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WIRELESS E-VEHICLE CHARGING USING INDUCTION COIL

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Abstract -Wireless charging utilizes inductive technology to transfer power without the need for physical cables. Wireless (inductive) charging offers a seamless and convenient experience for EV owners. In the proposed system, receiver coils have been added to maximize charging power. The main purpose of wireless transmission in electric vehicles is to transfer power over a small distance. Wireless transmission technology used to improve efficiency, with power transfer rates comparable to traditional plug-in chargers.

Key Words: electric vehicles (EVs), charging power, wireless power transmission system, wireless (inductive) charging

1.INTRODUCTION

Electric-powered vehicles will help reduce greenhouse gas emissions and increase fuel prices. The main purpose of wireless transmission in electric vehicles is to transfer power over a small distance. The wireless power transmission system consists of a transmitter and receiver part that is separated
by a small distance
The paper focuses on investigating the effectiveness of using two receiver coils compared to the traditional approach of using only one receiver coil in wireless power transmission systems for electric vehicles.

2. Working Mehtodology

In current scenario, lithium-ion batteries are majorly used for electric vehicles (EVs), which have a limited capacity that gives limitation to the driving range. The range can be improved by increasing the battery capacity, but it results in a heavier and more expensive vehicle. To address these challenges, we suggest the potential use of wireless power transmission (WPT) technology.
Table A shows various project work done regarding wireless charging vehicles. This paper is suggesting wireless power transmission (WPT) technology to improve efficiency, convenience, user friendly solution, flexibility etc.

Fig.1 shows basic block diagram of WPT system.

This paper focuses on Inductive WPT. Inductive wireless power transfer (IWPT) systems, which utilize principles of electromagnetism for power transmission. IWPT systems work akin to traditional transformers, operating on the principles of electromagnetic induction. An Alternating Current (AC) flowing through the primary side generates a time-varying

PROJECT	START YEAR	LOCATION	EFFICIENCY	FREQUENCY (Hz)	POWER (Kw)
Bus Project in italy	2003	Turin,Italy	90%	15–20k	60
KAIST (OLEV)	2009	South korea	72–83%	20k	6–100
IPT For E- bus	2010	Germany	>90%	20k	40–200
Wireless Advance Vehicle	2012	United States	90%	20k	25–50
ZTE Corporatio n project	2014	China	90%	45k	30, 60

Table 1: Comparison of E vehicle projects

magnetic field around the primary side coupler, following Ampere's law.
Magnetic Field Interaction: This magnetic field interacts with the magnetic coupler on the secondary side, inducing a voltage across the secondary coil as per Faraday's law of electromagnetic induction. This induced voltage represents the transferred power.
Rectification and Power Conversion: The induced voltage in the secondary coil is typically rectified to produce a Direct Current (DC) power signal. This DC signal can then be used to charge the battery of an electric vehicle or power other devices.
Frequency Tuning for Efficiency: Adjusting the frequency of the secondary coil to match the operating frequency of the system is crucial for enhancing efficiency. Matching frequencies optimizes the energy transfer process, minimizing losses and maximizing charging efficiency.

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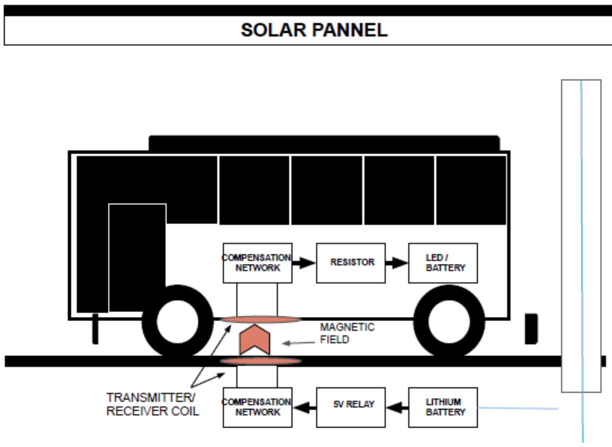

Fig. 2 Block diagram of proposed system

IWPT systems leverage electromagnetic principles to wirelessly transmit power between primary and secondary coils. Efficiency improvements can be achieved through frequency tuning, although there are constraints on the distance over which effective power transfer can occur, particularly when operating in the radio frequency range.

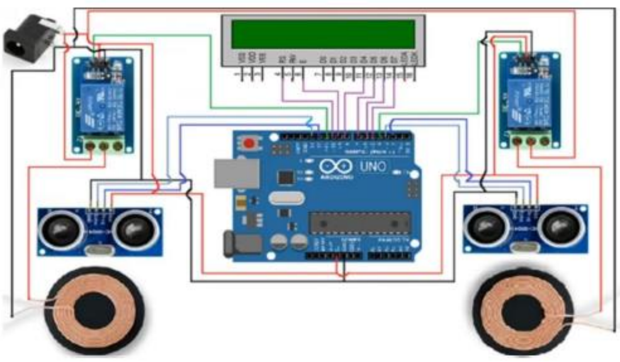

Fig -3: Wireless E-Vehicle Charging Using Induction Coil using Arduino Uno

When user reaches t charging station to charge battery, then ultrasonic sensor sense the car and gives signal to Arduino.
It gives signal to relay which activates transmitter coil.
The charging system consists of two coils: a transmitter coil (on the charging station) and a receiver coil (on the vehicle).
The transmitter coil is connected to a power source and generates an alternating magnetic field when energized.
The receiver coil, placed on the vehicle, is designed to resonate with the magnetic field produced by the transmitter coil.
When the vehicle is positioned over the charging station, the receiver coil captures the magnetic flux.
The changing magnetic field induces an electromotive force (EMF) in the receiver coil according to Faraday's law of electromagnetic induction.
The induced AC voltage in the receiver coil is then rectified using diodes and converted into DC voltage.
This rectification process ensures a stable and usable voltage for charging the vehicle's battery.
This energy transfer from the charging station to the vehicle occurs without any physical contact, making it a wireless charging system.
Efficient charging depends on the proper alignment of the transmitter and receiver coils.
Solar panel is provided to charge battery at charging station and provides additional advantage of conventional power source.
Advanced systems may incorporate technology to optimize coil alignment for increased efficiency.
Smart charging systems may include control mechanisms to manage power delivery, monitor battery status, and ensure safety. Overcurrent protection, temperature monitoring, and communication protocols may be integrated for a secure charging process.
In practical applications, this wireless charging technology is often used in electric vehicle charging stations, allowing users to charge their vehicles conveniently without plugging in.
By utilizing electromagnetic induction principles, wireless vehicle charging systems offer a convenient and efficient way to power electric vehicles without the need for physical
connections.

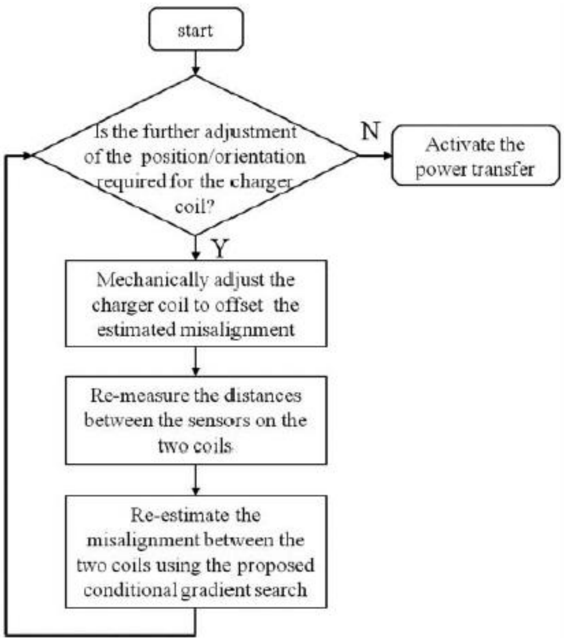

Fig. 4. Flowchart of Wireless E-Vehicle Charging Using Induction Coil

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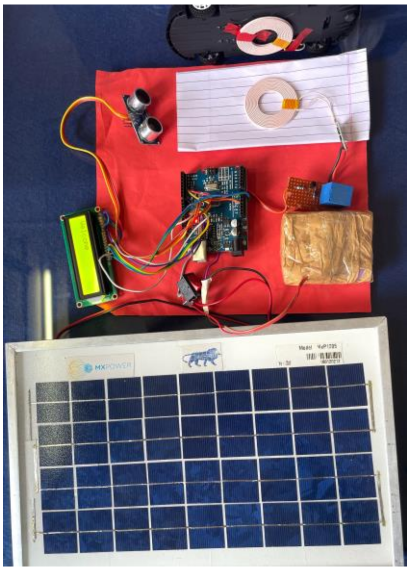
Output and prototype presentation:



Benefits:

1. Convenience: Users can simply park their vehicles over the charging pad, eliminating the need for plugging and
unplugging cables.
2. Reduced Maintenance: Without physical connectors, there's less wear and tear, leading to lower maintenance costs
compared to traditional charging methods.
3. Safety: Eliminates the risk of tripping over charging cables and reduces exposure to electrical components, enhancing overall safety.
4. Weather Resistance: Inductive charging systems are designed to withstand various weather conditions, ensuring
reliable operation in rain, snow, or other environmental challenges.
5. Power Efficiency: Advances in technology have improved the efficiency of wireless charging, minimizing energy losses
during the charging process
6. Lower life cycle costs
7. No Costs of Fuel or Gas – EV owners can save significantly on fuel or gas expenses since electricity is generally cheaper than gasoline on a per-mile basis. Electricity prices tend to be more stable and predictable compared to gasoline prices.

Limitations:

1. Distance between the transmission coils is a big issue when there is concern of system efficiency.
2. There will be power wastage due to continuous working of these coils.
3. To increase the efficiency of the system, selective switching of these coils is necessary.
4. Alignment between the charging pad and the vehicle must be precise for optimal performance.

3. CONCLUSIONS

The combination of environmental concerns, government incentives, technological advancements, improving infrastructure, and changing consumer preferences is driving the growing popularity of electric vehicles worldwide. In this context, the paper provides a overview of wireless charging technology for electric vehicles, highlighting its potential to enhance power efficiency, use of conventional source, reduce environmental impacts, lower life cycle costs, and improve comfort and safety for EV owners.

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