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Prototype of Wireless Charging for Electric Vehicle

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ABSTRACT: 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. 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 future applications finds in automotive sector especially in Electric Vehicles. This paper 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 the charging systems. The systems deal with an AC source, transmission coil, reception coil, converter and electric load which are battery.

KEYWORDS : Wireless Power Transmission, Electric Vehicles, Transmission coil, Reception coil, Converter

I. INTRODUCTION

Now days the most serious problem being faced by the world is the increasing energy demand and global warming, which is one of the most dangerous problems. The increase in the heat of Earth's surface leads to the melting of ice peaks which further causes an increase in the sea level. This is mainly because of pollution. The main polluting factors are the automobiles. This is because the automobiles emit carbon monoxide. Carbon monoxide is a very toxic and poisonous gas and it has a very harmful impact on the environment. Currently, the transportation sector is a large consumer of fossil fuels and contributes extensively to the global green house gas emissions. According to a report published in 2005, it was found that transport sector was responsible for approximately 15% of the greenhouse gases emissions to which road transport contributed 73%. Apart from the environmental impacts, the increasing fuel rates are also a problem and this too is well known that fuels available to us are limited in their amount and sooner or later we have to switch to an alternative energy resource. Electrification is widely considered as a viable strategy for reducing the oil dependency and environmental impacts of the road transport. Thus, Electric vehicles are introduced to create a pollution free environment.

An Electric vehicle (EV) is an automobile propelled by one or more electric motors drawing power from an onboard source of electricity. An electric vehicle has a battery instead of a petrol tank and an electric motor instead of an internal combustion engine. It must be plugged into an external source of electricity to recharge its battery . An electric vehicle may be powered through a collector system by electricity from off vehicle sources, or may be self-contained with a battery or generator to convert fuel to electricity. Electric vehicles include road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft.

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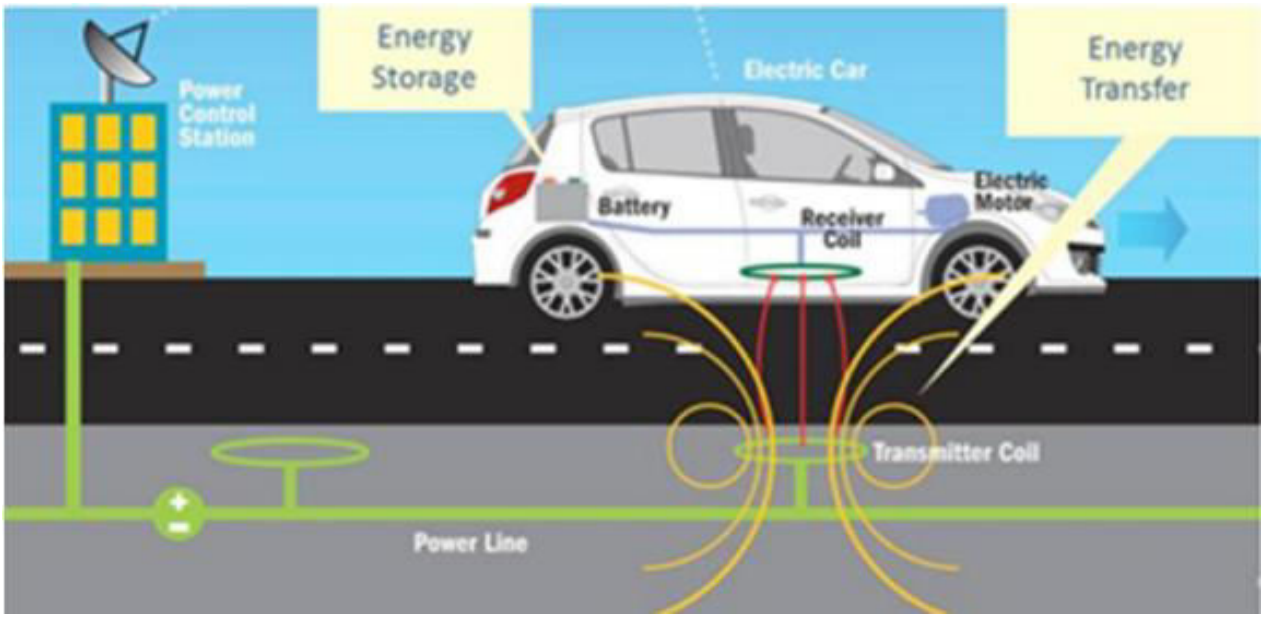

Fig.1. Electric Vehicle Charging Operation

II. OBJECTIVE

The main objective of this project is to make it possible for the electric vehicles to recharge the battery on the way along with driving. This is achieved only when the roads are electrified with wireless charging capability. Our project is mainly intended to accomplish the following

- The main objective of this project is to develop a system of wireless power transfer to be charge the electric vehicle dynamically while driving i.e. without stopping the vehicle when it gets discharged.
- To design a wireless power transfer circuitry and to design primary and secondary coils using suitable material.

Fig.2. Highway showing Move on the Charge for Vehicle

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III. NEED OF PROPOSED RESEARCH WORK

- As seen from the current scenario of electric vehicles in India, after every 160 km (approx.) the vehicle needs to be charged again.
- Moreover the electric fueling stations in India are under developing stage. Apart from this unavailability, it is well known that the charging time of electric vehicles is way too long.
- Switching from gasoline to electric vehicles is a necessity due to the energy and environment related issues.

Thus if the battery related issues are resolved then electric vehicles would be preferred over gasoline vehicles. Our project is intended to develop a system for electric vehicles that would enable the contact less and wireless charging of these vehicles.

IV. METHODOLOGY

The block diagram of the designed system is shown in Fig.3. This proposed project is an application of Faraday's laws of electromagnetic induction to transfer power without the usage of physical connectors for implementing charge on the move through wireless.

The charger device will create an E.M. field with alternating polarity using a coil of insulator copper wire & a similar coil will be placed inside the vehicle which convert E.M field back to electric current there by charging the battery. When a transmitting coil sends electromagnetic waves tuned to a frequency matching the resonance of a circuit holding a receiving coil, it will transfer energy to it very efficiently.

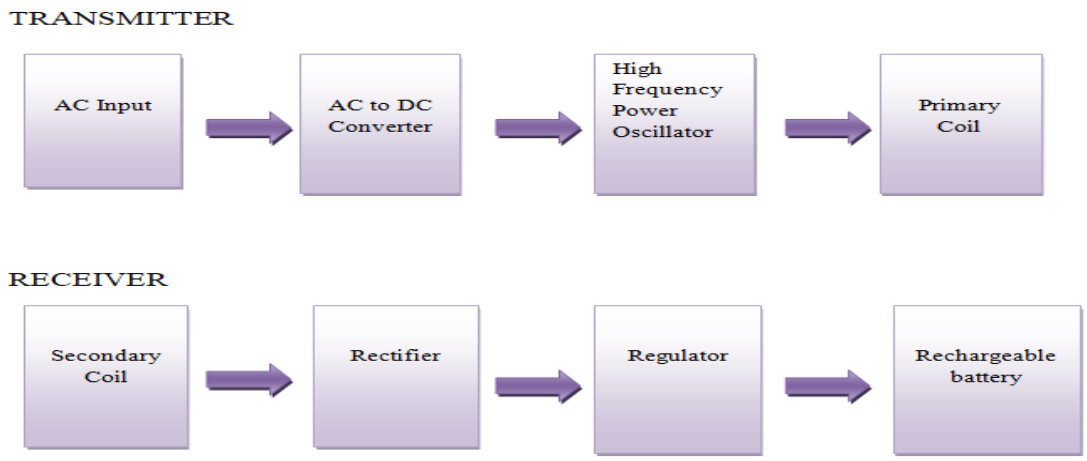

Fig.3. Block Diagram of the System

The charger device (Transmitter) will create an E.M field with alternating polarity using a coil of insulator copper wire & a similar coil will be placed inside the mobile device (Receiver) Induction chargers use an induction coil to create an alternating electromagnetic field from within a charging base, and a second induction coil in the portable device takes power from the electromagnetic field. Thus, here the alternating field in primary coil (transmitter side) induces an alternating field in the secondary coil (receiver side) and causes the production of AC power output in the secondary or

receiver coil. This receiver coil then converts the alternating field back into electric current and then current passes through full wave rectifier where AC is converted into DC current. This current will then be fed to rechargeable battery.

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V. TECHNICAL ASPECTS OF THE PROJECT

The system works on the principle of inductive wireless power transfer which use magnetic field coupling between conducting coils. A wireless Electric Vehicle charging system consists of the following two main parts:

➢ **MAGNETIC COMPONENTS**

The detached(or separated, loosely coupled) transmitting and receiving coils. Usually, the coils are built with ferrite and shielding structure, the term magnetic coupler is used to represent the entirety, including coil, ferrite and shielding.

In a dynamic charging system, the magnetic components are composed of a primary side magnetic coupler, which is usually buried under the road, and a secondary side pickup coil, which is mounted under an EV chassis.

➢ **POWER ELECTRONICS CONVERTER AND COMPENSATION NETWORK**

In a wireless power transfer system, the function of the primary side power electronics converter is to generate a high-frequency current in the sending coil. At the secondary side, a rectifier is adopted to convert the high-frequency ac current to dc current.

VI. RESULT AND DISCUSSION

The designed project work consists of an ac 230 volt 50 Hz to ac 20 KHz at 12 volt circuit .The output is fed to a tuned coil forming as primary of an air core transformer .The secondary coil is kept over the primary coil where air is used as the core. The output of the secondary is given to a high frequency bridge rectifier that delivers dc which is then regulated to maintain a constant charging current to a Lithium Polymer rechargeable battery.

Following outcomes can be list up:

- The designed project shows a prototype model of Electric vehicle and demonstrates the successful operation of dynamic charging of a rechargeable battery in an effective way wirelessly without using cables and other plug-in technology.
- The prototype discussed in this project implemented charging while driving thus making the whole process un obstructive and thus the vehicles could be charged faster, leads shorter journey time.
- The same concept could be adopted with scaling features in electric vehicles.
- Further studies in topology, control, inverter design, and human safety are still needed.

Fig.4. Actual Photograph of the Designed System

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VII. CONCLUSION

This paper presented a review of wireless charging of electric vehicles. It is clear that vehicle electrification is unavoidable because of environment and energy related issues. Wireless charging will provide many benefits as compared with wired charging. In particular, when the roads are electrified with wireless charging capability, it will provide the foundation for mass market penetration for electric vehicles regardless of battery technology.

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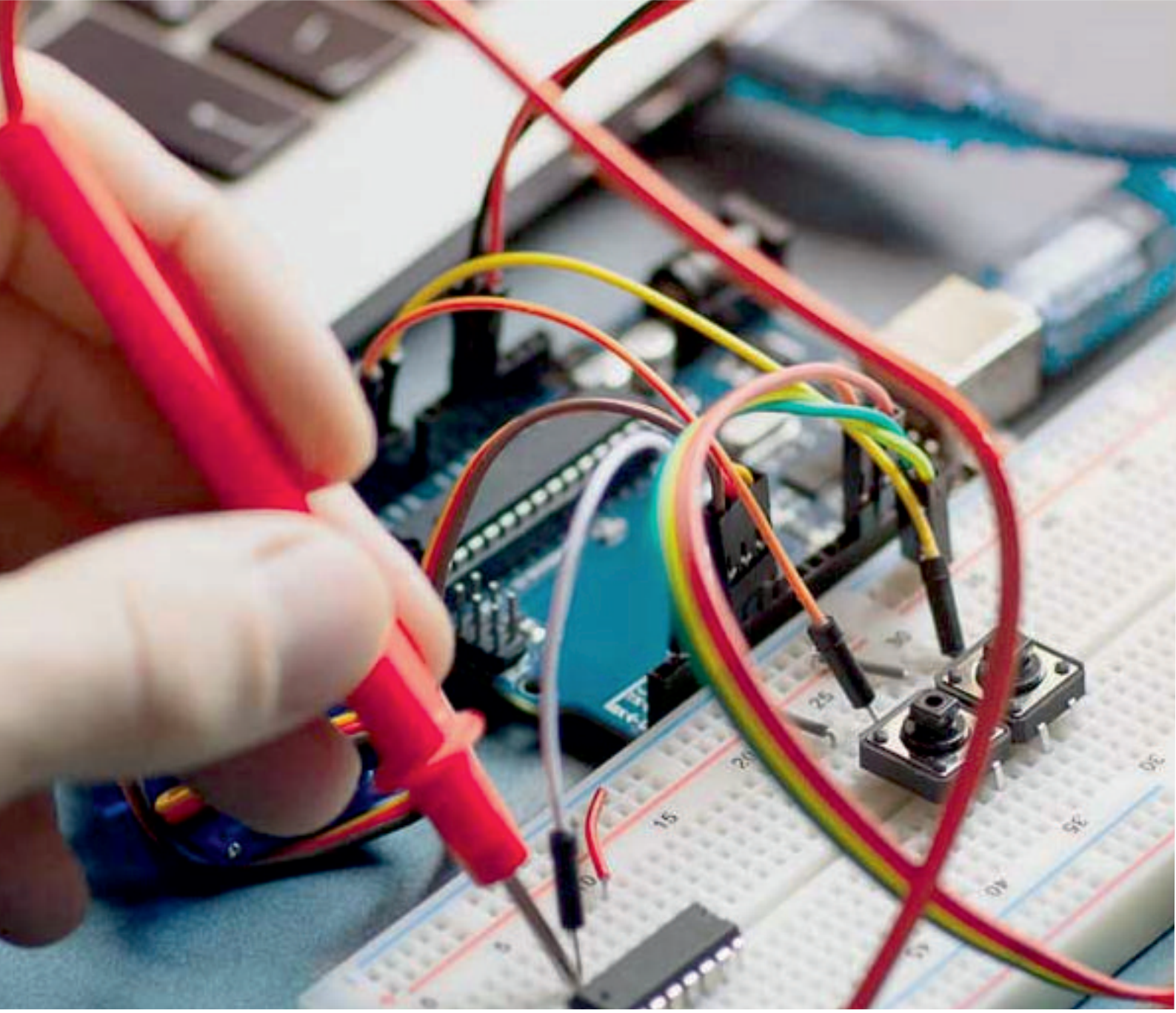

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