Section A-Research paper

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SOLAR WIRELESS ELECTRIC VEHICLE CHARGING SYSTEM

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Abstract

The primary functions of wireless charging involve using an electromagnetic field to transmit electricity across a certain area. In order to boost dependability and reduce continuous emissions, it's crucial to alter the battery charging cycle for electric vehicles. Electric car batteries should be able to be charged using wireless power transfer or plug-in charging at charging stations. The design of an electric vehicle charging station using solar energy is discussed in this paper. The important problems of fuel contamination and solar fuel contamination are addressed in this design. Solar energy is transformed into electrical energy by the solar panel. Power from a solar board is wirelessly transported through a transmitter

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circuit and received by a collector circuit in accordance with Faraday's law of enlisting. There is a transmitter and a collector curl. The same frequency as the transmitter curl drives the thunderous recurrence of the receiving loop. While being sent wirelessly, some power is lost. Wireless battery charger technology has made it possible to recharge electric vehicles, drones, emergency room equipment, and mobile phones. Additionally, this gadget lessens the need for cords.

Keywords: *Solar Wireless, Electric Vehicle, Charging System*

1. Introduction

In the global automobile business, electric vehicles (EVs) are a novel idea. To maintain the quality of the power networks in this situation, the battery charging process for EVs should be controlled. In any case, the possibility that the energy stream will be negative will rise as the number of Evs grows since more energy will be stored in batteries. One of the key innovations in later brilliant networks will be the intelligence with EVs, increasing the power matrix independent action. With V2G and V2H developments, it is advised to use an on-board bidirectional charger.

The electric vehicle has become more significant than a traditional gas-powered car due to its lower carbon dioxide emissions and growing reliance on non-renewable energy sources. However, there were a number of obstacles that prevented the EV from being generally adopted into the market, including expensive car costs, a sparse infrastructure for charging, and a limited all-electric drive. Electric vehicles (EVs) are autos that are powered fully or in part by electricity. Due to the virtually complete absence of fossil fuel use and the low number of moving parts that require maintenance, electric vehicles are economical to operate.

Electric vehicles should be the preferred mode of transportation in the future. Instead of using gases made from the by-products of fossil fuels and petroleum derivatives to store dc energy in the battery, electrical vehicles use electricity to do so. Because they emit less carbon dioxide and have higher petroleum derivatives, electric vehicles are now more competitive when compared to conventional gas-powered automobiles. They are also efficient, cost-effective to operate, less commotion-polluting, more effective, and environmentally friendly.

Wireless Power Transmission (WPT) is regarded as a more efficient solution for charging electric vehicles. Inductive coupling and appealing reverberation are the two innovations for these that require the most work. These reverberation types are used for mid-range distance

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because they have a functioning recurrence of mhz and can move capacity of several meters. Alternatively, there is the inductive coupling, which is typically used in transformers with air holes. It uses inductive coupling to transmit wirelessly. The inductive coupling curl is a collection of damaged wires that are formed into a sphere with a moving attractive field. Supporting wireless power transmission proves to be extremely reliable, safe, and comfortable. It greatly aids EV buyers in energy conservation and a reduction in the price of electricity. The essential curl and optional curl make up the two loops that make up the inductive coupling curl. The effectiveness of the system largely depends on the curls' value variable's strong points.

In addition, keep your surroundings clear, avoid overcharging, monitor the battery's levels, and be intelligent, environmentally friendly, and install charging stations in densely populated areas. These may be introduced in rest areas, malls, and even remote areas. When fully charged, this model will automatically disengage and begin charging again. Due to the trouble of charging, electric vehicles aren't suitable for trips over extended distances.

2. Literature Review

A novel solar wireless charging system for electric vehicles based on inductive power transmission is presented by Chen, Y., Zhang, and Jiang in their article titled "A Novel Solar Wireless Charging System for Electric Vehicles Based on Inductive Power Transfer" (2021). The authors detail the system architecture, control schemes, and performance assessment of the suggested system in a paper that appears in the IEEE Transactions on Vehicular Technology. The authors show the system's efficiency and viability by applying inductive power transfer technology. This study contributes to the expanding field of electric vehicle wireless charging systems. Inductive power transfer technology is used in this paper to provide a revolutionary solar wireless charging method for electric automobiles. It analyses the system architecture, control tactics, and performance assessment, proving the viability and effectiveness of the system.

A thorough examination of wireless power transfer technologies is given in the book "Wireless Power Transfer for Electric Vehicles and Mobile Devices" edited by Salous, S., Gavrilovska, L., Matolak, D. W., and Sousa, E. (2020). The book discusses a variety of wireless power transmission topics, such as solar-powered electric vehicle systems. It explores issues like electromagnetic theory, system design, application, and upcoming advancements. For scholars and professionals interested in wireless power transfer

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technologies, this article is a great resource. In-depth analysis of wireless power transfer technologies for electric vehicles, including solar-based systems, is provided in this thorough book. It addresses a number of topics, including electromagnetic theory, system design, implementation, and potential future advances.

An article titled "Solar-powered wireless charging system for electric vehicles: design and implementation" was published in the International Journal of Electrical Power & Energy Systems by Tan, K., Wang, Q., and Wang, X. (2018). The authors outline the development of an electric vehicle wireless charging system that is solar-powered. To demonstrate the efficiency and usefulness of their suggested system, they talk about the system design, the control algorithms, and give experimental findings. This work advances the design of solar-powered electric vehicle charging infrastructure. The design and installation of a solar-powered wireless charging system for electric automobiles are presented in this paper. The effectiveness of the system and its potential for real-world applications are shown through discussions of the system design, control algorithms, and experimental findings.

Gubbi, J., Buyya, R., Marusic, & Palaniswami (2013) offer an article in Future Generation Computer Systems titled "Internet of Things (IoT): A vision, architectural elements, and future directions" even though it is not specifically about solar wireless electric vehicle charging systems. The Internet of Things (IoT) and its potential effects on a number of applications, such as the integration of smart grid technology and the charging of electric vehicles, are discussed in further detail in this article. With technology improving and electric vehicle incorporation into smart grids, it is essential to comprehend the IoT and how it relates to charging systems. This study provides a broader view on the Internet of Things (IoT) and its possible consequences for different applications, including smart grid integration and electric car charging, even though it is not unique to solar wireless electric vehicle charging systems.

In their review article titled "A comprehensive review on the development of inductive power transfer technology for electric vehicles," Pandey, P., Chauhan, Y., & Ali (2017) give a summary of inductive power transfer technology for electric vehicles. The article discusses design factors, efficiency studies, and developments in the sector, albeit it is not specifically on solar wireless charging devices. It illuminates the possibilities of inductive power transfer technology, a vital part of many wireless charging solutions.

3. Implementation of Wireless Charging

Since conductive connections are required for wireless charging, conduction errors that can happen through wire can be completely eliminated. Similar to how treating wires with human hands during plug-in and plug-out charging systems can occasionally be dangerous if done incorrectly. In light of this, it is possible to avoid human mediation for security reasons. Wireless charging has some limitations even if it is by all accounts effective and feasible. The development of the framework, which must be completed to serve the purpose, is the key component of execution. This will necessitate massive capital speculation across all stages of the work, making it an expensive operation. In order to charge electric cars (EVs) in garages or public parking lots when the vehicle is not in use for a significant amount of time, the first wireless charging technology was fixed. Because a formal relationship is not necessary, the potential of charging EVs while they are moving has generated a lot of interest. Charge an EV while it is traveling by using dynamic wireless charging.

3.1. Electric vehicle static wireless charging system

Static WEVCS (Wireless Electric Vehicle Charging System) may absolutely replace the module charger and address associated safety issues like trip risks and electric shock with little effort on the part of the driver. The fundamental layout of the static WEVCS is shown in Figure 1.The power converter transforms the incoming energy from AC to DC and delivers it to the battery bank. The executive systems have a wireless correspondence organization to get feedback from the important side, preventing any battery problems, power control problems, or health problems. The amount of source power, the size of the charging cushion, and the distance between the two windings' air holes all have an impact on how long it takes to charge. Between 150 and 300 millimetres is the normal distance between light-duty cars. In exiting areas, car exits, houses, commercial buildings, malls, and park 'n' ride offices, static WEVCS can be implemented.

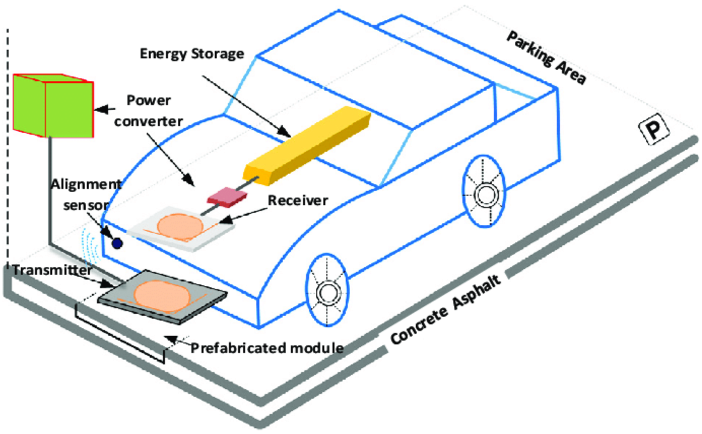

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Figure 1: Ev charging that is static wireless

3.2.System for Dynamic Wireless Charging

A dynamic wireless charging system enables an electric car to be charged while it is moving, as the name would imply. The main issues with electric car transmission are power and range. Vehicles' range can be increased with the use of dynamic wireless charging. The term "on street charging" is another name for the DWCS. A large-capacity battery is not necessary if charging is finished at the proper intervals, making the car lighter and more effective.

To expand its reach, DWCS offers an improved option for electrical car charging. The vehicle will have the battery bank, and the base unit will be positioned underneath the streets along predetermined routes. When charging, the car will ignore the road and only do so while it is driving. This will initially require a lot of guesswork and framework change, but over time, the system will aid in promoting electric cars as being a better option than traditional modes of transportation. The most advanced approach for recharging/charging EVs with almost little real touch between source and burden is wireless power transfer. WPT uses electromagnetics to transport electrical energy. WPT has a few advantages, such as:

(1) Less inadequate charging hardware is experienced when the genuine association requirement is avoided. Additionally, using the product interface—a mobile device, tablet, or in-car application—to begin the charging process is helpful.

(2) More EV charging can be accommodated at a station of the same size thanks to the subterranean installation of the charging equipment. Additionally, environmental dangers are shielded from the charging equipment.

In the US, there are a lot of wind and solar power plants that are in operation alongside parkways, making it possible to combine the distinctive WPT concept with cutting-edge sustainable power technology. In these scenarios, the major matrix power serves as a hold and the electricity utilized to charge EVs is mostly produced by solar photovoltaic arrays on the daytime side of the street and wind turbines on the evening side. This system helps to reduce transmission network congestion, lessen power transmission errors, accelerate the use of renewable energy sources, improve influence system management, and significantly reduce the transportation system's emissions of fossil fuels by providing EVs with an electric

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energy source nearby where the electricity is generated. A diagrammatic illustration of the DWCS system is shown in Figure .

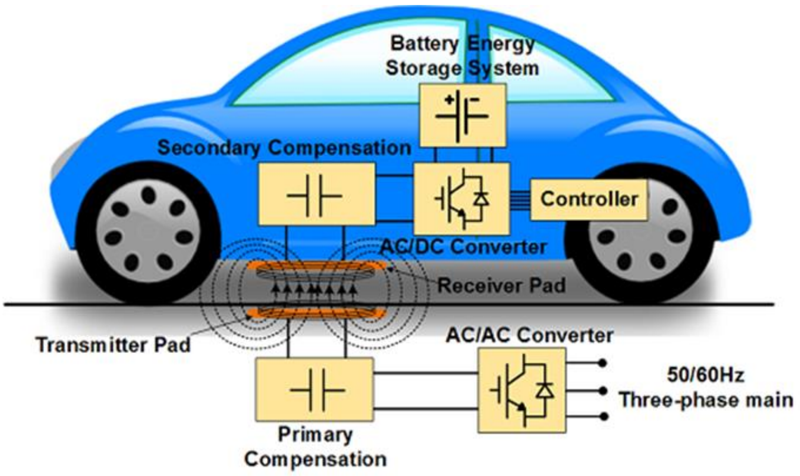

Figure 2: Dynamic wireless charging system

4. Methodology and Modelling

Power can be sent wirelessly if there are no physical wires present. It is possible to transmit with inductive coupling. The sending side and getting side portions of the system execution are completed separately.

Solar cluster mostly depends on solar energy for its power. The most extreme power point following (MPPT) is where this DC power goes after that. Additionally, MPPT examines the boards' results and packs it to the battery voltage. In fact, it calculates the board's ideal power output to recharge the battery and changes the current voltage to the ideal voltage to feed the battery with as many amps as feasible. Thirdly, the wireless charger circuit receives the most powerful DC power. Wireless battery charging there makes use of an attracting or inductive field between two objects. A regular battery is connected at the recipient end. The battery will finally be charged. Below, partial execution has been presented.

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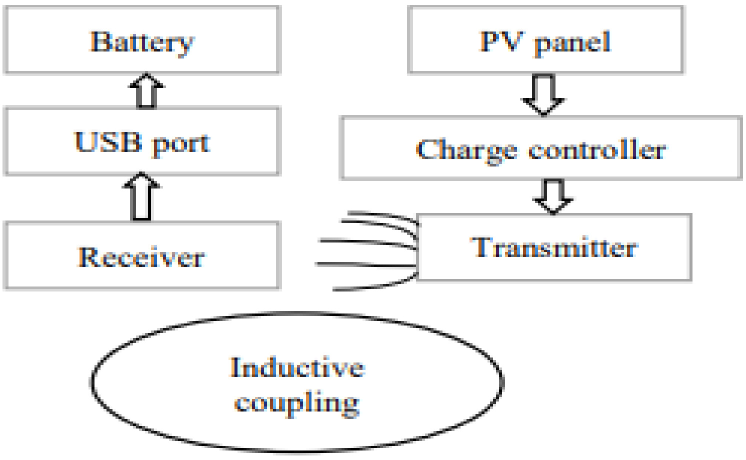

Figure 3: Wireless battery charger block diagram.

4.1. Transmitter Side

The n-channel MOSFET IRF540N, the IC 555 clock, the widely applicable semiconductor BC547, a few capacitors, a few resistors, and a tuned LC circuit are all present on the transmitter side. The tank circuit is another name for this tuned LC circuit.

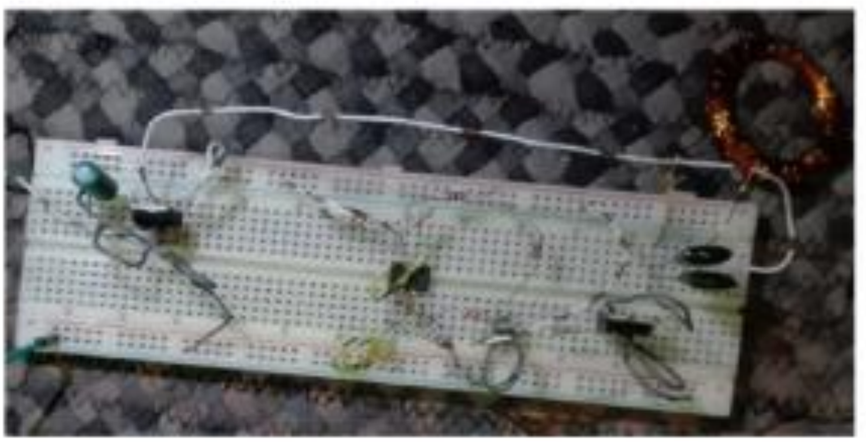

Figure 4: Circuit design for the transmitter in this system.

4.2. Solar Power Supply Setup

It is envisaged that a capacity device will store the energy that the solar cells produced during the equipment execution phase.

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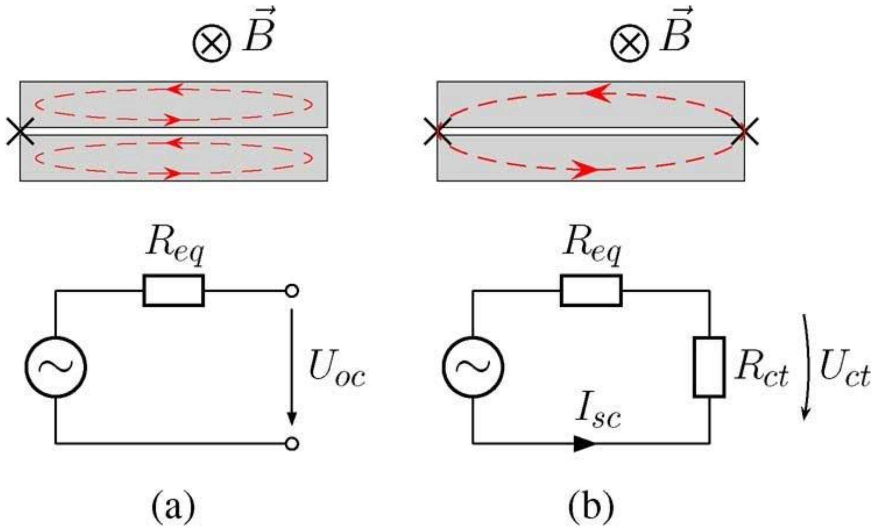

Figure 5: measuring the open circuit voltage and the short circuit current, respectively.

The electrical energy generated by solar cells is stored in batteries, which are a popular storage technology. When using a solar PV to recharge a battery, a charge regulator is an essential component. It will be essential to link a charge regulator in series between the solar panels and the batteries in this manner.

4.3. Voltage regulator setup

The voltage controller IC 7805 maintains a constant voltage yield for changeable information voltage, and the result voltage is +5 volt. There are 3 pins. Input is connected to pin 1, results are connected to pin 3, and ground is connected to pin 2. In this setup, the source and capacitor C5 are connected to pin number 1, which is also a pin. It also has a connection to the tuned LC circuit.

Capacitor C5 and C6 are connected to pin number 2, which is then connected to ground. Capacitor C6 is connected to pin number 3, which is also connected to the IC 555 clock by pin number 4.

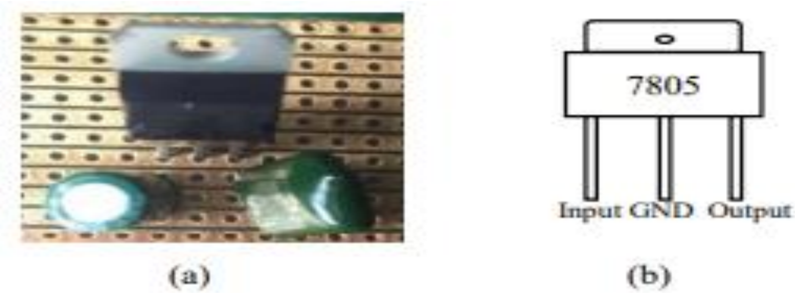

Figure 6: voltage regulator configuration (a) and voltage regulator IC (b).

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4.4. Installing an IC 555 timer

This integrated circuit is used to calculate age. For instance, there are three different temperaments for an IC clock. a monostable, stable, bis table. This approach makes use of a stable state of mind. It continuously emits a variety of rectangular heartbeats. Every heartbeat occurs at a predetermined frequency.

Pin 1 is grounded in this system. Setting off pin 2 is connected to a capacitor C6 and shorted to pin 6. The combination of pin 3 and the resistor R3 is a semiconductor. Pin 3 and pin 4 of the voltage controller IC 7805 are connected. Control voltage pin 5 is connected to a grounded capacitor, C4. One register, R2, connects the limit pin 6 and the discharge pin 7. 4 is shorted to pin 8

(a) (b)

Figure 7: Setting up the IC 555 timer in (a) and the system's rectifier in (b).

4.5. Tuned LC Circuit (transmitting end)

The capacitors C1 and C2 are used to create the tuned LC circuit. C1 and C2 are parallelly connected to an inductor. Copper wire is wound in 45 turns to create this inductor. The copper loop has a width of 7.3 cm. Comparable in operation to a heap circuit is this circuit. It establishes the frequency of swaying. In this tuned circuit, the transmitter and collector circuits are inductively coupled. A recommended voltage is present at both the transmitter and the receiving circuits.

4.6. Receiver End

This is where the attractive field's transmitted fluctuating induced voltage is obtained. The incited voltage is used to charge the battery. The acquiring component makes use of hardware like an LC tuned circuit, an ongoing controller IC MC34063, a Schottky diode 1N5819, and some removable equipment.

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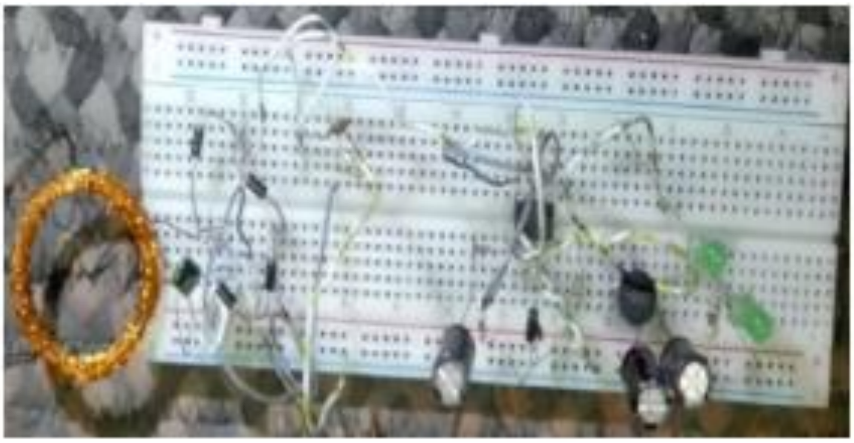

Figure 8: suggested system's receiver side.

4.7. LC Circuit with a tuned receiving end

Two capacitors C7 and C8 are connected in parallel with an inductor that has 50 turns of copper wire. This copper loop has a beautiful pivoting action. This loop measures 7.3 cm and is collected.

(a) (b)

Figure 9: copper coils for the transmitting and receiving ends, respectively.

4.8. Setup of Bridge Rectifier

Four diodes are used to create an extension rectifier. The rectifier is connected to a tuned LC circuit. The DC current and the swivelling magnetic field are separated by this extension rectifier. The capacitor C9 is connected to the rectifier.

4.9. Setting up the IC MC34063

This IC is a buck/support converter. In this setup, it serves as a buck converter.

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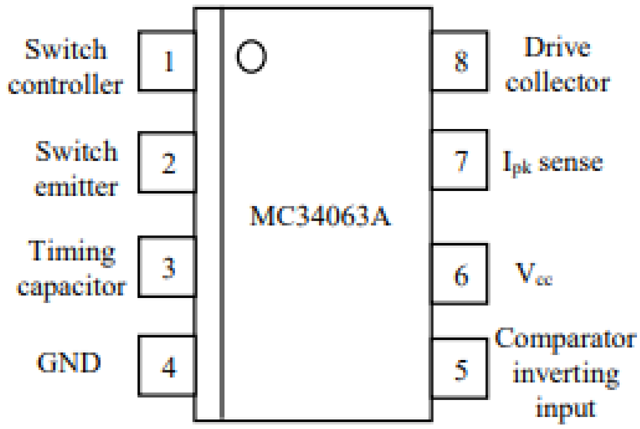

Figure 10: converter IC for buck-boost.

Buck converter helps maintain the constant voltage and current. Driver gatherer pin 8, IPK pin 7, and switch authority pin 1 are connected in a short circuit, and their usual locations are connected to resistor R8. Both an inductor and a diode are connected to switch producer pin 2. Then, two capacitors C12 and C13 are connected to various parts of the inductor at that moment. This typical indication of two capacitors has a heap attached to it.

5. Results and Analysis

Wireless power transfer links this proposed concept. The electromagnetic field causes power to be transmitted. The copper curl on the transmitter side helps it transform solar energy into a swaying appealing field. The recipient end of this swaying attracting field produces an initiated voltage, which completes the charging of a device's battery.

In Fig. 11, a cell phone's charging progress is shown.

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Figure 11: recharging a smartphone

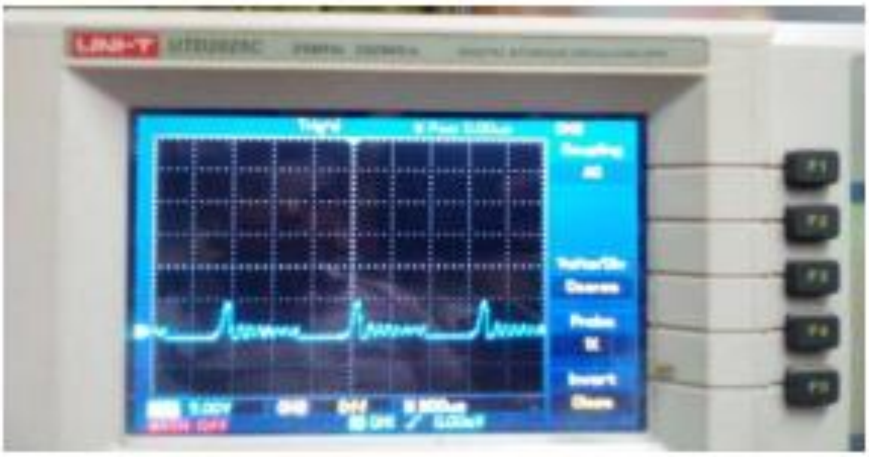

Figure 12: For the input voltage's waveform.

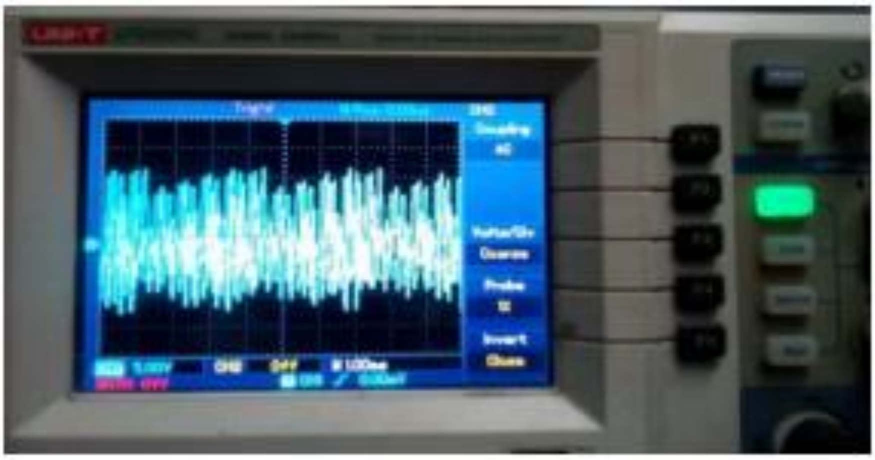

Figure 13: for the output voltage's wave form

6. Conclusion

Electric vehicle (EV) wireless charging technology could provide the EV industry a clear advantage. Wireless charging provides many benefits, including increased comfort, ease of use, and reduced wear and tear on charging ports, even if wired charging is currently more prevalent. Therefore, improvements in wireless charging technology may significantly enhance the EV charging experience and speed up EV adoption, which may finally result in a decrease in the waste products of fossil fuel use and contribute to the mitigation of climate change. A solar power wireless charger can efficiently charge the battery with nearly little wires. Cell phones and other wireless gadgets, as well as the vast majority of small electronics, are ideal candidates for this wireless charging technique. This experiment

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depends on wireless technology and solar electricity. Electronic items can then be readily charged without a wire or charger when traveling and during load shedding. This system thrives in a good environment and produces a lot of material.

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