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STUDY AND IMPLEMENTATION OF WIRELESS POWER TRANSMISSION

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Abstract: The major problem being faced today is the energy dissipation in power transmission and distribution process. According to the statistics losses occur due to network and the mode of operation, major part being distribution lines. With the increase in demand of power, the generation subsequently the losses are increased. In addition the cost per unit generation rises. Therefore the need for reducing these losses becomes the priority and prominent. Moreover in certain aspects where it is inconvenient to use interconnecting wires and places where it is hazardous for the operation of conventional wire system, thus there is an ultimate need for the alternative practice to fulfil the need. This also has its requirement in other fields like medical for charging up pace makers which is placed to aid for the defective heart valve. This also has its uses in domestic purposes. This is also needed in other fields, such as medicine to charge pacemakers that are implanted to help with a faulty heart valve. This has domestic applications as well.

The main objective of the project is to propose a device for wireless power transmission. This was first realized and worked upon by Nikolas Tesla. This would really bring many remarkable changes in the field of electrical engineering. Based on this our project is made to transfer power in small range and study its characteristics. The applications of the device are also on various things like Lighting, Charging, etc... The project provides the usage on Dc fans, lights, Phone charging reducing the risk of electrical shock. This concept is an emerging technology and far more achievements are yet to get done ahead.

Index terms: *Inductive coupling, Electromagnetic Induction, Power loss, Voltage, Wireless transmission.*

I. Introduction

Automation has created a lot of buzz in the technology world right now. The main reason being the proprietaries being provided like accuracy, energy conservation, reliability and less human intervene. The most technologies aiming for minimal losses in any of the system proposed and thus relies on efficient usage of the technologies and devices. Wireless power transmission refers to electrical energy from the source to load being transferred without any conventional wiring system. This system has it's diverge nature from that of wireless telecommunication, which latter has its energy being delivered at low for being differed from the background noise. But, with the wireless power transmission it has efficiency being its most vibrant parameter. The techniques followed are of two types. They are Electromagnetic radiation and Electromagnetic Induction. Induction type is of the most use. It gets further classified as Electrodynamic and Electrostatic induction which uses Inductive coupling and capacitive coupling for working respectively

In the project, the supply from the transformer is taken as a part of demonstrating it as supply end. The input supply is made to step down to 12v as all our devices used deal in low voltages. The output 12v is made to pass through the bridge rectifier to convert it to dc supply. The capacitive filters are connected to remove the ripples and provide constant output. The voltage regulator LM7805 is placed to provide the required output constant voltage to the PIC microcontroller for its operation irrespective of input variable voltage to regulator. The microcontroller acts as frequency generator providing the required electrical pulses to the Mosfet connected to copper coils. The pulses are provided at defined rate and the controller is operated accordingly with code dumped. The Mosfet tend to provide low power consumption and fine optimal electrical signal to get strengthen and thus provide it to the transmitting copper coils. The receiving copper coils tend to receive electrical power as means of wireless transfer and thus power gets transferred. The main principle behind this is Inductive coupling. The received power thus obtained is made to again go through rectification by use of bridge rectifier and thus connected to various devices as part of the applications.

II. Literature Survey:

1. Wireless Power Transfer System for Mobile Robots via Magnetic Resonant Coupling with Impedance Matching

(By: Toshiki Ohori, Xiang Li, Hideyuki Nakanishi, Shigeki Ozawa, and Wataru Hijikata)

In the project power transfer through magnetic resonant coupling is used to supply mobile robots within some distance of transmitting coil. The project is proposed to use a driver coil on the transmitting side in order to match the input impedance. The problem of power fluctuation, reflection due to impedance being varied is removed by regulating coupling coefficient between driver and transmitter. Thus the power reflection problem gets eliminated.

2. Wireless Power Transfer Techniques for Implantable Medical Devices
(By: Sadeque Reza Khan, Sumanth Kumar Pavuluri, Gerard Cummins)

This review associates with the use WPT in creating sustainable solutions for electrical powering in advanced micro-electric systems in biomedical implants. Miniaturized, multifunctional IMD's are of much prominence because they enable continuous monitoring, detection and treatment of dysfunctional organs. WPT type devices enable the potential capability of seamless and safe operation of IMD's. The Human safety being the most important aspect the wired scope of usage gets very harmful and thus the WPT has its vital usage to fulfil the medical requirements.

3. Wireless Power Transmission for Wireless Electric Vehicle Charger with Electromagnetic Coil-Based Position Correction Using Impedance and Resonant Frequency Detection
(By: Nameer Ahmed khan, Hirokazu Matsumoto, Oliver Trescases)

The WPT usage in this segment needs to deal with coil misalignment and large air gap. But this provides with compact WPT charger providing correction in lateral misalignment by using two integrated electromagnetic coils. This introduces closed loop three stage position correction controlling algorithm making it to detect impedance and resonant frequency. The project tends to achieve peak dc-dc efficiency of 90.1% and tend to laterally align within 1.75 seconds.

III. Theoretical Analysis:

ELECTROMAGNETIC INDUCTION:

The principle of electromagnetic induction wireless transmission is similar to that of working principle of the transformer in our life, that is, the excitation side coil forms an alternating magnetic field tend to link up with the receiving coil, and the induced electromotive force is generated on the other side coil by means of electromagnetic induction , thereby realizing energy transmission.

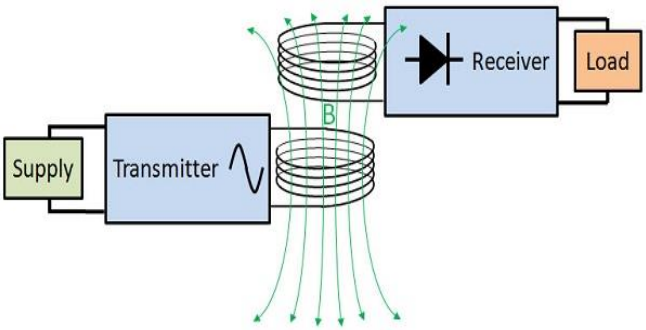

Fig 1: Electromagnetic Induction

Microcontroller:

Peripheral Interface Controller currently known as Programmable Intelligent Computer is a family of microcontrollers made by Microchip technology. They were first available in early 1976. It is based on Harvard architecture which supports RISC architecture. It consists of memory organizations, CPU, timers, counters, ADC, DAC, serial communication, CCP module and I/O ports. PIC microcontrollers are most successful in 8-bit. They are most popular in low-end architectures. They consist of simple processor executing 12-bit wide instructions. PIC is most popular for speed, Instruction set simplicity, Power-on-reset and brown-out-reset, watch dog timer, 4 optional clock sources, powerful output pin control.

IV. SYSTEM DESIGN AND METHODOLOGY

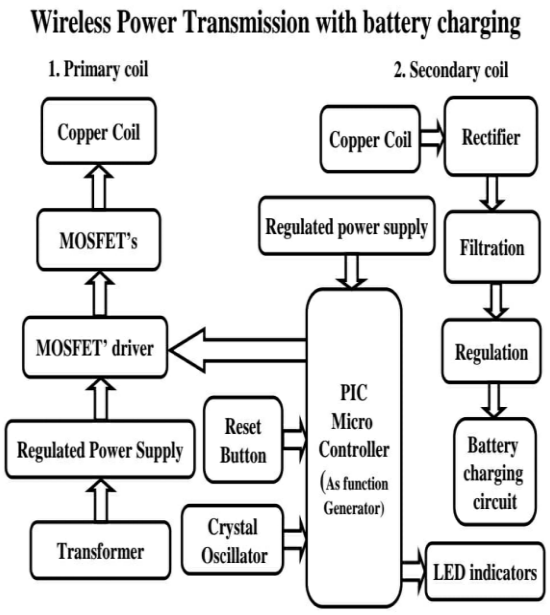

Fig 2: Block Diagram

1. Transformer:
Transformer is a static device used to transfer electrical energy from primary winding to secondary winding at constant power and frequency. In the project Transformer used is step down transformer. The supply voltage of 230v is stepped down to 12v to be able to operate on the devices used in the project. Transformer acts as supply end providing the required electrical power to be transferred.

2. Regulated Power Supply

2.1 Bridge Rectifier DB107:
Rectifier is a device used to convert Ac input voltage to dc output voltage. The diodes are the fundamental devices used for the process later many thyristors replaced them to achieve controlled rectification. In the project Bride rectifier is used to convert input 12v ac voltage to dc voltage for the operation. It is basically opted due to its less ripple factor and thus its output efficiency and economical aspects taken into consideration.

2.2 Capacitive filters:
The filters are used to reduce ripples from the rectifier's output voltage. The presence of ac components in the output voltage is unsuitable for operating the project's equipment and may result in output errors. The project employs capacitive filters to remove any undesirable ac components from the output dc voltage.

2.3 Voltage regulator LM7805:
The voltage regulator is used to keep the output dc voltage constant so that it can be fed to other devices. The regulator allows a constant dc voltage to be supplied regardless of the variable input voltage, allowing the PIC controller to operate with the required 5v input.

3. PIC microcontroller PIC16F72:
There are 28 pins on the PIC16F72. The DIP28 type is the most common. I/O pins make up the majority of the pins. Others serve specific purposes. The controller connects and controls the many devices in the project according to the code dumped. For operation, the output power from the regulator is connected to VDD pin 20 and VSS ground pin 19 is connected to ground. The controller here serves as a frequency generator, sending out the appropriate pulses to the Mosfet, which then transmits the input voltage wirelessly. The code is written in C to perform the project's required operations.

4. MOSFET:
MOSFET is an electronic device used for amplifying or switching electronic signals with change in amount of applied voltage. It has its various modes of operation like depletion and enhancement mode. The reason for the usage of MOSFET is its low drain resistance, good input impedance, and easier fabrication. The purpose it is fulfilling in our project is by providing required amplified signal to transmitting coil and thus ability to provide required signal with low power consumption.

5. LED:
When current passes through a light-emitting diode (LED), it produces light. Electrons recombine with electron holes in the semiconductor, producing energy in the form of photons. LEDs have a number of advantages over incandescent light sources, including lower power consumption, a longer lifetime, increased physical resilience, smaller size, and faster switching.
The led in our project is utilized to display the output produced at the receiving coil end, proving that energy was transmitted wirelessly and that applications could be made.

6. Dc Fan:
Any rotary electrical motor that converts direct current electrical energy into mechanical energy is referred to as a DC motor. The most common varieties rely on magnetic fields to produce forces. The speed of a DC motor can be varied across a large range by varying the supply voltage or adjusting the current intensity in the field windings. Tools, toys, and appliances all employ small DC motors. The universal motor is a lightweight brushed motor that can run on direct current and is used in portable power tools and appliances. In this project, we exhibited our application on a dc motor by allowing it to run on the power supplied by the receiving coil.

7. Battery charger:
A battery charger is a device that is used to charge the battery of any electronic device that is powered by a battery. The wireless power that was passed from the transmission coil to the receiving coil is also used to charge the battery charger. The application of a phone battery being charged by the electricity given by the receiving coil is demonstrated in this project.

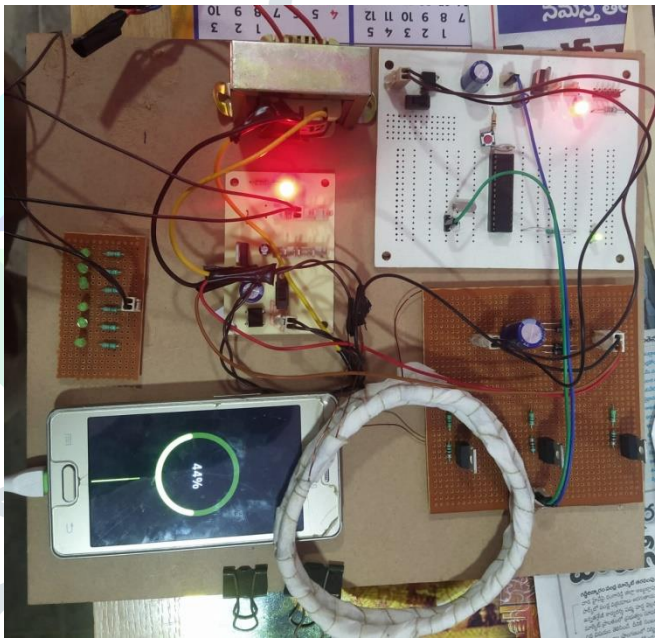

Fig 3: Wireless power transmission

V. RESULTS:
The Inductive coils are placed at various distances and the voltage transferred is measured. The distance is gradually increases from 0 to 6 cm and the corresponding voltage transferred is tabulated. Thus required distance load variation and its curve are obtained.

The same procedure is followed by connecting a DC fan and thus gradually increasing the distance the output voltage thus obtained is tabulated. Similarly the procedure is followed while charging the phone and lighting loads.

Thus from the following practices we obtained various results. The results are as follows:

S.NO	DISTANCE (cm)	VOLTAGE (v)
1	0	3.2
2	1	2.5
3	2	2.2
4	3	1.8
5	4	1.6
6	5	0.5

Fig 4: Distance vs Voltage

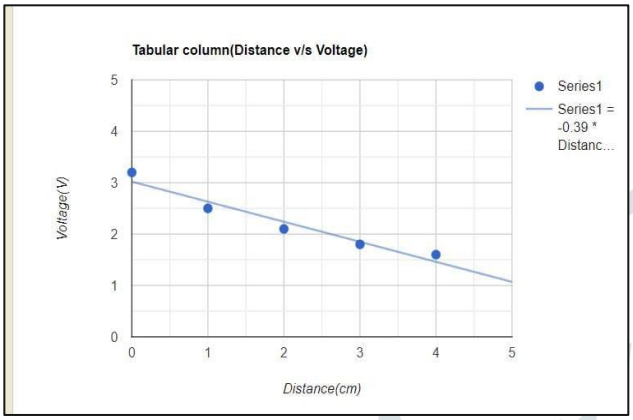

Fig 5: Distance vs Voltage graph

S.NO	DISTANCE (cm)	VOLTAGE (v)
1	2	4.6
2	3	4.1
3	4	2.95
4	5	2.8
5	6	2.5

Fig 6: Distance vs Voltage (when dc fan load is connected)

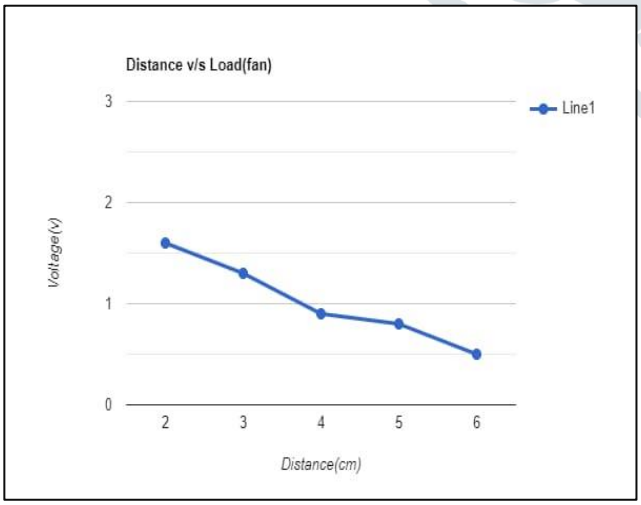

Fig 7: Distance vs Voltage graph (when dc fan load is connected)

VI. CONCLUSION AND IMPLICATIONS FOR THE FUTURE:

It has been designed to integrate functionality from all of the hardware components used. Every module's presence has been carefully considered and arranged, resulting in the best possible operation of the unit. Second, the idea was effectively implemented employing modern integrated circuits and growing technology. As a result, the project has been designed and tested successfully. The major goal of our project "Wireless Power Transmission" is to The transmission of electrical energy from a power source to an electrical load without a conductive physical link is known as wireless energy transfer or wireless power. When linking cables is difficult, hazardous, or impossible, wireless communication comes in handy.

This project resulted in a device that transmits energy wirelessly over a long distance using copper coils. At the transmitter circuit, the system uses a PIC16F72 microcontroller as a function or pulse generator. As a result, current flows wirelessly from the transmitter side coil to the reception side coil via a rectifier and regulator.
A transformer, RPS, Pulse Generator PIC16F72 microcontroller, a pair of copper coils, rectifier, filter, and a load are used in this project.

VII. References:

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