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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.

KEYWORDS*:* transmitter, receiver, electric vehicle, battery chager

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 [1][2]. 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 [3][4]. It cannot determine the regulation service and demand response capacity at the same time.

II. BASIC PRINCIPLE OF WIRELESS 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 [5][6]. 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. It has more advantages i.e

- Easy to design because it can be easily connected receiver circuit through the charging point.
- Increase efficiency of vehicles.
- Increase regulation of vehicles.
- Increase the sell of electrical vehicles.
- It can be implemented on existing road.

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III. LITERATURE REVIEW OF WIRELESS CHARGING ELECTRIC VEHICLE

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.

IV. DEVELOPMENT OF ALGORITHM BASED WIRELESS ELECTRIC VEHICLE

- To supply 30 volt Dc voltage
- To connect oscillator with grid to generate AC waveform
- Togive AC signal to the 1-phase transformer whose primary22 turn and secondary 32 number of turn.
- Toconnect output side of transformer with 1-phase rectifier to produce DC voltage.
- The dc voltage connected to voltage regulator to step down 12V DC.
- To charge 12V DC battery with charger.

FLOW CHART ANALYSIS

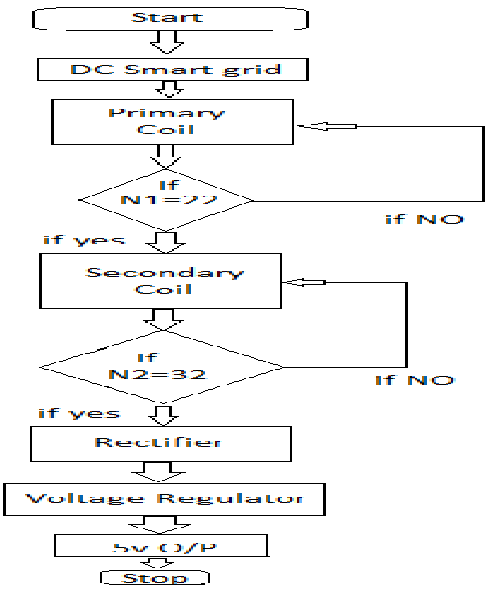

Fig 1: Flow chart analysis of wireless electric vehicle

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DESCRIPTION OF BLOCK DIAGRAM

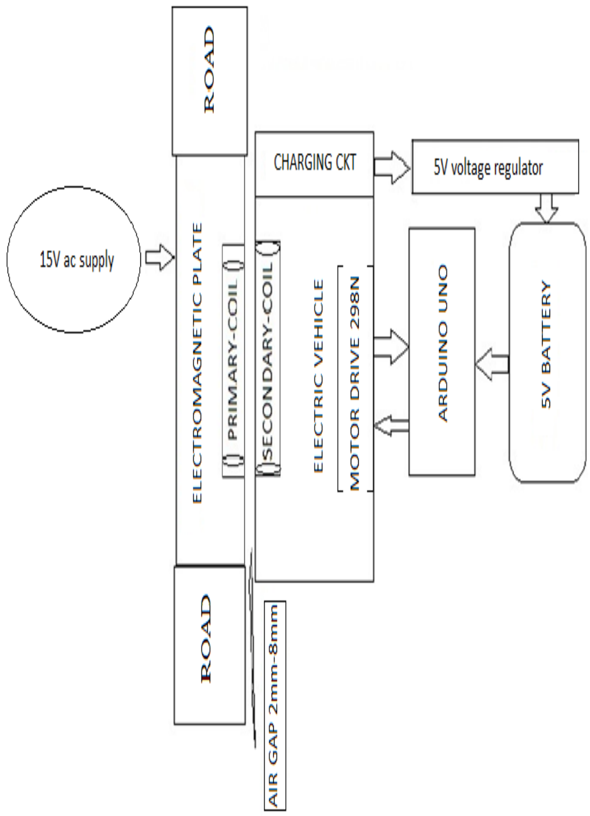

Fig 2: complete block diagram analysis of wireless electric vehicle

Basic principle of wireless charging is same as transformer working principle. In wireless charging there are transmitter and receiver, 220V 50Hz AC supply is converted into High frequency alternating current and this high frequency AC is supplied to transmitter coil, then it creates alternating magnetic field that cuts the receiver coil and causes the production of AC power output in receiver coil. But the important thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver [7][8]. To maintain the resonant frequencies, compensation networks are added at both sides. Then finally, this AC power at receiver side rectified to DC and fed to the battery through battery management system. This project consists on electromagnetic plate on the road which is work as primary coil and vehicles consist secondary winding. Primary and secondary winding power transfer depends upon air gap between both coils. 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.

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V. HARDWARE DESRIPTION AND RESULTS

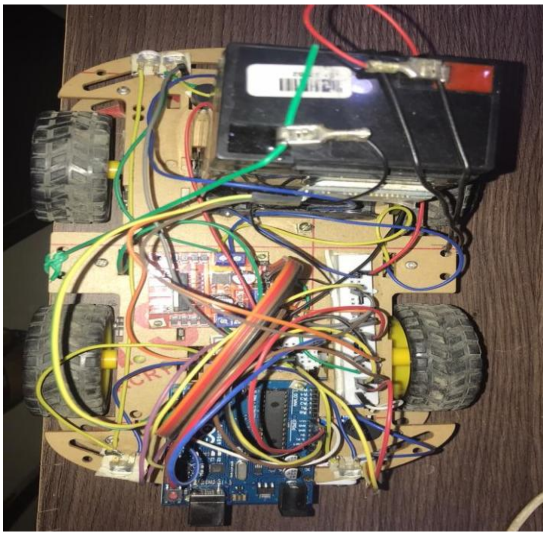

Fig.3 Front view of wireless electric vehicle

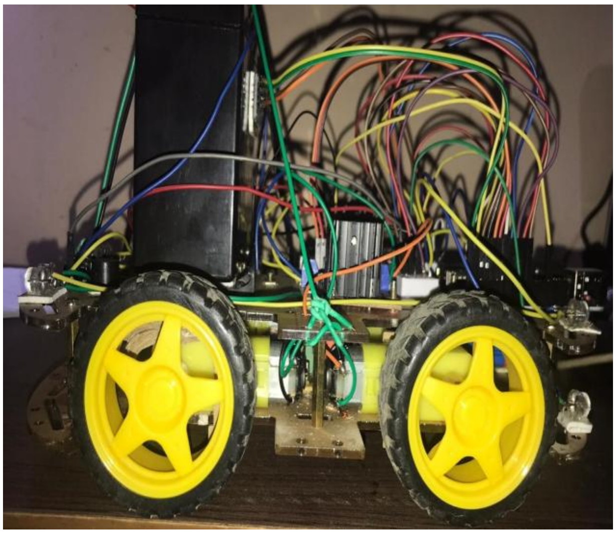

Fig 4 Front view of wireless electric vehicle

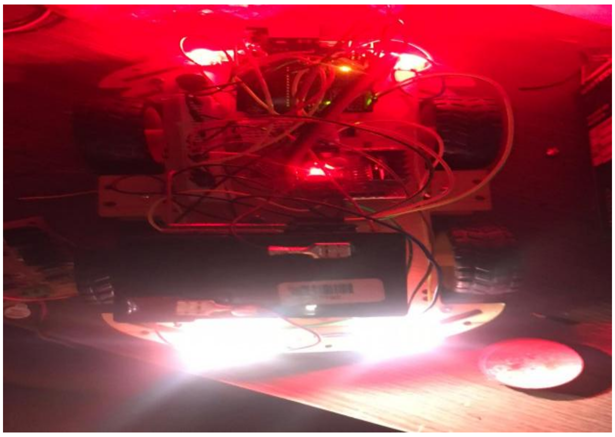

Fig.5 complete result in wireless charging in electric vehicle

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VI. 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.

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APPENDIX

Primary coil specification

Diameter of wire = 6mm copper type-magnet enamelled
Diameter of coil (a)= 16.5cm, or 16.5/2.54= 6.5 inches
Length of wire = 8.5cm, N1= numb of primary turn = 22
L=(0.001*N1(a/2)^2)/(114a+254l)H
L = 0.001×22× (0.165/2)2 / ((114×0.165) + (254×0.085)) H
L = 0.674 micro H
F = 1/2*pi* sqrt (LC)
= 0.5* 3.14* (0.674*10^-6 *6.8*10^-9)

Secondary coil specification
16 awg wire (dia = 2mm
Coil diameter = 8cm= 0.08m
Number of secondary winding turn = 32
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:

Voltage Source, V dc: 30V
Capacitors, C : 6.8 n F
Radio Frequency Choke,L1: 8.6 µ H

Radio Frequency Choke, L2: 8.6 μ H
Transmitter coil, L: 0.674 μ H
R1: 1K R2: 10 K R3: 94 ohm R4: 94 ohm R5: 10 K
D1: D4148 D2: D4148
MOSFET, Q1: IRF540

Receiver Section:
Diode, D1, D2, D3, D4: D4007
Resistor, R 1k ohm Voltage Regulator IC: IC LM 7805
Receiver coil, L: 1 .235 μ H
C1: 6.8 n F C2: 220 μ F
C1: 6.8 n F C2: 220 μ F