INTERNATIONAL JOURNAL OF ENGINEERING MANAGEMENT SCIENCE
journal homepage: www.ijems.online/index.php/ijems/index

Empowering E-Mobility: The Fusion of Solar Energy and RFID In Electric Vehicle Charging: A Review

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How to Cite the Article: Shital Yende et al., (2023). Empowering E-Mobility: The Fusion of Solar Energy and RFID In Electric Vehicle Charging: A Review. *International Journal of Engineering Management Science , 3(2), 55-61.*

Keyword

Cyber security, electric vehicles, RFID, electric vehicle charging stations, smart grids

Abstract

Wireless technology has found significant application in both industrial and home settings. The main goal is to transfer power wirelessly between the transmitting and receiving coils in the near field through resonant inductive coupling. Thus, we created a wireless solar-powered charging station for electric bicycles. High efficiency is required to verify optimal charging, which lowers energy losses. The RFID tag technology scans the individual bikes and permits charging in areas where unauthorized users have been warned or forbidden. This is frequently tracked and managed using a mobile app. It is more necessary to have a flexible wireless charging station for electric cycles in order to achieve wireless power transfer through inductive coupling. A charging station is essential for increased portability, mobility, and reduced infrastructure costs due to the absence of wires. Thus, an affordable electric cycle charging station has been built.

INTRODUCTION

The goal of this article is to use the direct power grid and solar energy to completely transform the manner that electric vehicles are charged (Bhambulkar & Titarmare, 2022). This document intends to make it easier for owners of electric vehicles to travel long distances without worrying about running out of electricity by installing charging stations along highways (Nayak, C.B. ,2021).Furthermore, the charging stations will be built to return any extra electricity produced by the solar panels to the grid, enabling it to lessen its impact on the environment and make money at the same time (Bhambulkar & Titarmare, 2021). This report is a step toward a sustainable future in which fossil fuels are obsolete and electric vehicles are th norm. Incorporating solar energy into our charging stations will not only lessen our dependency on fossil fuels but also offer a clean and sustainable energy source (Jadhav & Bhirud, 2015) .Constructing charging stations alongside highways also tackles the problem of range anxiety experienced by several owners of electric vehicles (Tijare et al., 2020).The most recent technological advancements will be included into these charging stations to guarantee electric vehicle owners a quick and effective charging experience (Uikey et al., 2023). The capacity to return surplus energy to the grid will benefit our paper financially as well as the stability and effectiveness of the grid as a whole (Gaurkhede et al., 2023).Our paper aims to encourage the adoption of electric vehicles and contribute to the reduction of carbon emissions, in addition to offering owners of electric vehicles a practical and sustainable charging solution (Ambudare et al., 2023).Since this paper is an investment in the future of sustainable transportation, it is an investment with a long time horizon (Baghele et al., 2023). Because it will generate jobs and strengthen the local economy, this paper will benefit the environment as well as the economy (Sahare, Mohadikar, Sharma, Bhambulkar, & Yerpude, 2019).This paper offers a novel approach to several problems, including clean energy, sustainable transportation, and economic expansion.

OBJECTIVES

Solar energy is a technology that has been expanding in popularity as it is further developed. In this paper, we will be utilizing solar energy to provide the supply for an outdoor charging station for devices such as electric vehicles (Bhambulkar, A., V., Gaur, H., & Singh, A. K. ,2021).Solar energy continues to be researched and enhanced as an alternative source of energy (Ganorkar R. A. et al. ,2014). This paper will assist global research efforts in helping protect our environment (Bhambulkar et al., 2023). These methods do create more energy, however, they are non-renewable and can cause harm to atmosphere and ecosystems (Patil, R. N., & Bhambulkar, A. V.,2020). The objective of this paper is to investigate the problem of providing an outdoor power source for charging devices in an environmentally friendly way to help decrease the demand for power from other methods and to design and implement a solar-powered EV charging infrastructure, integrated with Radio-Frequency Identification (RFID) technology (Bhambulkar, A. V., & Patil, R. N., 2020).

BLOCK DIAGRAM

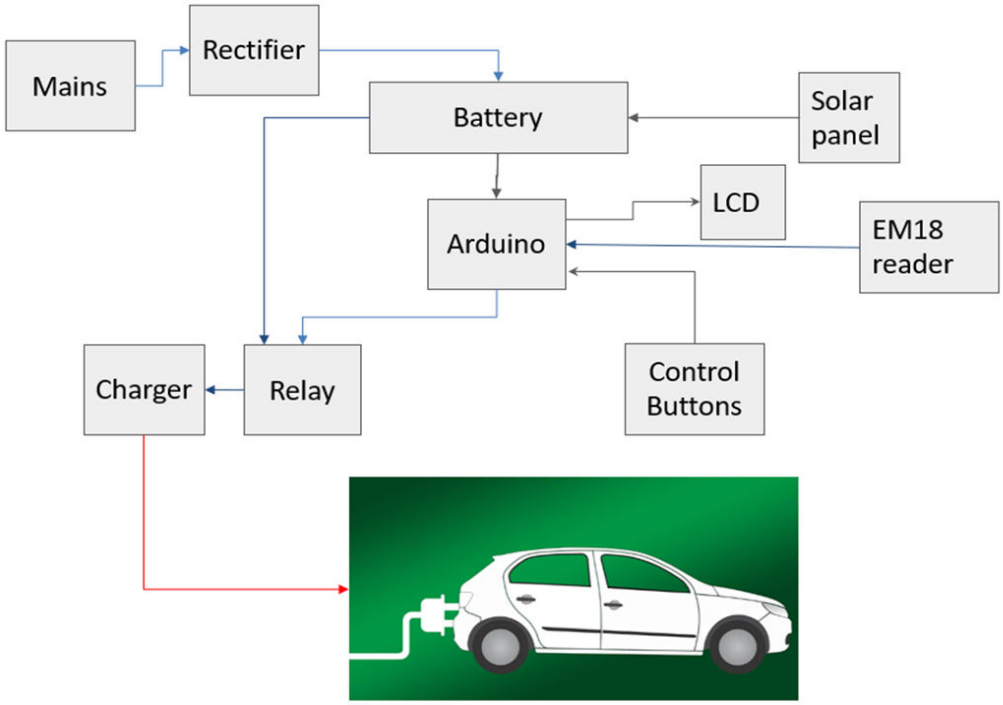

Fig. 1 Block Diagram for Solar EV Charger with RFID

As seen in fig. 1, the relay will turn on the charging circuit for ten seconds as a demonstration if the RFID tag number matches what is entered into the program.

- The charging will cease when the relay turns off after ten seconds.
- The RFID program is configured so that each time a mobile device is charged, money is taken out of the Tag wallet.
- The battery is recharged by the solar panel.
- We use a mobile device to test the system's charging during the demo.

The RFID tag number id set into the program and if the tag is matched then the relay will switch ON the charging circuit for 10 sec as a demo.
After 10 sec the relay will OFF so charging will stop.
The RFID program is set such a way that the money will deduct from the Tag wallet for every charging of the mobile.
The Solar panel use to recharge the battery
For demo we use mobile to check the charging using this system.

3. Hardware

a) Solar panel 3W (9v)

Solar panels are usually made from silicon, or another semiconductor material installed in a metal panel frame with a glass casing (Bhambulkar et al., 2021). When this material is exposed to photons of sunlight (very small packets of energy) it releases electrons and produces an electric charge (Rahul Mishra et al.,2013). When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow (Kajal et al., 2023); (Nayak, C.B. ,2022).

b) 7.4v 2200 mAH Rechargeable Battery

Rechargeable batteries (also known as secondary cells) are batteries that potentially consist of reversible cell reactions that allow them to recharge, or regain their cell potential, through the work done by passing currents of electricity (Nayak, C.B. ,2022).At 2200mAh capacity, you can expect to see up to 40 hours of gameplay time from a single charge. A short 4.5 hours is all it takes to bring this battery pack from 0 to 100% and provide another 40 hours of gaming time (Kajal et al., 2023).

c) Arduino Nano

Arduino NANO Version 3 is the open source smallest Embedded Development board launched by Arduino based on Atmega328 SMD Package Microcontroller (Pothi et al., 2023). Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. Arduino uses a variant of the C++ programming language (Wairagade et al., 2023). The code is written in C++ with an addition of special methods and functions. Moreover, when you create a 'sketch' (the name given to code files in this language), it is processed and compiled to machine language (John, B., Khobragade, N., & Bhambulkar, A. V. ,2022).

d) EM18, RFID Tags

The working principle of EM18 is about using radio waves to identify a specific RFID tag. So generally, the reader gives out a 125KHz frequency through its coils, and if a similar 125KHz passive RFID tag is within the frequency field, it gets energized. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods (Kokkawar et al., 2023)
.

e) Relay

The 12V SPDT relay is the 12V relay most commonly used switching device in electronics. It is commonly used in Home Automation projects to switch AC loads, To Control (On/Off) Heavy loads at a pre-determined time/condition, Used in safety circuits to disconnect the load from supply in event of failure and much more. A SPDT Relay (Single Pole Double Throw Relay) is a type of electrical switch that has two switching positions. In the first position, the switch connects the input terminal to the first output terminal. In the second position, the switch connects the input terminal to the second output terminal.

f) LCD

LCD screen technology is rather straightforward: LCD monitors are made of a substance that is permanently in a liquid state but has some properties inherent in crystal bodies. A Liquid crystal display is a passive device, which means it doesn't produce any light to display characters, images, video and animations. Arduino IIC/I2C interface was developed to reduce the IO port usage on Arduino board 16 characters wide,

2 rows Single LED backlight included can be dimmed easily with a resistor Supply voltage: 5V

g) Charging circuit for 3.7V battery

Basically, it uses basic power supply components like transformer, rectifier, filter and regulator. The Stepdown Transformer (230V to 15V) step down the AC power supply (Bhambulkar, A.V. ,2011). Next, the rectifier uses four 1N4007 diodes which convert step down AC into DC. Capacitor C1 and C2 are used for filter operation.

CONCLUSION

We have developed a system that uses RFID to provide an effective, practical, and affordable model of a PV-based EV charging station. RFID cards contain the necessary amount, so EV charging is completed. The building would isolate items that the client agreed were necessary based on their weight and overshadowing. Additionally, we can alter the system to suit the needs. This paper is designed to demonstrate the application of the framework. This framework finds errors and provides information about them, allowing businesses to update their computerization. Similarly, it reduces human effort and the rate of error in creation and business misfortune. This paper's primary conclusion is that using electric vehicle smart charging stations to meet the energy crisis is a viable alternative that also happens to be environmentally friendly. Electricity is the fuel needed to power the electric vehicles that are currently being developed. Due to the depletion of petroleum reserves, renewable energy sources have become essential for meeting our daily energy needs.

FUTURE ADVANTAGES

1. To charge an EV's battery, this solar based EV charging system uses inductive power transfer technology to move power from a pad buried in the ground to a pad fastened to the vehicle's undercarriage.
2. The plug-in issues that come with wired EV charging systems are avoided by using this charging system.
3. The problem of range anxiety and smaller batteries in electric cars.
4. Only users who are verified can charge their cars.
5. Using wireless charging for electric vehicles is easy, practical, and user-friendly.

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