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Optimized Renewable Energy Integration for EV High Power Dynamic Wireless Charging System

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Abstract **- Wireless battery charging (WBC) is an attracting solution to promote electric vehicles (EVS) in the market, which may provide superior charging infrastructure and unlimited driving range. Dynamic wireless power transfer is a practical method to solve electric vehicle range anxiety and reduce the cost of onboard batteries. Wireless recharging has long been common with pure electric vehicles and is designed to allow charging even when the vehicle is in motion. The in-moving vehicle charging has been researched and demonstrated by some institutes across the world using two possible track arrangements: stretched and lumped coil track. The former one is composed of a single elongated coil, much longer than the pickup size, and the later one is an arrangement of multiple coils placed one next to the other, the length of them being comparable to the pickup size. A lumped track permits activation / deactivation only of the coil interacting with a pickup. This ability is called segmentation and is very important for DWC to reduce the losses and to avoid exposing the people to electromagnetic radiations; therefore, a lumped track has been dealt with in this thesis. The contactless power transfer at large air gap is possible with high frequency (in kHz) and high-magnitude current supply of the track coils; as increasing supply frequency improves power transfer efficiency.**

Keywords: Electric Vehicles, Renewable energy and dynamic charging.

I. INTRODUCTION

Over the past 100 years, world have become increasingly dependent on people cars for meeting life's most basic needs. In most of the world, getting to and from work and holidays, bringing food home from the grocery store, or going to the doctor means using one's car. This reliance on the automobile and on the petroleum-powered internal combustion engine, in particular, comes with significant costs. People dependence on oil makes people overall economy and household budgets highly vulnerable to volatile oil prices. The pollutant emissions from the vehicles contribute to unhealthy air and global climate change.

Vehicles powered by electricity have the potential to reduce many of these problems. In most places, electric drive lowers the smog-forming and global warming pollution associated with vehicle use, and when powered by renewable resources, electric vehicles can nearly eliminate such pollution from vehicular operation. Electric vehicles powered by a clean electricity grid offer a key pathway to achieve the greater-than-80-percent reduction in global warming pollution. People need by mid-century to avoid the worst consequences of climate change. Powered by domestically produced electricity, electric vehicles (EVS) could be a significant part of reducing our oil dependence.

Electric vehicles (EV) are propelled by an electric motor that is supplied with power from a rechargeable battery. The required performance characteristics of an EV must compete with the conventional vehicle; therefore battery capacity and charging facility should be acceptable in the market. There are various technologies for the battery charging circuit like on board and off board charging. On board charging circuit is meant to be a compact system on the vehicle itself which can be connected to grid during charging but off board charging system is established at the charging station which provides appropriate form of power to be fed the battery. In recent years because of many unwanted precautions and massy arrangement of wired charging, the options of wireless charging are being investigated. The idea of wireless charging is to transfer power from grid to vehicle fully contactless. There are various concepts of contactless energy transfer like microwave, light, capacitive, inductive, reactive etc. However inductive power transfer among them is preferred technology for vehicular application.

II. LITERATURE SURVEY

To overcome the global emissions problem, most electric utility industries should move towards renewable resources such as wind, solar, and wave/tidal. The advancement of EV technology has increased the social and economic benefits in both the transportation and energy sector. Despite these

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benefits, battery technology limitations such as weight, lifespan, and storage capacity, and high battery cost are still the major hindrances to the broad acceptance of EVs. However, many automotive industries, organizations, and countries are investing in the research and development of EV battery technology. For example, Google spent $10 million, and the U.S. government spent $2 billion on the development of an EV battery. Moreover, the U.S. government has committed to bringing one million Plug-in EVs onto the road in the next five years. Considering the research and development in EV industries, according to the Australian Energy Market Commission (AEMC) global trend of increasing EV and decreasing ICE sales is also present. In Australia, the EV sale in 2019 was 6718, a 203% increase compared to 2018. Likewise, in recent years, the New Zealand government has set the target for the transition to 100% renewable electricity by 2035. In New Zealand 85% of electricity generation is based on renewable: 60% hydro, 18% geothermal, 5% wind, 2% biomass, and 15% is a fossil fuel. New Zealand's strong point is the wide mix of renewables such as hydro, geothermal, wind, and biomass for electricity generation. As 30% of the fossil fuel is consumed by the transportation sector, this offers a good opportunity to transition from fossil fuels to renewable energy by using technology, such as the electric vehicle.

III. OUTCOME OF LITERATURE SURVEY

Solar & Wind energy has been used in many applications for long time. Early usage of wind energy was in boat sailing. In the past decade, more and more interest in using wind energy for generating electricity had caught the attention of too many scientists, politician and common people. That was driven by high energy prices, scarcity of oil production and increase awareness among ordinary people to use environmentally friendly products as people became more environmentally conscience.

One possible way to be environmentally friendly is to drive vehicles that run on renewable energy. Many vehicles in the market use renewable energy sources either in a hybrid fuel-electric form like Toyota Prius or in a hybrid hydrogen fuel-cell-electric form like Honda FCX. When driving during nice conditions (e.g. down the hill) the engine dis-engages from fuel and switches to a DC operation mode using the batteries which drives the motor. Lots of progress has been made on large-scale deployment of electric vehicles such as Plug-in Hybrid Electric Vehicle (PREV) to serve as battery storage. The concept of utilizing electric vehicles as battery energy storage system to increase the flexibility in power system operation has been proposed almost two decades ago.

IV. PROBLEM STATEMENT

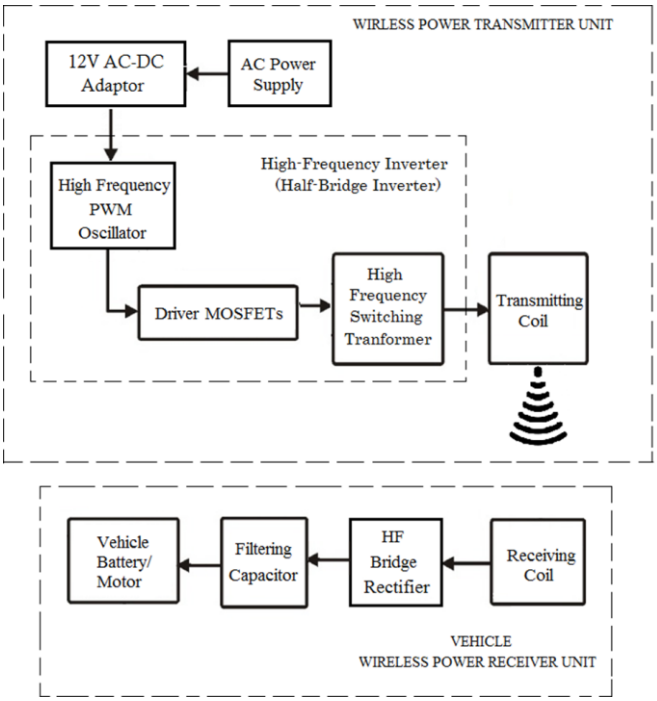
This project is based on dynamic wireless charging of electrical vehicles. The problem of electrical vehicles required too much time recharge the battery. The dynamic charging is the best concept that replaces the charging of battery. If you can directly charge the electrical car as they are travelling along the highway that save your recharging time of battery.

V. OBJECTIVES

- To provide contactless charging to EV
- To utilize renewable energy efficiently
- To preserve nonrenewable energy resource
- Gradual eradication of pollution

VI. METHODOLOGY

First the ac220v power is converted into 12v dc. Then the transmitter converts 12v dc into 12v ac. Transmitter is a high frequency inverter, which is a half bridge inverter type. It converts dc 12v into 12ac at 68KHz frequency. That high frequency ac power is given to the transmitter coil. The coil converts high frequency ac current into electromagnetic field.



The receiving coil converts received electromagnetic field gain into high frequency ac current. Which is rectified by a bridge rectifier and given as dc output for motor of car or for charging.

VII. RESULT AND DISCUSSION

The transmitter is given 12v DC power supply through adaptor which converts AC220v into DC 12v. IC 3525 is a

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PWM pulse generator. It produces switching pulses which is given to the gate pin of two MOSFETs. Drain pin of MOSFETs are connected to the primary winding terminals of the high frequency switching transformer. The center tap of the transformer is connected to the 12v DC voltage. The MOSFETs are turned ON and OFF alternatively with 90 degrees phase difference. When the first MOSFET is turned on, it produces a current in first half of the primary winding in HF transformer. Then the first MOSFET turns OFF and second MOSFET is turned ON which produces current in second half of the primary winding which is in opposite direction to the current produced in first half winding. So, in a complete cycle a AC current is produced in the transformer. A complete AC output will be produced at the secondary winding of the transformer.

VIII. ADVANTAGES AND DISADVANTAGES

8.1 Advantages

- No need of line of sight - In Wireless power transmission there is any need of line of sight between transmitter and receiver. That is power transmission can be possible if there is any obstructions like wood, metal, or other devices were placed in between the transmitter and receiver.
- No need of power cables and batteries - Wireless power replaces the use of power.
- Cables and batteries.
- Does not interfere with radio waves.
- Negative health implications - By the use of resonant coupling wave lengths produced are far lower and thus make it harmless.
- Highly efficient than electromagnetic induction - Electromagnetic induction system can be used for wireless energy transfer only if the primary and secondary are in very close proximity. Resonant induction system is one million times as efficient as electromagnetic induction system.
- Less costly - The components of transmitter and receivers are cheaper. So, this the bus operates.

8.2 Disadvantages

- Wireless power transmission can be possible only in few meters.
- Efficiency is only about 40% for long distances and near 85% for short distances.
- As wireless power is in development stage, lot of work is done for improving the efficiency and distance between transmitter and receiver.

IX. APPLICATIONS

- Wireless power has a bright future in providing wireless electricity. There are no limitations in power applications. Some of the potential applications are powering of cell phones, laptops and other devices that normally run with the help of batteries or plugging in wires.
- Wireless power applications are expected to work on the gadgets that are in close proximity to a source of wireless 'power, where in the gadgets charges automatically without necessarily, having to get plugged in.
- By the use of Wireless power there is no need of batteries or remembering to recharge batteries periodically. If a source is placed in each room to provide power supply to the whole house.
- Wireless power has many medical applications. It is used for providing electric power in many commercially available medical implantable devices.
- Another application of this technology includes transmission of information. It would not interfere with radio waves and it is cheap and efficient.

X. CONCLUSION

In this project, Introduction of a controller that can be used in Wireless EV charging systems to charge electric vehicles without wires is done. The proposed controller is capable of self-tuning the switching operations of the converter to the resonance frequency of the WPT system, and therefore eliminates the need for switching frequency tuning. Also, it enables soft-switching operations in the converter, which will result in a significant increase in the efficiency of the power electronic converter. Contactless electric vehicle (EV) charging based on inductive power transfer (IPT) systems is a new technology that brings more convenience and safety to the use of EVs. Since it eliminates the electrical contacts, it would not get affected by rain, snow, dust and dirt, it is a safe, reliable, robust and clean way of charging electric vehicles, reduces the risk of electric shock.

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