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# Solar Powered Wireless Electric Vehicle Charging Station

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## ABSTRACT

This paper describes our project on a solar powered wireless charging station for electric vehicles. We have used a solar panel as the energy source and a lithium-ion battery to store the energy. The main parts of the model are a TP4056 charging module, IR sensor, relay module, switching circuit, and transmitter and receiver coils. When an object comes near the charging area, the IR sensor detects it and the relay is used to switch the transmitter circuit. The transmitter coil produces a changing magnetic field, and the receiver coil gets electrical energy through electromagnetic induction. The paper explains the components, basic working, construction approach and possible uses of the model. This is a small academic prototype to understand the concept of solar energy and wireless power transfer. It is not a commercial EV charging unit.

**Key Words:** Solar Energy, Electric Vehicle, Wireless Power Transfer, Electromagnetic Induction, IR Sensor, Lithium-Ion Battery.

## SYSTEM BLOCK DIAGRAM

Solar Panel → TP4056 Charging Module → Lithium-Ion Battery → Power Switching Circuit → Transmitter Coil IR Sensor → Relay Module → Power Switching Circuit

Transmitter Coil ~~~ Magnetic Coupling ~~~ Receiver Coil → Output Load

## 1. INTRODUCTION

Electric vehicles are becoming more common because they do not use petrol or diesel for running. For charging these vehicles, electricity is required. Solar energy is one possible source of this electricity because a solar panel can convert sunlight into electrical energy. Wireless charging is another useful concept in which power is transferred without connecting a cable directly to the vehicle.

In our project, we have made a model of a solar powered wireless EV charging station. The solar panel is used to generate electricity and the battery stores the energy. An IR sensor is used to detect the vehicle near the charging area. A relay controls the supply to the transmitter circuit. The transmitter and receiver coils are used to show the basic concept of wireless power transfer.

## 2. PROBLEM STATEMENT AND OBJECTIVES

In normal charging, the vehicle is connected to a charger using a cable. Our project studies a different method in which solar energy is used and power is transferred wirelessly. The main challenge is to arrange the components properly and keep the two coils aligned so that energy can be transferred.

The objectives of this project are to use solar energy, store energy in a battery, detect the vehicle using an IR sensor, switch the transmitter circuit using a relay, understand wireless power transfer, and prepare a working model for educational demonstration.

## 3. LITERATURE REVIEW

We referred to published work related to solar based EV charging and wireless power transfer. These studies explain that solar panels can be used with energy storage, and that wireless power transfer can take place between two coils using electromagnetic induction. They also show that coil distance, alignment and circuit design affect the amount of power received [1]–[3].

From the study, we understood the basic arrangement required for our model. Our project uses a simple setup to demonstrate the main idea. It is not designed to charge a full-size electric vehicle.

## 4. COMPONENTS AND SYSTEM DESIGN

The model has three main sections: solar energy and battery storage, vehicle detection and switching, and wireless power transfer.

4.1 Solar Panel: The solar panel converts sunlight into DC electrical energy. Its output changes according to sunlight and the rating of the panel.

4.2 TP4056 Module and Lithium-Ion Battery: The TP4056 module is used for charging a single-cell 3.7 V nominal lithium-ion battery. The panel and charging circuit must have suitable voltage and current ratings. A proper battery protection arrangement is also important.

4.3 IR Sensor and Relay: The IR sensor detects an object near the charging area. Its output is used to operate the relay. The relay works like an electrically controlled switch for the transmitter circuit.

4.4 Switching Circuit and Coils: The battery gives DC supply. For wireless power transfer, the transmitter coil needs a changing current, which is provided by a suitable switching circuit. The receiver coil receives energy from the changing magnetic field. The received output may need rectification and regulation before it is connected to a DC load.

4.5 Mechanical Arrangement: The mechanical part includes the base or frame of the charging station, mounting of the components, vehicle positioning and alignment of the two coils. The structure should hold the components firmly and maintain the required coil gap.

## 5. WORKING PRINCIPLE

The project works on solar energy conversion, automatic switching and electromagnetic induction. First, the solar panel converts sunlight into electrical energy. The charging module is used to charge the compatible battery. When a vehicle or object comes near the charging area, the IR sensor detects it and gives a signal to the relay. The relay then switches the transmitter circuit ON.

The transmitter coil produces a changing magnetic field. When the receiver coil is kept opposite to it, voltage is induced in the receiver coil. This takes place due to electromagnetic induction. The output can be used for a small load, such as an LED, when the circuit is properly connected. Coil distance and alignment affect the received output.

## 6. METHODOLOGY

We followed these steps while preparing the project model:

1. We selected the required components according to the model design.
2. We arranged the solar panel, charging module and battery for energy storage.
3. We connected the IR sensor and relay for vehicle detection and switching.
4. We arranged the switching circuit and transmitter coil, and placed the receiver coil opposite to it.
5. We checked the different sections of the model, including sensor operation, relay switching and output at the receiver side. Any numerical efficiency value should be added only after taking actual voltage and current readings.

## 7. RESULTS AND DISCUSSION

The model explains how solar energy, battery storage, vehicle detection and wireless power transfer can be connected in one system. The IR sensor and relay are used for automatic switching. The transmitter and receiver coils demonstrate the principle of electromagnetic induction. Proper coil alignment and distance are important for getting output at the receiver side.

This is an educational model and not a full EV charger. We have not included numerical efficiency or charging-time results because verified measurement readings are not available in the project details used to prepare this paper. These values can be added after testing the model with suitable measuring instruments.

## 8. ADVANTAGES AND APPLICATIONS

The main advantages of the model are that it uses solar energy, demonstrates wireless power transfer, includes automatic detection and helps us understand the connection between mechanical and electrical systems.

The concept can be used for student demonstrations, engineering laboratories and small wireless power transfer experiments. With further development, similar technology may be studied for solar-assisted EV charging stations.

## 9. CONCLUSION AND FUTURE SCOPE

In this project, we studied and prepared a model of a solar powered wireless EV charging station. The model combines a solar panel, battery, IR sensor, relay, switching circuit and transmitter and receiver coils. It helped us understand solar energy storage, automatic switching and wireless power transfer. The mechanical arrangement is also important for proper mounting and alignment of the coils.

In future, the model can be improved by using a better solar charging arrangement, a suitable battery protection circuit, improved switching electronics, better coil alignment and safety features. More testing can also be done by measuring the input and output voltage and current.

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