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DESIGN AND DEVELOPMENT OF WIRELESS CHARGING IN ELECTRIC VEHICLE

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ABSTRACT

In this era of fast growing technology, electricity plays vital role in rapid change, where every system is being automated. In today's world electric vehicle is considered as the most popular thing to be carried out. The main objective is to focus on the charging of the electric vehicle through wireless charge system, that transmits power from transmitter to receiver without any contact between them. It can work properly within the limit of 3mm to 9mm air gap between transmitter and receiver. The electromagnetic plate has been designed in which the magnetic enamelled copper coil has been used in which the primary coil has 22 turns and secondary coil has 32 turns. The voltage regulator has been used for passing 5 volts to 12 volts constant voltage. The Arduino UNO at mega 328p has been used for controlling the vehicle. Use indicator for safety in turning and reverse.

Keywords*: Transmitter, Receiver, electric vehicle. Battery charging, magnetic field.*

I. INTRODUCTION

Electric vehicle soon will become the most widely used vehicle all over the world. So as to make it more efficient the technology used must be upgraded. The foremost thing to be dealt in electric vehicle is charging process which must be in simplest way and cost efficient. So, here in this project the main aim is to deal with the changing process wireless transmitting the power and charging the battery of vehicles. The transmitting is done through transmitter and receiver circuit. It is conventional power management technique for an electric vehicle application. The development of the transmission of power is done by placing the receiver circuit beneath the vehicle and transmitter on the selected area of roadways. Electric vehicles have attracted significant attention although much research provides options to manage this problem by scheduling set points [1] [2] [3].

It cannot determine the regulation service and demand response capacity at the same time. 12V Dc motor is used in electric vehicles which move forward and reverse direction. Four Red colour LED are used in electric vehicle which is use for safety like when vehicle turn in right side that time right side indicator will glow and when it will move in left direction that time left side indicator will glow. The same conditions apply on reverse left reverse right direction. If electric

vehicle move in reverse direction that time tail light also glow with all four indicator and buzzer glow with delay timing. Use two batteries in this vehicle one for operation of motor which is charge by external power only another battery use for accessories of vehicle which is charge internally. Bread board is used in this electric vehicle for wiring and other electrical connection [4] [5].

II. METHOD & MATERIAL

Methodlogy

Design one electromagnetic plate which has two magnetic enameled copper coil in which primary coil has 22 number of turns and secondary coil has 32 numbers of turns. In this coil supply has given by DC that power converted into AC power with the help of harmonic oscillator. After electromagnetic induction process rectifier connected between voltage regulator and output terminal of secondary winding.This voltage regulator is used for passing 5v to 12v constant voltage. The battery is connected with the voltage regulator with respect to polarity. Arduino UNO (at mega 328) is used for controlling the electric vehicle through command [6] [7] [8].

a. Design electromagnetic plate between road and electric vehicle
b. Design wireless charging System
c. Design transmitter and receiver.
d. develop electric vehicle
e. Arduino coding for control electric vehicle

Figure

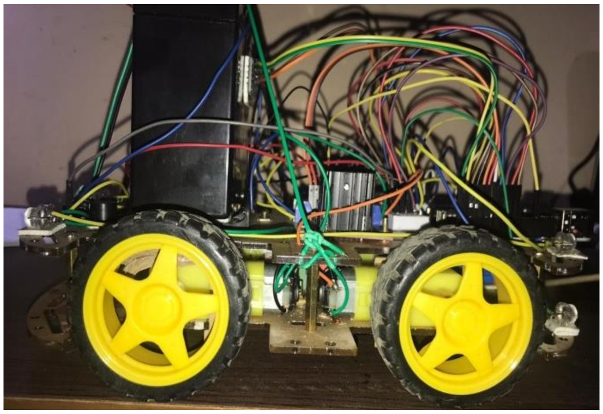

Fig 1.0 Complete design of electric vehicle

Charging plate

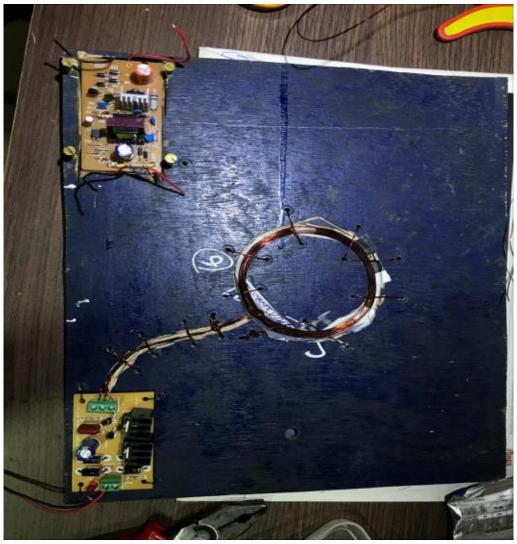

Fig 1.1 Transmitter circuit of electric vehicle

III. LITERATURE SURVEY

A. Kurs et al, proposed wireless Power Transfer via Strongly Coupled magnet resonances. It consisting of two wire coils each with a diameter of 60 cm, and a coil which transforms the energy to the load, to show that it is feasible to send power over a distance of two meters.

A.Karalis et al, describes the major disadvantages of existing wireless power transmissions are low efficiency. It is not considering biological effects, large and heavy equipment and only low amount of power transmissible. There have been extensive designs with inductively coupled wireless power transfer systems.

Aristeidis Karalis et al propose efficient wireless non-radiative midrange energy transfer, the major disadvantages of existing wireless power transmissions are low efficiency.

J. Falin, proposes an inductive wireless charging lane for electric vehicles is presented. The lane proposed here consists of multiple spiral coils, which are laid down on a track. The specific parameters for the layout of the proposed lane are determined through simulation by the finite element analysis (FEA) software Maxwell.

Wei Gu. Proposes the current wireless power transfer (WPT) technology on electric vehicle charging was discussed. Basic principles of the technologies, including capacitive, electromagnetic field and magnetic gear, are elaborated.
T. Thio proposes review of battery charging infrastructure from wired connection to on-road wireless charging for an EV. The initial part of the paper deals with the wired charging and its power electronics infrastructure.

B. Wang et al describes that A prototype of a wireless power transfer system built in battery state of charge is related with available capacity.

Algorithm

1. To supply 30 volt Dc voltage, we can use voltage converter for the supply, this converter should consist LM7805 voltage regulator.
2. To connect oscillator with voltage converter/battery to generate AC waveform
3. Togive AC signal to the 1-phase transformer whose
4. primary22 turn and secondary 32 number of turn.
5. Toconnect output side of transformer with 1-phase rectifier to produce DC voltage.
6. The dc voltage connected to voltage regulator to step down 12V DC.
7. To charge 12V DC battery with charger

Flow Chart

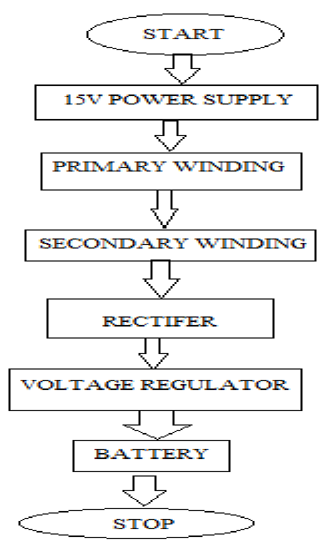

Fig 1.2 Flow chart wireless charging electric vehicle

Objectives

The main objective of this project is power transfer via air gap with the help of electromagnetic induction process, It will charge the electric vehicle's battery without any cable connection from source to battery. It can work properly within the limit of 150mm to 300mm air gap. For this project following components are required:

(i) Wireless charging
(ii) Electric vehicle charging service provider
(iii) Electromagnetic plate
(iv) Fast charging

Woking principle of wireless charging electric vehicle

Basic principle of wireless charging is, in wireless charging there are transmitter and receiver. DC supply from the smart-grid is converted into high frequency alternating current. This high frequency ac supplied to transmitter coil which further creates alternating magnetic field that cuts the receiver coil and produces ac power output in receiver coil. Then finally this ac power at receiver side rectified to dc and fed to battery through voltage regulator. It's not as efficient as a direct cable connection between the battery and wire. Wireless charging is around 60% - 70% efficient and it is done through a wireless connection. But for day – to –day use just lining up the coils and letting election electromagnetism do the rest is the simple value proportion at the heart of wireless charging.

Block Diagram

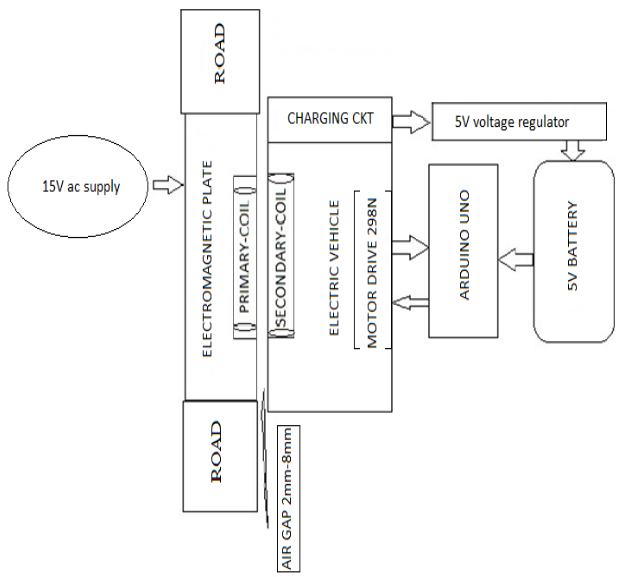

Fig 1.3 complete block diagram

Block diagram description

This project consists on electromagnetic plate on the road which is work as primary coil and vehicles consist secondary winding. Primary winding consist 22 turns and secondary winding consist 32 turns. Primary and secondary winding power transfer depend upon air gap between both coil. Charging circuit consist convert with including voltage regulator with convert alternating current to direct current. With help of voltage regulator voltage supply is constant for battery charger. Arduino is used for control the electric vehicle.

Primary coil specification

(i) Diameter of wire = 6mm copper type-magnet enamelled
(ii) Diameter of coil (a)= 16.5cm, or 16.5/2.54= 6.5 inches

(iii) Length of wire = 8.5cm, N1= numb of primary turn = 22
(iv) L= (0.001*N1(a/2)^2)/(114a+254l) H
put the value in formula
L = 0.001×22× (0.165/2)2 / ((114×0.165) + (254×0.085)) H
L = 0.674 micro H
(Voltage Source, V dc- 30V Capacitors, C - 6.8 n F , L - 0.674 µ H)
F = 1/2*pi* sqrt (LC) = 0.5* 3.14* (0.674*10^-6 *6.8*10^-9)

Secondary coil specification

(i) 16 awg wire (dia = 2mm
(ii) Coil diameter = 8cm= 0.08m
(iii)numb of secondary winding turn = 32
(iv)Length = 1 cm = 0.01m

L = 0.001 N2 (a/2)2 / (114a + 254l) H
Now we are applying the desired values for the coil,
L= 0.001×32× (0.08/2)2 / ((114×0.08) + (254×0.01)) H
L = 1.235 µ H

Component specification

Transmitter section:

(i) Voltage Source, V dc: 30V
(ii) Capacitors, C : 6.8 n F
(iii) Radio Frequency Choke,L1: 8.6 µ H
(iv) Radio Frequency Choke, L2: 8.6 µ H
(v) Transmitter coil, L: 0.674 µ H
(vi) R1: 1K R2: 10 K R3: 94 ohm R4: 94
(vii) ohm R5: 10 K
(viii) D1: D4148 D2: D4148
(ix) MOSFET, Q1: IRF540

Receiver Section:

1. Diode, D1, D2, D3, D4: D4007
2. Diode, D1, D2, D3, D4: D4007
3. Regulator IC: IC LM 7805
4. Receiver coil, L: 1 .235 µ H
5. C1: 6.8 n F C2: 220 µ F

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Hardware

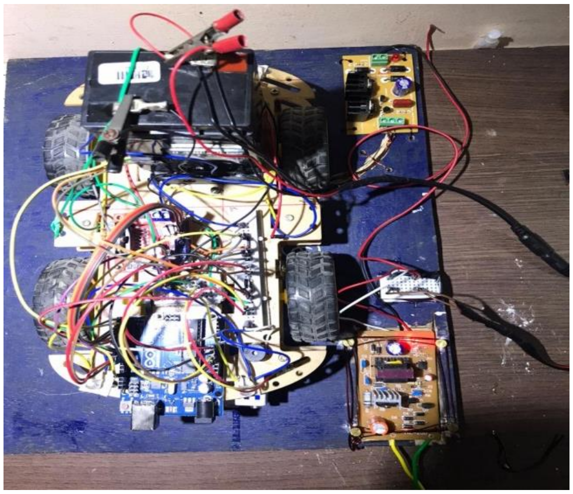

Fig 1.4 Transmitter with electric vehicle

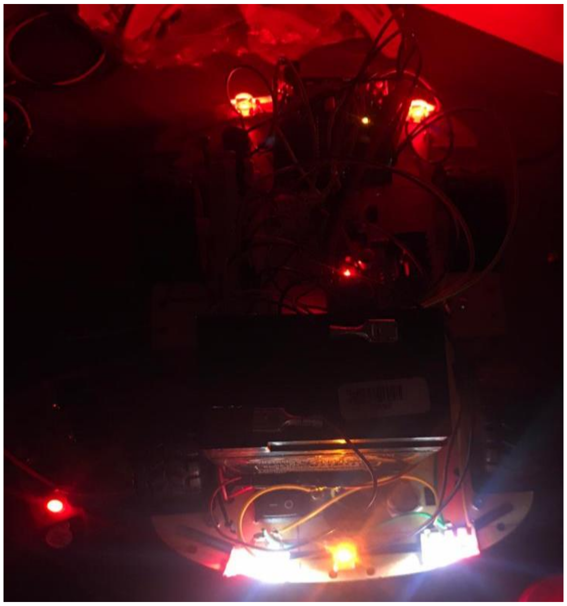

Fig 1.5 Static Charging mode

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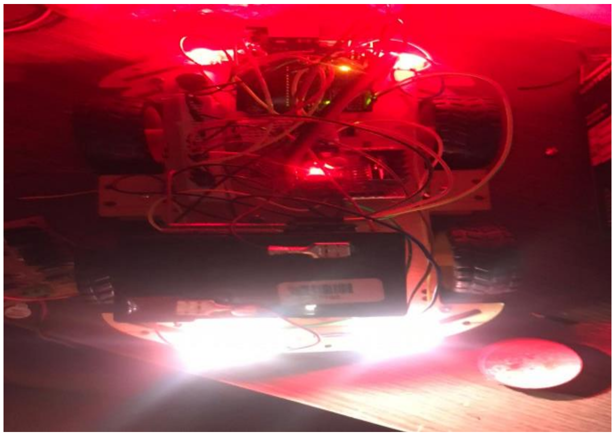

Fig 16 complete result in wireless charging in electric vehicle

Challanges faced by wireless electric vehicle charging service

- To install static and dynamic wireless charging stations on the roads, new infrastructure development is required as current arrangement are not suitable for the installations.
- Need to maintain the EMC, EMI and frequencies as per standards for the human Health and safety concern.

Impact on international market

Electric vehicles have the potential for significant contributions towards achieving the climate protection goals in the transport sector. However, the environmental impacts of a large scale introduction of electric vehicles are still unknown.

Advantage

1. Easy to design because it can be easily connected receiver circuit through the charging point.
2. Increase efficiency of vehicles.
3. Increase regulation of vehicles
4. Increase the sell of electrical vehicles.
5. It can be implemented on existing road.
6. Reduce pollution level

Impact of electric vehcle in india

i. Reduce pollution
ii. Noise cancellation
iii. Reduce the demand of petroleum
iv. Low maintenance cost

IV. RESULT & DISCUSSION

The EV charging that provided DR and ancillary service reduced the charging cost up to 25% during day time charging without any inconvenience to EV owners. With appropriate scheduling of EV charging, more economic benefits can be expected. Future work will involve methodologies for unexpected departures of electric vehicles with stochastic scheduling taken into consideration.

Formula:

Inductive coupling coefficient (m)= k* sq rt(L1+L2)
Where design value of k = (0.1 to 0.5)

m= 0.5 * sq rt(0.674+1.235) = 0.9545
m= 0.4 * sq rt(0.674+1.235) = 0.5527
m= 0.45*sq rt(0.674+1.235) = 0.6217
m= 0.46*sq rt(0.674+1.235) = 0.6356
m= 0.47*sq rt(0.674+1.235) = 0.6493
m= 0.48*sq-rt(0.674+1.235) = 0.6632
m= 0.49*sq rt(0.674+1.235) = 0.6770

The above coefficient values depend upon the air gap between primary and secondary winding.

Tables: air gap distance, received voltages and currents

Table 1. air gap distance, received voltages and currents

Air gap distance (in mm)	Received Voltage(v)	Received current(A)
1	5V	650mA
2	5V	600mA
3	5V	594mA
4	5V	550mA
5	5V	540mA
6	5V	508mA
7	5V	456mA
8	5V	440mA
9	5V	435mA
11	5V	432mA
12	5V	430mA
13	5V	385mA
14	5V	365mA
15	5V	300mA

V. CONCLUSION

The principle of wireless charging is in wireless charging there are transmitters and receivers. DC supply from the smart-grid is converted into high frequency alternating current. This high frequency ac supplied to transmitter coil which further creates alternating magnetic field that cuts the receiver coil and produces ac power output in receiver coil. Then finally this ac power at receiver side rectified to dc and fed to battery through voltage regulator. It’s not as efficient as a direct cable connection between the battery and wire. Wireless charging is around 60% - 70% efficient and it is done through a wireless connection. But for day – to –day use just lining up the coils and letting election electromagnetism do the rest is the simple value proportion at the heart of wireless charging.Future work will involve methodologies for unexpected departures of electric vehicles with stochastic scheduling taken into consideration.

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