WIRELESS ELECTRICAL VEHICLE CHARGING SYSTEM

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Abstract— Wireless Power Transfer (WPT) utilizing attractive reverberation is the innovation which could set humans free from the irritating wires. Recently WPT innovation is growing rapidly at the control level. This makes the WPT very useful to the electric vehicle (EV) charging applications in both stationary and dynamic charging situations. In this paper implementation of wireless electric vehicle charging model for a distance of 5cm is designed. Simulation is carried out using matlab software. Power is efficiently transferred and a maximum voltage of 13v is developed on the secondary side and displayed in the display system. The basic model is designed to charge a battery of 12v range

Keywords— *Wireless power transfer, Inductive power exchange, Electrical vehicle charging*

I. INTRODUCTION

To travel from one place to another humans have been using vehicles for transportation. Internal combustion (IC) engines are used to drive it. As the vehicle population is increased there is a vast increase in the environmental pollution rate. In future days, the concept of pollution free transportation will be of focus. Due to increasing greenhouse gas radiation, and scarcity of petroleum products for upcoming year's efficient use of electric vehicles and recharging them portably becomes important. Electric vehicles do not need petroleum products as fuel and the level of pollution caused is negligible when compared to regular vehicles. Hence, electric vehicles and efficient recharging process becomes the major concern. Main concern with electrical vehicles is charging. Thus, the concept of wireless power transfer is proposed, where a vehicle can be charged portably. The reason for taking up this concept is to make a model of wireless transfer of power for electric vehicles, which will enable dynamic charging in the electric vehicle, thereby increasing its range. The proposed concept in this paper is to have emitter coils on roads where the traffic moves really slow like toll gates, traffic signals, roundabout, traffic congested areas etc. A receiving coil attached to the belly of the vehicle will receive power from the transmitting coil and charge the battery. Electric vehicle consists of an electric motor, and generally a rechargeable battery which powers the motor [1].

II. RATIONALITY BEHIND CHOOSING CONCEPT

In destiny the fuel like coal, petrol, diesel will vanish because those are nonrenewable supply of electricity. The transportation device can have obstacles in future. Therefore, electric vehicles can be used for transportation purposes. Because of existing fuel vehicles, greenhouse gasses are increasing. Plug-in electric powered automobiles are environmentally friendly transportation and decrease a few extent of greenhouse fuel. The use of EV is presently extended but there are a few battery-related troubles together with slower charging fee, low electricity storage potential, length, and weight. It is needed to decrease battery related troubles and for the development of EVs. Because of charging related issues many consumers do not have to purchase EVs as a precedence basis. To lessen battery related issues, ozone harming substances and to settle the attractive control radiation issue the possibility of remote power transfer(WPT) is developed. Many charging stations are built up at the avenue, when you consider the user's journey, similarly distance by means of recharging their electric powered car.

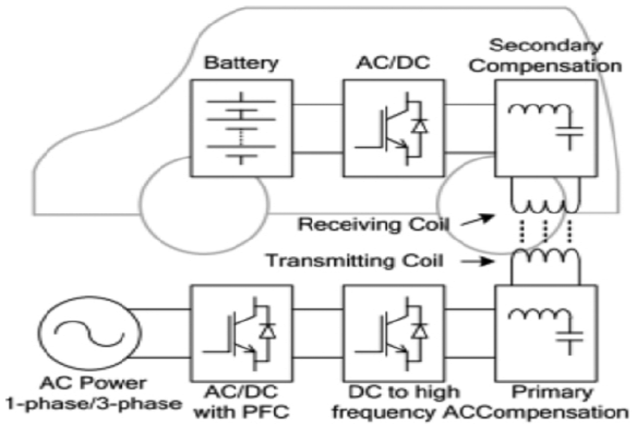

Fig-1: Block diagram of the EV Charging System

III. METHODOLOGY

The system comprises a transmission and receiver part. This paper uses the following components: on the transmitting unit with help of step down transformer, Rectifier Bridge, filter, high frequency section and transmitting coil. On the receiver unit: receiving coil, rectifier bridge, filtering, battery, voltage sensor. Initially 220v AC supply is converted into 12V DC by a step down transformer, Rectifier Bridge and filter. This is fed to a push pull oscillator Transistor and is fed to the High frequency transmission coil. In the receiver section side, after receiving this power, converting into pure dc using Rectifier Bridge and filter. Output of DC after filter is utilized to charge the battery. [3]

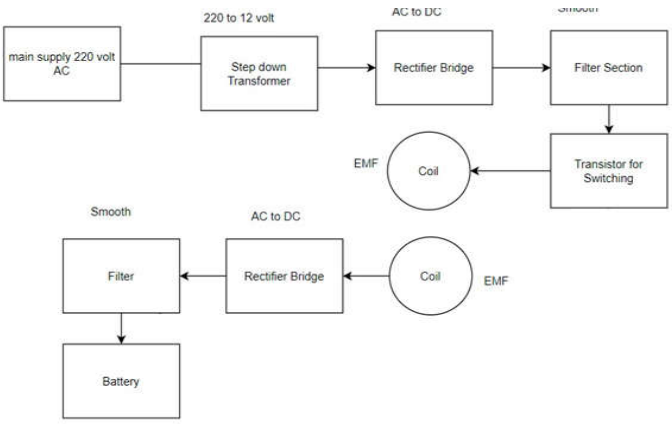

Fig. 2: Block diagram of EV Charger

In the transmitter section, the Transistor is generating high-frequency AC current across the coil and the coil is generating a magnetic field around it. As the coil is center tapped, the two sides of the coil start to charge up. One side of the coil is connected to the resistor and another side is connected to the collector terminal of the NPN transistor. During the charging condition, the base resistor starts to conduct which eventually turns on the transistor. The transistor then discharges the inductor as the emitter is connected with the ground. This charging and discharging of the inductor produces a very high frequency oscillation signal which is transmitted as a magnetic field.

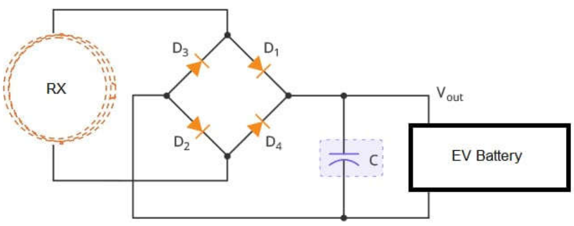

Fig. 3: Receiving part of the system

On the receiver side, that magnetic field is transferred into the other coil, the receiver coil starts producing EMF voltage which is further used to charge the battery. The construction diagram of a bridge rectifier is shown in Fig. 3. The bridge rectifier is made up of four diodes namely D_1, D_2, D_3, D_4 and load resistor R_L. The four diodes are connected in a closed loop (Bridge) configuration to convert the Alternating Current (AC) into Direct Current (DC). The main advantage of this bridge circuit configuration is that we do not require an expensive center tapped transformer, thereby reducing its cost and size. The number and the size of the coils is calculated based on the general formula of induction

$$N_s/N_p = V_s/V_p$$

Where, N_s =number of turns in the secondary side

N_p =number of turns in the primary side

V_s=Voltage in the secondary side

V_p =Voltage in the primary side

Here the voltage in the primary side known as we are using a transformer of 230v-12v, since the primary side voltage will be of 12v and number of turns is selected such that the balanced voltage will be achieved in the primary and secondary side. Here the number of turns is kept to be 140 turns on both sides which will help to achieve the voltage of 13.1v in the secondary side of the receiving end. [4]

IV. SIMULATION STUDIES AND RESULTS

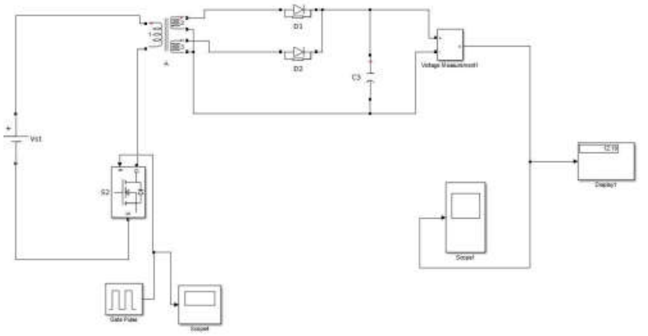

Fig. 4: Simulink Model of wireless charging system.

In the simulation model the input voltage is applied to the MOSFET which performs the switching action in the circuit. Due to that switching action of the circuit frequency can be increased to the range of 1khz, which is further fed to the transformer. Since air gap cannot be achieved in the matlab model, a transformer is used which has the same basic principle of induction. Thus the power is transferred from the primary side to the secondary side of the transformer. In the secondary side the capacitor is used as a filter. Voltmeter is placed at the end to identify the amount of voltage successfully achieved. The graph clearly shows that the voltage at the secondary side voltmeter will start increasing from 0v to 13.1 volts and remains constant throughout, by which the battery can be charged.

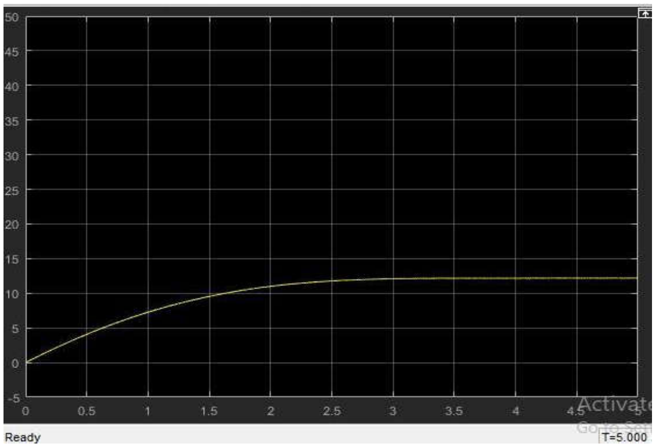

Fig. 5: Output waveform

V. HARDWARE SETUP

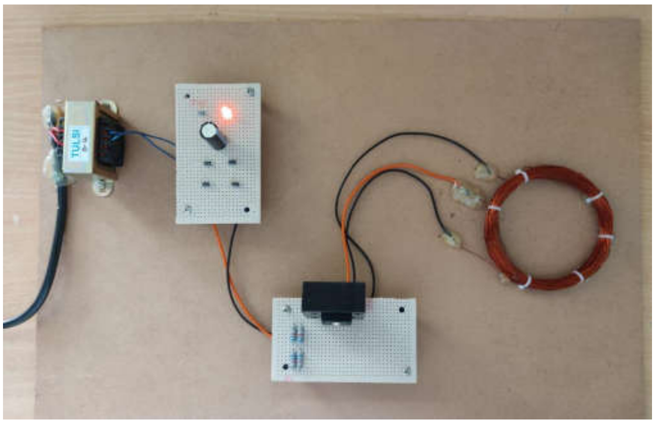

Fig. 6a: Transmitting side(Primary side)

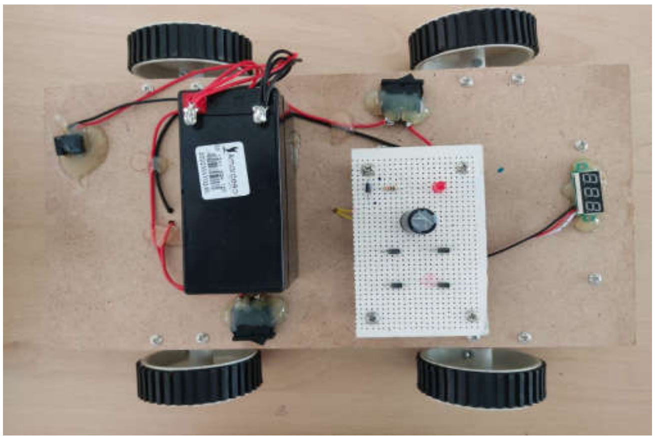

Fig. 6b: Receiving side (Secondary side)

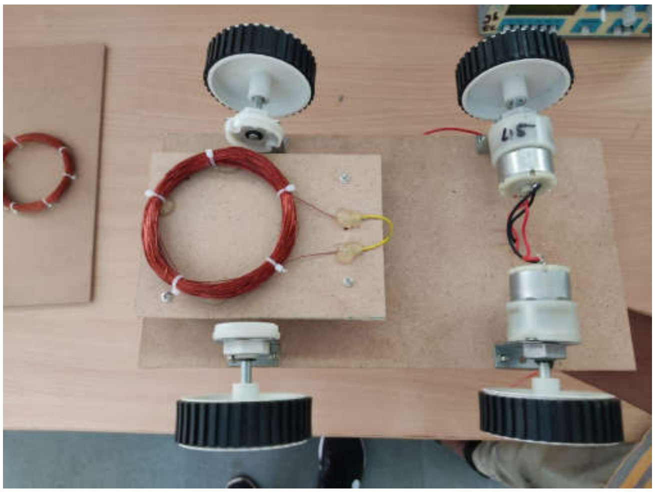

Fig. 6c: Final wireless power transmission setup

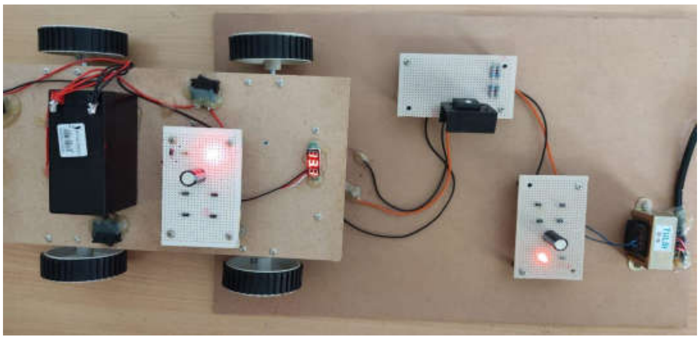

Fig. 6d: Experimental Setup

Table 1: Hardware specifications

COMPONENTS	SPECIFICATIONS
Transformer	230v - 12v, 0-1A
Diodes(1N4007)	1kv, 1A, 2pin
Capacitor	100uF
Resistor	3.3Kohm
Transistor	Vce=230v,Ic=15A,Pd=150w
Coil	140 Turns, 12v output
BATTERY	Volt - 12 volt Type – DC AH- 1.3 Ah
Motor	12v , 200rpm, 0.3A Iload
Switch	----------
LED	--------
Adapter	12V charger(Backup charging)

VI. RESULT AND DISCUSSION

The hardware prototype of the proposed EV battery charger was fabricated and tested using the components in the Table1 and achieved the effective transmission of 12v from primary to 13.1v in the secondary side with the distance of 5cm apart. Widespread adoption of Electric Vehicles (EVs) is a promising solution to address the environmental problems and decarbonize transportation sectors. In this paper, a prototype wireless charging device for EV is developed.

VII. CONCLUSION

This paper presented a design of wireless charging of electric vehicles. Wireless charging will offer many benefits as compared to wired charging under dynamic conditions. With technology development, wireless charging of EV can be brought to fruition. Further studies in topology, manage, other design, and human safety are nevertheless needed in the close to term.

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