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Modeling of Wireless Energy Transfer Circuit and Implementation of Wi-tricity System

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Abstract:

The main objective of this paper is to develope a device for wireless power transfer.The concept ofwireless power transfer was realized by Nikolas Tesla. Wireless power transfercan make a remarkable change in the field of the electrical engineering which eliminates the useconventional copper cables and current carrying wires. Based on this concept, the project is developed to transfer power within a small range. This system can be used for charging batteriesthose are physically not possible to be connected electrically such as pace makers (An electronicdevice that works in place of a defective heart valve) implanted in the body that runs on abattery.The patient is required to be operated every year to replace the battery. This is designedcharge a rechargeable battery wirelessly for the purpose. Since charging of the battery is notpossible to be demonstrated, we are providing a DC fan that runs through wireless power.Moreover this technique can be used in number of applications, like to charge a mobilephone, iPod, laptop battery, propeller clock wirelessly. And also, this kind of charging providesfar lower risk of electrical shock as it would be galvanically isolated. This concept is an EmergingTechnology, and in future the distance of power transfer can be enhanced as the research acrossthe world is still going on.

Keyword —*Wireless energy transfer, Magnetic field, Voltage, Distance, ESP Controller*

I. INTRODUCTION

Electrical power is significant to modern system. From the minimal components like sensors, controllers till satellites, it is important to deliver power by other means than transmission lines and cables. In this era of modernization, electricity has become the unavoidable part of life. The major source of conventional form of electricity is through wires. One of the major issue in power system is losses occurring during the transmission and distribution of electric power. Hence to overcome this problem Tesla has proposed methods of transmission of electricity using electromagnetic induction. The basic concept behind this electromagnetic wireless power transfer is the magnetic induction between the transmitting and receiving coil. Primary coil is the transmitter and the receiver is the secondary coil, magnetic field is generated by the current in the primary coil this field induces current at the receiver. This received current is used to generate the power.Wireless power transfer is the one which transmit electrical energy from source to the load withoutusing any physical medium like wires. In wireless power transfer technique if power has to betransmitted over a short distance then it should be by magnetic field using inductive couplingbetween coils of wire. This inductive coupling is able to charge the phone, electric vehicles, forthe high input voltage it is capable of glowing the tube lights. Thus, the tesla coil is used whichis an air coiled transformer which gives high frequency current and voltage output.

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This methodof transferring power wirelessly will bring a huge in the electrical system by avoiding the loss ofpower due to short circuit and will lead to revolution in industries.

II. LITERATURE SURVEY

Over the last decades, research has been conducted for new devices to design a good and reliable for Wireless Power Transfer System.

1	Girish Kumar, Abhishek Kumar, "Wireless Power Transfer for Mobile Charging Applications" IJRASET Volume 6 Issue VI, June 2018	• DC supplied by a power source, is converted into high frequency AC by specially designed electronics built into the transmitter. • The limitations and challenges associated with the WPT techniques are explored.
2	S. Lukic and Z. Pantic, "Cutting the cord: Static and dynamic inductivewireless charging of electric vehicles," IEEE Electrific. Mag., vol. 1,no.1, pp. 57–64, Sep. 2013.	• In this article, present's an emerging technology— IPT. • Which holds the key to more convenient charging. • For designing IPT systems for static and dynamic vehicle charging.
3	D.E. Upasani1 , S. Ruta, " Wireless Power Transmission for Portable Electronics " IJAREEL Vol. 6, Issue 5, May 2017	• As a whole, experimental result proved that the distance between two coils is inversely directional to the level of current and voltage in the receiving coil.
4	J. ukkar and P. H. Hirschboeck, "Wireless Power Adapter for Rechargeable Devices", Senior Design Project Report, 2006	• A wireless power receiver is developed which is capable of charging from either a Qi or a PMA • It is fully self-powered, allowing charging from the dead battery condition with no modifications to the mobile phone design. • The circuits such as clock recovery circuit and buck regulator circuit makes these systems bulky and complex.

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III. METHODOLOGY

BLOCK DIAGRAM

The system diagram of the project has been given in figure A, for the Transmitter, Receiver and ESP8266 WIFI module.

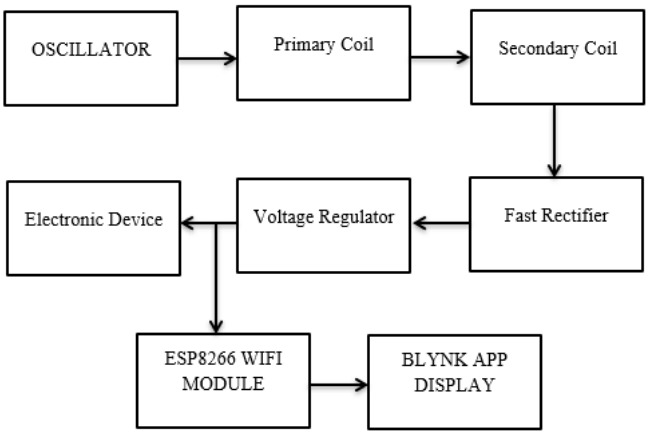

Fig. 1 Block Diagram of Wireless Power Transfer system

The Fig indicates the system, in the transmitter side the 230 V, 50 Hzacsignal is converted into 12 V at the frequency of 25 KHz. An AC-to-AC converter is usedthat uses a Bridge rectifier for lowering down the 230 Volts signal, An Inverter circuitconvertsthe Bridge output is given to a pair of transistors, which is a self-oscillatingcircuitwhere the twotransistors are driving in differing phase by feedback from theoutput circuit.Finally, the filter capacitor smoothens out the inverter output signal.A transmitting coil has anAC flowing through it generating magnetic field perpendicular to the flow of current. Thus, when another coil is placed in its vicinity, it will induce current in another coil. After the currentflow is established in the receiving coil, the proper current conversion circuits such as rectifierand voltage regulators are used to obtain a smooth output. This current will be the DC currentwhich will be used to power the ESP8266 WIFI Module to display data on Blynk app.

Hardware Description

- Oscillator
  An oscillator is a circuit which produces a continuous, repeated, alternating waveform without any input. Oscillators basically convert unidirectional current flow from a DC source into an alternating waveform which is of the desired frequency, as decided by its circuit components. The basic principle behind the working of oscillators can be understood by analysing the behaviour of an LC tank circuit shown in Figure 1 below, which employs an inductor L and a completely pre-charged capacitor C as its components. Here, at first, the capacitor starts to discharge via the inductor, which results in the conversion of its electrical energy into the electromagnetic field, which can be stored in the inductor. Once the capacitor discharges completely, there will be no current flow in the circuit.
- Coil

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Wireless power transfer system is used to transfer the power one device to another device through the air medium or intervening space by inductive coupling or capacitive coupling, we know that in inductive coil magnetic field will produce and in capacitive coil electric field will produce. In wireless power transfer system, there are two main system consist which is called transmitting or primary coil and another one is receiving or secondary coil. So, in wireless power transfer system instead of wire air medium or electric field/magnetic field takes place. Due to the supply voltage the coil which made by copper becomes magnetizing and it produce electromagnetic field, depend upon that magnetic field strength, the amount of power can transfer from primary side to secondary side. In wireless power transfer dc can't transfer in the coils because there is absence of oscillation in dc, so ac is commonly used for power transfer system or some converters can be used for this situation.

- Faster Rectifier

  A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The reverse operation is performed by the inverter.The process is known as *rectification*, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, wet chemical cells, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Historically, even synchronous electromechanical switches and motors have been used. Early radio receivers, called crystal radios, used a "cat's whisker" of fine wire pressing on a crystal of galena (lead sulfide) to serve as a point-contact rectifier or "crystal detector".

- Voltage Regulator

  A voltage regulator is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

  - ESP8266

  ESP8266 is an UART-Wi-Fi transparent transmission module with ultralow power consumption, specially designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions fromanotherapplicationprocessor.ESP-8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266 Serial Wi-Fi Wireless Transceiver Module is suitable for Uno, Mega 2560 and Nano.

Software Description

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BlynkApplication: -

It was designed for IoT. This app has capacity to remotely control hardware and also shows sensor information.

This app also helps to visualize and store data.

- This platform contains 3 main elements:

1) Blynk app- With the help of various widgets amazing interfaces for the projects can be created.

2) Blynk Server- Establishes a communication network between smartphone and hardware.

3) Blynk Libraries- All incoming and outgoing commands are processed and also enables communication between

server and process.

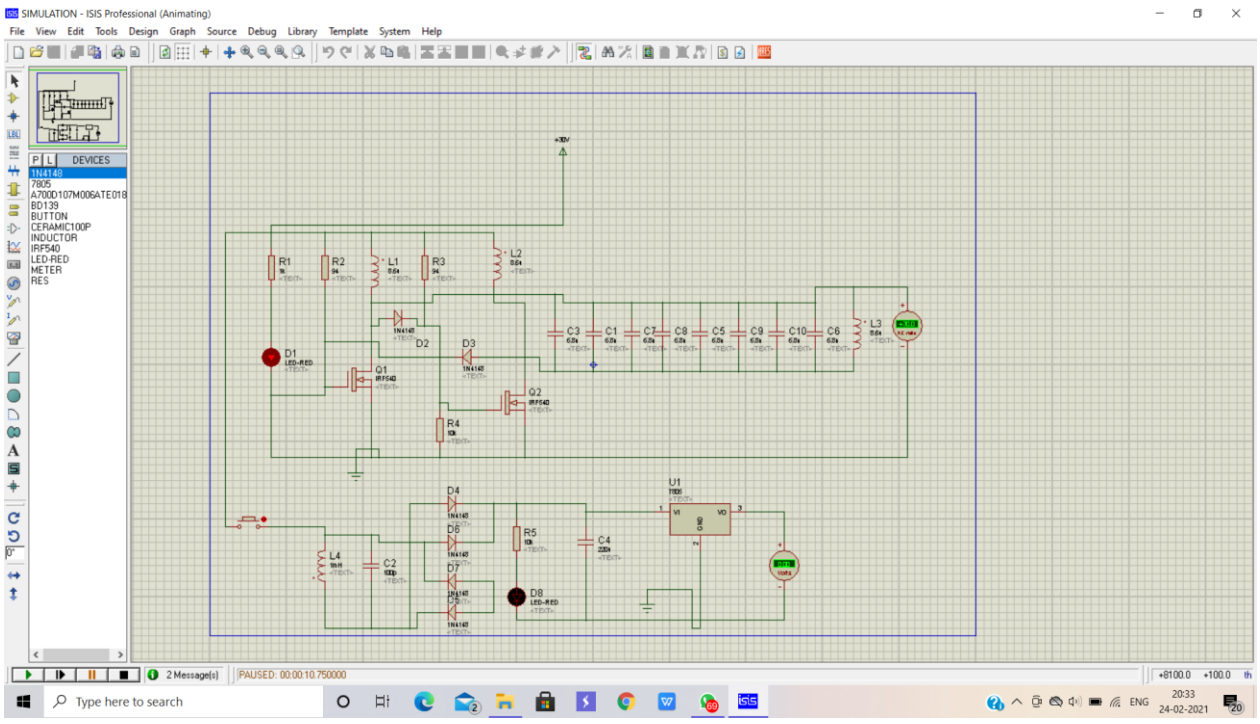
Features: -

1. as similar API and UI for supported hardware and devices.
2. With the use of Wi-Fi, Bluetooth, GSM, USB connects to the server.
3. Direct manipulation of pins with no code writing.
4. With the use of virtual pins of this app it is easy to add functionalities and integrate.
5. By the use of bridge widget, it is possible to have device to device communication.

IV. SIMULATION

OFF CONDITION

In this condition supply is not given to the transmitter coil because of which the current is not supplied from transmit side to the receiver side.



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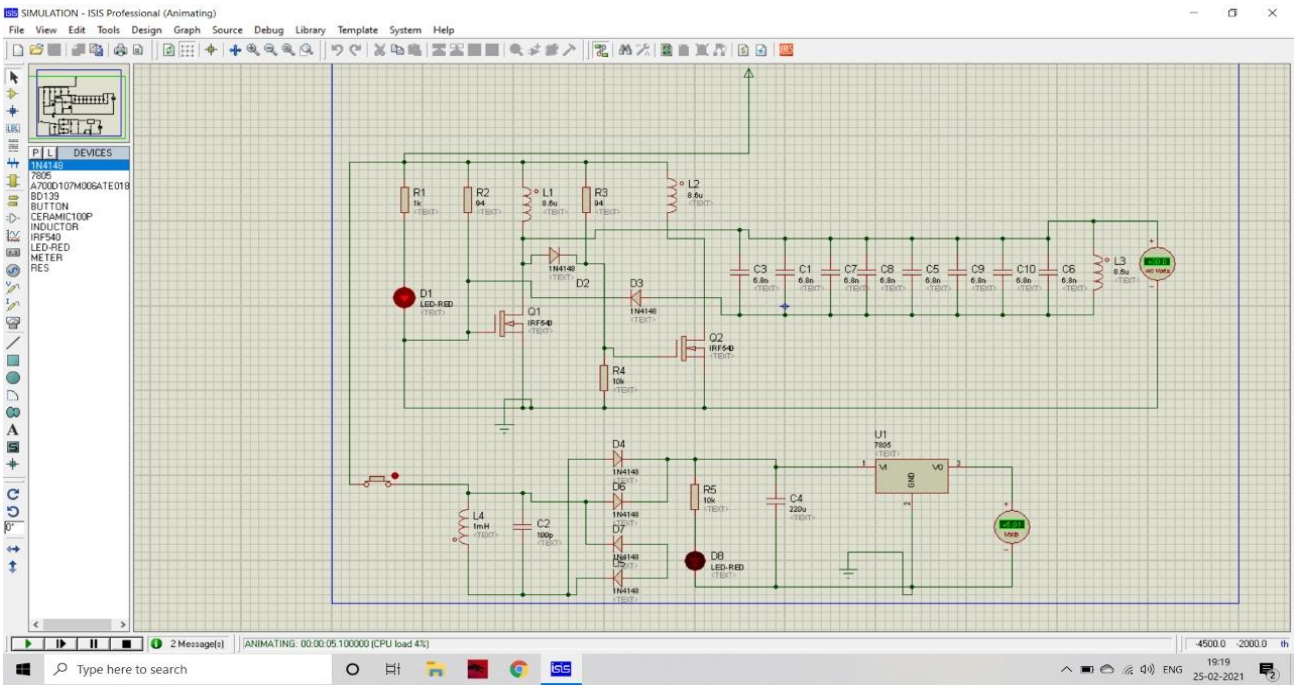

V. CONCLUSION

The concept of wireless power transmission offers greater possibilities for transmitting power with minimum losses. Furthermore, this could reduce our society's dependence on batteries, which are currently heavy and expensive. As wireless technology is getting popular now a days, the demand of battery is also decreasing. For the long range power transmission power can be sent from source to receivers instantaneously without wires, results in reducing the cost. Batteries need to be recharge or changed eventually, hence there is the need for this kind of work.

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