PROJECT REPORT

on

WIRELESS CHARGING OF MOBILE GADGETS USING GSM SERVICE PROVIDERS

Submitted for partial fulfillment for the award of the degree

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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FACULTY OF ENGINEERING AND TECHNOLOGY

SRM UNIVERSITY, VADAPALANI, CHENNAI-600026

MAY 2013

BONAFIDE CERTIFICATE

Certified that this project report titled “Wireless charging of mobile gadgets using GSM service providers” is the Bonafide work of **Mr. Essekia Paul.R (Reg.No.1040940075), Mr. Ravi Krishna Matha (Reg. No. 1040940196), Mr. Ravi Teja Reddy P.V (Reg. No.1040940197) and Mr. Reddy Eswar Prasad .M(Reg. No.1040940199),** who carried out the project work under my supervision as a batch. Certified further, that to the best of my knowledge the work reported herein does not form any other project report on the basis of which a degree or award was conferred on an earlier occasion for this or any other candidate.

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SYNOPSIS

Wireless Power Transmission started gaining importance after various university professors started to revisit the experiments of Tesla. Soon enough, wireless power transmission started gaining popularity.

Wireless technologies such as mobiles, PDAs, laptops, pagers, sensors, embedded controllers etc. have become an integral part of an individual's day-to-day life. Everyone would have faced the problem of their devices going out of charge. This project explores the possibilities of charging your cell phones wirelessly using RF waves. It is observed that the RF frequency can be harvested by converting it into the required DC voltage and supplying it to the cell phones.

Many wireless power transmission models these days use Induction phenomenon. This project was started as an exploration of Wireless Power Transmission using RF signals. The usage of RF signals by the GSM providers for communication purpose can be expanded for other applications as transmitting power- this is basis on which this project proceeds.

The RF signal that a GSM provider uses has a carrier signal and a message signal. The carrier signal has amplitude. This amplitude if properly utilized and made to cause a electrical instability in the receiver side of the transmission, we can cause current to flow through the circuit. This process can be utilized to power up the charging of a mobile phone.

Hence, using GSM based RF signals to make wireless power transmission possible for charging mobile phones. Hopefully, this can be expanded into many more applications in the future.

The circuit presented in this paper is just a small example to what arenas their technology can be extended.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 LITERATURE REVIEW

Cellular telephone technology became commercially available in the 1980’s. Since then, it has been like a snowball rolling downhill, ever increasing in the number of users and the speed at which the technology advances.

When the cellular phone was first implemented, it was enormous in size by today’s standards. This reason is two-fold; the battery had to be large, and the circuits themselves were large. The circuits of that time used in electronic devices were made from off the shelf integrated circuits (IC), meaning that usually every part of the circuit had its own package. These packages were also very large. These large circuit boards required large amounts of power, which meant bigger batteries. This reliance on power was a major contributor to the reason these phones were so big.

Through the years, technology has allowed the cellular phone to shrink not only the size of the ICs, but also the batteries. New combinations of materials have made possible the ability to produce batteries that not only are smaller and last longer, but also can be recharged easily.

However, as technology has advanced and made our phones smaller and easier to use, we still have one of the original problems: we must plug the phone into the wall in order to recharge the battery.

Most people accept this as something that will never change, so they might as well accept it and carry around either extra batteries with them or a charger. Either way, it’s just something extra to weigh a person down.

There has been research done in the area of shrinking the charger in order to make it easier to carry with the phone. One study in particular went on to find the lower limit of charger size. But as small as the charger becomes, it still needs to be plugged in to a wall outlet.

Wireless charging is any of several methods of charging batteries without the use of cables or device-specific AC adaptors. Wireless charging can be used for a wide variety of devices including cell phones, laptop computers and MP3 players as well as larger objects, such as robots and electric cars. There are three methods of wireless charging: inductive charging, radio charging and resonance charging.

Radio charging is used for charging items with small batteries and low power requirements, such as watches, hearing aids, medical implants, cell phones, MP3 players and wireless keyboard and mice. Radio waves are already in use to transmit and receive cellular telephone, television, radio and Wi-Fi signals. Wireless radio charging works similarly. A transmitter, plugged into a socket, generates radio waves. When the receiver attached to the device is set to the same frequency as the transmitter, it will charge the device's battery.

Now, think about this; what if it didn’t have to be that way? Most people don’t realize that there is an abundance of energy all around us at all times. We are being bombarded with energy waves every second of the day. Radio and television towers, satellites orbiting earth, and even the cellular phone antennas are constantly transmitting energy. What if there was a way we could harvest the energy that is being transmitted and use it as a source of power? If it could be possible to gather the energy and store it, we could potentially use it to power other circuits.

In the case of the cellular phone, this power could be used to recharge a battery that is constantly being depleted. The potential exists for cellular phones, and even more complicated devices - i.e. pocket organizers, person digital assistants (PDAs), and even notebook computers - to become completely wireless.

1.2 OBJECTIVES AND SCOPE OF THE WORK

The objective of this project is to enable the wireless charging of mobile phones with the help of the service providers like AIRTEL, DOCOMO.

The concept is initiated with the user sending a sms request to his service provider from his registered handset. The message if received at the service provider initiates a sequence of steps to check the authenticity of the number and the balance available in his account. After all this steps are performed the service provider will then switch on the transmission of the RF signal belonging to a particular frequency. This will be received at the handset and then passed through the setup described in the project to charge the mobile phone.

For the demonstration purposes we use an RF Module, it is a small electronic circuit used to transmit and/or receive radio signals on one or a number of carrier frequencies.
RF Modules are widely used in electronic design owing to the difficulty of designing radio circuitry.

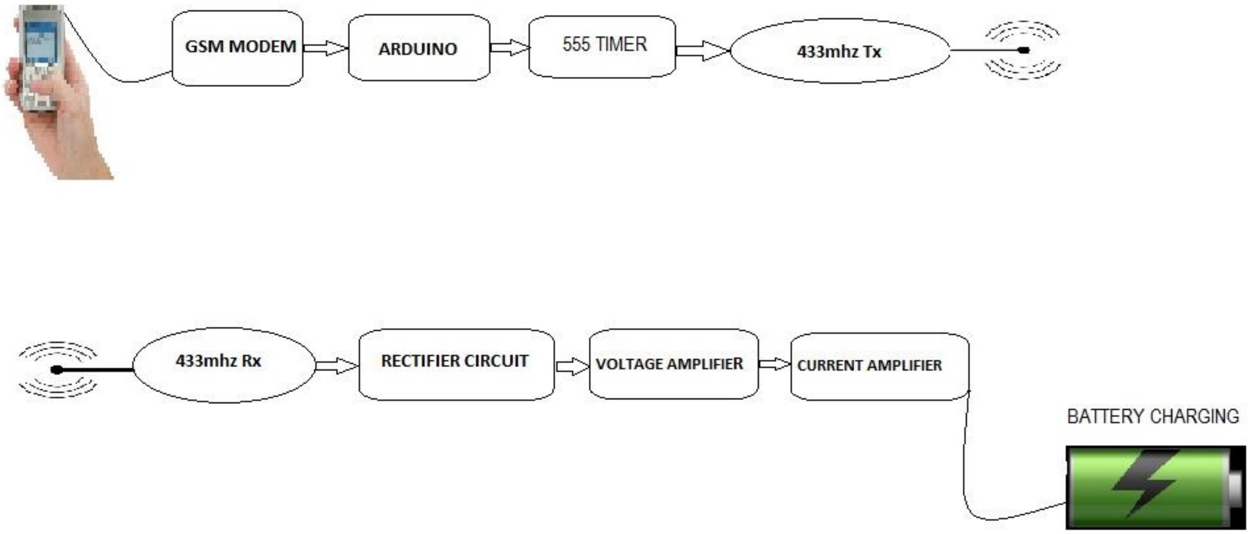
Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency.

RF Modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are often used to replace older infra red radio communication designs as they have the advantage of not requiring line-of-sight operation

Several carrier frequencies are commonly used in commercially-available RF modules, including 433.92MHz, 315MHz, 868MHz and 915MHz. These frequencies are used because of national and international regulations governing the use of radio waves for communication.

2. SYSTEM ANALYSIS

2.1 BLOCK DIAGRAM



2.2 WORKING PRINCIPLE

The Wireless charging setup begins with the initiation using 555 timer as the trigger. The 555 timer is trigger by the GSM modem representing a mobile phone, which can sen and receive sms and make and attend calls. Here, the GSM modem is used to receive a sms, which will be monitored by a personnel. In a real life scenario, this would be the personnel at the service station.

The GSM modem when it receives the sms, will display the details of the network and the user. These details or statistics will be displayed in the monitor. Here in the setup we can connect, the gsm to a computer to display the network details. The controller will then have to read the statistics and then check for permissions. If the stats meet the permissions, then the controller will have to give to Go signal. The Go signal is nothing but a voltage of value 1/3 of the maximum Vcc of the 555 timer. This will act as a trigger to enable the RF transmitter.

The next phase of the process starts here. When the RF transmitter is switched on by the trigger using 555 timer. The 555 timer which acts as the switch, activates the RF transmitter. The

RF transmitter transmits a RF signal which is different for different GSM providers, but for this setup, we transmit 433 MHz RF signal from a 433 Mhz RF transmitter.

The 433Mhz transmitter is powered by a power source which is stepped-down by a 12V-3A step down transformer. As the power is AC, it is then rectified using a bridge rectifier circuit made using 4 silicon diodes. Then a voltage regulator makes sure the voltage comes to the transmitter is 5v dc. The RF signal is received at the receiver section which will portrait our mobile phone.

The transmitter will then receive this in its data pin. This signal is then processed with voltage regulator and a bridge rectifier as before. Then it is voltage-amplified using LM358 and the amplifier is powered by an external power source using step-down transformer as before. The voltage amplified output is the current amplified using IC ULN2803

Finally, this is given to the charging pin of the mobile for charging the mobile.

3. COMPONENTS

3.1 GSM MODEM (SIM900A)

The modem used for the purpose here is SIM900A. It has an in built max 232 chip which enables communication with the microcontroller. The microcontroller enables the data communication using signals at the TTL level, but the SIM900A does not communicate at the TTL level, hence we use the max232.

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging. This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

Applications:-

- SMS based Remote Control & Alerts
- Security Applications
- Sensor Monitoring
- GPRS Mode Remote Data Logging
- Mobile Transport vehicles.
- LAN based SMS servers
- Alarm notification of critical events including Servers
- Network Monitoring and SMS reporting

Features:-

- Highly Reliable for 24x7 operation with Matched Antenna
- Status of Modem Indicated by LED
- Simple to Use & Low Cost
- Quad Band Modem supports all GSM operator SIM cards

Power Supply Requirement:-

- Use DC Power Adaptor with following ratings
- DC Voltage : 12V
- DC Current Rating at least : 1A
- DC Socket Polarity : Centre +ve& Outside –ve
- Current consumption in normal operation 250mA, can rise up to 1Amp peak while transmission so your power supply should be able to handle atleast 1Amp current.

GSM Module of SIM900A:-

Designed for global market, SIM900 is a quad-band GSM/GPRS engine that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 24mm x 24mm x 3mm, SIM900 can meet almost all the space requirements in your applications, such as M2M, smart phone, PDA and other mobile devices.

The physical interface to the mobile application is a 68-pin SMT pad, which provides all hardware interfaces between the module and customers' boards.

The keypad and SPI display interface will give you the flexibility to develop customized applications. Serial port and Debug port can help you easily develop your applications.

One audio channel includes a microphone input and a speaker output. The SIM900 is designed with power saving technique so that the current consumption is as low as 1.5mA in SLEEP mode.

The SIM900 is integrated with the TCP/IP protocol; extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

Top Features:-

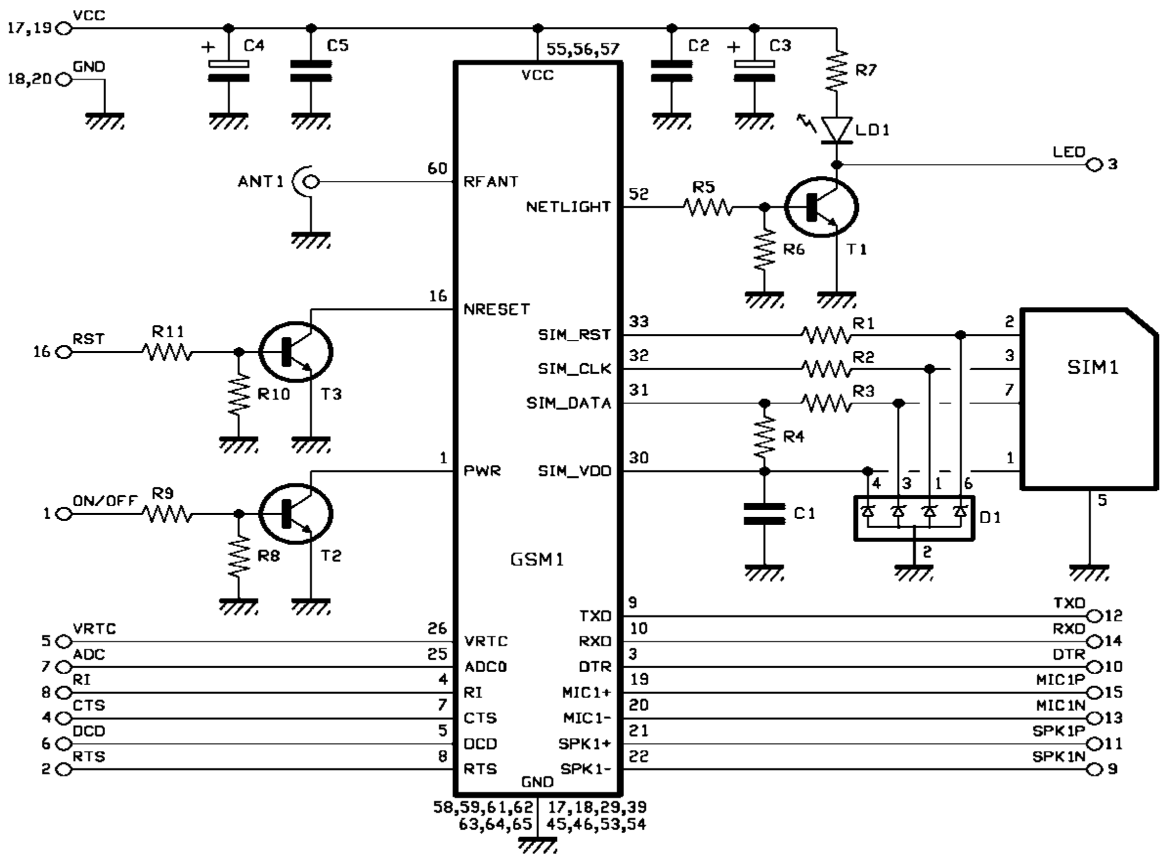
- Power supply: Single supply voltage 3.4V - 4.5V
- Power saving: Typical power consumption in SLEEP mode is 1.5mA.
- .Frequency Bands: -SIM900 quad-band: GSM 850,EGSM 900, DCS 1800, PCS 1900. The SIM900 can search the 4 frequency bands automatically. The frequency bands also can be set by AT command.
- .GSM class: Small MS

- Transmitting power
- GPRS connectivity:
- Temperature range:
- DATA GPRS
- .CSD: -CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent
- Phonebook management: Support phonebook types: SM, FD, LD, RC, ON
- SIM Application Toolkit: Support SAT class 3, GSM 11.14 Release 99
- Real time clock: Implemented
- Timer function: Programmable via AT command
- Physical characteristics: Size: 24mm x 24mm x 3mm Weight: 3.4g
- Firmware upgrade: Firmware upgrade by debug port
- SMS

3.1.1 AT COMMANDS

- **AT commands** are used to control MODEMs. AT is the abbreviation for Attention. These commands come from **Hayes commands** that were used by the Hayes smart modems. The Hayes commands started with AT to indicate the attention from the MODEM.
- The dial up and wireless MODEMs (devices that involve machine to machine communication) need AT commands to interact with a computer. These include the Hayes command set as a subset, along with other extended AT command**s**.
-
- The syntax rules followed by Telit implementation of either Hayes AT commands, GSM commands and FAX commands are very similar to those of standard basic and extended AT commands. A special command has been introduced in order to have an AT interface very close to the standard one.

PIN DIAGRAM OF SIM900



There are two types of extended command:

Parameter type commands. This type of commands may be “set” (to store a value or values for later use), “read” (to determine the current value or values stored), or “tested” (to determine ranges of values supported). Each of them has a test command (trailing =?) to give information about the type of its sub parameters; they also have a Read command (trailing?) to check the current values of sub parameters.

Action type commands: - This type of command may be executed or tested, to invoke a particular function of the equipment, which generally involves more than the simple storage of a value for later use.

AT commands with a GSM/GPRS MODEM or mobile phone can be used to access following information and services:

The AT commands can basically be split into three categories:

- Basic Syntax
- Parameter Syntax
- Extended Syntax

There are four types of ATCOMMANDS.

- **Test commands** - used to check whether a command is supported or not by the MODEM.
  SYNTAX: AT<command name>=?

- **Read command** - used to get mobile phone or MODEM settings for an operation.
  SYNTAX: AT<command name>?

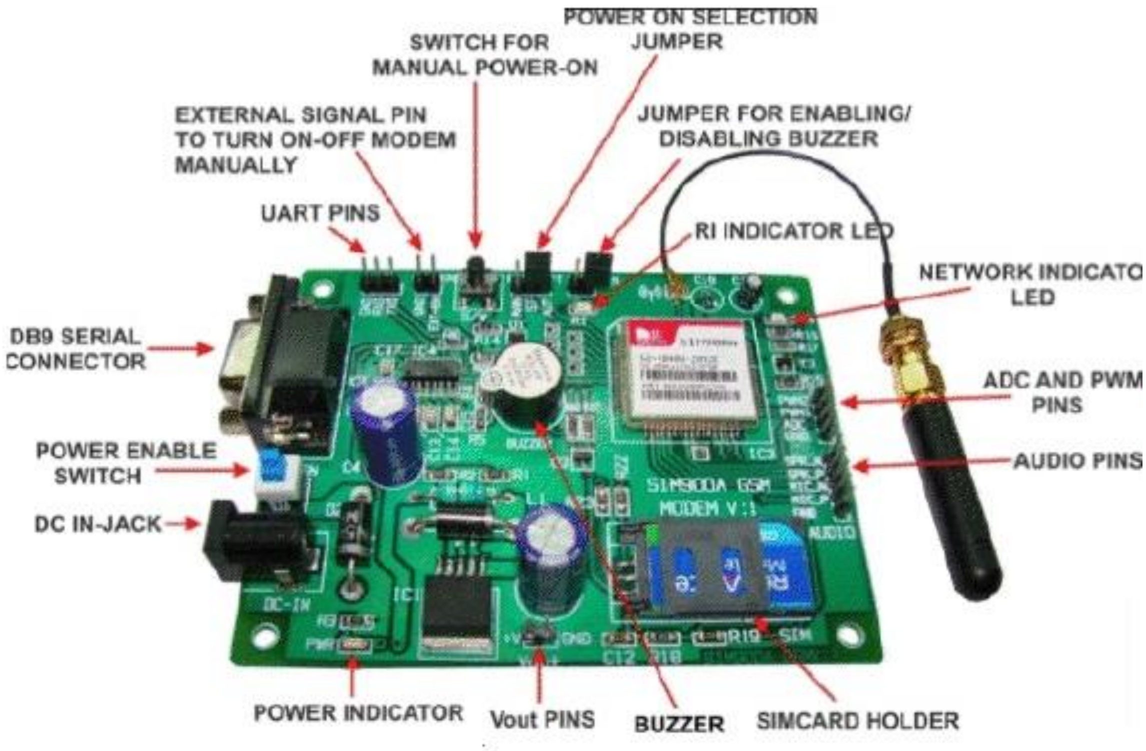
- **Set commands** - used to modify mobile phone or MODEM settings for an operation.
  SYNTAX: AT<command name>=value1, value2, …,valueN

- **Execution commands** - used to carry out an operation.
  SYNTAX: AT<command name>=parameter1, parameter2, …, parameter.

Some of the AT Commands are:-

- AT+GMI →Request manufacture Identification
- AT+GOI →Request Global Object Identification
- AT+COPS→Operator Selection
- AT+CPIN→Enter Pin
- AT+CCLK→Clock
- AT+CMGR→To Read Message
- AT+CMGD→To Delete Message
- AT+CMGS→To Send Message
- AT+CSAS→Save SMS Settings

GSM MODEM SIM 900 FIGURE:-



3.2.2 - RS232 COMMUNICATION

INTRODUCTION:-

RS-232 is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between DTE (data terminal equipment) and DCE (data circuit-terminating equipment). It is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pinout of connectors.

An RS-232 serial port was once a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterruptible power supplies, and other peripheral devices.

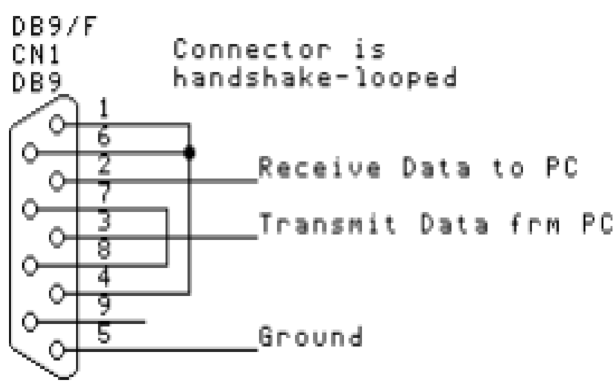
However, the low transmission speed, large voltage swing, and large standard connectors motivated development of the Universal Serial Bus, which has displaced RS-232 from most of its peripheral interface roles. Many modern personal computers have no RS-232 ports and must use an external USB-to-RS-232 converter to connect to RS-232 peripherals. RS-232 devices are still found, especially in industrial machines, networking equipment, and scientific instruments.

It is the telecommunications standard for connecting certain types of electronic equipment. In computer networking, RS-232 cables were commonly used to connectmodems to the compatible serial ports of personal computers. So-called null modem cables could also be connected directly between the RS-232 ports of two computers to create a simple network interface suitable for transferring files.

Today, most uses of RS-232 in computer networking have been replaced by USB technology. Some computers and network routers possess RS-232 ports to support modem connections. RS-232 also continues to be used in some industrial devices, including newer fiber optic cable and wireless implementations.

The RS232 connector was originally developed to use 25 pins. In this DB25 connector pinout provisions were made for a secondary serial RS232 communication channel. In practice, only one serial communication channel with accompanying handshaking is present.

RS232 Connections:-



Handshake looping a PC serial connector

Only very few computers have been manufactured where both serial RS232 channels are implemented. Examples of this are the Sun Sparc Station 10 and 20 models and the Dec Alpha Multi. Also on a number of Tele bit modem models the secondary channel is present. It can be used to query the modem status while the modem is on-line and busy communicating.

On personal computers, the smaller DB9 version is more commonly used today. The diagrams show the signals common to both connector types in black. The defined pins only present on the larger connector are shown in red. Note, that the protective ground is assigned to a pin at the large connector where the connector outside is used for that purpose with the DB9 connector version.

The pin out is also shown for the DEC modified modular jack. This type of connector has been used on systems built by Digital Equipment Corporation; in the early days one of the leaders in the mainframe world.

Although this serial interface is differential (the receive and transmit have their own floating ground level which is not the case with regular RS232) it is possible to connect RS232 compatible devices with this interface because the voltage levels of the bit streams are in the same range.

Where the definition of RS232 focussed on the connection of DTE, data terminal equipment (computers, printers, etc.) with DCE, data communication equipment (modems), MMJ was primarily defined for the connection of two DTE's directly.

RS232 PIN ASSIGNMENTS:-

DB-9 Pin	Signal Name	Dir	Description
1	CD	←	Carrier Detect
2	RXD	←	Receive Data
3	TXD	→	Transmit Data
4	DTR	→	Data Terminal Ready
5	GND	—	System Ground
6	DSR	←	Data Set Ready
7	RTS	→	Request to Send
8	CTS	←	Clear to Send
9	RI	←	Ring Indicator

RS232 DESCRIPTION:-

The Sabrent USB to Serial 9-Pin DB-9 RS-232 Adapter Cable is perfect for use with serial devices that you would want to convert to USB. It allows you to use bridge/connectivity between the Universal Serial Bus (USB) and Serial Port Interface.

Sabrent USB to Serial 9-Pin DB-9 RS-232 Adapter Cable:

- Converts a standard 9-pin serial port to USB
- Complies with USB Specification v2.0 and 1.1(0) & USB CDC v1.1
- Full Compliance with USB specification v2.0 and 1.1
- Supports the RS 232 Serial interface (standard 9-pin serial)
- Supports automatic handshake mode
- USB full speed communication and Bus Powered
- Single Cable USB to Serial communication
- Supports up to 1 Mbps data transfer rate
- Supports Automatic handshake mode

- Supports Remote wakeup and power management
- 1 Ft. Length
- Provides a 96 byte buffer for each upstream and downstream data transfer
- Drivers and Manual on a CD
- Easy Installation

3.3 POWER SUPPLY

A power supply is a hardware component that supplies power to an electrical device. It receives power from an electrical outlet and converts the current from AC (alternating current) to DC (direct current), which is what the computer requires. It also regulates the voltage to an adequate amount, which allows the computer to run smoothly without overheating. The power supply an integral part of any computer and must function correctly for the rest of the components to work.

The power supply on a system unit by simply finding the input where the power cord is plugged in. Without opening your computer, this is typically the only part of the power supply you will see. If you were to remove the power supply, it would look like a metal box with a fan inside and some cables attached to it. Of course, you should never have to remove the power supply

Power in an electric circuit is the rate of flow of energy past a given point of the circuit. In alternating current circuits, energy storage elements such as inductance and capacitance may result in periodic reversals of the direction of energy flow. The portion of power that, averaged over a complete cycle of the AC waveform, results in net transfer of energy in one direction is known as real power. The portion of power due to stored energy, which returns to the source in each cycle, is known as reactive power.

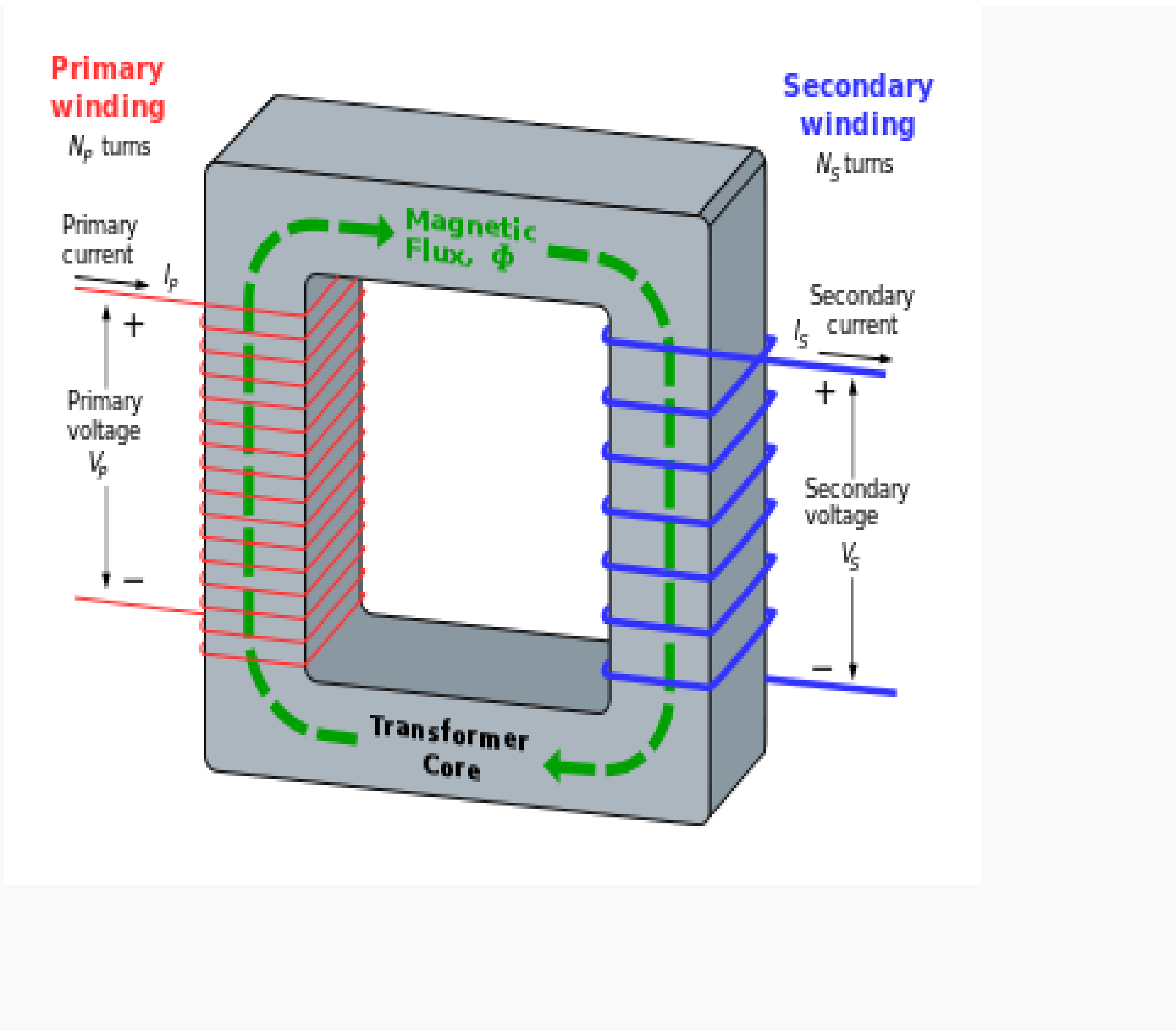
STEP DOWN TRANSFORMER:–

A transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (emf) or voltage in the secondary winding.

Transformers range in size from thumbnail-sized used in microphones to units weighing hundreds of tons interconnecting the power grid. A wide range of transformer designs are used in electronic and electric power applications. Transformers are essential for the transmission, distribution, and utilization of electrical energy.

Induction law:-

The transformer is based on two principles: first, that an electric current can produce a magnetic field and second that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). Changing the current in the primary coil changes the magnetic flux that is developed. The changing magnetic flux induces a voltage in the secondary coil.



Referring to the two figures here, current passing through the primary coil creates a magnetic field. The primary and secondary coils are wrapped around a core of very high magnetic permeability, usually iron, so that most of the magnetic flux passes through both the primary and secondary coils. Any secondary winding connected to load causes current and voltage induction from primary to secondary circuits in indicated directions.

Ideal transformer and induction law

The voltage induced across the secondary coil may be calculated from Faraday's law of induction, which states that:

$$V_{\mathrm{S}} = E_{\mathrm{S}} = N_{\mathrm{S}} \frac{\mathrm{d}\Phi}{\mathrm{d}t}.$$

where $V_s = E_s$ is the instantaneous voltage, N_s is the number of turns in the secondary coil, and $d\Phi/dt$ is the derivative[d]of the magnetic flux Φ through one turn of the coil. If the turns of the coil are oriented perpendicularly to the magnetic field lines, the flux is the product of the magnetic flux density *B* and the area *A* through which it cuts. The area is constant, being equal to the cross-sectional area of the transformer core, whereas the magnetic field varies with time according to the excitation of the primary. Since the same magnetic flux passes through both the primary and secondary coils in an ideal transformer,[6] the instantaneous voltage across the primary winding equals

$$V_{\mathrm{P}} = E_{\mathrm{P}} = N_{\mathrm{P}} \frac{\mathrm{d}\Phi}{\mathrm{d}t}.$$

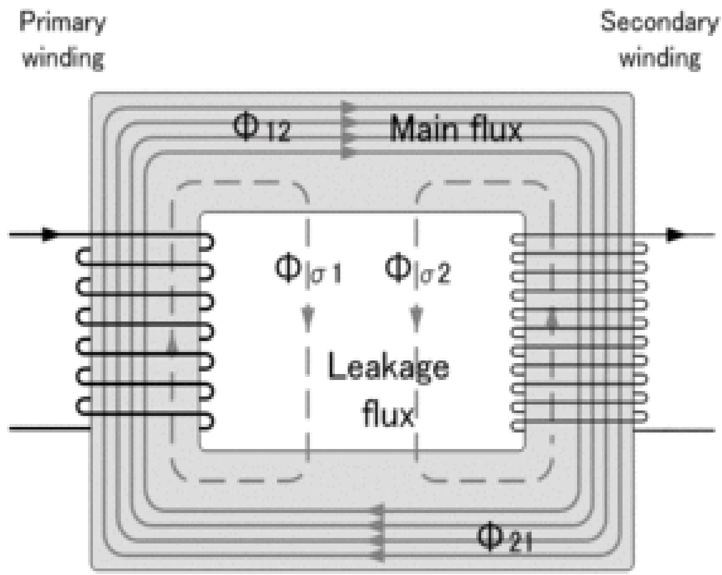
Taking the ratio of the above two equations gives the same voltage ratio and turns ratio relationship shown above, that is,

$$\frac{V_{\mathrm{P}}}{V_{\mathrm{S}}} = \frac{E_{\mathrm{P}}}{E_{\mathrm{S}}} = \frac{N_{\mathrm{P}}}{N_{\mathrm{S}}} = a.$$

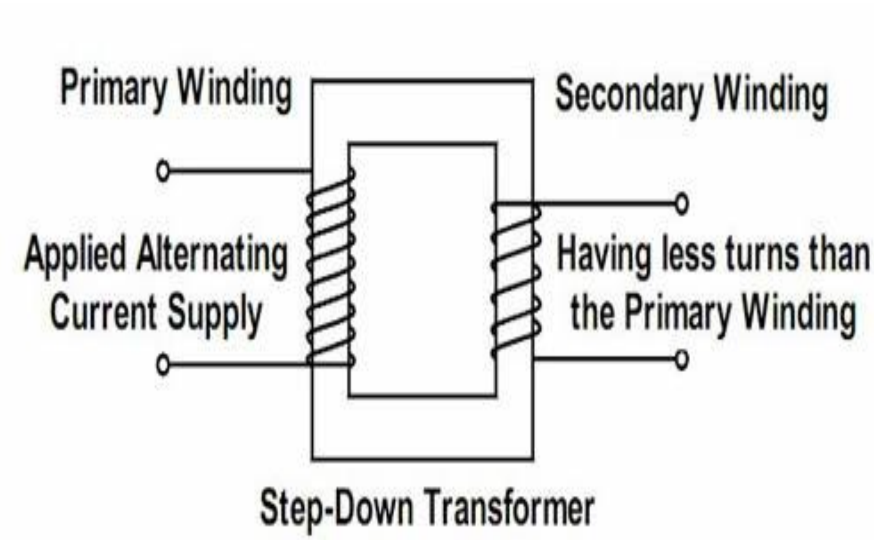
The changing magnetic field induces an emf across each winding. The primary emf, acting as it does in opposition to the primary voltage, is sometimes termed the counter emf. This is in accordance with Lenz's law, which states that induction of emf always opposes development of any such change in magnetic field.

As still lossless and zero-impedance, the transformer still behaves as described above in the ideal transformer.

LEAKAGE OF FLUX: –



The ideal transformer model assumes that all flux generated by the primary winding links all the turns of every winding, including itself. In practice, some flux traverses paths that take it outside the windings. Such flux is termed leakage flux, and results in leakage inductance in series with the mutually coupled transformer windings. Leakage flux results in energy being alternately stored in and discharged from the magnetic fields with each cycle of the power supply. It is not directly a power loss but results in inferior voltage regulation, causing the secondary voltage to not be directly proportional to the primary voltage, particularly under heavy load.



Transformers are therefore normally designed to have very low leakage inductance. Nevertheless, it is impossible to eliminate all leakage flux because it plays an essential part in the operation of the transformer. The combined effect of the leakage flux and the electric field around the windings is what transfers energy from the primary to the secondary.

A transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the Primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (emf) or voltage in the secondary winding.

Transformers range in size from thumbnail-sized used in microphones to units weighing hundreds of tons interconnecting the power grid. A wide range of transformer designs are used in electronic and electric power applications. Transformers are essential for the transmission, distribution, and utilization of electrical energy.

Step down transformers are designed to reduce electrical voltage. Their primary voltage is greater than their secondary voltage. This kind of transformer "steps down" the voltage applied to it. For instance, a step down transformer is needed to use a 110v product in a country with a 220v supply.

Step down transformers convert electrical voltage from one level or phase configuration usually down to a lower level. They can include features for electrical isolation, power distribution, and control and instrumentation applications. Step down transformers typically rely on the principle of magnetic induction between coils to convert voltage and/or current levels.

Step down transformers are made from two or more coils of insulated wire wound around a core made of iron. When voltage is applied to one coil (frequently called the primary or input) it magnetizes the iron core, which induces a voltage in the other coil, (frequently called the secondary or output). The turns ratio of the two sets of windings determines the amount of voltage transformation.

Step down transformers can be considered nothing more than a voltage ratio device. With step down transformers the voltage ratio between primary and secondary will mirror the "turns ratio" (except for single phase smaller than 1 KVA which have compensated secondaries). A practical application of this 2 to 1 turns ratio would be a 480 to 240 voltage step down. Note that if the input were 440 volts then the output would be 220 volts. The ratio between input and output voltage will stay constant. Transformers should not be operated at voltages higher than the nameplate rating, but may be operated at lower voltages than rated. Because of this it is possible to do some non-standard applications using standard transformers.

Single phase step down transformers 1 KVA and larger may also be reverse connected to step-down or step-up voltages. (Note: single phase step up or step down transformers sized less than 1 KVA should not be reverse connected because the secondary windings have additional turns to overcome a voltage drop when the load is applied. If reverse connected, the output voltage will be less than desired.)

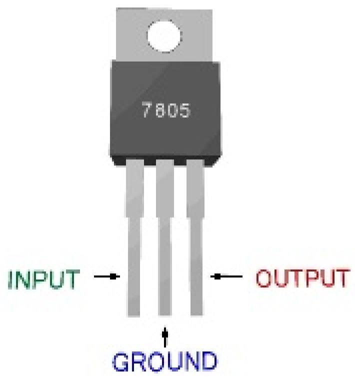
3.2.2 VOLTAGE REGULATOR:-

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. 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.

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current.

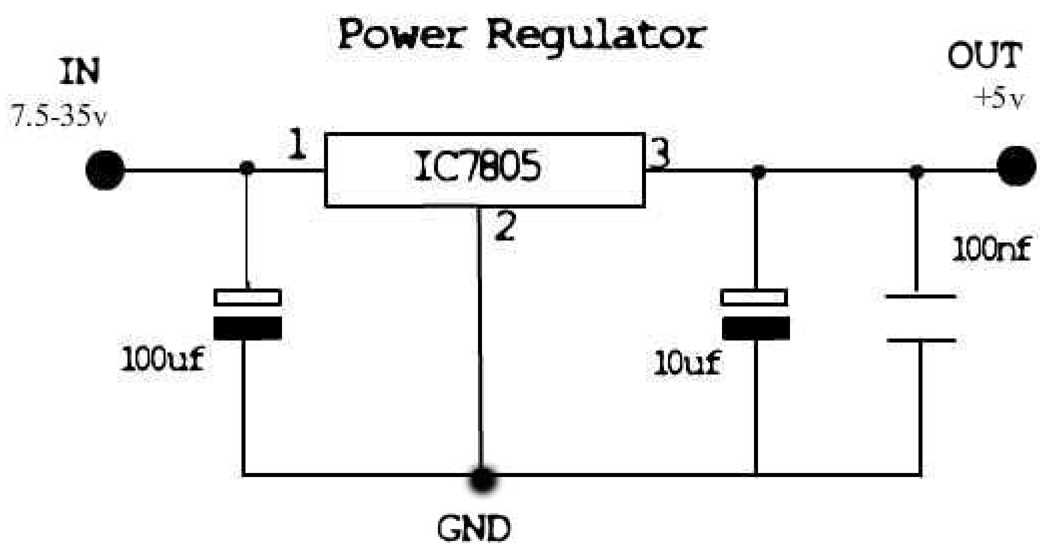
Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.



Voltage regulator IC's are the IC’s that are used to regulate voltage.

IC-7805 is a 5V Voltage regulator that restricts the voltage output to 5 v.It comes with provision to add heat sink .The maximum value for input to the power | Voltage regulator is 35 v. it can provide a constant steady voltage flow of 5 v for higher voltage input till the threshold limit of 35v. If the voltage is near to 7.5 V then it does not produce any heat and hence no need for heat sink. If the voltage input is more, then the heat produced is more.

In the circuitry voltage fluctuation is fatal, for this situation to ensure constant voltage IC-7805 Voltage Regulators are used. For more information on specifications of IC-7805 Voltage Regulator please refer the data sheet here (IC-7805 Voltage Regulator Data Sheet).



The schematic given above shows how to use the IC-7805. There are 3 pins in IC-7805, pin 1 takes the input voltage and pin 3 produces the output voltage. The GND of both input and out are given to pin 2.

Voltage regulator is one of the most important and commonly used electrical components. Voltage regulators are responsible for maintaining a steady voltage across an Electronic system.

Voltage fluctuation may result in undesirable effect on the electronic system, so to maintain a steady constant voltage is necessary according to the voltage requirement of a system.

The voltage regulator regulates the voltage to limit so that it does not cause any damage to the components involved in the circuit.

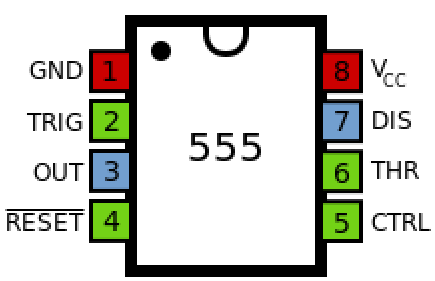
3.3 TRANSMITTER

3.3.1 555 TIMER:–

The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide up to four timing circuits in one package.

Introduced in 1972 by Signetics, the 555 is still in widespread use, thanks to its ease of use, low price, and good stability. It is now made by many companies in the original bipolar and also in low-power CMOS types.

555 timer pin diagram:-



The connection of the pins for a DIP package is as follows:-

Pin	Name	Purpose
1	GND	Ground reference voltage, low level (0 V)
2	TRIG	The OUT pin goes high and a timing interval starts when this input falls below 1/2 of CTRL voltage (which is typically 1/3 of V_{CC}, when CTRL is open).
3	OUT	This output is driven to approximately 1.7V below $+V_{CC}$ or GND.
4	RESET	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts. Overrides TRIG which overrides THR.
5	CTRL	Provides "control" access to the internal voltage divider (by default, 2/3 V_{CC}).
6	THR	The timing (OUT high) interval ends when the voltage at THR is greater than that at CTRL.
7	DIS	Open collector output which may discharge a capacitor between intervals. In phase with output.
8	V_{CC}	Positive supply voltage, which is usually between 3 and 15 V depending on the variation.

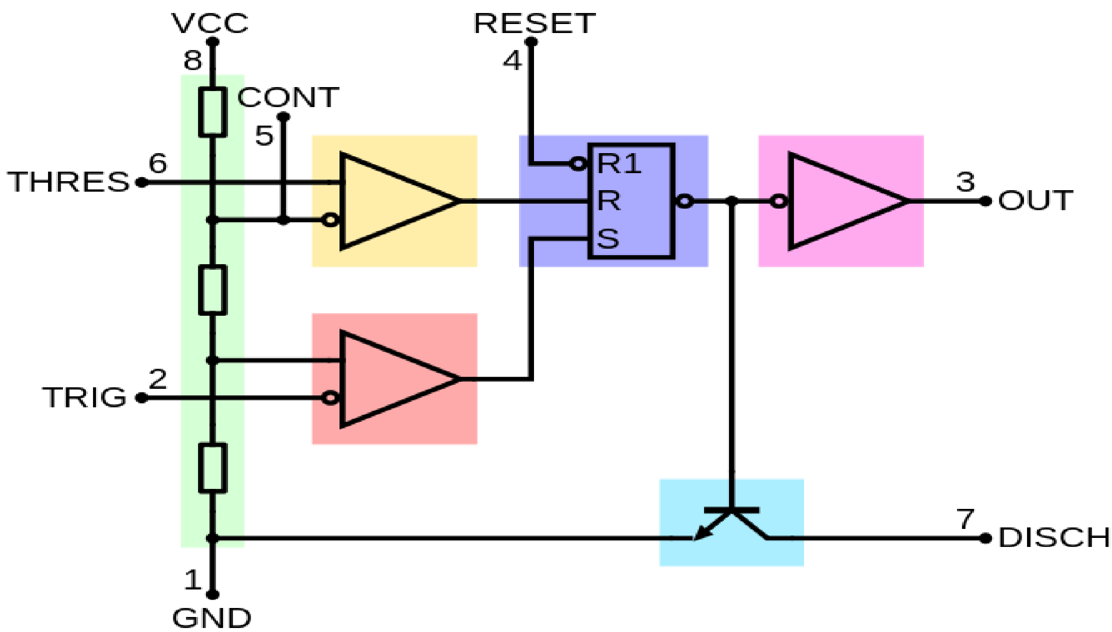
Pin 5 is also sometimes called the CONTROL VOLTAGE pin. By applying a voltage to the CONTROL VOLTAGE input one can alter the timing characteristics of the device. In most applications, the CONTROL VOLTAGE input is not used. It is usual to connect a 10 nF capacitor between pin 5 and 0 V to prevent interference. The CONTROL VOLTAGE input can be used to build an astable with a frequency modulated output.

Modes:-

The 555 has three operating modes:

- Monostable mode: In this mode, the 555 functions as a "one-shot" pulse generator. Applications include timers, missing pulse detection, bouncefree switches, touch switches, frequency divider, capacitance measurement, pulse-width modulation (PWM) and so on.

Internal block diagram:-



- Astable (free-running) mode: The 555 can operate as an oscillator. Uses include LED and lamp flashers, pulse generation, logic clocks, tone generation, security alarms, pulse position modulation and so on. The 555 can be used as a simple ADC, converting an analog value to a pulse length. E.g. selecting a thermistor as timing resistor allows the use of the 555 in a temperature sensor: the period of the output pulse is determined by the temperature. The use of a microprocessor based circuit can then convert the pulse period to temperature, linearize it and even provide calibration means.
- Bistable mode or Schmitt trigger: The 555 can operate as a flip-flop, if the DIS pin is not connected and no capacitor is used. Uses include bounce-free latched switches.

MONOSTABLE-

In the monostable mode, the 555 timer acts as a "one-shot" pulse generator. The pulse begins when the 555 timer receives a signal at the trigger input that falls below a third of the voltage supply. The width of the output pulse is determined by the time constant of an RC network, which consists of a capacitor (C) and aresistor (R). The output pulse ends when the voltage on the capacitor equals 2/3 of the supply voltage. The output pulse width can be lengthened or shortened to the need of the specific application by adjusting the values of R and C.

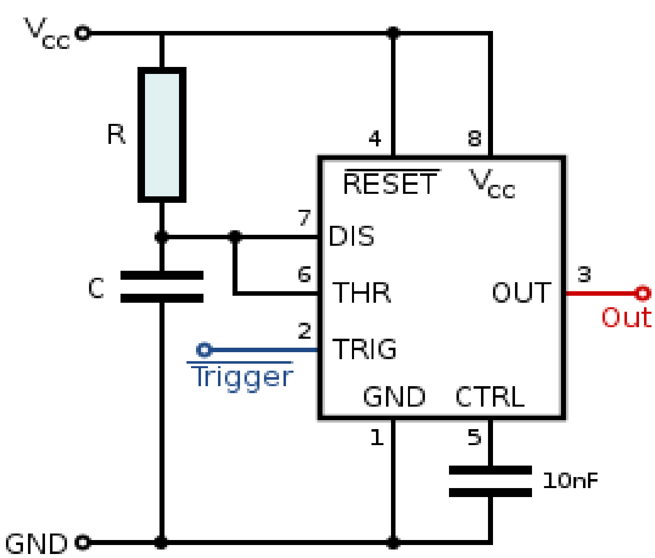
The output pulse width of time t, which is the time it takes to charge C to 2/3 of the supply voltage, is given by

$$t = RC\ln(3) \approx 1.1RC$$

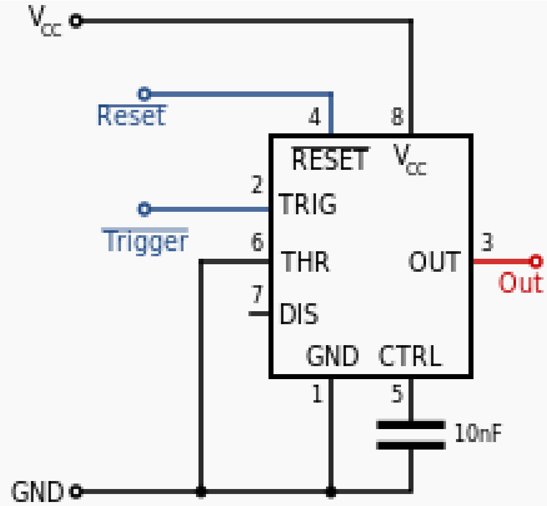
where t is in seconds, R is in ohms and C is in farads.

While using the timer IC in monostable mode, the main disadvantage is that the time span between any two triggering pulses must be greater than the RC time constant.

MONOSTABLE DIAGRAM:-



BISTABLE:-



Schematic of a 555 in bistable mode

In bistable mode, the 555 timer acts as a basic flip-flop. The trigger and reset inputs (pins 2 and 4 respectively on a 555) are held high via Pull-up resistors while the threshold input (pin 6) is simply grounded. Thus configured, pulling the trigger momentarily to ground acts as a 'set' and transitions the output pin (pin 3) to Vcc (high state). Pulling the reset input to ground acts as a 'reset' and transitions the output pin to ground (low state). No capacitors are required in a bistable configuration. Pin 5 (control) is connected to ground via a small-value capacitor (usually 0.01 to 0.1 uF); pin 7 (discharge) is left floating.

ASTABLE:-

In Astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R_1 is connected between $V_{CC}$and the discharge pin (pin 7) and another resistor (R_2) is connected between the discharge pin (pin 7), and the trigger (pin 2) and threshold (pin 6) pins that share a common node. Hence the capacitor is charged through R_1 and R_2, and discharged only through R_2, since pin 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.

In the astable mode, the frequency of the pulse stream depends on the values of R_1, R_2 and C:

$$f = \frac{1}{\ln(2)\cdot C\cdot(R_1+2R_2)}$$ [7]

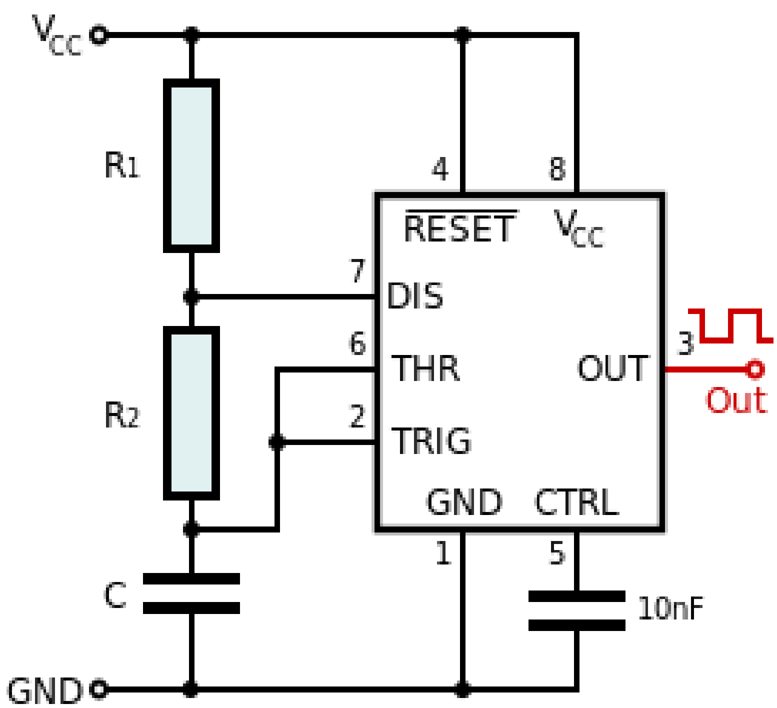
The high time from each pulse is given by:

$$\mathrm{high} = \ln(2)\cdot(R_1+R_2)\cdot C$$

and the low time from each pulse is given by:

$$\mathrm{low} = \ln(2)\cdot R_2\cdot C\frac{V_{cc}^2}{R_1}.$$

where R_1 and R_2 are the values of the resistors in ohms and C is the value of the capacitor in farads.



SPECIFICATIONS –

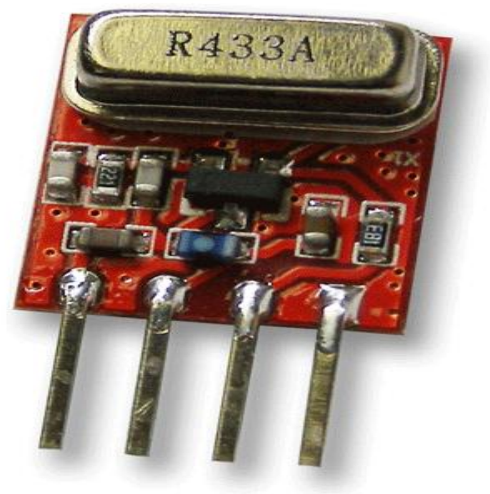
These specifications apply to the NE555. Other 555 timers can have different specifications depending on the grade (military, medical, etc.).

Supply voltage (V_{CC})	4.5 to 15 V
Supply current (V_{CC} = +5 V)	3 to 6 mA
Supply current (V_{CC} = +15 V)	10 to 15 mA
Output current (maximum)	200 mA
Maximum Power dissipation	600 mW
Power consumption (minimum operating)	30 mW@5V, 225 mW@15V
Operating temperature	0 to 70 °C

-

3.3.2 433MHz transmitter

In this transmitter part of the project which includes 50khz message signal which gives sine wave , 555 timer , 433Mhz transmitter which transmits the message signal through antenna.



RF MODULE:-

An RF Module (Radio Frequency Module) is a (usually) small electronic circuit used to transmit and/or receive radio signals on one of a number of carrier frequencies.

- RF Modules are widely used in electronic design owing to the difficulty of designing radio circuitry.
- Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency.
- Design engineers will design a circuit for an application which requires radio communication and then "drop in" a radio module rather than attempt a discrete design, saving time and money on development.
- RF Modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are often used to replace older infra red radio communication designs as they have the advantage of not requiring line-of-sight operation

Several carrier frequencies are commonly used in commercially-available RF modules, including 433.92MHz, 315MHz, 868MHz and 915MHz. These frequencies are used because of national and international regulations governing the used of radio for communication

The term RF Module can be applied to many different types, shapes and sizes of small electronic sub assembly circuit board. It can also be applied to modules across a huge variation of functionality and capability. Most standard, well known types are covered here:

- Transmitter module
- Intelligent transmitter module
- Receiver module
- Intelligent receiver module
- Transceiver module
- Intelligent transceiver module

3.3.3 RF Signal Modulation:-

There are three types of signal modulation methods commonly used in RF transmitter & receiver modules:

- ASK
- FSK
- OOK

This is an ASK Hybrid transmitter module at 433 Mhz. The transmitter Module employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. The transmitter Power supply ranges from a 3-12V, making it ideal for battery-powered applications. There is no requirement of external RF components except Antenna.

The STT-433 is ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 1.5-12V supply, making it ideal for battery-powered applications.

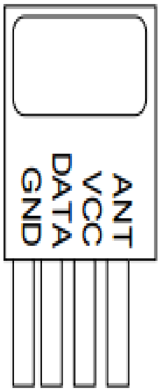
The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy. The manufacturing-friendly SIP style package and low-cost make the STT-433 suitable for high volume applications.

Features

- 433.92 MHz Frequency
- Low Cost
- 1.5-12V operation
- 11mA current consumption at 3V
- Small size
- 4 dBm output power at 3V

Parameter	Symbol	Min	Typ.	Max	Unit
Operating Voltage	Vcc	1.5	3.0	12	Volts DC
Operating Current Data = VCC	Icc	-	11mA @3V 59mA @5V	-	mA
Operating Current Data = GND	Icc	-	100	-	uA
Frequency Accuracy	TOL fc	-75	0	+75	Khz
Center Frequency	Fc	-	433	-	Mhz
RF Output Power		-	4 dBM@3V (2 mW) 16 dBM@5V (39 mW)		dBm / mW
Data Rate		200	1K	3K	BPS
Temperature		-20		+60	Deg. C
Power up delay			20		ms

Pin Description



Pin Name	Description
ANT	50 ohm antenna output. The antenna port impedance affects output power and harmonic emissions. An L-C low-pass filter may be needed to sufficiently filter harmonic emissions. Antenna can be single core wire of approximately 17cm length or PCB trace antenna.
VCC	Operating voltage for the transmitter. VCC should be bypassed with a .01uF ceramic capacitor and filtered with a 4.7uF tantalum capacitor. Noise on the power supply will degrade transmitter noise performance.
DATA	Digital data input. This input is CMOS compatible and should be driven with CMOS level inputs.
GND	Transmitter ground. Connect to ground plane.

Data rate - The oscillator start-up time is on the order of 40uSec, which limits the maximum data rate to 4.8 Kbit/sec

The transmitter is basically a negative resistance LC oscillator whose center frequency is tightly controlled by a SAW resonator. SAW (Surface Acoustic Wave) resonators are fundamental frequency.

3.4 RECEIVER

3.4.1 433 MHz Receiver

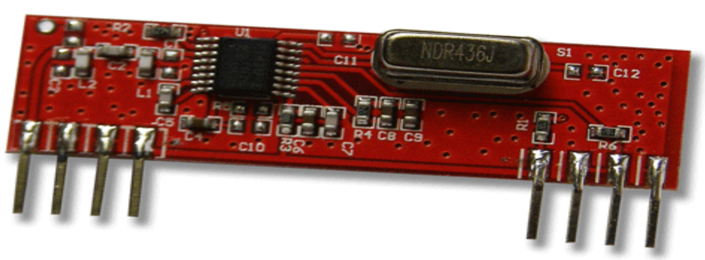
The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications.

Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

The RF module is often used alongwith a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.



The Specifications of RF Receiver:-

Except for the frequency and antenna length, RF_RX_315 and RF_RX_433 share the same product specifications as shown in table below:

No.	Specifications	RF Receiver
1.	Operating Voltage	5.0V ± 0.5V
2.	Operating Current	≤5.5mA @5.0V
3.	Operating Principle	Monolithic super heterodyne receiving
4.	Modulation	OOK/ASK
5.	Frequency	315MHz, 433.92MHz
6.	Bandwidth	2MHz
7.	Sensitivity	-100dBm
8.	Rate	<9.6Kbps (315MHz @-95dBm)
9.	Data Output	TTL
10.	Antenna Length	24cm (315MHz), 18cm (433.92MHz)

- Reliable RF reception due to matched antenna, connector, and PCB.
- Modular design that allows multiple RM-433 units to be wired together. This allows for any desired coverage area.
- Output signal is compatible with industry standard infrared repeating systems. This allows multiple IR and/or RF receivers to be wired together into an RTI control system.
- No dedicated power supply required. Power is derived directly from the RTI control system.
- A feedback LED confirms operation.
- Available only to professional system integrators.

3.4.2 RECTIFICATION USING GE BASED DIODES:–

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 process is known as rectification. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, solid-state 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 sulphide) to serve as a point-contact rectifier or "crystal detector".

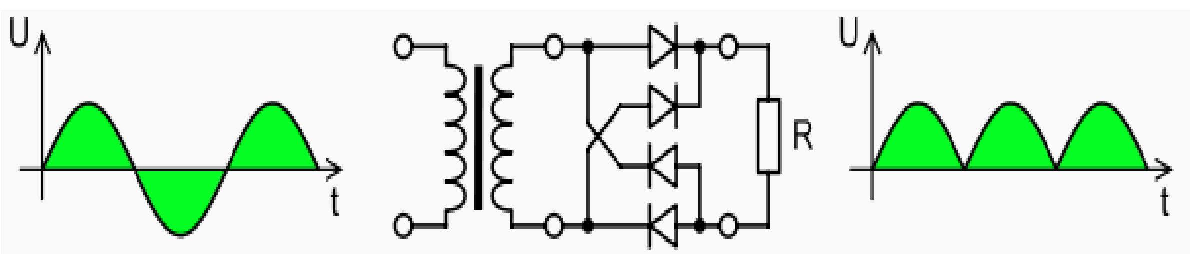
Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power. As noted, detectors of radio signals serve as rectifiers. In gas heating systems flame rectification is used to detect presence of flame.

The simple process of rectification produces a type of DC characterized by pulsating voltages and currents (although still unidirectional). Depending upon the type of end-use, this type of DC current may then be further modified into the type of relatively constant voltage DC characteristically produced by such sources as batteries and solar cells.

A device which performs the opposite function (converting DC to AC) is known as an inverter.

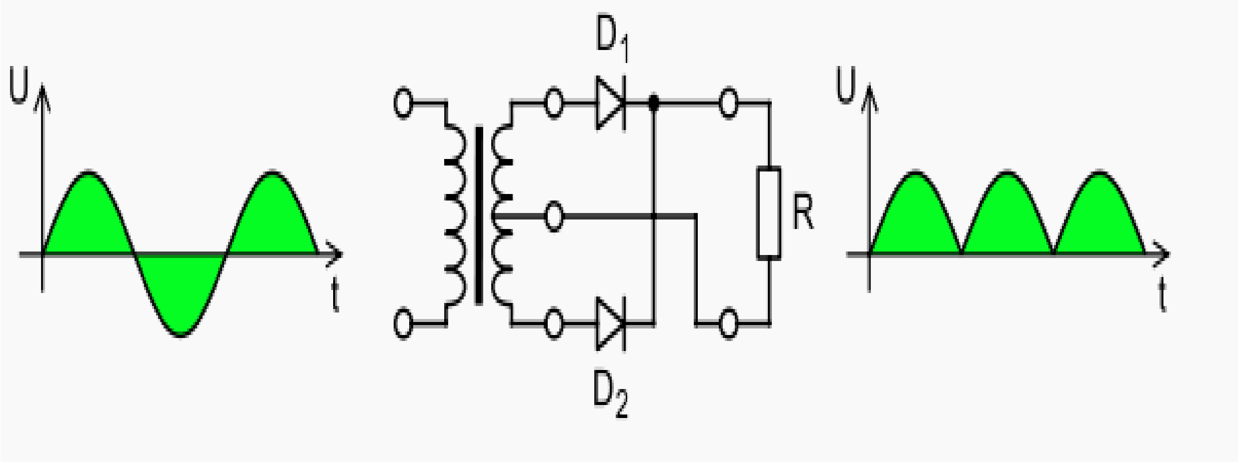
Full-wave rectification:-

A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and yields a higher mean output voltage. Two diodes and a center tapped transformer, or four diodes in a bridge configuration and any AC source (including a transformer without center tap), are needed. Single semiconductor diodes, double diodes with common cathode or common anode, and four-diode bridges, are manufactured as single components.



Graetz bridge rectifier: a full-wave rectifier using 4 diodes.

For single-phase AC, if the transformer is center-tapped, then two diodes back-to-back (cathode-to-cathode or anode-to-anode, depending upon output polarity required) can form a full-wave rectifier. Twice as many turns are required on the transformer secondary to obtain the same output voltage than for a bridge rectifier, but the power rating is unchanged.



Full-wave rectifier using a center tap transformer and 2 diodes. The average and root-mean-square no-load output voltages of an ideal single-phase full-wave rectifier are:

$$V_{\mathrm{dc}} = V_{\mathrm{av}} = \frac{2V_{\mathrm{peak}}}{\pi}$$

$$V_{\mathrm{rms}} = \frac{V_{\mathrm{peak}}}{\sqrt{2}}$$

A very common double-diode rectifier tube contained a single common cathode and two anodes inside a single envelope, achieving full-wave rectification with positive output.

CIRCUIT DIAGRAM FOR RECTIFIER

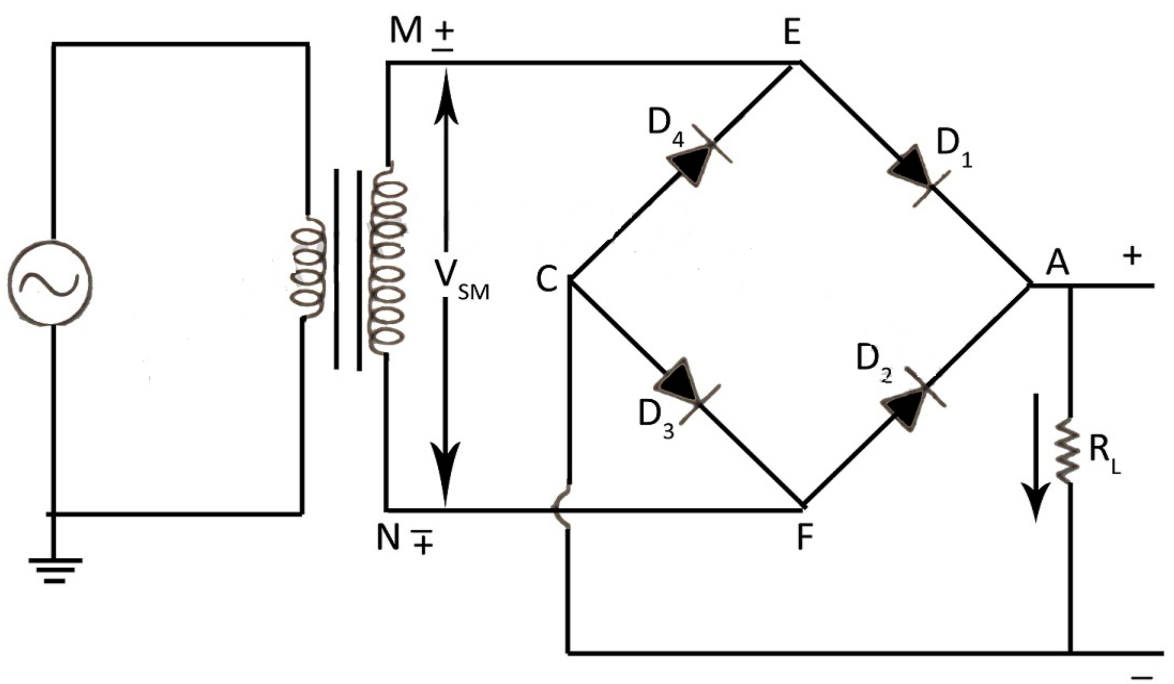
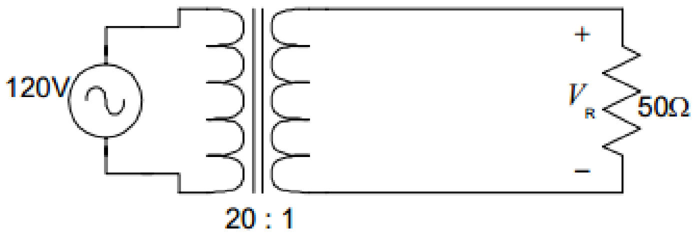


Figure 1: Single-Phase Bridge rectifier

In the modern world, silicon diodes are the most widely used rectifiers for lower voltages and powers, and have largely replaced earlier germanium diodes. For very high voltages and powers, the added need for controllability has in practice caused simple silicon diodes to be replaced by high-power thyristors and their newer actively gate-controlled cousins

AC to DC: Using a full-wave diode rectifier circuit

The 20:1 turns ratio transformer here reduces the rms voltage from the wall outlet – 120 V – by a factor of 20 to in volts rms. The voltage across the load resistor still has positive and negative values.



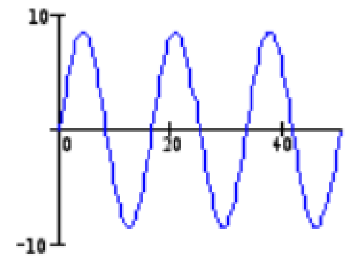
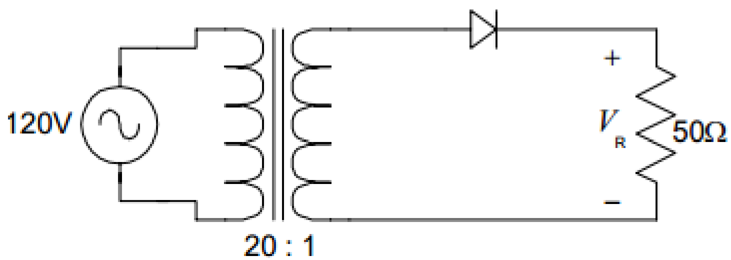


Figure 0.1 Step-down transformer power supply

Putting a single diode in the circuit eliminates the negative going voltages, but is inefficient because of that, and the output voltage is not a steady value as a function of time**.**



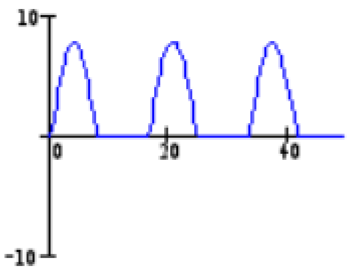
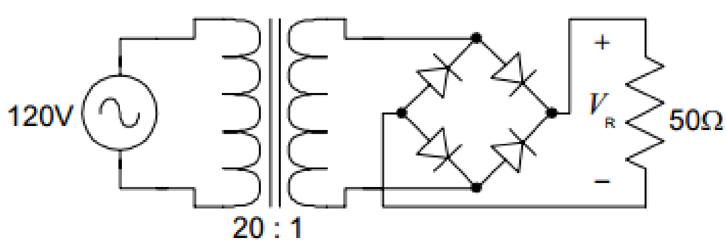


Figure 0.2 Half-wave-rectifier power supply

Using four diodes connected as shown produces only positive-going voltages (more efficient) but the voltage is not steady – it has very large “ripple”.



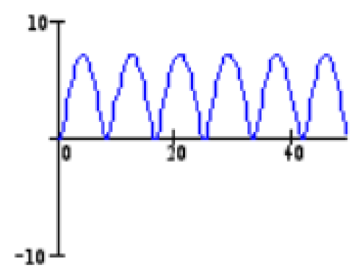
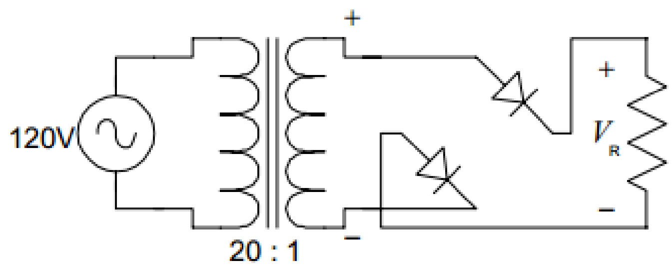


Figure 0.3 Full-wave-rectifier power supply

To see how the four-diode (full-wave rectifier) works, look first at the voltage polarity across the load resistor. When the top of the transformer secondary is positive, the two diodes shown are forward biased and the current is downward through the load resistor. When the top of the transformer is negative with respect to the bottom, these two diodes are reverse-biased and pass no current.



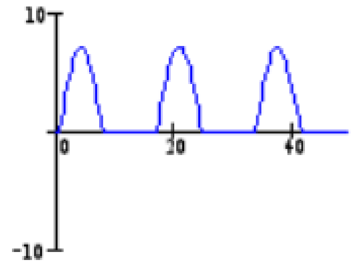


Figure 0.4 Positive transformer output causes the pair of diodes shown to conduct in the fullwave-rectifier power supply.

3.4.3 VOLTAGE AMPLIFICATION

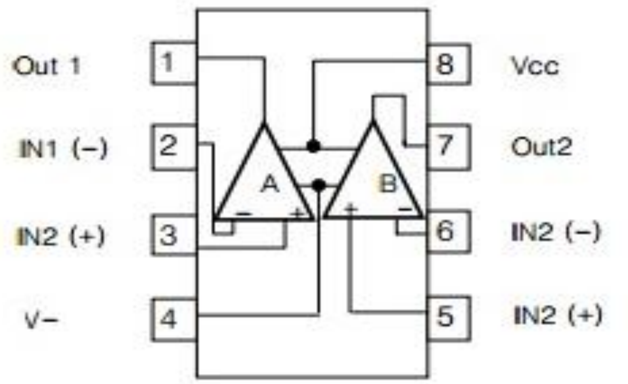
Operational amplifier

- An **operational amplifier** is DC-coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output. An op-amp produces an output voltage that is typically hundreds of thousands of times larger than the voltage difference between its input terminals
- The op-amp is one type of differential amplifier. Other types of differential amplifier include the fully differential amplifier (similar to the op-amp, but with two outputs), the instrumentation amplifier (usually built from three op-amps), the isolation amplifier (similar to the instrumentation amplifier, but with tolerance to common-mode voltages that would destroy an ordinary op-amp), and negative feedback amplifier (usually built from one or more op-amps and a resistive feedback network).

The ratio of the alternating voltage produced at the output terminals of an amplifier to the alternating voltage impressed at the input terminals

LM358 is consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltage.

8 SOP/ 8 DIP PIN FUNCTION



Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifier, DC gain blocks and all the conventional OP amp circuits which now can be easily implemented in single power supply systems.

FEATURES:-

- Internally frequency compensated for unity gain
- Large DC voltage gain: 100dB
- Wide power supply range: 3V~32V(or±1.5V~16V)
- Input common-mode voltage range includes ground
- Large output voltage swing: 0V DC to VCC-1.5V DC
- Power drain suitable for battery operation

3.4.4 CURRENT AMPLIFICATION

An electronic amplifier, amplifier, or (informally) amp is an electronic device that increases the power of a signal. It does this by taking energy from a power supply and controlling the output to match the input signal shape but with large amplitude.

Numerous types of electronic amplifiers are specialized to various applications. An amplifier can refer to anything from an electrical circuit that uses a single active component, to a complete system such as a packaged audio hi-fi amplifier.

Power amplifier:-

The term power amplifier is a relative term with respect to the amount of power delivered to the load and/or sourced by the supply circuit. In general a power amplifier is designated as the last amplifier in a transmission chain (the output stage) and is the amplifier stage that typically requires most attention to power efficiency. Efficiency considerations lead to various classes of power amplifier based on the biasing of the output transistors or tubes

The ULN2803A is a high-voltage, high-current Darlington transistor array. The device consists of eight npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. The Darlington pairs may be connected in parallel for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. The ULN2803A has a 2.7-kΩ series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.

SPECIFIATIONS:-

- 500 mA Rated Collector Current (Single Output)
- High-Voltage Outputs 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Compatible with ULN2800A Series

The I/O 24 ULN2803 Switch Board shown below in diagram 1 is a very useful accessory board that allows much higher voltage and current devices to be interfaced to the low level logic provided by the I/O24 modules.

The board consists of a ULN 2803 and LED indicator setup to indicate which channels are currently active.

The ULN2803 consists of 8-bit TTL-input NPN Darlington sink drivers. Each Darlington driver can handle a maximum of 500mA continuous (when using a single channel only) and can withstand a maximum 50V in its off state. This makes the ULN2803 well suited to provide an interface between the low logic level interfaces and higher current/voltage devices such as relays, solenoids, motors and lamps.

The connections to the board are by screw terminals that will accept cables 0.5 – 2mm1.The connection between the I/O24 module and the ULN2803 switch board is via a 30 cm IDC connection cable provided with the board. The board has been designed to a 72mm standard width so that it can easily be mounted in DIN rail mounting modules.

BOARD FEATURES

- 1 x ULN2803 High Voltage / High Current Transistor Array.
- Indication LED's for channel status.
- Screw Terminal Blocks for outputs.
- 72mm Standard width for DIN Rail Modules.

BOARD CONNECTIONS:-

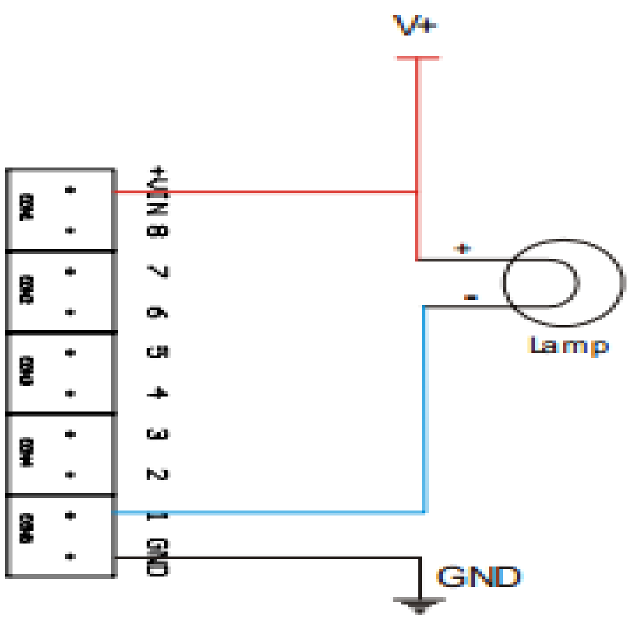
18 pin Box Header Pin out

Shown in the diagram below is the I/O port Connector for each of the Ports on the module.

OPERATION:-

The following circuit configuration is provided as an example. It uses an Incandescent lamp other devices like relays could be used as an alternative. To operate the ULN2803 board an external power supply (not exceeding maximum ratings) needs to be connected to the +VIN connection terminal and the positive terminal for the lamp. The negative terminal connects to the channel. When the channel is activated by the IO24 module the connection to the lamp will go low causing the lamp to turn on. The circuit can be modified to activate relays, solenoids etc.

Note: Care must be taken not to exceed the maximum specifications of the ULN2803. For more information in regards to the ULN2803 please refer to the datasheet.



THE OTHER APPLICATIONS:-

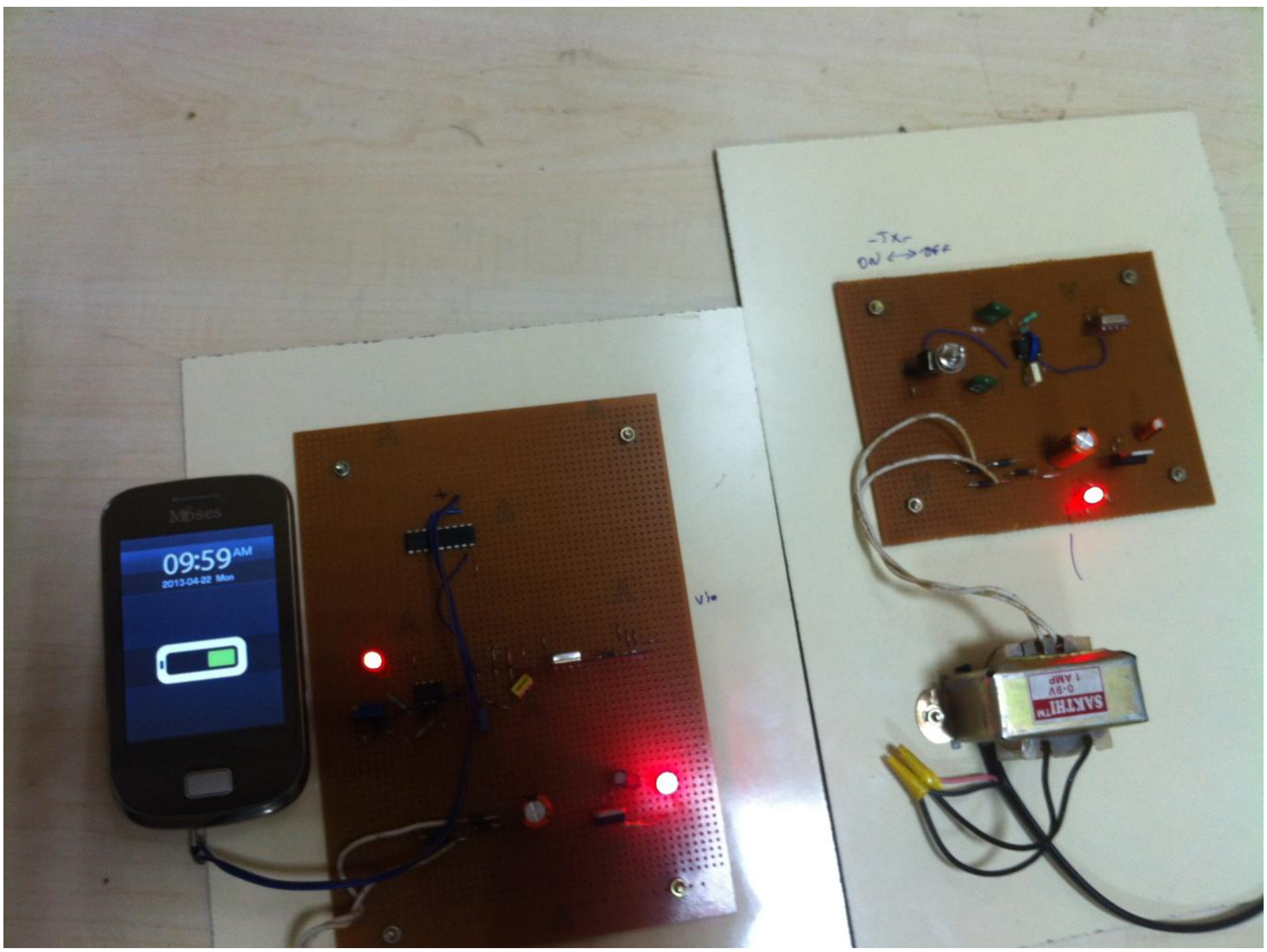
- Power Switching
- On/Off Control
- Home Automation
- Relays, Motors
- Solenoids, Solenoid valves
- Lamps etc

3.4.5 INTERFACING FOR CHARGING THE DEVICE:-

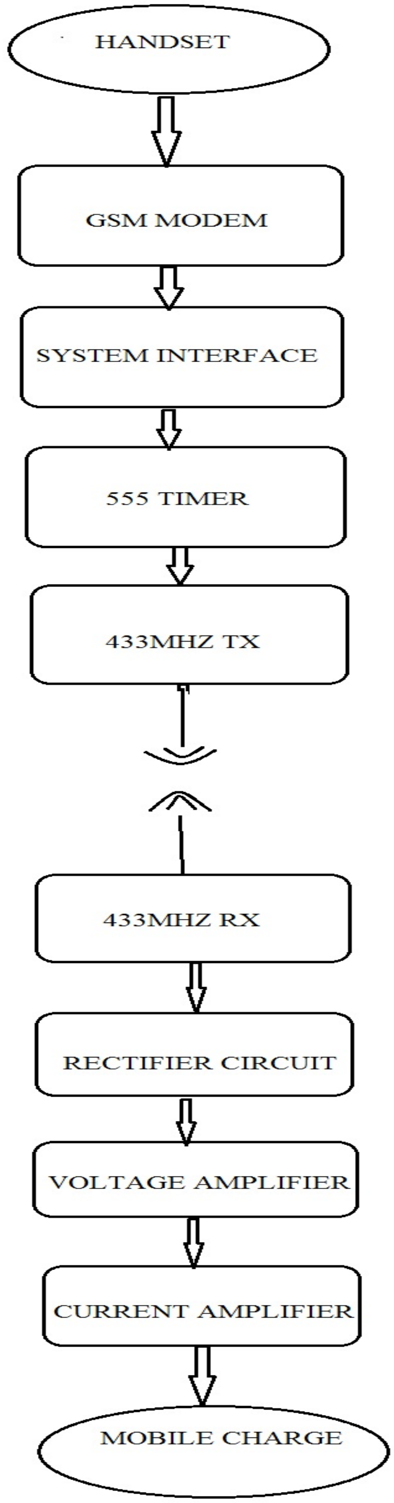
The power generated at the receiver is given to the mobile phone to charge the phone. This is done with the help of a proper pin that connects the charging port of the mobile to the pin that delivers the output to the device. The pin that is being used is small lean pin that fits into most of the basic mobile phones.

4. PROJECT BOARD

4.1 PROJECT BOARD



4.2 FLOW CHART



5. PERFORMANCE EVALUATION

5.1 RESULTS AT TRANSMITTER:

The GSM modem receives the message. The message is checked for proper information regarding the phone number of the user and other details. This checking if successful will manually trigger the 555 timer.

The message signal generated using the 555 timer (approx 50 KHz) is modulated efficiently using the 433MHz. The 433MHz wave acts as the carrier wave. The modulated wave is then transmitted over to the receiver side. The efficiency of transmission is found to increase with the addition of an antenna. Solenoidal antenna is preferred for low distances.

5.2 RESULTS AT RECIEVER SIDE

The modulated wave from the transmitter is obtained without much of noise and disturbance, at the transmitter pin. The RF wave is then demodulated with the help of in built circuitry to obtain the transmitted wave. The wave is then passed through a bridge rectifier to obtain DC voltage. It is then passed through a voltage amplifier and then through the current amplifier, hence obtaining the power to adequately charge the phone wirelessly

.

6.CONCLUSIONS AND FUTURE DEVELOPMENTS

The project demonstrates that wireless charging of mobile devices using the GSM service providers can be done. The transmitted frequency is 433MHz, which is the carrier wave. The received wave is rectified and power amplified to proper range so as to enable the successful charging of the mobile phones.

FUTURE DEVELOPMENTS

The whole process demonstrated in the project can be automated with the help of microcontroller that would automatically trigger the transmission of the RF waves after the checking the message.

The receiver module can be designed into a cap like structure, during the process of bulk manufacturing that can be hooked up with the phone to enable easy charging of the phone.

As the technology advances and reaches new heights, we could be in proud possession of devices that cause even lesser loss, while the execution of the project. Such devices after their discovery could play a pivotal role in developing systems with even higher efficiency.

7. REFERENCES

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APPENDIX

Tx- Transmitter

Rx- Receiver

GSM- Global System For Mobile Communications

SMS- Short message service

LED- Light Emitting Diode

RF- Radio Frequency

DC- Direct Current

AC- Alternating Current

I/O- Input/output

mA- milli Ampere

rms- root mean square

Op-amp- Operational Amplifier

TTL- Transistor Transistor logic

Kbps- Kilo bits per second

dB- Decibel

MULTIDISCIPLINARY ACTIVITY

This project involves the usage of the Electronics and communication Engineering Lab facilities.

Department	Utilised for	Remarks
Basic Math/Sciences		
Mechanical Engineering		
Instrumentation and Control Engineering		
Electronics And Communication Engineering	Circuit design, Circuit Implementation, Analysis, Testing, modification and Soldering	
Computational/IT		
Biomedical Engineering		
Purchase Section		
Maintenance Department		
Desktop publications	Report	