© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716709

Solar Based Wireless Power Transfer System For EV

ABDUL AZEEZ[1], GADE SRINU[2], SHAIK SHAAZMI WASI[3], TAMMA DINESH REDDY[4], THALAPUREDDY BHARATH REDDY[5]
[1]*Assistant Professor in dept. of ECE in Amritasai Institute of Science and Technology in Vijayawada, Andhra Pradesh.*
[2, 3, 4, 5]*UG Student in dept. of ECE in Amritasai Institute of Science and Technology in Vijayawada, Andhra Pradesh.*

Abstract- ***This project aims to design and implement a solar-powered rooftop wireless charging station for electric vehicles (EVs). The system harnesses solar energy through rooftop-installed solar panels, which is then converted into electrical energy using a solar inverter. This energy is stored in a battery bank to ensure continuous power availability, even during low sunlight or nighttime conditions. A key feature of the proposed system is wireless charging technology, which eliminates the need for physical cables, providing a convenient and user-friendly experience for EV owners. The station is equipped with a wireless charging pad that automatically aligns with the EV's receiver coil, ensuring efficient power transfer through resonant inductive coupling technology. The increasing adoption of electric vehicles (EVs) has intensified the demand for efficient, sustainable, and user-friendly charging technologies. Solar-based wireless charging solution by integrating renewable energy generation with inductive power transfer to enable convenient, cable-free charging. This research work explores the design, operation, and performance evaluation of a solar-powered wireless EV charging system, highlighting the architecture, components, methodology, challenges, and potential applications. The proposed system uses solar photovoltaic (PV) modules to supply DC power, which is then conditioned and transmitted wirelessly through a resonant inductive coupling mechanism. Experimental analysis demonstrates the feasibility and efficiency of the system under different operating conditions. The results indicate that solar-assisted wireless charging can reduce dependence on grid power, minimize infrastructure complexity, and support the development of green transportation ecosystems.***

Keywords: Electric Vehicle (EV), Solar PV, Wireless Charging, Induction Power Transfer (IPT), Renewable Energy, Relay Control, Arduino IDE

I. INTRODUCTION

The rapid global shift toward electric mobility is driven by the need to reduce green house gas emissions, mitigate fossil fuel consumption, and enable sustainable transportation. However, traditional plug-in EV charging systems are limited by issues such as cable management, user inconvenience, exposure to environmental conditions, and possible safety hazards. Wireless power transfer (WPT) has emerged as a modern alternative that offers automatic charging without physical connectors. Combining solar PV technology with wireless charging enhances system sustainability by generating clean energy while reducing reliance on grid supply. This is especially beneficial in countries with high solar irradiance. This paper examines the design, working principles, and practical considerations involved in developing a solar-based wireless EV charging system.

II. LITERATURE REVIEW

2016 Researchers demonstrated resonant inductive coupling as a viable method for mid-range wireless power transfer, highlighting coil alignment issues.

- 2018Studies reported improved efficiency using LCC compensation circuits for EV wireless charging, achieving up to 90% transfer efficiency.
- 2019 Solar-based EV charging stations were explored, showing reductions in grid load and
- operational costs.
- 2020 Advancements in power electronics enabled high-frequency inverters optimized for wireless EV charging applications.
- 2021 Hybrid renewable-powered wireless charging prototypes were developed using MPPT controllers for improved PV performance.
- 2023 AI-enabled solar–wireless charging systems were introduced, improving energy

management through predictive algorithms. control. Microcontrollers used, such as Arduino,

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716709

ESP8266/ESP32, and Raspberry Pi, are popular owing to easy inter facing of sensors and internet connectivity. The IoT solution provides an advantage of much lower latency, fine-grained user inter action, and better analytics compared to GSM. The sensor technology has also evolved. Modern systems utilize precise digital metering modules like the PZEM-004T, ADE7758, and HLW8012 that boast an accuracy of ±0.5–1% and even provide much safer isolated communication. From literature, theft detection techniques vary from simple current threshold methods up to pattern recognition and machine learning .While ML provides a high degree of accuracy, threshold-based detection remains popular for low-cost prototypes. Most of the recent systems implement cloud platforms such as Blynk, Thing speak, Firebase, and MQTT for real-time dashboards and remote load control. The two-way actuation makes the IoT system more flexible than those using GSM based designs. Other works also discuss dual-meter architectures for detecting illegal connections between households by comparing load profiles. Security remains a concern, and the recommendations are for lightweight encryption and authenticated APIs. Overall, the trend clearly moves from GSM systems to IoT-based architectures with a focus on real-time monitoring ,cloud dashboards, dual-load measurements, and fast theft detection. The proposed system builds on this by combining, in hybrid edge-cloud design ,dual PZEM modules for measurement, Arduino-based processing, IoT control, and relay-based theft prevention.

III. SYSTEMARCHITECTURE

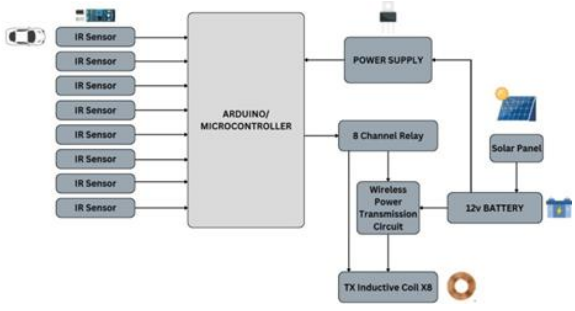


Fig: Block Diagram

The following procedures were followed to design, develop, and test the Solar-Based Wireless Electric Vehicle Charging System. Each step outlines the practical workflow used in the project.

1. Solar Power Generation Setup

1. A 100 W solar photovoltaic (PV) panel was mounted under standard test conditions.
2. The open-circuit voltage (Voc), short-circuit current (Isc), and maximum power point (Vmpp, Impp) were measured.
3. An MPPT charge controller (Perturb & Observe algorithm) was connected to regulate the PV output.
4. A 12V lithium-ion battery was connected to store energy from the solar panel.

2. DC–DC Boost Converter Implementation

1. A boost converter was designed to step up 12V DC to 36–48V DC required for wireless power transfer.
2. MOSFET switching frequency was set between 20–30 kHz.
3. The duty cycle was tuned experimentally to maintain a stable boosted output.
4. Output voltage and current were measured using a digital multimeter and oscilloscope.

3. High-Frequency Inverter Design

1. The boosted DC voltage was fed to a single-phase high-frequency inverter.
2. The inverter output frequency was set to 30 kHz for optimal resonant coupling.
3. Series–Series (SS) compensation capacitors were calculated and connected to achieve resonance.
4. AC output waveform was monitored to ensure sinusoidal high-frequency output.

4. Transmitting Coil (Tx) Fabrication

1. A spiral-shaped coil was wound using 1.0 mm Litz copper wire.
2. The coil diameter was maintained at 20–25 cm for better coupling.
3. The number of turns (typically 15–20) was optimized through testing.
4. The coil was mounted on a wooden base and connected to the inverter output.

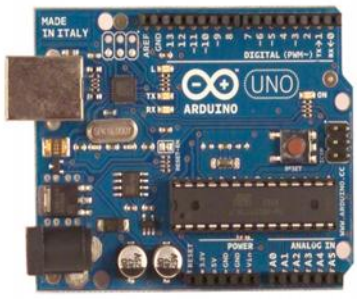
5. Receiving Coil (Rx) Fabrication

1. A similar spiral-shaped coil was prepared for the receiving side.
2. The Rx coil was connected to a high-frequency rectifier circuit..

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716709

Arduino

Arduino is open source physical processing which is base on a microcontroller board and an incorporated development environment for the board to be programmed. Arduino gains a few inputs, for example, switches or sensors and control a few multiple outputs, for example, lights, engine and others. Arduino program can run on Windows, Macintosh and Linux operating systems (OS) opposite to most microcontrollers' frameworks which run only on Windows. Arduino programming is easy to learn and apply to beginners and amateurs. Arduino is an instrument used to build a better version of a computer which can control, interact and sense more than a normal desktop computer. It's an open-source physical processing stage focused around a straightforward microcontroller board, and an environment for composing programs for the board. Arduino can be utilized to create interactive items, taking inputs from a diverse collection of switches or sensors, and controlling an assortment of lights, engines, and other physical outputs. Arduino activities can be remaining solitary, or they can be associated with programs running on your machine (e.g. Flash, Processing and Maxmsp.) The board can be amassed by hand or bought preassembled; the open-source IDE can be downloaded free of charge. Focused around the Processing media programming environment, the Arduino programming language is an execution of Wiring, a comparative physical computing platform.



16*2 LCD DISPLAY

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

BUZZER

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

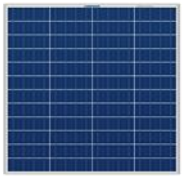
This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716709

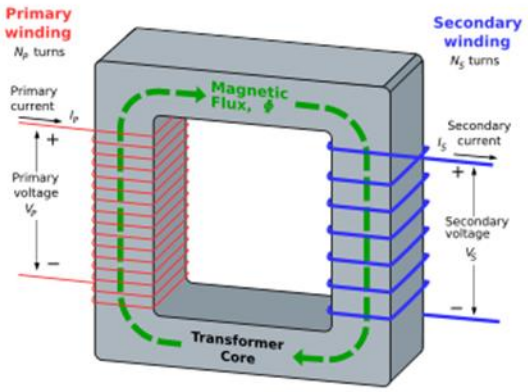
RELAY MODULE: Internally, a relay consists of several key components that work together to achieve this switching operation. The electromagnetic coil is responsible for generating the manetic field when energized. The armature is a movable metal component that responds to the magnetic field and physically moves to change the contact position. A spring mechanis misused to return the armature to its original position when the coil is de-energized.

The second is the relay itself, which, in this case, is a blue plastic case. Lots of information can be gleaned from the markings on the relay itself. The part number of the relay on the bottom says “05VDC”, which means that the relay coil is activated at 5V minimum – any voltage lower than this will not be able to reliably close the contacts of the relay. There are also voltage and current markings, which represent the maximum voltage and current, the relay can switch. For example, the top left marking says “10A 250VAC”, which means the relay can switch a maximum load of 10A when connected to a 250V mains circuit. The bottom left rating says “10A 30VDC”, meaning the relay can switch a maximum current of 10A DC before the contacts get damaged.

SOLAR PANEL



As we stand at the precipice of a pivotal moment in human history, the widespread adoption of solar panels holds the promise of a brighter, cleaner, and more sustainable future for generations to come. By embracing the power of the sun, we illuminate the path towards a world where energy is abundant, accessible, and equitable for all. Together, let us harness the transformative potential of solar panels to usher in an era of prosperity, harmony, and environmental stewardship for our planet and all who call it home. By harnessing a virtually inexhaustible source of energy in the form of sunlight, solar panels mitigate reliance on finite fossil fuel resources, reduce greenhouse gas emissions, and mitigate the impacts of climate change. Furthermore, solar energy promotes energy independence and resilience, empowering communities to generate their own power and insulate themselves from the volatility of global energy markets.



TRANSFORMER: A transformer is a fundamental electrical device used to transfer electrical energy between two or more circuits through electromagnetic induction. It is primarily used to step up or step-down voltage levels in power systems and electronic circuits. Transformers play a crucial role in power distribution, ensuring that electrical energy is transmitted efficiently over long distances and delivered at suitable voltage levels for various applications.

IV. RESULTS& DISCUSSION

Solar-based wireless power transfer (WPT) systems utilize photovoltaic panels to generate electricity, which is then transmitted via electromagnetic induction to a receiver without cables, achieving efficiencies up to 98.78% at close range (0–10 cm). These systems are primarily used for efficient, eco-

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716709

friendly charging of electric vehicles and small electronic devices, with potential applications for space-based power transmission.

A 16×2 LCD has two registers like data register and command register. The RS (register select) is mainly used to change from one register to another. When the register set is '0', then it is known as command register. Similarly, when the register set is '1', then it is known as data register.

Command Register
The main function of the command register is to store the instructions of command which are given to the display. So that predefined tasks can be performed such as clearing the display, initializing, set the cursor place, and display control. Here commands processing can occur within the register.

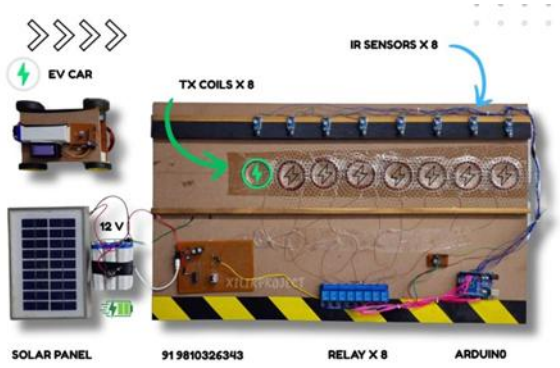
Data Register
The main function of the data register is to store the information which is to be exhibited on the LCD screen. Here, the ASCII value of the character is the information which is to be exhibited on the screen of LCD. Whenever we send the information to LCD, it transmits to the data register, and then the process will be starting there. When register set =1, then the data register will be selected.

3.2.6 16×2 LCD Commands
The commands of LCD 16X2 include the following.

- For Hex Code-01, the LCD command will be the clear LCD screen
- For Hex Code-02, the LCD command will be returning home
- For Hex Code-04, the LCD command will be decrement cursor
- For Hex Code-06, the LCD command will be Increment cursor
- For Hex Code-05, the LCD command will be Shift display right
- For Hex Code-07, the LCD command will be Shift display left
- For Hex Code-08, the LCD command will be Display off, cursor off
- For Hex Code-0A, the LCD command will be cursor on and display off
- For Hex Code-0C, the LCD command will be cursor off, display on
- For Hex Code-0E, the LCD command will be cursor blinking, Display on
- For Hex Code-0F, the LCD command will be cursor blinking, Display on
- For Hex Code-10, the LCD command will be Shift cursor position to left
- For Hex Code-14, the LCD command will be Shift cursor position to the right
- For Hex Code-18, the LCD command will be Shift the entire display to the left
- For Hex Code-1C, the LCD command will be Shift the entire display to the right
- For Hex Code-80, the LCD command will be Force cursor to the beginning (1st line)
- For Hex Code-C0, the LCD command will be Force cursor to the beginning (2nd line)

For Hex Code-38, the LCD command will be 2 lines and 5×7 matrix

4.5LCDDisplayOutputs
Normal Operation: Row 1 displays 'I:0.270A' and Row 2 displays 'NORMAL ON'.
Theft Detection: Row 1 displays 'I:0.520A' and Row 2 displays 'Current Theft'.
System Restoration: Row 1 displays 'I:0.110A ' and Row 2 displays 'RESTORED ON'.



V. CONCLUSION & FUTURE SCOPE

CONCLUSION

- Developing Hybrid system in renewable energy resources is the most convenient and effective for the production of electricity as compared to non-renewable energy sources. It is not only less costly but also does not affect the environment i.e. Non-polluting. It is also placed in some hilly area for producing electricity in place of non- conventional

methods. In future the world is full of electricity by non-conventional energy resources. The hybrid system have less maintenance and longer life span. It just only has high initial investment for the production of electricity. In future, most of the companies implemented hybrid renewable systems for power supply

future scope

The future scope of a charging system using wind, solar, and footstep energy is promising, offering clean and sustainable power for off-grid areas, smart cities, portable devices, and contributing to environmental sustainability with advancements in technology and government support.

REFERENCES

[1] Sahdev, Fundamental of Electrical Engineering and Electronics, Dhanpat Rai Pub., 2006, pp. 130-137.

[2] Solar-Wind Hybrid Energy System Using MPPT (IEEE Paper).

[3] Hybrid MPPT Controlled Solar/Wind Power System for Pumping System (IEEE Paper).

[4] https://www.solarbyluminous.com/solar-basics.

[5] https://energyswaraj.org/watch-training-videos.php