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Advance Manless E-Vehicle Charging Station

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Abstract— Environmental Friendly Automotive technology, such as electric vehicles, have become more accessible and affordable because to public demand for cleaner air. As the number of plug-in hybrids and fully electric vehicles (EVs) on the road grows, so does the need for charging stations [1]. A better understanding of existing EV charging habits is necessary for optimizing the performance and efficiency of the EV charging infrastructure. In order to facilitate real-time authentication of users, this research makes use of RFID (radio frequency identification) technology. In this system, electromagnetic waves are used for both the transmission and reception of data. Radio frequency identification is a feature of modern credit cards that employ RFID technology. By tapping or scanning the card you're using in front of an ATM or card reader, you may quickly and simply access your funds. Tags and readers make up Radio Frequency Identification (RFID), a wireless technology [3]. The reader is a piece of electrical hardware that can receive signals from RFID tags through radio waves, thanks to its one or more transmitting antennas. To adjacent to passive readers, active tags broadcast their identity and other data through radio waves. Batteries are unnecessary for passive RFID tags since they acquire their power from the reader. Batteries are essential to the operation of active RFID tags. In addition to a serial number, RFID tags may also hold a large quantity of text.

Keywords— Electric vehicle, Motor Circuit, Controller Subsystem, Radio Frequency Identification (RFID).

I. INTRODUCTION

A. *Objectives*

Featuring an Audrino, relays, and an RFID, we built a simple charging station for EVs that can power the user's vehicle. The process of charging at a charging station is simplified and streamlined with the help of this RFID charging station authorization system. The advantages of radio frequency identification (RFID) technology in battery charging stations, include their use in the management of the charging area and the identification of electric vehicles. These advantages make RFID technology a better tool for managing electric car battery charging stations [1]. The installation of charging stations for electric vehicles has begun in several areas, although this process is far from complete. In this method, an RFID system installed at the charging station enables automatic user authorization, drastically cutting down on operational time. Cabinets, rooms, and buildings can be outfitted with reader systems. As the number of EVs on the road grows, charging infrastructure plays an increasingly important role in balancing the demands of EV drivers and the local distribution grid. This article developed an RFID system for user identification and charging authorization as part of a smart charging infrastructure with charge monitoring and management. For efficient EV charging that takes into account grid restrictions and the demands of EV users, the RFID offers a low-cost technique of identifying and permitting cars for charging. The manner in which a vehicle charges is dependent on the voltage. Using IOT, we can check our charging status in this system from anywhere at any time by connecting to the server [2].

B. *Necessity*

As Charging amenities in public parking lots and private garages are becoming more common as the number of electric vehicles on the road rises. The needs of the distribution grid, EV owners, and parking garage managers will be the responsibility of these stations. These charging stations will perform a wide variety of functions, including authorization from users, verification, and invoicing. A short-range RFID card serves the same purpose at other commercial charging stations, such as Coulomb and Blink. In both cases, the customer must take more active actions to give their consent to be charged. The authors of propose using middleware and a unified charging controller in conjunction with standard RFID tags installed inside EVs and RFID readers installed on parking garage entry gates to authorize, allocate, and allow charging. However, this tool still requires user input and isn't as adaptable as some might hope [4].The suggested enhancements make it possible for simultaneous charging authorization at many charging stations within a single geographical region. VMMs are installed in EVs and serve as RFID tags for tracking and identifying purposes. Useful both for identifying vehicles and authorizing charges. The "internet of things," also known as the "matters related net," is a network that uses radio-frequency identification tags to establish connections between everyday objects and the internet for the purpose of sharing and transferring data. This study aims to discuss the implementation of radio frequency identification (RFID) technology inside battery charging stations, and to assess the technological benefits of RFID technology within the identification of electric vehicles and their charging compartments. The output power supply in this case is a switching mode power supply (SMPS) [1]

II. LITERATURE SURVEY

A. *History of EV Charging Technology*

The biggest issue was many households didn't have electricity until the early 20th century, making it impossible to charge a car inside. Home electrification made EVs more widely available to the general public. As a result, an increasing number of people would purchase and use EVs. 38% of American cars at the turn of the 20th century were electrically propelled. These cars either had batteries within the car to charge or the battery was taken out, charged elsewhere, and then put back on the car [3]. General Electric introduced the first Electrify charging stations in the early days of electric vehicles. Around the major US cities, similar to phone boxes, these were placed so that EV owners could use them to recharge their vehicles. Due to the automobile industry's development in the 1920s and increased road quantity and quality, EVs with their restricted range were not more prevalent suitable for journeys, and this meant that their purpose was limited. Cheaper gasoline price during this period surely had even more influence on usage of internal combustion engine vehicles. This meant that EVs were only a novelty in the automotive business up until the late 20th century. As the public's awareness of airpollution grew in the latter half of the 20th century, the idea of manufacturing EVs once more began to gain traction. After automakers began producing EV cars, the issue of charging infrastructure arose. The first versions of these EVs could be charged at home using a standard outlet. Hybrid automobiles were once thought of as a compromise between ICE and EVs, and home charging was sufficient to refuel them. A suitable public charging infrastructure was urgently needed as soon as manufacturers began producing plug-in electric vehicles [4]. Now we are in the twenty-first century, the era of electric vehicles and charging technology. In a parking lot next to Los Angeles International Airport, there are public charging outlets. Two outdated 6 kW AC chargers are displayed. The usage of Level 2 (single-phase AC) EVSE, as defined by NEC-1999, was favored by many of the EVs that were originally introduced in the United States in the late 1990s and early 2000s, including the GM EV1 and Ford Ranger EV. These EVSEs were equipped with conductive connectors (often AVCON) or inductive connectors (Magnet Charge). GM, Nissan, and Toyota supported the inductive system whereas DaimlerChrysler, Ford, and Honda supported the conductive system. There were two sizes of magnet charge paddles: an older, bigger paddle (used for the EV1 and S-10 EV) and a smaller, more modern paddle [1]. The more compact paddle (first in 2000) interfaced with an air-cooled intake while the larger paddle (first produced in 1994) was necessary for accommodating a liquid-cooled vehicle inlet charge port. The initial version of SAE J1773, which outlined the technical specifications for inductive paddle coupling, was published in January 1995 [5]. A subsequent revision was published in November 1999.The Magnet Charge paddle wasphased out by the following March when the important California Air Resources Board embraced the conductive connector as its standard on June 28, 2001, citing cheaper costs and durability. Avcon (also known as butt-and-pin, employed by Ford, Solectron, and Honda), Yazaki (also known as pin-and-sleeve, on the RAV4 EV), and ODU (which is utilized by DaimlerChrysler) were the three conductive connectors in use at the time [6].

Avcon butt and pin connectors support both Class 2 and Level 3 (DC) charging and are defined in the appendix of SAE J1772 Recommended Practice Primary Model (1996). In the 2001 model, the connector notation was transferred to the substance, and it became a de facto trend in the United States. IWC approves Avcon butt connectors for North America based on environmental and durability testing. As mentioned earlier, Avcon connectors have four contacts on Level 2 (L1, L2, Pilot, Ground) and Level 3 (L1, L2, Pilot, Com1, Com2, Ground, Clean Information Plane, DC+, DC-) use By 2009, J1772 had replaced the spherical pin and sleeve connector (Yazaki) as a common implementation, replacing his square Avcon butt connector. The idea of a removable battery service was proposed in 1896 [7]. It was first introduced from 1910 to 1924 by the Hartford Electric Light Company through the Electric Vehicle Battery Service (GeVeCo). The car owner purchased the car without a battery from Standard Vehicle Organization (GeVeCo), which owns electric vehicles. Power was supplied by Hartford Electric in the form of removable batteries. All motors and batteries are designed for quick replacement. The owner paid a variable mileage fee and a monthly provider fee to cover truck maintenance and storage. He has driven these vehicles over his 6 million miles. At a higher level, Tesla and Mitsubishi Heavy Industries were considering battery relocation approaches. A complicating factor was that this approach required changes to the car's design. In 2012, Tesla began building its own Tesla Supercharger fast charging network. In 2013, Tesla announced it would also support battery pack replacement, but that program was discontinued. With the development of electric vehicles, a lot of research has started on the layout and technology of public charging stations [1]. C. Panatalaniye et al. (2016) developed a charging station with microcontroller ATMEGA8535 and RFID as controller or identifier for EV users. It has desirable properties for electric vehicles from a network of renewable energy sources connected to solar panels. Harilet at (2018) developed a wireless charging station for electric vehicles controlled by RFID tags. Charging was very easy because the power supply method is wireless. N.KALYANI et al. (2014) used 8051 microcontroller to develop his RFID-based secure access system, which is very widely used in offices, laboratories, homes, etc. By referring to this paper, I understood the interface between RFID and 8051. (2013) proposed a mesh network RFID system for user identification and charging authorization for intelligent charging network connectivity. Provides a cost-effective solution for vehicle identification and authentication. Jin Wentao and others (2017) investigated the impact of location of BEV public charging facilities on mixed conventional gasoline vehicle (GV) and BEV networks [3].

B. *Existing System*

In this work, the solar panel controller and power optimization are done to solve this shortcoming. Here the panel rotates according to the readings read from the LDR. Therefore, working in full sunlight and using LDR also optimizes performance. This work is mainly designed to automatically control the solar panel, keep it facing the sun. This is done by controlling the mechanical movement of the solar panel. The sun rises in the east and sets in the west. If you're facing east in a normal star system, you can't turn toward the sun at sunset [3]. Because of this, solar panels may not receive enough sunlight to function. These problems are overcome by using this work. In this work, we also build a very nice microcontroller-based solar charger. The coin-based mobile battery charger developed in this work will provide a unique service to people in rural areas where commercial power is partially or full-time unavailable and will be a revenue generator for location he providers. Install outside the office. The mobile phone market is a major industry, and it is spreading as an indispensable means of communication in rural areas. Urban people use more sophisticated mobile phones with powerful batteries for several days, while rural people buy second-hand mobile phones that need to be charged frequently. Battery often runs out during calls, especially at inconvenient times when standard chargers are not accessible. Coin base mobile battery charger aims to solve this problem. The user has to insert the mobile phone into her one of the adapters and insert a coin. The phone will then receive micro pulses to charge. You can't bring your phone from 'dead' to fully charged Mobile phone charging power is designed using predefined values [3]. The system provide three levels of output. While normal EV charging stations only have one output port available, this system provides up to three output ports, including 60V, 48V and 12V output ports. When you input the RFID tag into the RFID reader, the reader will read the specific value of the tag, and after the signal has passed through the Arduino controller, the controller will switch the respective relay coil. Finally, the EV system is charged for a given period of time. Connect the Wi-Fi module to the Arduino controller while tapping the RFID tag that sent the information to the owner and save the total charging time in cloud storage [4].

III. PROPOSED METHODOLOGY

The illustration 3.1 depicts the components of an, which include a microprocessor, RFID, power supply circuit, and relays. The 328 microcontroller manages the relay switching. The microcontroller is programmed to charge the electric vehicle for a set length of time when the user presses a button, then to cut off the power and deduct that amount from the user's account. When a user clicks a button, Rs 10–20, etc., are deducted from their balance. The starting balance on the user's card is $100.Technologies Central to RFID "RFID" is shorthand for "radio frequency identification," which is what "electronic tags" mean. RFID requires only two simple elements to function as a wireless technology [6]. Several tags with transponders. Mostly made up of chips and joint pieces. Every label has a specific electronic code connected to it for the purpose of identification. Tag reader/writer: Read/write to the device's tag. Portable and fixed readers are both available.

The antenna is responsible for relaying a high-frequency signal from the tag to the reader. RFID kinds and categorizations for choosing. An RFID system's reader may read and write information from an electronic tag or tags. Electrical tags provide a framework for categorizing RFID technology. According to their charging mechanism, electric tags may be broken down into three categories: passive, semi-passive, and active. Low-band high-frequency tags, medium- and high-frequency high-frequency tags, ultra-high-frequency (UHF), and microwave tags are the several types of electric tags that may be classified by their working frequency. UHF and microwave passive electronic tags are used in this paper [5].

Powered by their own operations, passive electronic tags use the radio frequency energy sent by the reader to generate a small amount of direct current. The tags require little upkeep, are cheap, and last a long time. Also, the reader feels more involved. This label is commonly used in systems that keep track of battery packs RF and microwave identification: Frequencies of 433.92MHz, 862-928MHz, 2.45GHz, and 5.8GHz are often used. Tags and readers communicate with one another through electromagnetic coupling. Both active and passive tags can receive radio frequency energy from the reader's emitted radiation. Typically, the read range of an RFID system is between 4 and 6 meters, with a maximum of 10 meters. This tag is used for tracking and identifying vehicles. The concept of RFID. Fundamentals of Operation [1].

A. Control Circuit

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1) Relay

- *Normally Operates at 5V DC*
- *Current at rest is 70mA;*
- *Maximum AC load current is 10A at 250VAC or 125V AC.*
- *Operating time is 10msec,*
- *Release time is 5msec, maximum switching is 300 operations per minute,*
- *DC load current Max is 10A at 30V DC or 28V DC,*
- *5-pins included, resilient design.*

2) Microcontroller ATmega328P:

The Atmel's AVR® upgraded RISC technology is showcased in the ATmega328/P, an 8-cycle CMOS microcontroller. By executing highly efficient instructions in a single clock cycle, the ATmega328/P reaches performance near 1 MIPS per MHz This paves the way for infrastructures that value efficiency over raw processing power. The UNO Microcontroller from Arduino. Keep in mind that the Arduino board's microcontroller actually executes the software. This realisation means we can finally retire the absurd "Arduino is a microcontroller" benchmark. The Arduino UNO R3 relies on the ATmega328 microprocessor for its primary control. The AVR 8-bit MCU is known as ATmega328. It can transport data and has eight internal registers to store data simultaneously [4]. The ATmega328 can access three distinct memories. The programme can be saved in the 32 KB of non-volatile memory (streak memory), saving you time and effort. Unsecure random access memory (SRAM) amounts to 2 KB. During runtime, the application stores its variables here. EEPROM Memory: 1 KB of non-volatile memory can be used to store information that must be accessible regardless of whether or not power is being supplied to the card. Atmel's AVR® upgraded RISC technology is showcased in the ATmega328/P, an 8-cycle CMOS microcontroller. By executing highly efficient instructions in a single clock cycle, the ATmega328/P reaches performance near 1 MIPS per MHz this paves the way for infrastructures that value efficiency over raw processing power [2]. The UNO Microcontroller from Arduino. Keep in mind that the Arduino board's microcontroller actually executes the software. This realisation means we can finally retire the absurd "Arduino is a microcontroller" benchmark. The Arduino UNO R3 relies on the ATmega328 microprocessor for its primary control. The AVR 8-bit MCU is known as ATmega328. It can transport data and has eight internal registers to store data simultaneously. The ATmega328 can access three distinct memories. The programme can be saved in the 32 KB of non-volatile memory (streak memory), saving you time and effort. Unsecure random access memory (SRAM) amounts to 2 KB. During runtime, the application stores its variables here. EEPROM Memory: 1 KB of non-volatile memory can be used to store information that must be accessible regardless of whether or not power is being supplied to the card [3].

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3) LCD

LCD screen, short for liquid crystal display, is a versatile electronic display module used for a variety of purposes. A 16x2 LCD display is a common component because of its low cost and ease of integration. There are two lines in a 16x2 LCD, each of which can display 16 characters. Each character on this LCD is shown in his own individual 5x7 pixel matrix. The 224 distinct letters and symbols are all supported by the 16x2 intelligent alphanumeric dot-matrix display. This LCD features separate command and data registers [1]. The display's command register keeps track of the user's input for the screen. The display data is saved in the data register. The data that makes up the picture to be shown should be placed in the data register, while the instructions should be placed in the instruction register. The LCD library streamlines this process so that you may focus on your Arduino project without worrying about the nitty-gritty details. A potentiometer hooked up to the VEE pin may be used to modify the display's contrast.

• Power used when powered down: 10uA (minimum)

B. POWER TRANSMISSION KIT

1. *MFRC522 RFID Module*

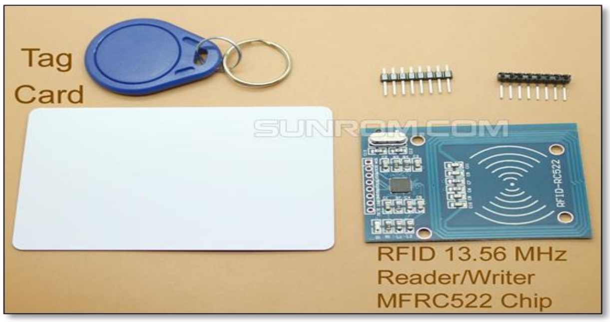


Fig. 3.3: RFID Transceiver Module

The RC522 is an NXP semiconductors-based 13.56MHz RFID module that uses the MFRC522 controller. The module is often an I2C-, SPI-, or UART-compatible packaged with a keychain RFID reader and card. It finds widespread usage in attendance tracking and other forms of biometric identification.

- Range of usable power supplies: 2.5V to 3.3V
- Top Data Transfer Rate: 10 Mbps
- Range of Reading: 5cm Power Required: 13-26ma

2. *Wireless Power Transfer*

Fig. 3.4: Wireless power Transmission Kit

The primary main components of WPT, or wireless are the transmitter and the receiver. A coil in each half serves as an antenna for sending and receiving signals. If you adjust the distance between the transmitter and reception coils, you'll see a corresponding change in the amount of current flowing out of the transmitter.

Input voltage: 9-12 Volts, Transmitter Module Features of Wireless Power Transfer Module. The following are the prerequisites for a norm transmitter and receiver:

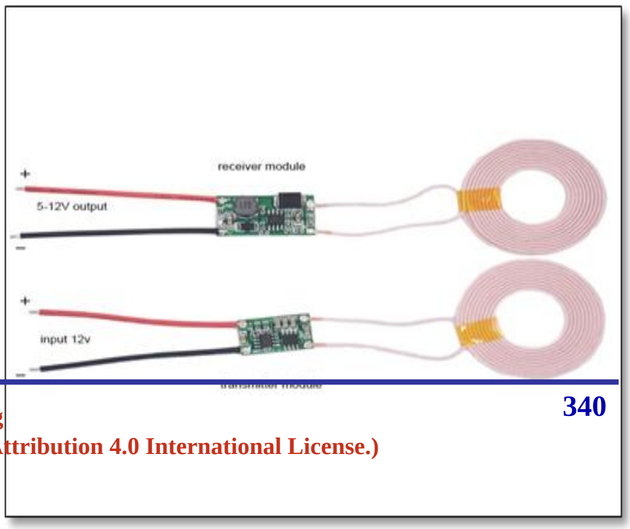
- Transmitter module dimensions: 22 mm x 12 mm x 2 mm
- No-load current: 40 mA or so
- Transmitting coil size: 30 mm x 1 mm
- Receiving coil size: 30 mm x 1 mm
- Receive regulator board dimensions: 27 mm x 5 mm x 2.5 mm • Receives the output voltage: 5 V
- Receives the output current: 350 mA

IV. SYSTEM RESULTS

Fig. 4.1: Results for Different Inputs

CONCLUSION

A stable communication field from the RFID reader and transponder works best when the license plate is 60 cm above the ground and the angle between the plane of the license plate and the plane of the RFID reader is 0°. As the transponder position (height, angle) changes, the size of the stable communication field decreases. Communication will be unstable if the RFID antenna plane is perpendicular to the transducer plane. For industrial installations, the optimal angle for the RFID reader is 30° to the plane of the charging



station. This allows better communication between RFID readers and transponders at different electric vehicle license positions, alleviating the need for high precision when parking.[8] Designers of RFID systems for EV services must consider the potential impact of other RFID devices already deployed in modern vehicle systems, as well as RFID devices that may be nearby. Reducing interference between different RFID transponders could become a very important issue in the future [5].

Electric vehicles (EVs) are growing in popularity. Thanks to constantly modernized technology, they are becoming more efficient and expanding their operational range. However, like all vehicles (scooters, cars), they need charging stations and there is growing interest in user-friendly locations such as shopping malls, parking lots, or specially prepared “e-Charge” charging networks Increase As well as the availability of a charging station, the speed of charging and the convenience of settling payments for each kWh unit charged are also important. This is where RFID comes up to the challenge again, enabling the "e-Charge" network of chargers to build their own customer management system and payment settlement, including subscription payments, fleet payments, etc. Each customer of the "e-Charge" service provider receives its own card, on the basis of which the system, thanks to an RFID reader installed in the application, uniquely identifies the user and grants (or denies) access to the charger, counting the downloaded kWh units on his customer account[6]. As examples from real life show, vehicle charging systems are used not only by individual customers, but more and more often entire fleets, including public / public transport vehicles, fleets of small and medium-range delivery vehicles (courier companies decide to use electric vehicles in large agglomerations), use their own charging stations. In conjunction with extensive GPS-based fleet applications, it is possible to significantly optimize the available resources by mapping the optimal routes for electric fleet vehicles, locating the vehicle and its safety (by switching off the ignition without having the appropriate card). Here you can use a turbocharger or fast charger for efficient and fast operation. This saves time on charging. By connecting this charging station system to a computer network, it can provide electronic billing instead of manual billing and store data on how long users have used this charging service [4].

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