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Wireless Power Transmission for Portable Electronics

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ABSTRACT: Wireless power Transfer (WPT) is nowadays visible to us in many different areas of technology and in many different forms and types. The technological areas vary from the crucial biomedical technology to commercial products such as wireless electric vehicle, wireless charging units and many more. Wireless transmission is useful in cases where instantaneous or continuous energy transfer is needed but interconnecting wires are inconvenient, hazardous, or impossible. The wireless energy transfer gets unique in its area of technology because of its efficiency which is the most important parameter under consideration. This makes the wireless energy transfer different from other information transfer methods. Wireless power systems for near field energy transfer, are typically classified as either inductive or resonant. The wireless power transfer surpassing efficiency is the optimum technique to transfer the power wirelessly and power up the low power devices such as Mobile phones, small fans, and any microcontroller unit.

KEYWORDS: Wireless Power Transfer, Near Field Communication, Low power Devices.

I.INTRODUCTION

Wireless Power Transfer (WPT) is a method to transfer the electricity without using wires or conductors. It is mainly useful where transfer of electricity is not possible using conductors. This technology mainly works on the principle of electromagnetic induction. Electromagnetic induction works on the principle of a primary coil generating a magnetic field which produces an attractive field and an optional loop being inside that field so a current is induced inside its coils. This results the comparatively short range due to the amount of power required to generate an electromagnetic field. Tesla Quoted that "Power can be, and at no distant date will be, transmitted without wires, for all commercial uses, such as the lighting of homes and the driving of aeroplanes. I have discovered the essential principles, and it only remains to develop them commercially. When this is done, you will be able to go anywhere in the world — to the mountain top overlooking your farm, to the arctic, or to the desert — and set up a little equipment that will give you heat to cook with, and light to read by. This equipment will be carried in a satchel not as big as the ordinary suit case. In years to come wireless lights will be as common on the farms as ordinary electric lights are nowadays in our cities" [1]. Wireless power systems for near field energy transfer, are typically classified as either inductive or resonant. In an inductive wireless charging system, the primary coil and secondary coil of the system are not directly connected.

In a wireless charging system, the effectiveness and the measure of energy transferred to the output are influenced by the source (i.e. transmitter) and load (i.e. receiver) impedances. The main downside of presently existing wireless power transfer systems for consumer applications are, amongst others, the comparatively low overall efficiency and the limited power transfer ability. This outcomes in long charging circumstances which hampers the boundless utilization of the wireless power exchange innovation. To overcome these problems, various improvements have been done in the proposed system.

There should be a charging solution to eliminate the need for the hazardous electrical wires, which needs a lot of efforts to organize them. This solution can provide us with the simplified way of charging the day to day usage electronic equipment. This solution can also provide us to travel with only one charging unit that charges our mobile phones, laptops, toothbrush, hair trimmer and many others simultaneously.

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II.LITERATURE SURVEY

In the field of biomedical electronics, the implants with low-efficiency in WPT applications may cause discomfort and possible complications for the patients using it. This paper exhibits a shut frame logical answer for the ideal load that accomplishes the greatest conceivable power productivity. The reported power efficiency in such systems is between 30 to 50% [2].

Resonant wireless power transfer (RWPT), compared with conventional inductive power transfer, the frequency of RWPT is usually much higher. To cut down the frequency of resonance while sustaining the transfer efficiency constant at the same transfer distances, two solutions are proposed and realized in this paper. There are two methods of reducing the resonant frequency: increasing the inductance and increasing the capacitance. The condition of reducing the resonant frequency is to maintain similar transfer efficiency at the same distance. This paper states that, increasing the turn number of the resonant coils can effectively cut down the frequency of resonance and maintain similar transfer efficiency. A large turn number of the resonant coils also results in bulkiness and the advantage over the case of using the field-shaping technique is missing [3].

A senior design project group at Illinois has completed a project entitled “Wireless Power Adapter for Rechargeable Devices” [4], which was almost a year ahead of the MIT group. In the project, the group successfully demonstrated that a cell phone can be wirelessly charged. A wireless power receiver is developed which is capable of charging from either a Qi or a PMA or a proprietary resonant charger operating at 6.78 MHz power is converted though a single power path with no switches in the ac network. The overall size of the receiver is compatible with mobile phone requirements and comparable to commercial Qi solutions on the market today. 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.

The paper [5] portrays how roadway difficulties are being met and frameworks the issues that still exist and the arrangements designers are finding them. Inductive Power Transfer (IPT) includes the coupling of at least two loops: when coupled a current in one curl reasons an incited voltage in the other to power some application. Such power transfer is clean, unaffected by chemicals or dirt, and has the capacity to transform many engineering procedures. The biggest encounter for IPT systems today is carriage for both public and private vehicles on networks of railways and roadways in every country in the world. IPT offers the opportunity to power these vehicles electrically using electric wires under the ground to provide power, charge, and alignment means for cars, buses, and trains. This paper reviews the important fundamentals required to develop high-power IPT systems.

In [6] In this article, we present an emerging technology—inductive power transfer (IPT)—that holds the key to more convenient charging by means of contactless or wireless powertransfer through induction. We review the fundamentals of the IPT technology and its history and also present some considerations for designing IPT systems for static and dynamic vehicle charging.

In [7] the transmitter and receiver loops are arranged in conventional way. An AC current in the transmitter loop creates magnetic field, which prompts a voltage in the receiver loop used to control the load. Inductive power transmission in a bigger separation is extremely wasteful. Just low power levels, which are not helpful for customer applications like charging or enlightenment, can be transmitted without squandering critical measure of energy. Possible applications could be industrial, e.g. for sensors, which requires only low power.

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III.PROPOSED SYSTEM

The system diagram of the project has been given in figure 1, for the Transmitter, Receiver. The Figure 2 explains the PIC Microcontroller interfacing block diagram.

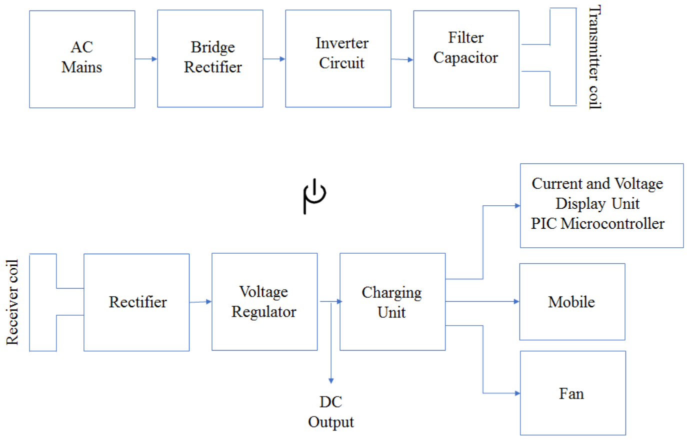

Figure 1: System Block Diagram

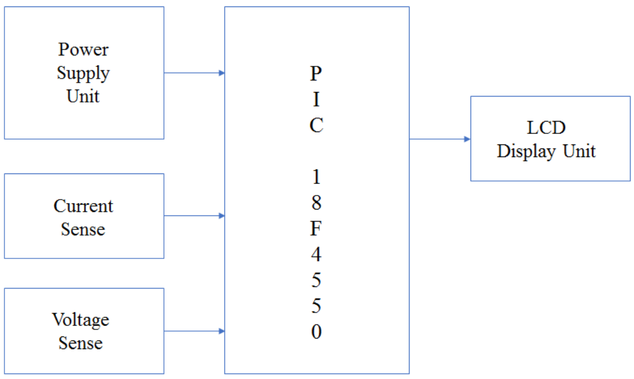

Figure 2: PIC Interfacing Block Diagram

The Figure 1 indicates the proposed system, in the transmitter side the 230 V, 50 Hz ac signal is converted into 12 V at the frequency of 25 KHz. An AC to AC converter is used that uses a Bridge rectifier for lowering down the 230 Volts signal, An Inverter circuit converts the Bridge output is given to a pair of transistors, which is a self-oscillating circuit where the two transistors are driving in differing phase by feedback from the output circuit. Finally, the filter capacitor smoothens out the inverter output signal. A transmitting coil has an AC 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 current flow is established in the receiving coil, the proper current conversion circuits such as rectifier and voltage regulators are used to obtain a smooth output. This current will be the DC current which will be used to power the mobile phone, Microcontroller unit and low power fan.

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IV.RESULT AND DISCUSSION

The following table shows the electrical description of the system after the final implementation.

Table 1: Electrical Parameter Obtained Result

Parameter	**Value**
Input Voltage (Transmitter Coil)	230 V
Input Frequency (Transmitter Coil)	50 Hz
Output Voltage (Transmitting Coil)	12 V
Output Frequency (Transmitting Coil)	25 KHz
Input Voltage (Receiver Coil)	39 V
Voltages Taken for Output Application	12 V, 5 V

The Following shown figure 3, figure 4 and figure 5, shows the implementation of the proposed concept. Figure 3 shows the wireless power transfer for fan, a 12 V DC fan is used here. The figure shows the ON State of the DC Fan.

Figure 3: Wireless Power Transfer for Fan

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Figure 4: Wireless Power Transfer for Mobile

The Figure 4 shows the implementation of wireless power transfer for mobile phones. The Current and the Voltage is displayed on the LCD Module in ON State are shown in figure 5(a) and 5(b).

Figure 5 (a): The Maximum Voltage and Current Display at the micro- controller side

Figure 5 (b): The Minimum Voltage and Current Display at the micro- controller side

The Figure 5(a) displays the maximum current and voltages when the transmitter and receiver coils are placed closest to each other. The Figure 5(b) displays the minimum current and voltages when the transmitter and receiver coils are placed away from each other i.e. when the maximum distance between the coils is achieved. The Figure 6 below shows the implementation for the wireless power transfer for microcontroller unit.

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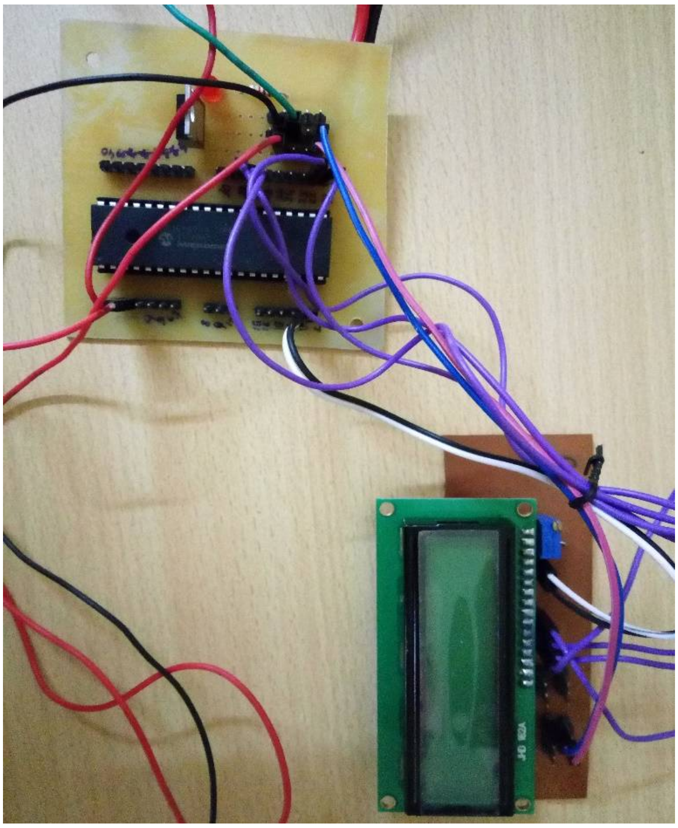

Figure 6: Wireless Power Transfer for micro-controller Unit

VI.CONCLUSION

Wireless power transfer is a method of transferring the power wirelessly. This idea eliminates the need of wires and chargers for each electronic device. The proposed wireless power transfer system, consisting of the microcontroller unit with the voltage and current sensing circuits interfaced, has been successfully implemented providing a general solution for low power devices. The Proposed system having the inductive power transfer method allows to implement a very simple design with low cost. Here, the successful implementation of the three modules, that are, DC Fan, Mobile Phone, Microcontroller unit has been done.

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