ISSN No:-2456-2165

Design and Analysis of Wireless Charging Station for Electrical Vehicle

[1]M Payani
Electrical and Electronics Engineering
Sri Ramakrishna Engineering College
Coimbatore, India

[2]Asmitha P
Electrical and Electronics Engineering
Sri Ramakrishna Engineering College
Coimbatore, India

[3]Jyoti Shekhawat
Electrical and Electronics Engineering
Sri Ramakrishna Engineering College
Coimbatore, India

Abstract:- Electric vehicles are advancing globally today in automobile industries all over. They offer a number of advantages over conventional internal combustion engines, particularly in the terms of higher efficiency, lower local emissions and so on thereby providing sustainable technology paths. Electrified transportation helps in reducing hikes of petrol price and emissions. It requires setting up of various types of charging stations in a user-friendly environment, to motivate the adoption. The drawback of dynamic charging of Electric Vehicles is the coil misalignment. Thus, Static Wireless Electric Vehicle Charging Systems (SWEVCS) can be a right substitute technology in charging the electric vehicles without any plug - in problems. Static wireless mode of charging rejects the open contact hazards of cables thus providing reliable and safe charging of EVs. A primary coil is installed on the ground or below in the road and the receiver coil is generally installed below in center of Electric Vehicle, or in the front or rear. Wireless charging systems works by the principle of electromagnetic induction between these two coils thereby charging of electric vehicle takes place.

Keywords:- *Static Wireless EV Charging, Wireless Power Transfer, Plug-in Systems, Electromagnetic Induction, Electric Vehicle, Copper Coils, Capacitive Wireless Charging, Inductive Wireless Charging.*

I. INTRODUCTION

An electric vehicle (EV) is the one that works on the electric motor alternative of internal-combustion engine. Thus, this type of vehicle is seen as a practicable substitute for present generation automobiles, thereby addressing the problem of increasing global warming , pollution, depleting natural resources, etc. Even though the idea of electric vehicles has been around for pretty long time, it has gained a substantial topic of interest in the last decade amongst a rising carbon footprint and various environmental impact of fuel-based vehicles.

India's target on next-gen movement has unquestionably expanded under the present government, but the 'National Electric Mobility Mission Plan (NEMMP) 2020' was disclosed in 2013 below the antecedent Congress-led government. From then on, the country is interested in adopting super fledged approach thereby willing to become into an EV nation. At primary level, the electric vehicles provide an extremely lower cost of operating when seen with conventional internal combustion engines. On an average, the electric vehicles are 70-75% less cost compared to fuel and maintenance view, that is in turn an essential consideration for many users who have increased use. This condition is true from factors because the material is cheaper in battery charging when seen to refueling a liquid fuel tank.

The alternating current in the coil determines the size of the coil. For example, to have the same flux density the number of turns in the coils are reduced with the help of high frequency current. The electricity is generated in the nearby coil when the alternative current passes through it. The number of turns, gap between coils, etc. affects the magnitude of the generated electricity.

II. BODY OF PAPER

The principle of inductive wireless energy is uncomplicated. The same principle is for wireless chrging of electric cars.

2.1 Resonant Inductive Coupling

It is an altered way of inductive charging and the wide of charging is a hardly any meters whereas the inductive charging has very less range. The method of resonant inductive charging is generally applicable for wireless charging of electric vehicles. The two copper coils are used to move the energy in inducive charging. The two coils are managed to the same electromagnetic frequency where one coil has to be energized from the external supply. The next coil that is managed to the same frequency there the energy is transferred. The charging station and car will be both equipped with coil to charge the electric car. The power

ISSN No:-2456-2165

socket is connected with transmitter coil that reserves the room with a non-radioactive magnetic field. It transports the power to car battery i.e, receiver coil.

2.2Capacitive Wireless Charging

In this method, electrostatic power transfer happens instead of mutual induction. A late of capacitor is installed below the care and the other one is installed on the road and the electric power is transferred through the electrostatic effect from charging station to the battery. High-frequency AC transfers the power from charging station.

2.3Advantages of Wireless Charging

Following are benefits of wireless charging for electric vehicles

- Big charge cables are not required to be carried
- Charger use is convenient
- Safer to use
- It is maintenance-free
- Immune to water and dirt

2.4Disadvantages of Wireless Charging

Despite of wireless charging being the right option, there are a less disadvantages also. The disadvantages are as follows

- Charging system is standardization
- The challenges in wireless charging installation.
- The car is to be parked exactly above the coil installed on the ground.

III. EXISTING SYSTEM

In the existing systems, a wide variety of charging option is not available and in the recent years, the trend is more flexible on wired systems. The liveness of the electrical vehicle is in demand for the development of variety of charging options.

Many places have started to install EV charging, which helps EVs available for staff with long travelling, and also for visiting. The exact design challenge is production of right charging system that can be easy to install in various units with centralized management, and conjusted reach controls to enable, for example, guest usage.

Charger for using in public address must be more, early and generally fast charging rates, and to adjust fundamentally to serve various vehicle, different vehicle types and battery conditions. It is usually supported by multiple usage per charger (generally more than two). They also have to allow usage by customer from various public charging services that have evolved requited allowed allowances to expand their area area. The exact design challenge is in delivering large number of amount of charging power in a way that is safe, fast and easy to be used.

IV. PROPOSED SYSTEM

The main idea of such a system is that it contains electrified driveway which offers wireless charging using magnetically coupled coils. The battery charging can take place in a wireless mode.

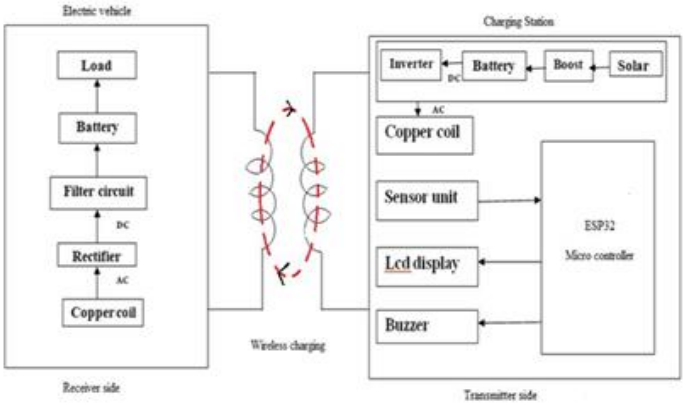

FIG 1: Block diagram

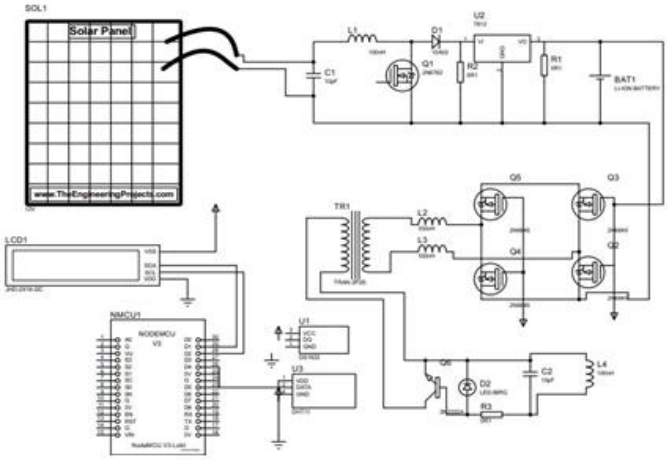

FIG 2: Circuit Diagram- Transmitter side

This project will short out the previous drawbacks because here we are using wireless mode of charging the vehicles. The electromagnetic induction takes place between the low magnetic coils and thus charging happens.

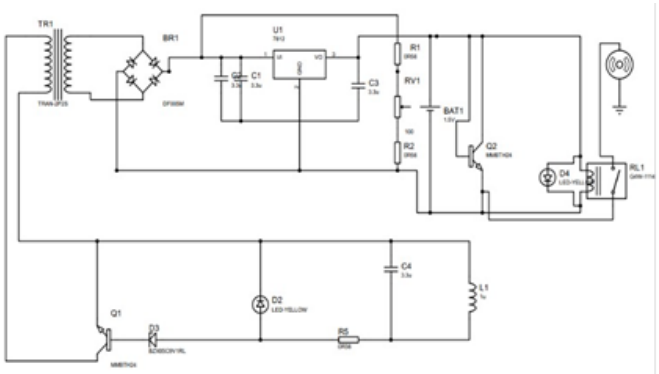

FIG 3:Circuit Diagram- Receiver side

ISSN No:-2456-2165

There are transmitter and receiver in the wireless charging, a 50Hz 220 V AC supply is transformed to High frequency alternating current and the high frequency alternating current is given to transmitter coil, thereby creating alternating magnetic field that cuts receiver coil and results in the production of AC power output in the receiver coil. But the crucial thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver. To maintain the resonant frequency, both ends has compensation networks. Lastly, at receiver side the AC is rectified to the DC power and then fed into the battery from the receiver side of electric vehicle.

Advantages

- The energy consumption is low.
- The status of the charging of the vehicle is displayed.
- More than one vehicle can be charged at a time.

Applications

- Static wireless electric vehicle charging system (S-WEVCS) WEVCS unlatch additional door to lay out a user-friendly surrounding for consumers (and to prevent all the safety related problems with the plug-in). It is used in the EVs to find the near charging station.
- Dynamic wireless electric vehicle charging system (D-WEVCS) Plug-in or BEVs are abide because of two important obstacles- one is cost and the other range. In a way to raise the range, EVs are required to charge either quite regularly or installing a battery pack.

V. HARDWARE DESCRIPTION

ESP32MICROCONTROLLER:

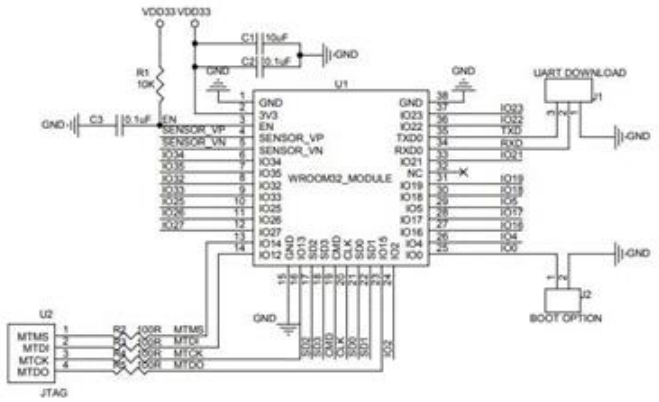

FIG 4: TEMPERATURE SENSOR

VOLTAGE SENSOR:

FIG 5 : VOLTAGE SENSOR

A voltage sensor that is appeared in the fig is a sensor that is used to ascertain and screen the measure of voltage in an item. The AC and DC voltage levels are decided by the voltage sensors.

ESP8266 MODULE:

FIG 6 :ESP8266 Module

Li ION BATTERY:

FIG 7: Li ION Battery DC REGULATOR:

FIG 8: DC Regulator CURRENT SENSOR:

FIG 9: Current Sensor

COPPER COIL:

FIG 10: Copper Coil

BOOST CONVERTER:

FIG 11:Boost Converter

VI. RESULT

There are transmitter and receiver in the wireless charging, a 50Hz 220 V AC supply is transformed to High frequency alternating current and the high frequency alternating current is given to transmitter coil, thereby creating alternating magnetic field that cuts receiver coil and results in the production of AC power output in the receiver coil. But the crucial thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver. To maintain the resonant frequency, both ends has compensation networks. Lastly, at receiver side the AC is rectified to the DC power and then fed into the battery from the receiver side of electric vehicle.

FIG 12: Output of Hardware

VII. CONCLUSION

In this paper, a ferrite lower pad for electric vehicle is proposed. A power pad and a DD power pad is combined for the construction of ta new design. The DD power pads and the circular pad use the physical dimension as recommended dimensions in SAE recommended practice J2954. The circular coil and the DD coil are placed 1mm apart with an insulation between them. The circular and DD coils share the same pair of leads and are connected in parallel. The system consists of an electrified driveway that allows the vehicles the probability of moving and charging at the same time. EVs battery charging can take place either motionless in any station or the EV can be charged when they are in the motion. In the later, we have an induced emf in the receiver side of coil, that is caused by the movement and to the transformation, also. We have analyzed this case where the emitter consists of only a coil. In case of various emitting coils and only one receiver coil, the result of wireless coupling action takes place.

ACKNOWLEDGEMENT

This paper work would have not been possible without the exceptional support of our project supervisor Mr M Payani. We are immensely grateful to him for extending his guidance throughout the completion of the project. We would like to express our gratitude to Almighty for sustaining us throughout our project. We offer a special thanks to our beloved parents and friends for their great encourage.

REFERENCES

[1]. G. de Freitas Lima and R. Godoy, "Modeling and Prototype of a Dynamic Wireless Charging System Using LSPS Compensation Topology", IEEE Trans. Ind. Appl., vol. 55, no. 1, pp. 786-793, Janury/February 2019.
[2]. Ahmad, M. S. Alam, and R. Chabaan, "A comprehensive review of wireless charging technologies for electric vehicles," IEEE Trans. Transportation Electrification, vol. 4, no. 1, pp. 38-63, March 2018.
[3]. X. Liang and M. S. A. Chowdhury, "Emerging Wireless Charging Systems for Electric Vehicles-Achieving High Power Transfer Efficiency: A Review," Proceedings of 2018 IEEE Industry Applications Society Annual Meeting (IAS), pp. 1-14, 2018.
[4]. SAE Recommended Practice J2954, “Wireless power transfer for lightduty plug-in/electric vehicles and alignment methodology,” November 2017.
[5]. J. M. Miller, O. C. Onar, and M. Chinthavali, "Primary-side power flow control of wireless power transfer for electric vehicle charging," IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 3, no. 1, pp. 147-162, March 2015.
[6]. D. Patil, M. K. McDonough, J. M. Miller, B. Fahimi, and P. T. Balsara, "Wireless Power Transfer for Vehicular Applications: Overview and Challenges," IEEE Trans. Transportation Electrification, vol. 4, no. 1, pp. 3-37, March.