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# RFID and Solar based E Vehicle Charging System

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**ABSTRACT:** field which causes electrons to move through the tag's antenna and subsequently power the chip. The RFID system consists of two main components, a tag attached to an object to be identified, and a Transceiver also known as Reader. A Reader consists of a Radio Frequency module and an antenna which generates a high frequency electromagnetic field. On the other hand, the tag is usually a passive device, meaning it doesn't contain a battery. Instead, it contains a microchip that stores and processes information, and an antenna to receive and transmit a signal. To read the information encoded on a tag, it is placed in close proximity to the Reader. The Reader generates an electromagnetic field.

**KEYWORD:** E Vehicle charging, solar panel, RFID reader

## I. INTRODUCTION

To develop this project, we are using an ARDUINO technology with sensors, RFID card readers and RFID tags, the RFID tag which emits unique codes and is fixed on the charging terminal of the car and provided with the complete data and technical specification of the car model. As the car interacts with the RFID tag reader on the charging station, the corresponding technical specification data are picked up by the RFID reader and sent to the ARDUINO controller. The ARDUINO controller is programmed and interfaced to an LCD display and relay unit which selects the proper voltage tapping to start charging the car with safe voltages.

The ARDUINO controller is connected with the relay interfacing unit which gets the control signal from the ARDUINO output terminals and according to the data and the technical specification read from the RFID tag, the particular voltage required for the particular battery voltage is generated through the relay drive circuit and the signals supplied from the ARDUINO controller unit and 6V or 12V to the car battery and starts to charge with a proper safe and accurate voltage with the help of the battery and solar panel. The ARDUINO controller which is interfaced to the LCD display starts providing user interaction messages like welcome to the fuel station and displaying the technical specification of the charging voltages of the battery and also displaying some safety parameters.

## II. LITERATURE SURVEY

As the number of EVs on the road increases, charging stations in both parking structures and private garages will become more prevalent. These stations will be responsible for meeting the requirements of the distribution grid, EV owners, and parking structure operators. For security and financial reasons, among the many functions these charging stations will perform are user authorization, authentication, and billing.

Other commercial charging stations, such as Coulomb and Blink, require a short-range RFID card for the same purpose. In both cases, extra steps on the part of the user must be taken to authorize charging. The authors propose using conventional RFID tags inside EVs and RFID readers on parking garage access gates together with middleware and an aggregate charging controller to authorize, assign, and enable charging. However, this system still requires action from the user and is not as flexible as may be desired.

The proposed improvements allow charging authorization to take place seamlessly at multiple charging stations in a single geographic location without any action on the part of the user. Vehicle Monitoring/Identification Modules (VMMs), located in EVs, act as RFID tags for vehicle identification and charging authorization. The Internet of Things, also called things- linked internet, it refers to a kind of network that adopts RFID (radio frequency identification) and to enable the linkage between any articles and the internet, to enable the exchange and communication of information.

### III. PROBLEM STATEMENT

With the growing adoption of electric vehicles (EVs) worldwide, the demand for efficient, accessible, and sustainable charging infrastructure is rapidly increasing. However, existing charging stations face several challenges, including limited access to renewable energy sources, the inefficiency of conventional power grids, and complex user authentication processes. These challenges hinder the widespread acceptance of EVs and raise concerns regarding the environmental impact of charging infrastructure.

### IV. OBJECTIVES

The integration of RFID technology and solar power into electric vehicle (EV) charging stations offers numerous benefits, aiming to address the challenges faced by existing charging infrastructure.

The objectives of this system are Reduction of Carbon Footprint, Improvement of Charging Infrastructure Efficiency, Enhancement of Charging Station Accessibility, User-Friendly and Scalable System, Real-Time Monitoring and Reporting & Promotion of Renewable Energy Usage.

### V. EXPERIMENTAL PROCEDURE

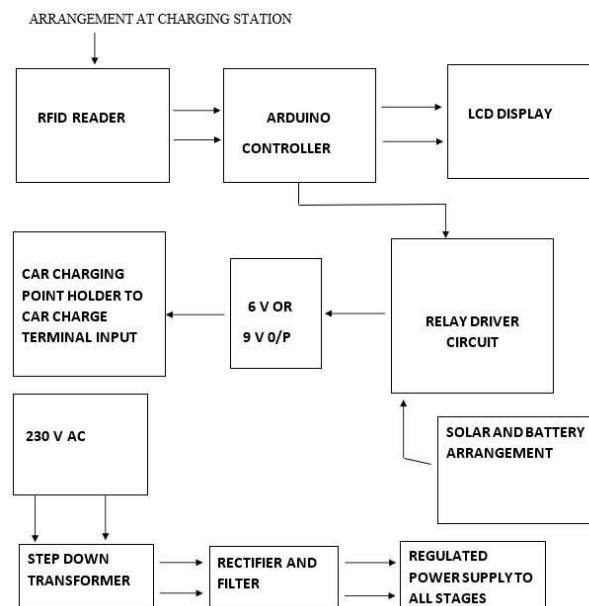


Fig-Block diagram

### 1. ATMEGA328 P



Fig-ATMEGA328 P

ATmega 328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). Other characteristics will be explained later. ATmega 328 has several different features which make it the most popular device in today's market. These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock for software security, throughput up to 20 MIPS etc. ATmega328 is mostly used in Arduino.

### 2. LIQUID CRYSTAL DISPLAY(LCD)



Fig-LCD

An LCD is an electronic display module that produces visible images by using liquid crystals. The 16x2 LCD is a simple module that can be found in many DIY projects and circuits. 16x2 represents a two-line display of 16 characters each. Each character is displayed as a 5x7 pixel matrix on this LCD screen. Figure 3.2 depicts a 16x2 LCD diagram.

### 3. RELAY



Fig- RELAY

Relay is an electromechanical switch & it works on the principle of energizing an electromagnet. It consists of primary coil, 2 contacts, one is normally open contact "NO" & the other is normally closed contact "NC" & pole normally identified a common. When relay is in off state the pole (common) is connected to normally closed (NC contact). The load may be a fan or dc motor or heater coil, when transistor starts conducting current starts flowing through the coil. Which develops its own magnetic flux when the strength of current is suitable; whenever a sufficient flux is produced it

attracts the pole to make contact with normally open position 'NO'. Hence the load connected to it performs its operation until the contact is broken. A diode connected in parallel across the primary coil is to eliminate the effect of back EMF on the transistor. Relays have great application in industry. Using the principle of energizing an Electromagnet we can handle large voltages & current application. Without the risk of shocks.

#### 4.SOLAR PANEL



Fig-SOLAR PANEL

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. 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. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.

#### 5.RFID TAG AND RFID TAG READER



Fig-RFID TAG AND RFID TAG READER

An RFID system consists of two main components, a transponder or a tag which is located on the object that we want to be identified, and a transceiver or a reader. The RFID reader consists of a radio frequency module, a control unit and an antenna coil which generates high frequency electromagnetic field. On the other hand, the tag is usually passive components, which consist of just an antenna and an electronic microchip, so when it gets near the electromagnetic field of the transceiver, due to induction, a voltage is generated in its antenna coil and this voltage serves as power for the microchip.

## VI. RESULTS AND DISCUSSIONS

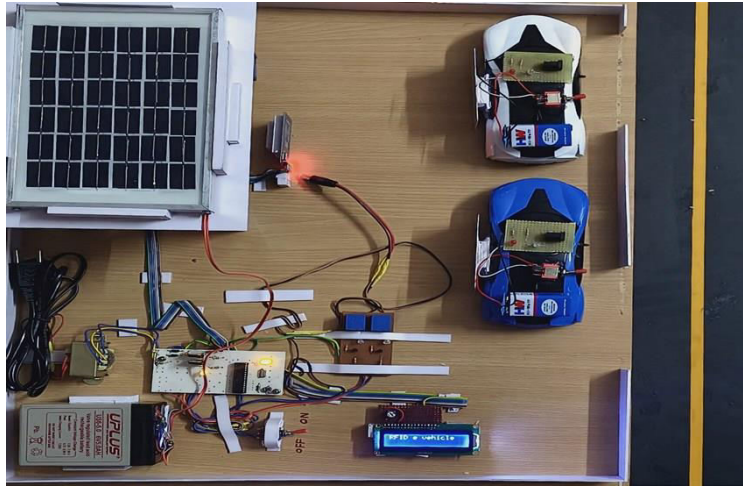


Fig-MODEL

The implementation and testing of the RFID-based smart electric vehicle charging system followed a systematic approach to validate functionality and reliability. Individual hardware components such as RFID readers, voltage and current sensors, and the relay for power regulation underwent rigorous testing protocols to ensure compatibility and performance. Through simulated charging scenarios with various devices, the system demonstrated accurate user authentication, realtime power monitoring, and effective charging regulation. Comprehensive tests across diverse charging loads validated the system's versatility and adaptability. Overall, the project achieved its objectives and showcased robust functionality, reliability, and effectiveness in providing efficient and secure charging solutions for electric vehicles. User feedback during testing highlighted the system's ease of use and readiness for real-world deployment, emphasizing its potential contribute to sustainable transportation and environmental conservation. technology's role in addressing environmental challenges and shaping a greener future.

### ADVANTAGES

- Convenient and Automated: RFID-based charging stations offer a seamless and automated charging experience, eliminating the need for physical payment or authentication.
- Secure and Reliable: RFID technology ensures secure and reliable transactions, reducing the risk of unauthorized access or payment disputes.
- Easy Tracking and Monitoring: RFID enables real-time tracking and monitoring of charging sessions, making it easier to manage and optimize the charging infrastructure.
- Reduced Labor Costs: Automated RFID-based charging stations minimize the need for manual intervention, reducing labor costs and improving efficiency.

### DISADVANTAGES

- Interoperability Issues: Compatibility problems may arise between different RFID systems and EV models.
- Signal Interference: RFID signals can be disrupted by other electronic devices or physical barriers.
- Solar Panel Efficiency: Solar panels may not operate at maximum efficiency due to factors like weather, temperature, and panel quality

### APPLICATIONS

- Seamless User Authentication and Access Control (RFID): RFID tags or cards are used to identify registered users when they arrive at a charging station.
- Automated Billing and Payment: The RFID system tracks the start and end of each charging session, recording the amount of electricity consumed. This data is used for automatic billing, linked directly to the user's RFID tag or account.

- Solar-Powered Charging Stations (Solar Power): Solar-powered EV charging stations use solar panels to generate electricity from sunlight, reducing reliance on traditional grid-based electricity.

## VII. CONCLUSIONS

The RFID and Solar-Based EV Charging Station is an innovative solution for addressing the growing demand for electric vehicle charging infrastructure. By combining solar energy with advanced RFID technology, the station not only offers an environmentally sustainable charging option but also enhances user convenience and operational efficiency. Although challenges such as dependence on sunlight and system reliability must be addressed, the long-term benefits of cleaner energy, cost savings, and improved user experience make this solution a promising choice for the future of EV infrastructure.

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