IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 2, May 2023

Wireless Charging of Electric Vehicle While Driving

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Abstract: *Nowadays, the depletion of fossil fuels and the phenomena of global warming are key factors that push us to change our modes of transportation. Vehicle-based internal combustion engines are no longer desired, they contribute significantly to climate changes, and they are dependent to the petroleum product. The electric vehicle (EV) is an alternative choice, it can be considered as a suitable method for a sustainable transportation, it has the advantage of zero emissions and it is powered by electricity which can be considered as a renewable energy. However, the basic configuration of an EV contains a rechargeable battery pack which can be considered as its main drawback. The battery needs to be recharged frequently because of its low capacity; thus, the charging operation takes several hours, which reduce the driving range of the EV and limit its success in the market. Several methods are used to recharge EV batteries. In the conductive charging, the power is transferred efficiently to the vehicle by cables, but the user must intervene in this operation which is dangerous in certain specific conditions such as snow and rain that can cause electric shocks. Powering an electric vehicle using the wireless method is much easier and safer for the user, thus, the absence of physical contact (no mechanical friction) can prolong the product life and reduce its maintenance. The wireless power transfer (WPT) can be in a stationary or dynamic way. In stationary mode, the vehicle is wirelessly charged while parked in a location (parking or garage) equipped with a specialized power utility. The dynamic charging which means that the vehicle can be recharged while moving is invented as an attempt to reduce the size of the battery (i.e. reduce long charging times and vehicle weight) and extend the vehicle driving range.*

Keywords: Wireless Charging

I. INTRODUCTION

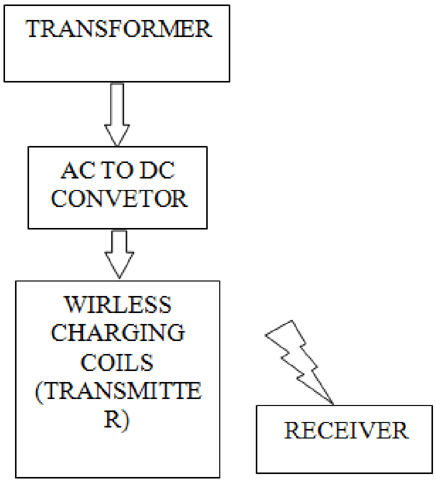
Nowadays, the depletion of fossil fuels and the phenomena of global warming are key factors that push us to change our modes of transportation. Vehicle-based internal combustion engines are no longer desired, they contribute significantly to climate changes, and they are dependent to the petroleum product. The electric vehicle (EV) is an alternative choice, it can be considered as a suitable method for a sustainable transportation, it has the advantage of zero emissions and it is powered by electricity which can be considered as a renewable energy. However, the basic configuration of an EV contains a rechargeable battery pack which can be considered as its main drawback. The battery needs to be recharged frequently because of its low capacity; thus, the charging operation takes several hours, which reduce the driving range of the EV and limit its success in the market. Several methods are used to recharge EV batteries. In the conductive charging, the power is transferred efficiently to the vehicle by cables, but the user must intervene in this operation which is dangerous in certain specific conditions such as snow and rain that can cause electric shocks. Powering an electric vehicle using the wireless method is much easier and safer for the user, thus, the absence of physical contact (no mechanical friction) can prolong the product life and reduce its maintenance. The wireless power transfer (WPT) can be in a stationary or dynamic way. In stationary mode, the vehicle is wirelessly charged while parked in a location (parking or garage) equipped with a specialized power utility. The dynamic charging which means that the vehicle can be recharged while moving is invented as an attempt to reduce the size of the battery (i.e. reduce long charging times and vehicle weight) and extend the vehicle driving range

II. LITERATURE SURVEY

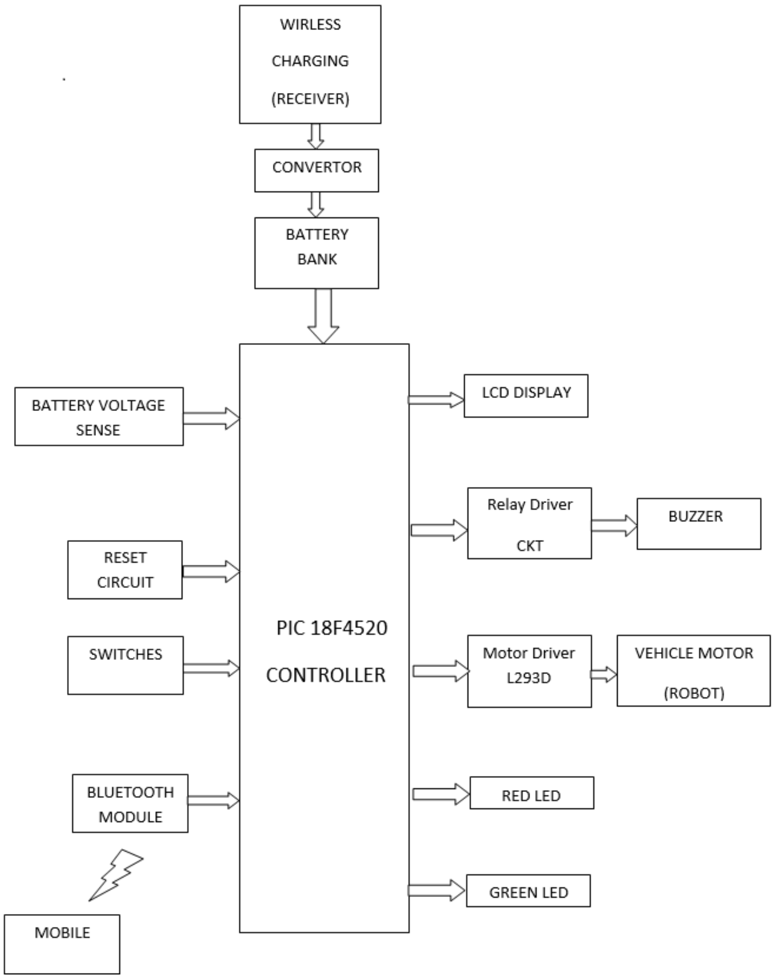
Authors	Paper title	Year	Method Used
K.Chandra mouli, N.Pannirselvam, V. Anitha, D.V.V.Nagasai pardhu.	A Study on EHighway - Future of Road Transportation	2018	the transportation area "enslavement on fossil fuels by presenting a new system as Electrical Road Systems-ERS."
Alexander M.E. Plougmann, Kristan L. Kvist	Design of a Siemens eHighway System Implemented across Funen	2017	Siemens eHighway across Funen using overhead power lines to which HDV's with pantographs will be able to connec
Maria Talgegard	The impact of an Electrification of Road Transportation on the Electricity system	2017	The energy and power demand on hourly power balance level in the electricity system

2.1 Block Diagram

Transmitter section



Block diagram: vehicle unit



Test Method

Check that component agree with the part list (value and power of resistors, value and voltage eating of capacitor, etc.) if in any doubt double check the polarized components (diodes, capacitor, rectifiers etc.)

If there is a significant time elapse between circuits, take trouble to read the article; the information is often given in a very condensed from. try to get most important point out of the description of the operation of the circuit, Even if you don't understand exactly what is supposed to happen.

- If there is any doubt that some component may not may be equivalent, check that they are compatible

-Only use good quality IC socket.

-check the continuity of the tracks on the PCB (and through plated holes with the double sided boards) with a resistance meter or continuity tester.

-Make sure that all drilling, filling and other 'heavy' work is done mounting any component.

-If possible keep any heat sinks well isolated from other components.

-Make wiring diagram if the layout involves lots of wires spread out any all direction.

-Check that the connectors used compatible and that they are mounted the right way round.

-Do not reuse wire unless it is of good quality. Cut off the ends and strip it a new.

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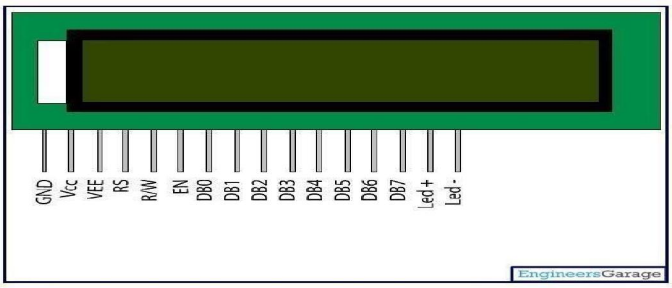
PIC18F4520 Microcontroller

PIC18F4520 is a low-cost, low-power, high- speed 8-bit, fully-static Microcontroller unit that has 40 pins out of which 36 pins can be used as I/O pins. It has Power- on-Reset (POR) as well as the Extended Watchdog Timer (WDT) circuitry, which can be programmed for 4ms to 131s It is an 8-bit enhanced flash PIC microcontroller that comes with nona Watt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end- user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip

PIEZOELECTRIC BUZZER

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval. This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

16*2 LCD DISPLAY



LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special& even custom characters (unlike in seven segments). Animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data

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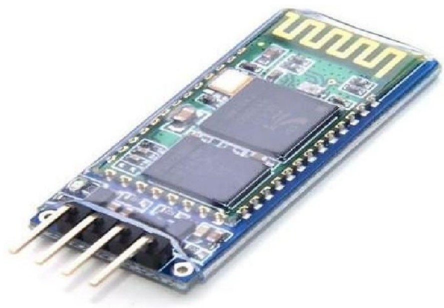
Motor Driver L293D

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. They are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as their high- current/high-voltage loads in positive-supply applications.

Bluetooth Module HC-05



The IOT enabled projects require two way communication between the microcontroller and various sensors. There are various methods you can do that, Wired Communication, Wi-Fi, Bluetooth are some among them. The **HC-05 Bluetooth Module** adds wireless communication to your project to communicate via Bluetooth to any Bluetooth enabled Laptop or Mobile Device. The module communicates at 9600 baud rate via USART protocol. It can be used in applications like communication between two microcontrollers, data logging, wireless robots, wireless sensors data acquisition and home automation

Battery -

12V 2Ah Rechargeable Lead Acid Battery is normally use for robots in competition. Wired or Wireless Robots runs for a long time with high speed with this type of battery. Seal Lead Acid (SLA) Rechargeable battery is the most common general purpose battery.

Low cost, robust and less maintenance required are the advantages of SLA. But it is considered heavy weight for certain robotic application. To charge SLA batteries, you can use any general DC power supply as long as it provides the correct voltage to your battery.

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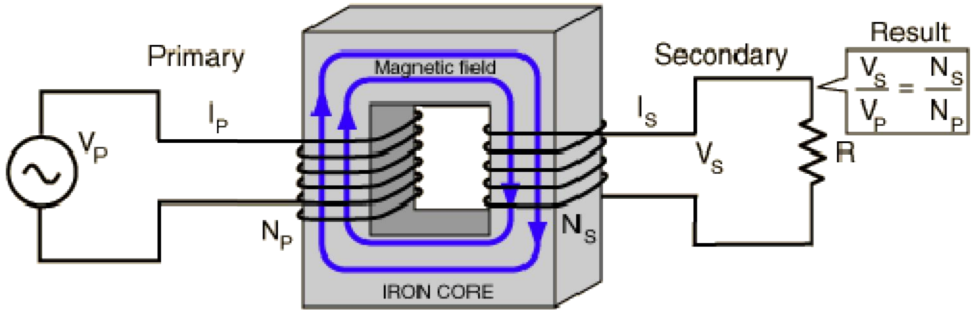
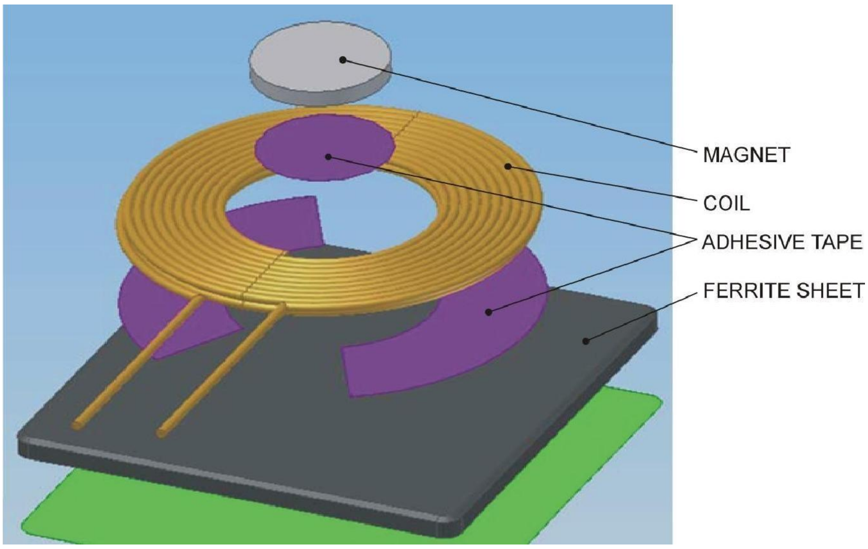
Transformer

A transformer makes use of Faraday's law and the ferromagnetic properties of an iron core to efficiently raise or lower AC voltages. It of course cannot increase power so that if the voltage is raised, the current is proportionally lowered and vice versa.



Coil



The coil winding can be one or two layers of the Litz wire. The adhesive tape between coil and ferrite sheet maintains the required distance and the mechanical fixation. The center positioned magnet can be used to provide better alignment between the transmitter and the receiver coils. The ferrite sheet providesthe one side magnetic shield and forms the magnetic field. The ferrite properties (material and thickness)have influence to the maximal power transfer for the certain temperature rise.

For the power level 5 W and higher, usually various types of the ferrite material are used. For the power level lower than 5 W, the thin ferrite tape or other soft magnetic materials could be used. The thickness ofthe magnetic shield is from 0.5 mm to 5 mm depending on the type of coil

III. WORKING & OPERATION

The main component of this system is the various ways of stepping down the incoming voltage. A conventional 220Vrms/50 Hz means is stepped down using the transformer to our required voltage and then converted to DC voltage. By using an inverter, the DC is converted to AC of our desired high frequency. The power is then transmitted through the transmitter coil to the receiver coil through inductive coupling. The receiver coil is placed at a particular distance and AC power is delivered at the end. This power is then rectified and regulated using a bridge rectifier and Zener diode circuit. Afterwards, the energy is harnessed to charge the battery. The transmitter and the receiver coils were designed to achieve maximum quality factor to maximize power transfer at the frequency of operation.

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AC main from the grid is converted into high frequency AC through AC/DC and DC/AC converters to enable power transfer from transmission coil to the receiving coil. Series and parallel combinations-based compensation topology are used in both receiving and transmitting sides to improve the overall system efficiency . Receiving coils are fixed under the vehicle to convert the oscillating magnetic field to high frequency AC. The high frequency AC is converted into a stable DC supply which can be used by the on- board batteries. To avoid any kind of health and safety issues and stable operation the power control, communications, and battery management system (BMS) are used. To reduce any harmful leakage fluxes and to improve magnetic flux distribution, magnetic planar ferrite plates are used at both transmitter and receiver sides.

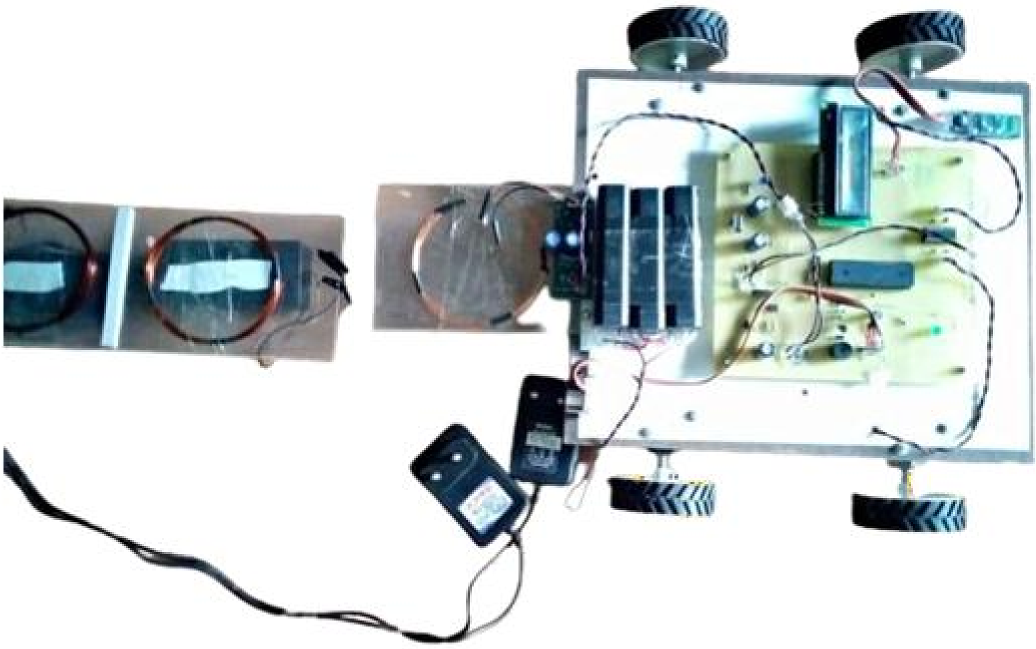
CHARGING METHOD

Low-frequency ac power from the grid is converted into a high frequency (hf) ac through ac-dc converter and dc-ac inverter. To ensure maximum power transfer to the receiving end, s-s compensation topology is used in the transmitter coil and the receiver coil. The transmitting pad is typically mounted beneath the surface of the road and the receiving pad is mounted underneath the vehicle [25]. The receiver pad is usually mounted lower from the frame of the EV to help to catch more magnetic flux. The high-frequency AC is then converted into DC by using an AC/DC converter and sent to the battery bank. The battery management system (BMS) communications and power controller are used to ensure stable operation and avoid any safety issues.

IV. SOFTWARE SPECIFICATIONS

MPLABIDE8.91

RESULT



V. SCOPE OF PROJECT

It is looking increasing likely that electric vehicles will play a major role in the future of road transportation. While Commercial electric vehicle exists, their uptake has been limited due to high purchase costs, limited battery range, and a lack of charging convenience. Furthermore, while developments are underway, electric and hybrid drive trains are yet to be efficiently integrated with a heavy goods vehicle. A novel way to overcome such challenges are Electric Road Systems; a branch of technologies that allow vehicles to charge while in motion. Limited information exists regarding the comparative performance of ERS solutions, market readiness, costs, and implementation issues. To this end, the World Road Association commissioned TRL to undertake a state-of-the art review and feasibility study of ERS concepts; focusing on ERS implementation from the perspective of a road administration.

VI. ACKNOWLEDGMENT

"Perfect and precious guidance, hard work, dedication and full encouragement are needed to complete a project successfully in the life of every student illumination of project work is like engraving a diamond

We take this opportunity on the successful completion of our project so thank all the staff for their valuable guidance, for devoting their precious time, sharing their knowledge and their co-operation throughout all course of development our project and the academic year of education.

We a deep guidance to our project **Prof. PAGIRE.R.R (Project Guide)** whose valuable guidance, which has been a key factor in the successful completion of our project. Also we a deep guidance to our project **Prof. Borhade G.L (project Co-ordinator)** has been a key factor in the successful completion of our project A remarkable and unspeakable person in our life **Prof Kulkarni B. L HOD E&TC** Department) whom we havea gratitude and respected for developing entrepreneurship qualities and sharing his knowledge and lifetime experience to make our future glorious Also our special thanks to **Prof. V. B. DHUMAL (Principal)** & management staff whose assistance is also an important part in completion of our project Lastly we take opportunity to thank one and all who directly or indirectly have helped using the successful completion of our project.

VII. CONCLUSION

The use of WPT systems for EVs was the focus of this article. The key components of the WPT were studied with respect to the compensation topology and the coil construction. The key result of this study is concerned with the static and dynamic modeling of the proposed WPT method. A new model is developed and defined that incorporates both static and dynamic problems. On laboratory work, this model was experimentally validated. The results obtained were satisfactory and confirmed the effectiveness of the reported observations. This was done all over a single receiver coil. The mutual inductance enhanced value determines the efficiency. Furthermore, having two coil receivers under the EV is an upgrade to the methodology and it was discussed in detail. The mutual inductance is an important parameter in the WPT scheme. As a result, the considered one or two coils cases were extended to derive the used mutual inductance values. An assessment technique was addressed, and the two cases were compared and concluded.

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