electrical loads (lights, fans, monitors, surveillance cameras, telecom and process control equipment, etc.). the controller safely charges and maintain batteries at high state of charge without overcharging. A good solar charge controller can extend battery life, whereas a poor quality charge controller can cause battery failure and which causes the entire off-grid system to shut down. Solar charge controllers are also commonly called solar charge regulator.

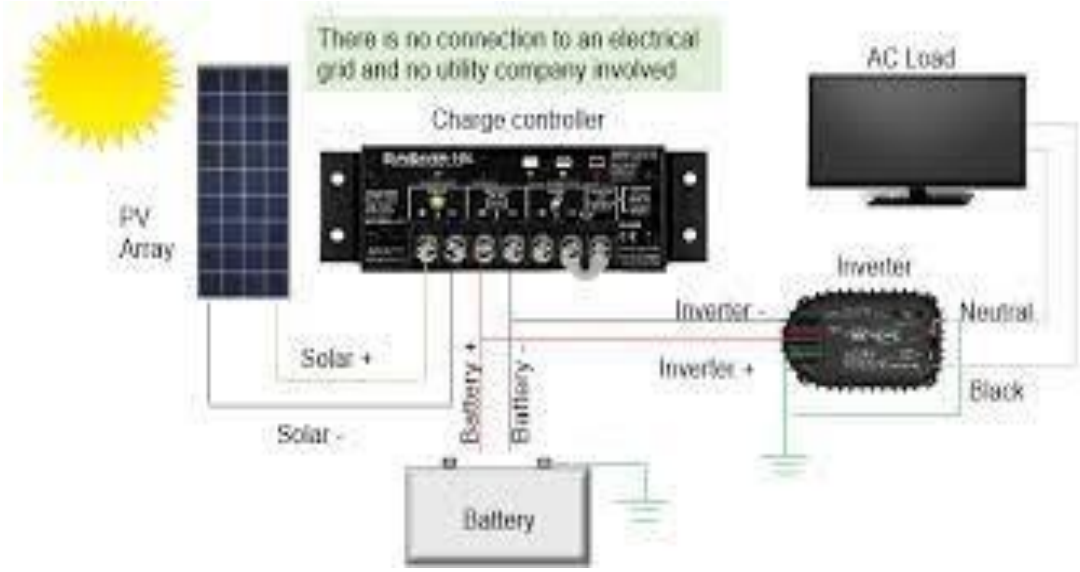

Figure1: Off-grid Diagram with DC Load

Solar charge controllers typically deploy either pulse width modulation (PWM) or maximum power point tracking (MPPT) technology to regulate and deliver the right amount of current and voltage from PV arrays to run electrical loads and safely charge batteries during the day. Then during the evening when there is no sunshine, the controller allows the battery bank to run the electrical loads. Solar controllers have electronic protections to protect against nighttime reverse current, short circuiting, high voltage, high temperatures, and battery reverse polarity. Additionally some controllers have low voltage disconnect capabilities and are equipped with LED warning lights to alert about installation errors and faults within the system.

When disconnecting, you reverse that order. The battery provides power to the controller so always make sure that solar and loads are disconnected before connecting or disconnecting the battery from the controller. Connections between the battery, load, PV array, and the controller should have disconnect switches to enhance safety and facilitate ease of installation and breakdown.

In the wire diagram schematic above with DC load, sunlight contacts the solar modules, which convert solar into DC electrical power that it delivers to a charge controller. The charge controller regulates the amperage and voltage that is delivered to the loads and any excess power is delivered to the battery system so the batteries maintain their state of charge without getting overcharged. During the evening when there is no sunlight, battery power is used to run the load. It's important to note that the inverter is connected and powered from the battery, not the controller's load terminals like we did in the DC load example. That's because the inverter can have a high energy surge upon startup, and this high current surge might be higher than the rated capacity of the charge controller, whereas the batteries will be able to meet the high energy surge requirement.

Features of Solar Charge Controller:

- Protects the battery (12V) from overcharging
- Reduces system maintenance and increases battery lifetime
- Auto charged indication
- Reliability is high
- 10amp to 40amp of charging current
- Monitors the reverse current flow

5.3- 1.3Ah lead acid battery:-

12V 1.3Ah Rechargeable Lead Acid Battery is normally use for robots in competition. Wired or Wireless Robots runs for a long time with high speed with this type of battery. Seal Lead Acid (SLA) Rechargeable battery is the most common general purpose battery. Low cost, robust and less maintenance required are the advantages of SLA. But it is considered heavy weight for certain robotic application. To charge SLA batteries, you can use any general DC power supply as long as it provides the correct voltage to your battery.

Features:

- Rechargeable
- Recyclable
- No Memory Effect
- Able to use for most of the 12V controllers, motors or any other appliances

Specification:

- Voltage: 12V
- Capacity: 1.3Ah
- Size: 98mm x 43mm x 52 mm
- Weight: 0.450kg

Fig- 1.3ah lead acid battery

VI. CONCLUSION:

•With these we come to following fact that no of expected vehicles doubling on the road in the near future the need for this alternative energy is very evident and has promising returns.•Important to produce vehicles that do less, have a longer range buse less energy.•Lower our toxic emissions and localize greenhouse effects.•Increase the overall energy efficiency of vehicles.

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