Design and Implementation of Universal Charger for Wireless Charging between Low Power Devices

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ABSTRACT

The traditional way of charging is through wire. Wired charging is done in various devices like mobile, laptop, coffee maker, trimmer, etc. The drawback of this system is we have to carry wired chargers and in absence of it, it becomes very difficult to charge our devices. In case of damage of these wired chargers, wireless charging is an alternative method to charge our devices. The main goal of this project is transmission of wireless power using resonance coupling. This is done using charging a resonant coil from ac and then transmitting subsequent power to the load. This project is meant to charge low power devices without use of wires. We can also charge mobile battery by using wireless charging. In this project, we are designing and implementing universal charger which can charge laptops, trimmers, wifi router, mobile battery etc.

Keyword:- *wireless, universal charging, low power devices*

INTRODUCTION

Technology is one thing that keeps on changing to make life simpler .But, let's take the case of charging a device ,for decades ,we still confine to the old traditional style of wired system . The solution is to go with wireless power transfer using inductive coupling .

Wireless power transmission using inductive coupling, is one of the effective ways to transfer power between points without the use of conventional wire system. Wireless power transmission is effective in areas where wire system is unreachable or impossible. The power is transferred using inductive coupling, resonant induction or electromagnetic wave transmission depending on weather its short range, mid-range or high range.

The goal of this project "wireless power transmission between two low power devices" is using inductive coupling to charge a low power device, using wireless power transmission to charge another mobile. This is done using charging a resonant coil from DC Battery and then transmitting subsequent power to the other mobile battery. The project is meant to charge a low power device quickly and efficiently by inductive coupling without the help of wires.

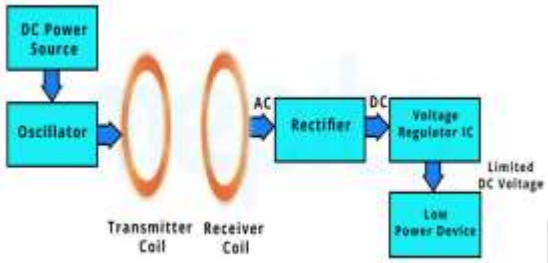
Organization of Paper:

Taking into consideration the literature survey we will discuss the general block diagram, the 2 main section of project: [1.] Universal Charger and [2.] transmission circuit with all calculations. Then conclusion/applications derived from the approaches we used and future scope of enhancement. At the end references used for preparing this paper are shown

Literature Review:

After the study of all the wireless technologies that is, near field or non-radiative and far field or radiative region. Among these for our project we will consider near field region technologies as it is more efficient and have safety measures i.e. non-harmful to humans and other living being. And among near field technologies i.e. inductive, capacitive and resonance. Inductive coupling is the key concept of the project as it doesn't make it bulky and it is more efficient.

Block Diagram:



First step of Project—(Universal Charger):

- A Power Supply is an electronic device that supplies electric energy to an electrical load.
- The primary function of a power supply is to convert one form of electrical energy to another and known as a electric power converters.
- Every student project requires a regulated DC power supply to be used. The power supply requirement is generally 12V , 5V and 3.3V DC output with about 3 Amp (Max) current capacity.

Block diagram of power supply

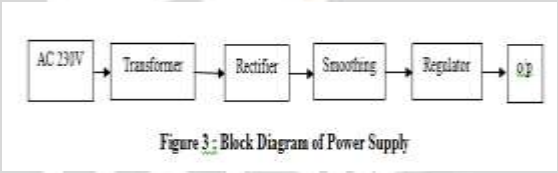


Figure 3 : Block Diagram of Power Supply

Each of blocks are described in detail below:-

Transformer: Step down high voltage AC mains to low voltage AC.
Rectifier: Converts AC to DC ,but the DC output is varying.
Smoothing: Smooths the DC from varying greatly to a small ripple.
Regulator: Eliminates ripple by setting DC output to a fixed voltage.

Universal Power Supply Design Specifications

INPUT :-

- Nominal RMS AC voltage = 230 V.
- Frequency, f = 50 Hz.
- Frequency variation tolerance = $\pm$ 1 Hz
- Single phase ,3 Wire = Live, Neutral and ground
- Angular rate = 314.1593 Radians / sec.
- Voltage variation = $\pm$ 10%
- Minimum RMS AC voltage = 207V.
- Nominal RMS AC voltage = 230V.
- Maximum RMS AC voltage = 258V.

OUTPUT:-

1) Nominal D.C Voltage = +12 Volt.

- Output Current – Min = 10 mAmp, Max = 1 Amp

2) Nominal D.C Voltage = +5 Volt

- Output Current – Min = 10 mAmp, Max = 3 Amp

3) Nominal D.C Voltage = 3.3 Volt

- Output Current – Min = 10 mAmp, Max = 3Amp

4) Nominal D.C Voltage = -5 Volt

- Output Current – 10 mAmp, Max = 3 Amp

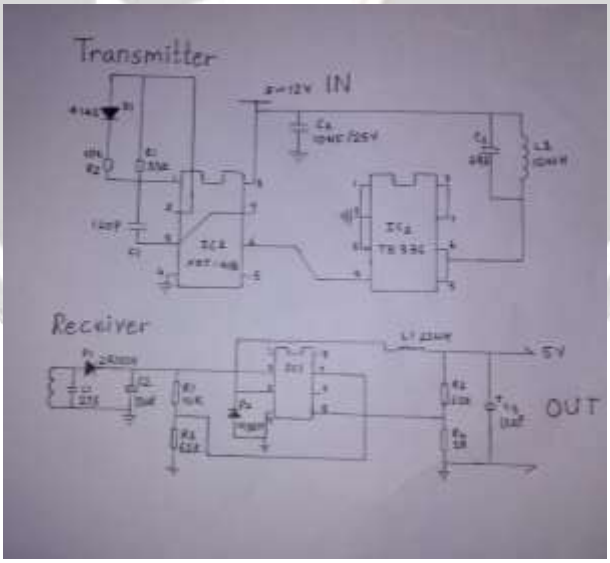
5) Nominal D.C Voltage = -12 Volt

- Output Current – 10 mAmp, Max = 1 Amp

Second Step of Project—(Transmission Section):

During any energy conversion there will be losses from one form to the another form. The magnitude of those losses is what dictates the practicality of any type of wireless charging. Magnetic or inductive charging, in particular has been effectively used for some time to power various kinds of biomedical implants. Presently it is the safest and most enduring method to accomplish the job of transferring power to the inside of the body. In these systems, oscillating current in an external coil of wire generates a changing magnetic field which induces a voltage inside an implanted coil. The current resultant from this voltage can charge a battery or power the device directly.

Circuit Diagram:



Specifications

Transmitter Input Voltage	+12V
Maximum Transmitter Input Voltage	+13.5V
Receiver Output Voltage	+5V DC regulated fixed
Maximum Receiver Current Capacity	600mA (Based on distance)
Coil Inductance	30uH
Transmit Receive Distance	1-20mm
Coil Dimensions	38mm Diameter x 2mm Height

Current Consideration

The transmitter coil and the receiving coil distance suitable is from 1mm to 20 mm. Increase the number of turns of the receiver coil to increase the transmission distance when low current is suitable in your application. As distance increase current capacity of receiver will drop.

Test data for current as distance increases are as below

Distance	Receiver Voltage - Fixed Regulated	Receiver Current
1mm	5V	600 mA
2mm	5V	450 mA
3mm	5V	360 mA
4mm	5V	310 mA
5mm	5V	240 mA
6mm	5V	210 mA
7mm	5V	162 mA
8mm	5V	150 mA
9mm	5V	132 mA
10mm	5V	120 mA
11mm	5V	110 mA
12mm	5V	70 mA
13mm	5V	54 mA
14mm	5V	41 mA
15mm	5V	28 mA
16mm	5V	19 mA
17mm	5V	17 mA
18mm	5V	10 mA

Conclusion:

Hence by using this technology one can transfer power to other low power device. One can implement this circuit in various low power devices and use it for charging other low power devices anywhere . One can also use for various purposes like coffee maker charging, electric toothbrush charging.

Future enhancement:

- One can embed this technology in smart phones.
- One can make application on android operating system as its open source system for sharing energy, just like share it has for sharing data.
- By making application we can also provide security to our project.

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Reference:

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