SMART WIRELESS VEHICLE CHARGING STATION USING IOT

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ABSTRACT

World is shifting towards electrified mobility to reduce the pollutant emission caused by non-renewable fossil fuel vehicles. So electric vehicle came into existence. In electric vehicle charging of battery through charger and wire is expensive, hazardous and inconvenient and drawback of wire charging technology is waiting at charging stations for hours. So now wireless charging gives us opportunity to charge our vehicle just by parking the vehicle on parking spot or even while driving we can charge our electric vehicle. As if now we are very much familiar with wireless transmission of data, audio and video signals than why not transfer power over the air. Wireless power transfer can be implemented as a static and dynamic charging system. This paper presents how the electric vehicle and development of charging methods.

I. INTRODUCTION

Fossil fuels are finite resource and India has plans to make a major shift to electric vehicles by 2030. Development of electric mobility and sustainable energy will result in new technologies that require electric vehicles that are low cost and fully autonomous. These attributes can be realized through wireless charging. An electric car is an automobile that uses an electric motor as its primary source of propulsion. Electric vehicles (EVs) use electrical energy which is stored in rechargeable batteries. Plug-in based electric vehicles are suffering due to two major obstacles-cost and range.

In order to increase range, EVs are required to charge either quite frequently or to install a larger battery pack which results additional problems such cost and weight. In addition, it is not economical to charge a vehicle frequently.

The existing gasoline and petrol engine technology vehicles are responsible for air, noise pollution as well as for greenhouse gases. Hence a Wireless Charging System for Electric Vehicles by inductive coupling method is proposed which can reduce the problems associated with range and cost of EVs. It is the only solution for future automation EV.

The ongoing climatic conditions have led to the research and development of electric vehicles over the past decade. The increasing global warming has caused an awareness among the people to switch to electric vehicles. The time required to wait at charging stations while the battery is being charged will be reduced by a considerable amount of time when the charging will be done on road while driving the vehicle. Even though electric vehicles are an alternative, there needs to be development in its charging system to make it the prime option for transport. For this purpose, the charging systems should be developed.

II. LITERATURE SURVEY

Wireless charging for EVs, also known as inductive charging, relies on electromagnetic fields to transfer energy between a charging pad on the ground and a receiver on the vehicle. research indicates significant progress in improving the efficiency and alignment tolerance of wireless charging systems. Studies by **[Wang et al. (2019)]** highlight advancements in coil design and power electronics that enhance energy transfer efficiency and reduce energy loss.

The combination of solar power with wireless charging systems offers a sustainable energy solution for EVs. Solar panels can be installed on rooftops, parking lots, and other structures to capture sunlight and convert it into electrical energy. Studies such as **[Li et al. (2020)]** demonstrate the feasibility of integrating photovoltaic systems with EV charging infrastructure, highlighting the potential for significant reductions in operational costs and environmental impact.

IoT technology enhances the functionality and user experience of wireless charging stations Research by [**Ghosh et al. (2021**)] explores the use of IoT in smart charging infrastructure, emphasizing improved efficiency, user convenience, and energy management.

Wireless charging, or inductive charging, uses electromagnetic fields to transfer energy

from a charging pad to a receiver in the vehicle. Recent advancements have significantly improved the efficiency and alignment tolerance of these systems. Studies like [**Kim et al. (2017**)] innovations in coil design and power electronics that enhance energy transfer efficiency, reducing energy loss and increasing the convenience of wireless charging.

III. METHODOLOGY

In this proposed system, we are implementing Arduino based wireless charging station. Here we are using copper coils as primary and secondary coils. Two IR sensors are used detect car available in slot or not. If car is available in slot, Arduino will turn on charging through relay.

Objective:

The main feature of wireless charging is that it can transmit power by an electromagnetic field. This will increase the use of electric vehicles and also make them reliable and efficient for large distance respectively.

Wireless Charging Working:

The transmission of electrical energy from source to load for a distance without any conducting wire or cables is called Wireless Power Transmission. [1]The concept of wireless power transfer was realized by Nikola Tesla. Wireless power transfer can make a remarkable change in the field of the electrical engineering which eliminates the use conventional copper cables and current carrying wires. [2]For this purpose we use a high frequency transformer to convert mains input to 12 V DC. This output is supplied to the charging pad coil When the adapter coil comes in range of the charging pad coil, the power is transferred wirelessly to the receiving coil and this 12 V dc is provided to the small DC cooling fan . [3]The system can be further allows us to charge the mobile phone wirelessly without plugging it in. The system can be further enhanced by integrating the charging adapter within the mobile itself so that user just needs to place his/her mobile phone on the charging pad to charge it.

Block Diagram:

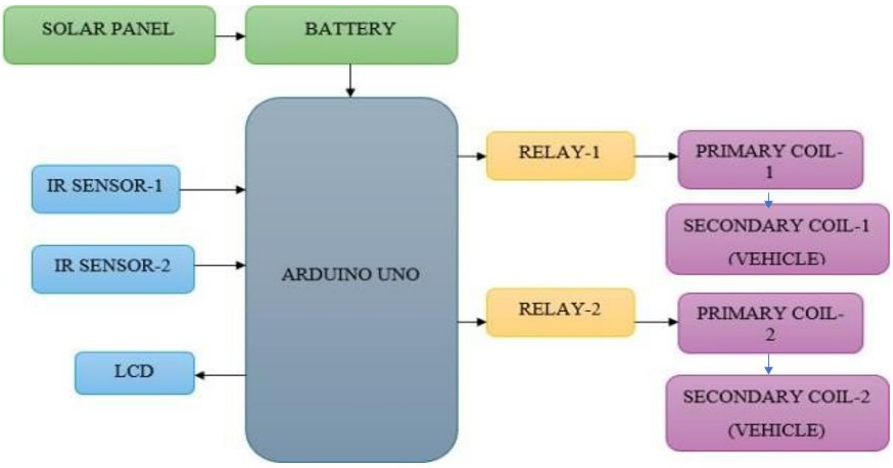


Fig 1 Block Diagram

IMPLEMENTATION

Solar Panels: Install solar panels to capture sunlight and convert it into electricity. The number and size of panels depend on factors like location, sunlight exposure, and power requirements of the charging station.

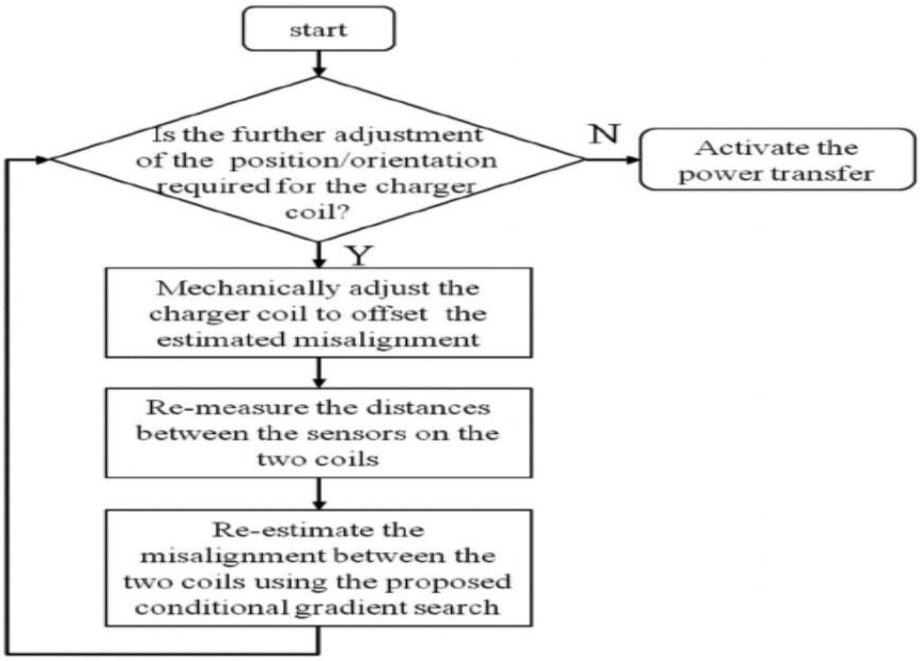
Battery Storage: Integrate a battery storage system to store excess solar energy generated during the day for use during periods of low sunlight or high demand.

Wireless Charging Pad: Use a wireless charging pad capable of delivering power to the EV without the need for physical cables. This pad should be compatible with the charging standard used by the EVs.

IoT Connectivity: Incorporate IoT devices for monitoring and control. This includes sensors to measure factors like solar panel output, battery levels, and charging status. IoT connectivity allows remote monitoring and management of the charging station.

Communication Protocols: Choose appropriate communication protocols for connecting IoT devices, such as Wi-Fi, Bluetooth, or cellular connectivity. This enables real-time data transmission and remote access to the charging station.

Charging Management System: Develop or integrate a charging management system to optimize charging schedules based on factors like solar availability, energy demand, and EV battery status. This system ensures efficient use of renewable energy and minimizes grid dependency.



IV. HARDWARE RESULTS

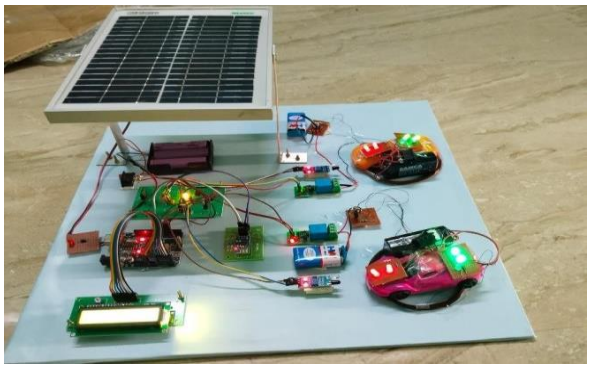


Fig 5 Prototype of the system

when vehicle is at the charging station it starts charging and the led indicates that the vehicle is charging.

Fig 6 LCD Output Display

Fig 7 IOT Results

V. RESULTS

A smart wireless vehicle charging station using solar energy integrated with IoT technology offers significant advancements in the field of electric vehicle (EV) charging. These systems utilize solar panels to harness renewable energy, reducing dependency on fossil fuels and cutting carbon emissions. IoT technology enhances the efficiency and user experience by enabling real-time monitoring and management of the charging process.

Feature	Wireless Charging with Solar and IOT	Wired Charging
Technology	Wireless power transfer (efficiency ~70%)- Solar power (efficiency ~15 - 20%) IOT Integration and control	Direct electrical connection (efficiency ~ 90-95%)
Convenience	No need for cables IOT enables remote management and automation	Requires physical connection Consistent straight forward usage
Environmental Impact	Carbon footprint reduction due to solar power Environmental cost of manufacturing Solar panels and IOT devices	Dependent on energy sources (renewable reduces footprint) Higher efficiency means less energy wasted
Use case flexibility	Ideal for outdoor, public, and Remote areas- suitable for renewable energy projects	Ideal for homes, office, and stable environments-Reliable in areas with stable power supply

VI. CONCLUSION

With the development of EV technology, charging infrastructure and grid integration areas, EV popularity is expected to grow significantly over the next decade. In this context, wireless charging has sparked widespread attention as it has no spark, is locally independent and operates in a vacuum. This paper explains in detail the wireless charging technology for EVs. This paper elaborates on EVs wireless charging technology. technology offers the potential for better power efficiency, lower environmental impacts, lower life cycle costs, and greater comfort and safety operating benefits

References

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