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Multimode Contactless Vehicle Charging System

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Abstract: Wireless power transfer system transfer electric energy from a source to load without any wired connection WPT's are attractive for many industrial applications because of their advantages compared to the wired charging such as no use of any wires, easy charging and comfortable transmission of power in adverse environmental conditions. In WPT we used two coils and we charge our battery with the use of magnetic coupling between two coils. In electric vehicle charging method transmitter coils are placed under the road and receiver coils are placed in the vehicle. IWPT, method is mainly used for high power transfer applications like EV charging because its exhibits greater efficiency. As we know the battery is heart of e-vehicle, without battery E-vehicle there is no use of it. But according to the size of battery it has its own specific limitation. Aim of this project is to provide charging to battery in either in both modes moving and steady.

Keywords: Atmega328p-pu, LCD 16*2, Voltage Tripler circuit, Opt coupler, 12V 1 A adapter, 5W 12V solar panel, square wave inverter PCB, 12V battery, 3205 n-channel MOSFET, 21 gauge copper coil, bulb

I. INTRODUCTION

The wireless charging solution is increases for the use of battery charging of electric vehicle. The standard technology of wireless ev battery charging is based on inductive power transfer between two coupled coils are connected to the electrical grid and the other one is connected to rechargable battery. The IPT provides benefits in the terms of saftey and comfort due to the absense of a plug in operation to IPT the electrocution risk is typically arising from power cords is neglected and the battery charging can be automatically start. According to the condition of electric vehicle there are two types of Inductive power transfer for the wireless charging,
1)Static IPT – When the vehicle is stationary and nobody is inside (for eg. In parking area)
2) Dynamic inductive power transfer – When the vehicle is in moving condition obviously represent the only solution for dynamic charging, since the wired connection would be impossible during motion. Due to the magnetic coupling between the 2 coils there is unavoidable minimum leakage magnetic field leading to an energy loss. As far as safety is concerned even if IPT allows reducing the electrocution rays some care is required regarding the magnetic field exposure. Suppose one person has his own electric vehicle. And he wants to reach 600 km distance but the vehicles battery capacity is fixed. Suppose his battery capacity is to reach 200 km at one charge, what he will do?
First he will reach 200 km distance then he will charge his vehicle then he will cover next 200 km distance then again he will charge his vehicle, then after he will reach his destination as we see the process is very time consuming and lengthy. Our main objective to solve this problem. What if our vehicle is continuously charging either it is in motion or in steady position by using of inductive power transfer technique; we charge our vehicle either the vehicle is in steady position or moving. In the inductive power transfer we use two coils one is transmitter coil which is placed in the road other is receiving coil placed in vehicle to receive power from transmitting coil and the receiving coil is connected to the battery and our vehicle is continuously charged by using of the coil

❖ **Inductive Charging principle**

- Inductive charging is one of the small distance wireless charging.
- This method is works as similar to "ELECTROMAGNETIC INDUCTION" where the charger device will create an E.M field with alternating polarity using a coil of insulated copper wire and a similar coil will be placed inside the E-vehicle which will convert E.M field back to electric current and it supplies to the battery.
- In inductive charging method inductive coupling will happen. first the alternating current passes through the induction coil in the charging station or pad the moving electric charge creates the magnetic field which fluctuates in strength because the electric current amplitude is fluctuating.
- This charging magnetic field creates an alternating electric current in the portable device induction coil which in turn passes through a rectifier to convert it to the direct current; finally direct current charges the battery.

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II. LITERATURE REVIEW

Paper 1:
There are different types of methods for wireless transmission so that's why we are referring bidirectional wireless power in V2G system paper. For Electric vehicles Inductive power transfer is perfect method. 81% efficiency has been achieved from this research, But by increase the distance range of project up to 30 cm which itself a very unique achievement. 15 cm is required distance for better results. The output Voltage and current at 30 cm distance between coils are 12 V and 3 A DC, Which is good for charging a electric vehicle

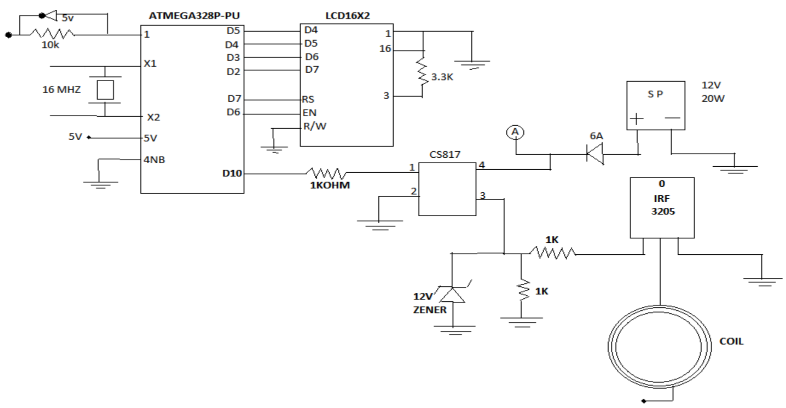
Wireless power transfer (WPT) is human free method from the annoying wires. In WPT same basic theory which has already been developed for at least 30 years with the term inductive power transfer. WPT technology is developed very fastly in recent years. The WPT is very helpful for electric vehicle charging application in both stationary and dynamic charging scenarios. By introducing the charging time, range and cost can be easily mitigated. Battery technology no longer relevant in the mass market penetration of EV's. It is hoped that researchers could be encouraged by the state of the art achievements, and push forward the further development of publically as well as the expansion of EV. .[1]

Paper 2:
It is obvious that electrification of vehicle is unavoidable because of environment and energy related issues. Wireless charging has many advantages than wired. In particular, when the roads are electrified using the coils with wireless charging capability, it will provide the foundation for mass market penetration for EV regardless of battery technology.
As the develop of Electric Vehicles the vehicle to grid V2G concept, which studies the interaction between mass EV charging and the power grid, is also a hot research topic in smart grid and EV areas. If the EV charging procedure will be happened, it could have many benefits for the grid. The batteries in the EVs are like energy preservation, thus some unstable new energy power supply, like wind power, could be connected to the grid more easily. Results show, the drivers are more willing to connect their EV into the grid [113], which could maximize the V2G benefits. .[4]

III. METHODOLOGY

The system will work in two modes
1. EV charging station contactless to vehicle battery
2. Vehicle to grid AC supply conversion using Vsi.
A. EV charging station is incorporated with solar pv array and ac grid, ac supply is converted to dc then as per solar power and grid power availability power is contactless transferred to Ev battery to be charged.
B. vehicle to grid
Dc supply for Ev battery is converted to AC 230v single phase using Vsi unit and is transferred to grid. VSI unit will have H-BRIDGE INVERTER with SPWM technique.

Working (transmitting side) :



We are using 12 V, 1 A two adapters for power supply one is for charge controller and other one is for grid charging during night mode. The 12 V goes through charge controller ckt. In charge controller one regulator is present which converts 12 V to 5 V. The 5V supply goes to LCD display and atmega controller. The working of charge controller is to receive the input source from pannel and grid but the input source from panel and grid are dc but the transmitting coil requires ac supply.The charge controller ckt. Converts the dc supply into ac ie. Square wave by using switching technique.

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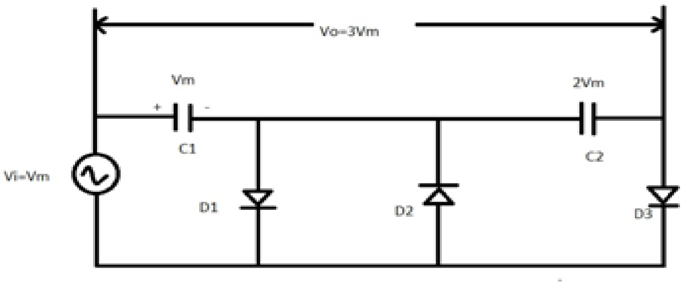
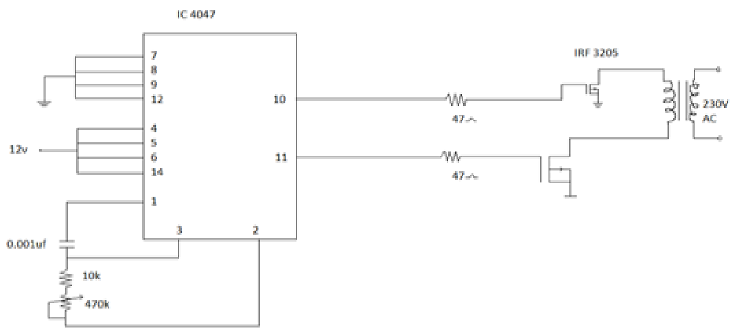
But switching technique requires pwm. The atmega 328p-pu IC generats pwm. We give 60% duty cycle on time and 40% off time.

The supply from charge controller goes to pwm unit which consist of MOSFET and diodes, because of pwm ckt. The 12 V and 22 V pulses goes to the coil and the flux will be generated. The frequency of this is up to 1khz and maximum frequency is 10khz but in 1khz will be better result and also the direction of coil affects to the voltage.

Working (receiving side) :



The flux will be generated from transmitting coil is received by the receiving coil. The receiving coil receives the current or flux and it will be given to the voltage trippler ckt. As we know the battery charges at dc current. But we get a ac signal from receiving coil the voltage trippler ckt converts the ac signal to dc signal and then it triples the voltage ie from 12 V to 36 V. Suppose a battery charges at 14 V then the voltage will be cut off automatically at 14 V. The dc signal from voltage tippler ckt is given to a battery and battery will be charges continuously. And the battery voltage is continuously measured by LCD 16*2which is placed on receiving side



Another one inverter is placed for domestic use in inverter SG 3524 IC will be used. The IC SG3524 is also called as pwm based square wave generator IC. The IC works for the MOSFET switching. The input of inverter is 12 V, but because of step up transformer the voltage will be rises up to 12 V to 230 V. As a result the 50% of battery we can use for domestic purpose by using the inverter.

IV. APLLICATIONS

1. Mobile battery charging:

Wireless charging is mostly used as a Smartphone feature, but the technology has wider implications that will one day have a massive impact on industry at all levels. When you spot the battery indicator on your smart phone is low, so you place the device on a charging pad. No struggle with cables; an easy way to grab your phone and go. It's the public face of wireless charging. Usually found at home, wireless charging for smart phones is increasingly appearing in the workplace.

2. Military use:

It is not easy for US military personnel to carry 110-150 lbs of equipment at one time, with roughly 20 of those pounds being batteries. This is mainly due to the variety of various devices, these soldiers have that need power sources like night vision goggles, radios, sensors, GPS devices, headsets, flashlights, and laser sights (just to mention a few). One of the ways the forces track mobile US army is by finding disposed batteries, which inadvertently serve as a sort of “breadcrumb trail.” Aside from the extra weight batteries load, it’s not ideal for soldiers to leave signs of their whereabouts, let alone litter and risk further harm to the environment.

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V. RESULT

By inductive wireless charging method we can successfully charge vehicle battery up to specific distance between them.
And by using 50 watt inverter we can successfully using the ac voltage for home appliance.
By setting discharging battery voltage cut up to 60%
And the main parameters voltage and current for battery charging depend on two points –
1. Distance between TX and RX
2. Moving or stationary
3. Direction of coil

VI. CONCLUSION

In this work, design and analytical experiments were performed for wireless power transmission and charging system. We accurately designed all the models for individual system and co-simulated in the end. We see that maximum efficiency of the system depends on the resonance and distance between coils to achieve an optimal power transmission.

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