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Next-Generation Wireless Charging with Solar Energy

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ABSTRACT:

The project "Next Generation Wireless Charging with Solar Energy" is designed to provide an innovative,eco-friendlysolution for electricvehicle (EV) charging. Solar panels are employed tocapturesunlightand convertitintoenergy, which is then stored in a battery for future use. A voltage sensor constantly monitors the battery's voltage to ensure optimal performance. The ESP32 controller manages and processes data from various system components. An IRsensor detectsavailableparking slots, allowing efficient space management. Payment is facilitated through an RFID cardsystem, making transactions seamless for users. An LCD display is incorporated to visualize the status of various sensors, providing real-time information to users. Furthermore, IoT technology is implemented to send alerts to authorized personnel for system monitoring and maintenance, ensuring smooth operation and timely interventions. This system offers a sustainable, automated, and user- friendly approach to EV charging, reducing dependency on non-renewable energy sources.

Keywords: Wireless charging, solar energy, electric vehicle (EV), ESP32, voltage sensor, IR sensor, RFID payment, IoT, LCD display, renewable energy, smart parking, automated charging, sustainable technology, battery storage, real-time monitoring, eco-friendly transportation.

1. INTRODUCTION

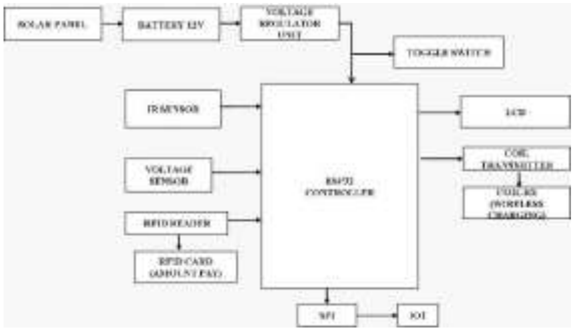
With the rapid adoption of electric vehicles (EVs), the demand for efficient and sustainable charging solutions is increasing. This project, "Next Generation Wireless Charging With Solar Energy" aims to develop a smart and eco-friendly charging system powered by solar energy. The system utilizes solar panels to harness energy from sunlight, which is then stored in a battery for continuous power supply. A voltage sensor monitors the battery

voltage, while the ESP32 controller manages the chargingprocessandsystem operations. Toenhance user convenience, an IR sensor detects parking slot availability, and an RFID card system facilitates seamless payment for charging services. Additionally, an LCD display provides real-time sensor data and system status. Through IOT integration, the system sendsalertsandnotifications to the authorized personnel for monitoring and maintenance. This innovative approach ensures an efficient, renewable, and smart EV chargingsolution.

2. Proposed Methodology

A solar panel captures sunlight and converts it into electrical energy to power the EV charging station. A battery stores the solar energy, ensuring continuouspower availabilityeven when sunlightis insufficient.Avoltagesensor continuouslymonitors the battery voltage, preventing overcharging or undercharging issues. An ESP32 controller processes data from all sensors, manages power distribution, and ensures efficient operation. An IR sensor detects available parking slots and updates the system for user convenience. An RFID card system enablesuserstomake secureand contactless payments for charging their EVs. An LCD screen provides users with real-time updates on available slots, charging status, and energy levels. IoT-based Alerts&Notifications–TheIoTmodulesendsreal- time alerts and notifications to the authority regarding system status, faults, or power issues.

3. Block Diagram:



Ablock diagram ofa solar wire-less electricvehicle charging system typically includes:

Theprojecteffectivelyharnessessolarenergy throughsolarpanels,ensuringasustainableand eco-friendly charging solution for electric vehicles. The system efficiently stores solar energy in batteries, with voltage sensors monitoring battery levels to optimize charging performance. The integration ofan ESP32 controller enablesreal-time processing, sensor management, and automated controlofthechargingstation, enhancing efficiency and user convenience. Features like RFID-based payment, IR sensors for parking slot detection, and an LCD display for status updates improve the usability and accessibility of the charging station.

TheIoT-enabled notificationsystemensures real-timealertsandmonitoring,allowingauthoritiesto track station status, faults,andmaintenanceneeds remotely.

Solar Panel

Asolar panel is a device that converts sunlight into electricitybyusingphotovoltaic(PV)cells.PV cells are made of materials that produce excited electrons when exposed to light. These electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries.

IR Sensor

In a solar wireless electric vehicle charging system, an infrared (IR) sensor detects the presence of an electric vehicle and activates the charging process. The IR sensor isplaced in theparking area to detect when a vehicle enters or leaves. When an electric vehicle moves into the charging lane, the IR sensor detects the vehicle and activates the power supply.

Battery

The battery in a solar wireless electric vehicle charging system stores the electrical energy generated by the solar panels. The battery also regulates the charging and discharging process. It is connected to the battery management system. The batterymanagement system is regulate the charging and discharging process. The battery store DC power. The DC power is converted to AC using a transformer.

Coil

In a solar wireless EV charging system, the transmitter coil and receiver coil are essential components for wireless power transfer (WPT), typically using inductive coupling or resonant inductive coupling. Here's their purpose. Located in the charging station or embedded in the road. Generates an alternating magnetic field when AC current flows through it.the receiver coil using electromagnetic induction in Transfers energy wirelessly. Captures the alternating magnetic field from the transmitter coil. Converts the received magnetic energy back into electrical energy. Supplies power to charge the EV battery. Solar panelsgenerateelectricity.ConvertsDC from solar panelstoACforthetransmitter coil.Thetransmitter coil produces a magnetic field, which induces current in the receiver coil.The receiver coil converts AC back to DC to charge the battery.

LCD Display

A 16×2 LCD display is a commonly used alphanumericliquidcrystaldisplaythatcanshow

16 characters per line on 2 rows. It is easy to interface with microcontrollers like Arduino and PIC.Thedisplayoperatesin4-bit or 8-bitmodeand requires a power supply of 5V. It features an LED backlight, contrast adjustment, and multiple command functions like cursor control and custom character creation. Widely used in embedded systems, automation, measuring instruments, and DIY electronics, the 16×2 LCD is popular for its low power consumption, affordability, and ease of use.

ESP32

The ESP32 module is used in solar wireless electric vehicle charging systems to monitor the charging process, collect data, and provide real-timefeedback to the user. It monitors the charging process in real-time. It collects data about the chargingprocess. It provides feedback totheuserin real-time. It helps make the charging stationefficient and reliable.

RFID Card

RFID reader is used to identify the vehicle and initiate the charging process. The RFID tag is installed on the vehicle, and it contains information such as the vehicle's unique identification number and chargingrequirements. Remotelyvia the app or start charge page. RFID cards are used to make it easy to pay for charging at charging points. It can activate a charging session using your smartphone via the app and clicking to start charge.

Voltage Sensor

Insolar wirelesscharging systems, a voltagesensor is utilized to detect and maintain voltage values thereby facilitating seamless energy transmission.Its main purposes include. What measures the voltage generated by the solar panel in order to monitor power generation Helps improve charge efficiency as battery state of charge changes by dynamically changing the voltage. It makes sure, that both the transmitter and the receiver are working with the even voltage levels for effective energy transfer. Monitors voltagechanges, protects againstpowersurgesordrops.

4. Conclusion

The project effectively harnesses solar energy through solar panels, ensuring a sustainable andeco-friendly charging solution for electric vehicles. The system efficiently stores solar energy in batteries, with voltage sensors monitoring battery levels to optimize charging performance. The integration ofan ESP32 controller enablesreal-time processing, sensor management, and automated controlofthechargingstation,enhancing efficiency and user convenience. Features like RFID-based payment, IR sensors for parking slot detection, and an LCD display for status updates improve the usability and accessibility of the charging station. The IoT-enabled notification system ensures real- time alerts and monitoring, allowing authorities to track station status, faults, and maintenance needs remotely.

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