International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

WIRELESS CHARGING FOR ELECTRICAL VEHICLES

Saba Tasneem[1], Shalini S[2], Sanjay H S[3], Mallikarjuna N M[4], Zuhaib Baig[5]

[1]Saba Tasneem, department of EEE & Vidya Vikas institute of engineering and technology

[2]Shalini S, department of EEE & Vidya Vikas institute of engineering and technology

[3]Sanjay H S, department of EEE & Vidya Vikas institute of engineering and technology

[4]Mallikarjuna N M, department of EEE & Vidya Vikas institute of engineering and technology

[5]Zuhaib Baig, Assistant Professor, department of EEE & Vidya Vikas institute of engineering and technology

---

Abstract - Nowadays Wireless power transmission (WPT) is popular and gaining technology finding its application in various fields. The power is transferred from a source to an electrical load without the need of interconnections. Wireless power Transmission (WPT) is useful to power electrical devices where physical wiring is not possible or inconvenient. The technology uses the principle of mutual inductance. One of the best future applications finds in automotive sector especially in Electrical Vehicles. This project deals with research and development of wireless charging systems for Electric Vehicles using Wireless transmission. The main goal is to transmit power using resonance coupling and to build charging systems. The System deals with AC source, transmission coil, reception coil, converter and electric load which are battery. As Electric Vehicles (EVs) continue to gain popularity as a sustainable transportation solution, the need for efficient charging infrastructure becomes increasingly critical. Wireless charging technology presents a promising solution to address the limitations of traditional plug-in charging systems, offering convenience and flexibility to EV users. This Project explores the concept of wireless EV charging while the vehicle is in motion, also known as dynamic wirelesscharging (DWC). By integrating inductive power transfer (IPT) technology with dynamic charging infrastructure embedded in roadways or dedicated lanes, vehicles can replenish their batteries continuously while in motion, extending their range and reducing the need for frequent stops. Furthermore, DWC has the potential to enhance the feasibility and adoption of EVs in various sectors, including public transportation, logistics, and personal mobility. This abstract provides a comprehensive overview of the emerging field of wireless EV charging while the vehicle is inmotion, highlighting its benefits, challenges, and future prospects.

1. INTRODUCTION

Mankind has been using automotive vehicles for transportation from one place to another. These vehicles use internal combustion (IC) engines to drive it. Due to increased number of vehicles, there is environmental pollution caused by IC engines and reduction in fossil fuels. The latest innovations in the Automotive Industry are helping to improve fuel efficiency and reduce emissions. One such technological advancement is Hybrid Vehicles which use both IC engines and electric motors to drive the vehicles or a car in simple words, helping to reduce the amount of emissions produced maintaining the performance of the engine. However, in the future, the focus is on clean and green energy producing zero emissions. Design and manufacture of electricvehicles has led to major interest in current industry. Since these vehicles run on battery the main drawbacks are high cost, short distance travel and long charging time. Consumers are constantly looking for a better solution to improve the travel efficiency. Hence wired charging systems were built at every gas station. Wired charging also have some limitations like socket points, spacing occupied by the charging station, limited range of wire, vehicle has to change its orientation to connect to the charger. These can be addressed by wireless charging systems for electric vehicles. This provides flexible and hassle free charging. Many wireless power transfer techniques are used to implement this technology. These methods use coils to transmit power. Coil will produce a short range magnetic field, when a second coil is placed an electric current will flow through it. The magnetic field hastransferred power from one coil to other called Induction. It is necessary to analyze these techniques based on the application to obtain optimum results for the system to function correctly.

Fig1: Electronic system for wireless charging

Wireless charging helps to eliminate the need for holding cables and thus the possible loss of conductivity over the wire can be completely eliminated. Also, manipulating the wires during the plug charging and discharging process can sometimes be dangerous if not done properly. Thus, human intervention can be avoided for security purposes. Although wireless charging seems to be time-saving and

efficient, it does come with some restrictions. A key element of implementation is the development of the infrastructure that needs to be done to achieve the goal. This will require significant investment in all phases of the project and that is why it is costly. The first wireless charging technology to be developed is standard, the system is designed to charge EVs in garages or public parking lots, where the vehicle is not operating for a long time. Because a portable connection is not required, there has been a great deal of interest in the possibility of charging EVs while on the go. Charging the EV while on the go is called flexible charging. The proposed system uses wireless charging based on the ARDUINO microcontroller or a production method for charging electric vehicles. This program contains ARDUINO microcontroller, inductive coils, motor prototype module. Persistent weather conditions have led to the research and development of electric vehicles over the past decade. Rising global warming has created awareness among people to switch to electric vehicles. The waiting time required for charging stations while the battery is being charged will be reduced the amount of time that the discharge will be performed at the station. Although electric vehicles are an alternative, there is a need for improvements in their charging system to be the best mode of transportation. For this purpose, charging systems should be upgraded. Solid charging systems are very reliable, easy to use and timely. Also, the battery size can be reduced, and the width can be improved. This charging system can also be used in big cities. Wireless charging performance is based on Electromagnetic Induction.

Fig2: Wireless charging using coils

2. PROBLEM STATEMENT:

- In electrical vehicle, charging of battery through charger and wire isinconvenient hazardous and expensive.
- The charging of battery often takes about 3 hours, which nowhere matches efficiencyof a gas refuel.
- The charging cables on the floor may bring tripping hazardous.
- Leakage from cracked old cables, particularly in cold zones, can bring additional hazardous condition to the owner.

3. OBJECTIVES OF THE PROJECT:

The main objective of the proposed system is

- This enable EVs to charge their batteries without any stop at charging stations. This can help to extend the driving range and reduce the lengthy charging breaks.
- Wireless charging of EVs can operate continuously. Hence it provide flexible and hassle free charging.

4. OVERVIEW OF THE PROJECT:

As shown in Fig 3.1 the power transmitters are installed in some segments in the route. When the vehicle is traveling on the route where the transmitters are installed, the battery is charged. When the vehicle is running where no transmitter is installed, the motor is operated from the energy stored in the battery. Therefore, in this case, the energy in the battery is depleted. There is a trade of between the allocation of the power transmitters and the size of the battery. If more transmitters are installed, the vehicle could travel with a small battery since more frequent charges are possible. On the other hand, the vehicle carries a large battery, less number of transmitters need to be installed since it can travel a longer distance without frequent charges. This method uses inductive coupling to transfer energy between a transmitter coil embedded in the road and a receiver coil mounted on the underside of the vehicle. An alternating current (AC) passed through the transmitter coil generates a magnetic field. The receiver coil in the vehicle interacts with this magnetic field, inducing an AC current in the coil.This current is then rectified and used to charge the vehicle's battery. A transmitter coil embedded in the road generates a magnetic field when energized with AC current.A receiver coil mounted on the vehicle's undercarriage interacts with this field, inducing a current within itself.

Road System:

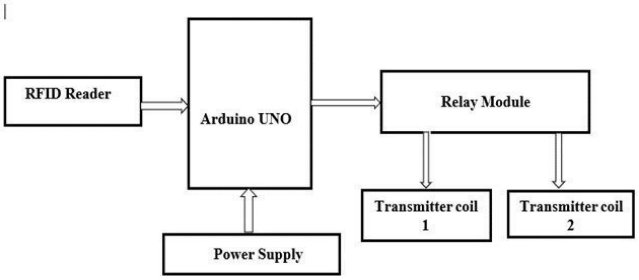

Fig4: Block diagram of road system

The road system consist of Arduino Uno, RFID reader, relay module and two transmitter coils. Initially the mains supply is given to the Arduino Uno. The ATmega328p Arduino Uno works as the brain for the entire system and it control overall action of the system.

In this Road system, RFID reader is used to identify the authorized vehicle, when a vehicle passes through it. Then it will pass a signal to relay module, then relay module will turn-on only if the car is authorized. If not, RFID reader doesn't allow the relay module to turn-on. This relay module energize the transmitter coils then this transmitter coils use to produce an EMF to charge batteries through induction method. Initially when a power supply is provided to Arduino Uno and turn-on RFID reader, it will read the RFID card data of a car, if it is authorized it will send the signal to turn-on relay module, if vehicle is unauthorized RFID reader doesn't send any signal to relay module and relay module will be in off state. Relay module energize both the transmitter coils and these transmitter coil transmit power through Electro Magnetic Induction to Car system.

Car System:

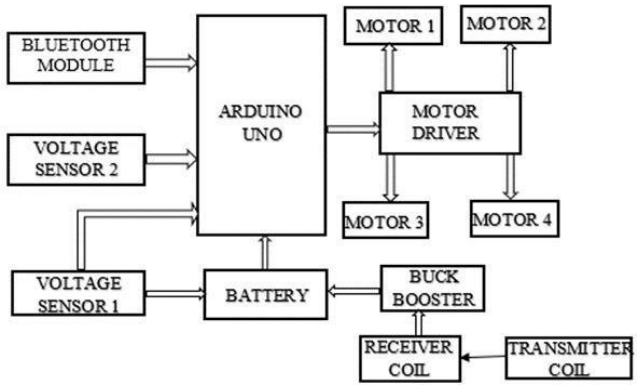

Fig 3.2.2 Block diagram of Car System

The car system consist of Receiver coil, Bluetooth module, Arduino Uno, Motor driver, 4 DC motors, buck Booster, Battery and Voltage sensors. In car system also ATmega328p Arduino Uno is used to control the overall actions of the car system. The L298N 2A based motor is used to drive / run the DC motor with directional speed control. This motor driver have capacity to run two or four DC motor at a time. The L-shaped 300 rpm four DC motors are used to run the vehicle and control the vehicle speed in both forward and reverse direction. Receiver coil receives the power through EMF method, which is transmitted by transmitter coil. Buck booster step-up or increase the voltage level that will received by receiving coil. Lithium ion battery is used to store the power and it have a storage capacity up to 2900MAh. Bluetooth module will control the operation of vehicle like direction and speed through the mobile application. The voltage sensor measures the voltage. Initially the receiving coil receives the power which is transmitted by transmitter coils, that will placed in the road system. The receiving voltage is insufficient to charge the battery or to run the motors. Hence, the buck booster is used to increase the voltage level, which is sufficient to charge the batteries or run the motors. Then battery gets charged. The battery will provide supply to motor driver to run the DC motors or to move the vehicle.

5. CONCLUSIONS

Streamlined and automated charging processes, reducing the time and effort required for EV owners to charge their vehicles. Increased convenience, allowing users to schedule and manage charging remotely through mobile applications or other interfaces. Integration with smart grids and dynamic pricing models, leading to optimal utilization of energy resources and reduced strain on the electrical grid during peak times. Enhanced energy efficiency during the charging process, minimizing wastage and promotingsustainable practices. Improved user interfaces and authentication processes for a more user- friendly experience. Transparent billing systems, providing users with clear and easily understandable information on charging costs. Smart grid integration to enhance grid stability by managing fluctuations in energy demand and supply. Prevention of grid congestion and overloads through intelligent charging management. Contributing to environmental sustainability by promoting the adoption of electric vehicles and reducing reliance on traditional combustion engine vehicles. Facilitating the integration of renewable energy sources, aligning with global efforts to reduce carbon emissions. The electric vehicle (EV) revolution is gaining momentum, driven by environmental concerns and advancements in battery technology. However, one of the lingering challenges for EV adoption is the inconvenience associated with traditional plug-in charging. Enter wireless charging – a promising technology that eliminates the need for cables and connectors, offering a more seamless and user-friendly experience. This concluding section delves into the potential of wireless charging for EVs, exploring its benefits, current limitations, and the road ahead for widespread adoption.

REFERENCES

1. C. Lee, G. Jung, K. Hosani, B. Song, D. Seo and D. Cho, "Wireless Power Transfer System for an Autonomous Electric Vehicle", IEEE Wireless Power Transfer Conference, Nov 15 - 19. 2020.
2. C. Zhu, J. Jiang, K. Song and Q. Zhang, "Research progress of the key technologies for dynamic wireless charging of electric vehicle", Automation of Electric Power System, vol. 41,pp. 61-65, 2017.
3. F. Lu, H. Zhang and C. Mi, "A review on the recent development of capacitive wireless power transfer technology", MDPI Energies, vol. 10, no.11, pp. 1752, 2017.
4. H. He A.H. Aswathy, G.M. Sukumar, M.S.

Swapnil, C.A. Asha and V.R. Pandi, "Solar Powered intelligent electric Wheel chair with health monitoring System", Proceedings of 2017 IEEE International Conference on Technological Advancements in Power and Energy2017, pp. 1-5, 2018.

5. B.G. Abhinandh, P.K. Preetha and C.A. Asha, "Solar Integrated Electric Spring for Hospital ICU", 2019 Innovations in Power and Advanced Computing Technologies I-PACT 2019, pp.8960101, 2019.