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SMART INFRASTRUCTURE FOR DYNAMIC WIRELESS EV CHARGING

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Abstract:- Dynamic Wireless Charging of Electric Vehicle approach revolutionizes the changes in Electric Vehicle Industry. Existing Electric Vehicle Batteries are designed to power the Drive for minimum hundred kilometers range. Beyond hundred kilometers range the Battery capacity must be increased which in turn increases the cost of electric vehicle and charging time. With Dynamic Wireless Charging the Battery size can be reduced for same travel range, Thereby reducing the cost of electric vehicle and charging time.

The Present work deals with the Development and Simulation of Dynamic Wireless Charging of Electric Vehicle (i.e. charging in motion). Dynamic Wireless Charging of Electric Vehicle system contains road embedded number of inductive coils. Selection of number of inductive coils depends on the track length. Each inductive coil acts as a Transmitter, for wireless power transfer the transmitter coil terminals are excited by high frequency resonant inverter. Solar panel along with Boost converter supplies dc power to resonant inverter which in turn converts dc input to high frequency AC output. Wireless charging using resonant inductive power transfer utilizes high frequency magnetic field to transfer power from primary to secondary over a large air gap. Receiver Coil is placed on Chassis of Electric Vehicle and connected to on board rectifier circuit. Rectifier with capacitor filter converts the bidirectional signal to unidirectional signal and provides regulated dcoutput

Keywords- *EV Charging, Dynamic EV Charging, etc.*

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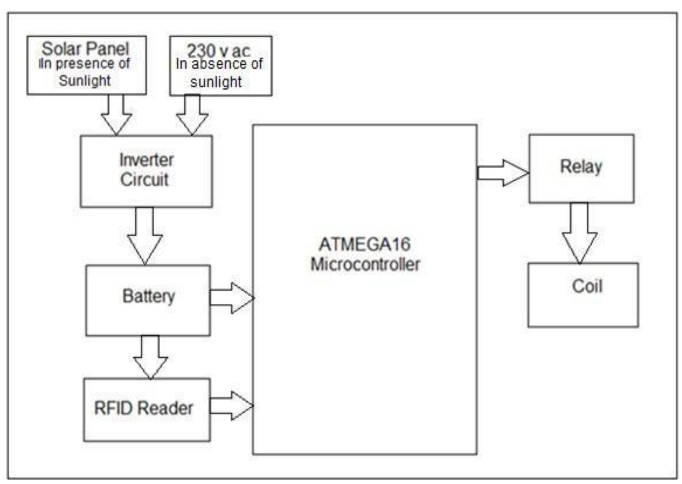
I INTRODUCTION

Wireless dynamic charging of Electric Vehicles (EV) is a key technology in reducing our global dependence on fossil fuels and allows greatly increased operating range without the added expense and weight of a larger battery pack. Inductive Power Transfer is the most promising technique to achieve this goal, offering advantages such as higher performance, safety through electrical isolation, and resistance to contamination. A typical dynamic charging system consists of roadway mounted coils, referred to as primary pads, which are magnetically coupled to secondary pads mounted on the underside of a dynamic charging equipped EV. As the EV moves over each primary pad, energy is transferred to the EV through the secondary pad and the power processing circuit. The primary pad array must be energized selectively in sections that are smaller than the overall dimensions of the vehicles travelling over them. It has also been demonstrated that discrete pads are more economically feasible than a single continuous track due to civil engineering constraints.

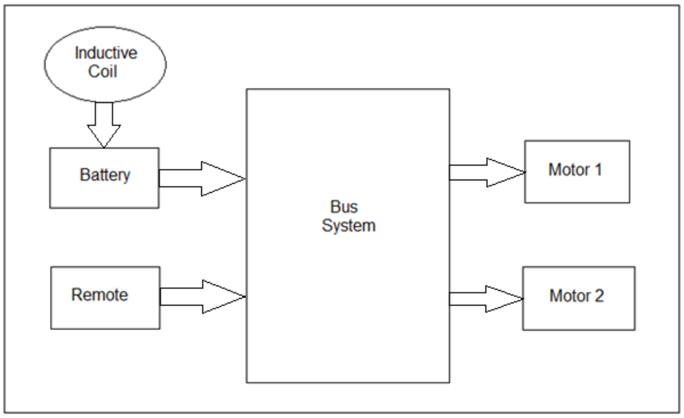
II PROPOSED SYSTEM



The block diagram of the transmitter section is shown in Fig . For battery charging purpose we need DC supply so to convert AC supply into DC we are using inverter circuit in it. The ATMEGA16 controller is used for the operation.

Transmitter Section

Receiver section block diagram is shown in Fig . The motors are operated using the battery charged through secondary coil.



Receiver Section

On the receiving end, we have another LC tank circuit which is designed to resonate/Oscillate at the same frequency as transmitter LC tank circuit i.e. 50-75 KHz. Since there is a resonant inductive coupling between transmitter & receiver LC tank circuits, significant power gets transferred. High frequency AC output of receiver tank circuit then converted to 5V DC by means of rectifier circuit. 5V DC output is then given to the load (can be mobile battery/LED module etc.) From above, we have seen that power gets effectively transferred from transmitter to receiver without any connection of wires i.e. power gets transferred wirelessly.

The ATMEGA16 controller is used for the operation. Secondary coils are energized through primary coils on the road and the battery charging takes place. Single phase 230V, 50Hz is given to the power supply which converts 230V AC input to 5V DC output. 5V DC supply is given to drive the Oscillator circuit. Oscillator gives high frequency alternating (10-100 KHz) AC output which is given to the Amplifier. Amplifier converts low level power output of oscillator (nearly 5-10mA) to the higher level (nearly 500mA). Alternating output (5V, 500 mA AC, 50-75 KHz) is fed to the parallel LC tank circuit. LC tank circuit is basically air cored inductor with capacitor across it. Since high frequency AC input is given to LC tank circuit, high frequency oscillating magnetic field is produced. The energy will transfer back and forth between the magnetic field in the inductor and the electric field across the capacitor at the resonant frequency. This oscillation will die away at a rate determined by the Q factor which is high is our case. Because the Q is high, even when low power is fed in to the transmitter coil, a relatively intense field builds up over multiple cycles, which increases the power that can be received at resonance far more power is in the oscillating field than is being fed into the coil, and the receiver coil receives a percentage of that.

III. ADVANTAGES & APPLICATION

Advantages:-

The advantages of our project are as mentioned below.

1. More Convenient.
2. No manual recharging or changing batteries.
3. More Reliable.
4. Never run out of battery power.
5. More Environment Friendly.
6. Reduce use of disposable batteries.

Application:-

Some of the applications are as mentioned below.

1) Wireless charging of dynamic electric vehicles.

2) Wireless charging of any dynamic electronic device

IV. CONCLUSION

Dynamic Wireless Charging of Electric Vehicle approach revolutionizes the changes in Electric Vehicle Industry. Dynamic Wireless Charging of Electric Vehicle reduces the cost and size of the battery, thereby reducing the cost of electric vehicle. Simulation of Dynamic wireless charging system with transmitter and receiver coils at an air gap of 27cm at 23KHZ frequency with K=0.9 coefficient of coupling and efficiency of 93.4% have been achieved. Simulink models High frequency 23 kHz resonant inverter and solar panel with Boost converter are developed at transmitter end. Simulink models of rectifier with filter and traction motor have been developed at receiver coil end. Simulation results of state of charge (SOC) of electric vehicle battery at different alignment and misalignment positions of coils have been achieved. The Electric vehicle batteries which use to take 2-3hrs to charge up to the rated value will be charged with in 40min as their battery capacity is reduced. With reduced new battery capacity using dynamic wireless charging system electric vehicles can be charged under motion.

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