NEW HORIZON
COLLEGE OF ENGINEERING
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
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"METAL DETECTOR USING IC 555"

A MINI PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree of

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IN

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NEW HORIZON COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled **"METAL DETECTOR USING IC 555"** carried out by **MELITA ROSE G(1NH18EC071), NIKITHA MS(1NH18EC079), MANISHA PREM(1NH18EC067), NEHNA MANOJ M(1NH18EE037),** bonafide students of Electronics and Communication Department , New Horizon College of Engineering, Bangalore.

The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said degree.

Project Guide HOD ECE

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ABSTRACT

The device being constructed is a metal detector that detects the metals around its surrounding without touching it.

This metal detector circuit being constructed detects metals based on the concept of inductive sensing.
There are many electrical as well as electronic components that are being used in this circuit which make its working efficient. The basic concept incorporated includes the fact that the presence of a metal will vary the value of the inductance.

This circuit makes use of a series RLC circuit that has a resistor, inductor (coil) and capacitor connected in series; and this forms the metal detecting part.
The impedance varies when metal is in the proximity thereby varying the input given to the IC.
The circuit is built on a breadboard (wherein all the connections are made) and any metal that is being brought near the coil (inductor) connected will trigger an alarm through a loud speaker.
In recent days metal detectors prove to be of great use.

They are being used to detect metal devices like bombs, guns for security reasons. This is used to prevent unauthorized or illegal entry of metal devices, harmful weapons, guns/bombs carried in bags to public places like parks, malls, theatres, railway stations, hotels, etc.

ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would be, but impossible without the mention of the people who made it possible, whose constant guidance and encouragement helped us succeed.

We thank **Dr. Mohan Manghnani**, Chairman of **New Horizon Educational Institution**, for providing necessary infrastructure and creating good environment.

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CHAPTER 01

INTRODUCTION

Fig 1(a):Walk through metal detector

Fig 1(b): Handheld metal detector

The metal detector project being done shows the construction of a metal detector which is an electronic device that detects the presence of metal nearby to it. Metal detectors are used to detect metal that are being hidden within objects, or even those metal objects that are buried underground.

These detectors often consist of a handheld unit with a probe (sensor probe) that can be swept either over the ground or other objects. So when the sensor comes near a metal piece then it will be indicated by the changing tone in buzzer, or by a needle moving on an indicator.

There are many ways of constructing a metal detector but this model makes use of the 555 IC and an air core coil of around 160 turns that forms the metal detector part. The first industrial metal detectors were developed in the year 1960s and were used widely for the prospecting of minerals and many other applications of the industry. This was importantly used for detecting land mines ,useful for the detection of weapons like knives and guns (mainly in airport security), geophysical prospecting, and also treasure hunting.

But nowadays, these metal detectors can be seen used in many places that we visit in our day to day life and these detectors prove to be very useful; that is the reason we observe them being used in many places like theatres, malls, showrooms, etc for the safety of the public. The figures 1(a) and 1(b) shown above depict a walk through metal detector and a handheld unit.

A very commonly used metal detector are the stationary walk through metal detectors, these are the detectors that are used for security purposes at the access points in courthouses, prisons and airports to detect metal weapons on the body of a person.

This project report will mainly focus on the below listed aspects:

- The proposed methodology which includes the various methods available to create the project and the opted method and its details.
- The project description which gives the detailed analysis of how the project has been constructed .
- The hardware components used to build the circuit. Every component that has been used for circuit construction will be given details on.
- The literature survey will cover the papers being used for reference.
- The results part which gives the observations made and the output of the circuit.
- The discussions page will be included that highlights discussions made on the observations.
- The important conclusions that were observed will be highlighted.
- The future work and future scope will also be discussed.
- References made and the flowchart demonstrating the working in short will be depicted.

This introduction gives an overview of what this report will contain. All the above mentioned topics will be further discussed in the upcoming chapters which this report will contain.

CHAPTER 02

LITERATURE SURVEY

1) **PAPER 1:**
   TOPIC: Smart Home automation based on 555 timers
   AUTHOR AND YEAR OF PUBLICATION : Krishna Sarath Chandra Kotcherlakota, Vamsi Bharadwaj Reddy (May 2016).

   This paper deals with the automation done using 555 integrated timers . The automation processes done describe the detailed functions of the circuit. All the required information about the integrated circuit 555 timer has been discussed in this paper. Information on the basic and various components of the Integrated circuit, timers, the advantages, different application and data about 555 IC that is necessary to be known to go ahead with the project has been imbibed from this paper.

2) **PAPER 2:**
   TOPIC: Basic analysis of metal detector
   AUTHOR AND YEAR OF PUBLICATION: S.Yamazaki, H.Nakane, A.Tanaka, (August 2002).

   This paper covers the basic analysis of a metal detector. The purpose or the need for a metal detector has been explained clearly in the introduction part. The next chapters of the paper discusses the basic credentials required to get the abstract idea into actual construction, the various ways of constructing a metal detector using different components. The explanation for each method has been done very clearly. Some of the points discussed in the conclusions of the paper where able to solve certain doubts that had existed regarding the working while making the model. The concept of how the disturbance that incurs when magnetic field is generated in the transmission coil helps in detecting metal pieces, which was discussed in the paper, was helpful for the better understanding of the working.

3) **PAPER 3:**
   TOPIC: Metal detector head analysis
   AUTHOR AND YEAR OF PUBLICATION: Zhuoran Tang (2011).

   The paper written on the head analysis of metal detector describes the importance of the sensor or the detecting part; the role or the exact significance of the detecting

part to complete the working of the detectors are explained. Since metal detectors can be constructed in different ways, the different designs have different sensor heads/detecting part to complete the working. Unless the detecting part of the circuit does not work fine , there is no significance of the entire detector; these points have been made clear in the discussions done in the paper. The idea that the performance of the entire constructed metal detector circuit depends heavily on the sensor head and need to make sure its constructed properly and works fine has been imbibed from the paper.

4) **PAPER 4:**
TOPIC: Research of the metal detector based on finite element analysis
AUTHOR AND YEAR OF PUBLICATION: LV Yilin, Wei Dong (2017).

This paper includes the research concepts that have been made on the finite element analysis of the metal detector. The various aspects that have to be taken into consideration while constructing metal detector circuits have been discussed. Their practical usage in view of industry and other modifications have been covered. In terms of industrial applications, the detection environment is bad and external interference factors are more, therefore using transmission coil is not that recommended, we can use an inductance detection coil, which is more helpful in detecting metal pieces. These concepts that are required to be known have been the required outcome of this paper.

CHAPTER 03

PROPOSED METHODOLOGY

The metal detector circuit can be done using many methods:

1) Metal detector using Arduino Board:

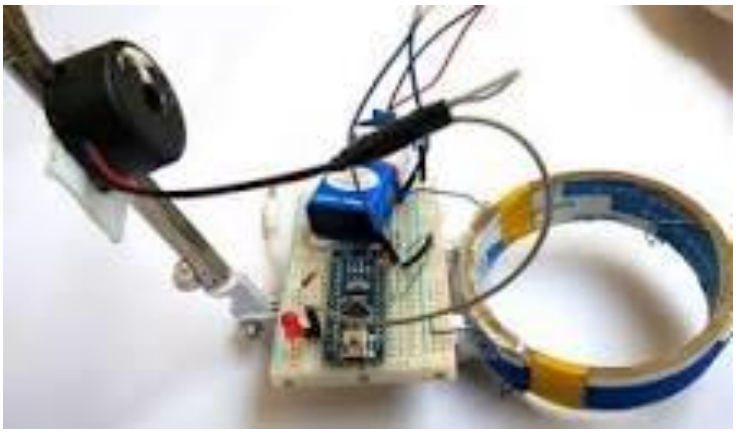

Fig 3(a): Picture of arduino based metal detector

This circuit using arduino board is constructed using various components as shown in the fig 3(a) above, like buzzer, resistors, Light Emitting Diode, breadboard, battery, diodes, coil, capacitors, wires and mainly the arduino board. The main detection of the coil is done by the coil and capacitors. The wave generated by arduino is being fed to the LR(inductor-resistor) circuit. Because of this, short signals(spikes) will be generated for each transition of the coil. The inductance of the coil is being proportional to the pulse length and so the inductance can be measured using these pulses. The capacitor used is charged by the rising pulse to a level where the arduino pin can read the voltage. The results are then transferred to the Light Emitting Diode and buzzer where presence of metal will be detected. In the programming of this arduino, two pins are being used: one for the generation of pulse and the other for reading the capacitor voltage. Two more pins are also used for connecting the buzzer and Light Emitting Diode. Whenever a metal is detected, the buzzer buzzes and the light emitting diode tends to blink quickly.

2) Metal detector using transistor:

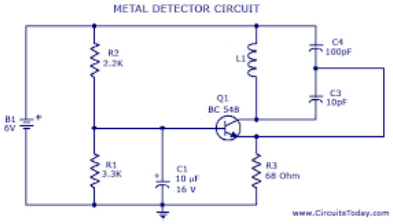

Fig 3(b): circuit of metal detector using transistor

This circuit makes use of components like resistors, battery, switch, capacitors, wires and mainly the transistor as depicted in the fig 3(b) shown above. The capacitor and the coil is given input by the pulse. The capacitor starts to discharge and then begins charging . current is driven into the coil; the base of the transistor is being kept steady and constant by the activity of the capacitors and the transistor turns of. The process continues and ultimately collector is withdrawn from the circuit.
Initially the buzzer just makes a sound , but when metal is brought near the coil region, the frequency of the sound decreases and will be differentially heard.

3) Metal detector using transistor and different ICs:

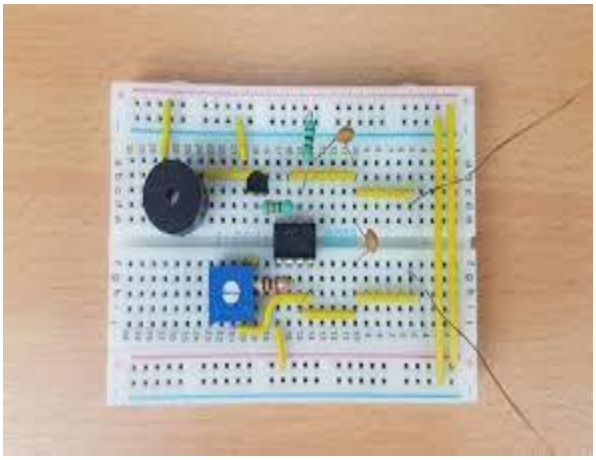

Fig 3(c): Picture of metal detector with transistors and IC

This circuit involves the usage of components like resistors, buzzer, capacitors, coil, battery, proximity sensor IC, transistor. There is an LC (inductor-capacitor) circuit with whose help the transistor acts as an oscillator at a specific frequency. The construction is made as shown above in fig 3(c). When there is a resonating frequency from the metal nearby that is detected by the LC circuit, there will be a magnetic field that will be created and there will be current in the coil so the signal flowing in the coil will change.
When the detection of the metal takes place the LC circuit will have its signal changed and this changed signal will be given to proximity sensor IC which detects the changes in the signal and will react accordingly. An output of around 1mA will be provided by the IC when the metal is not present; and an output of around 8mA or greater will be provided by the IC when there is presence of metal. When the transistor is turned on, the Light Emitting Diode starts glowing and the buzzer gets activated.

The method proposed here is :-

METAL DETECTOR USING 555 IC:

This project makes use of a 555 IC timer that acts as a square wave generator and it generates pulses with those frequencies which are only audible to humans. The capacitor that is being used between pin2 and pin1 has not changed as it is required for generating audible frequencies.

In the circuit there is an RLC circuit formed by 47K resistor, 2.2µF capacitor, and 160turn inductor. The RLC circuit is the part that detects the metal.

An inductor that has metal core has high when compared to an inductor that has air core. The coil wound here is an air cored one, so when a piece of metal is brought near the coil, the metal piece becomes a core for the air cored inductor. Because of this metal which is acting as a core, the inductance of the coil changes or increases considerably.

Because the inductance of coil increases suddenly ,there will be overall increase in inductance of the coil when it is compared to the time without metal detection.
First time when there is no metal piece the speaker causes some audible sound.

Now with the reactance change around the RLC circuit the signal sent to speaker will no longer be the same as before, because of the sound produced by the speaker will be loud now. Impedance RLC changes making the signal to change resulting in variation to sound generated in speaker.

GENERAL PICTURE OF THE PROJECT

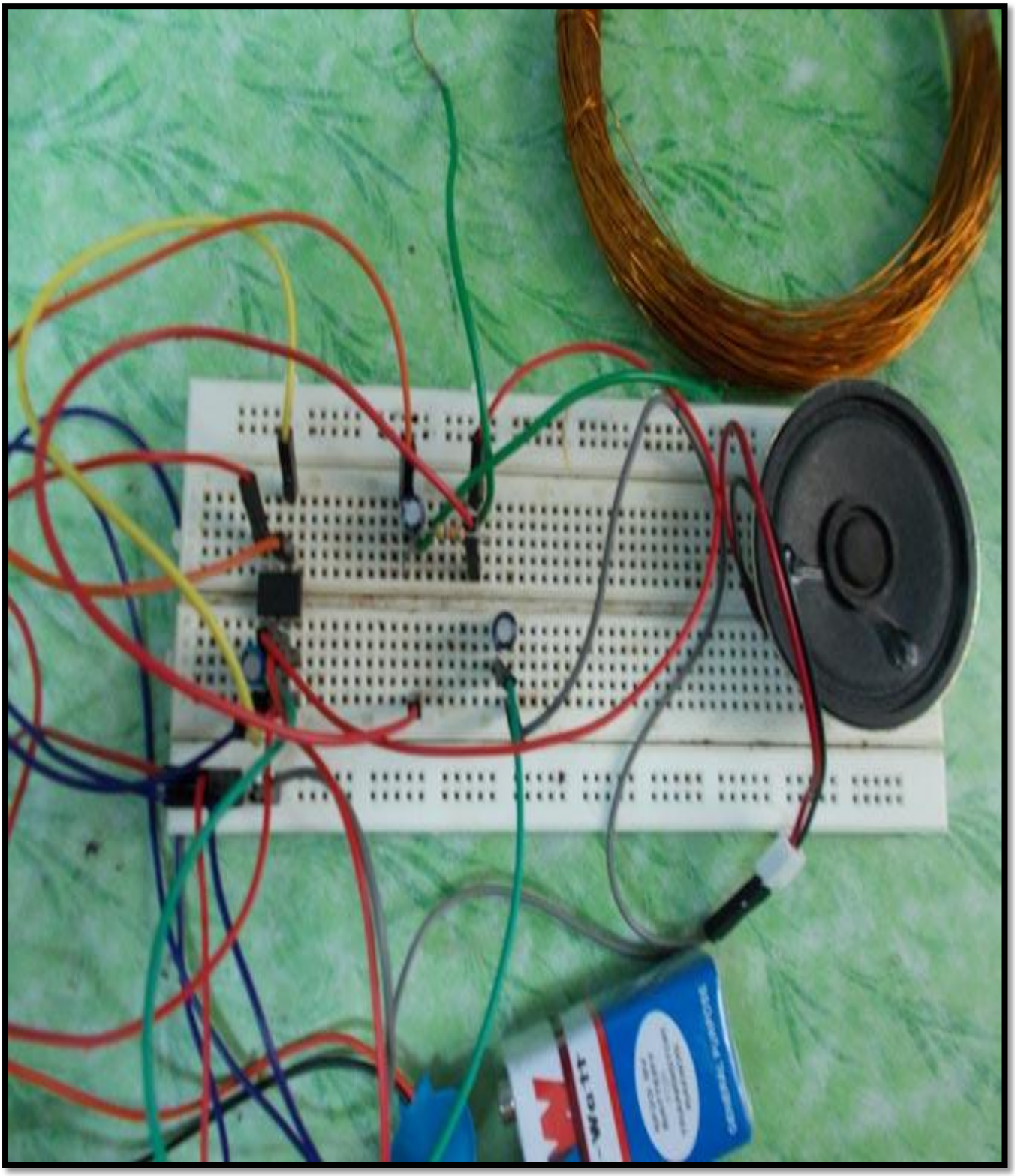

Fig 3(d): General picture of project

CHAPTER 04

PROJECT DESCRIPTION

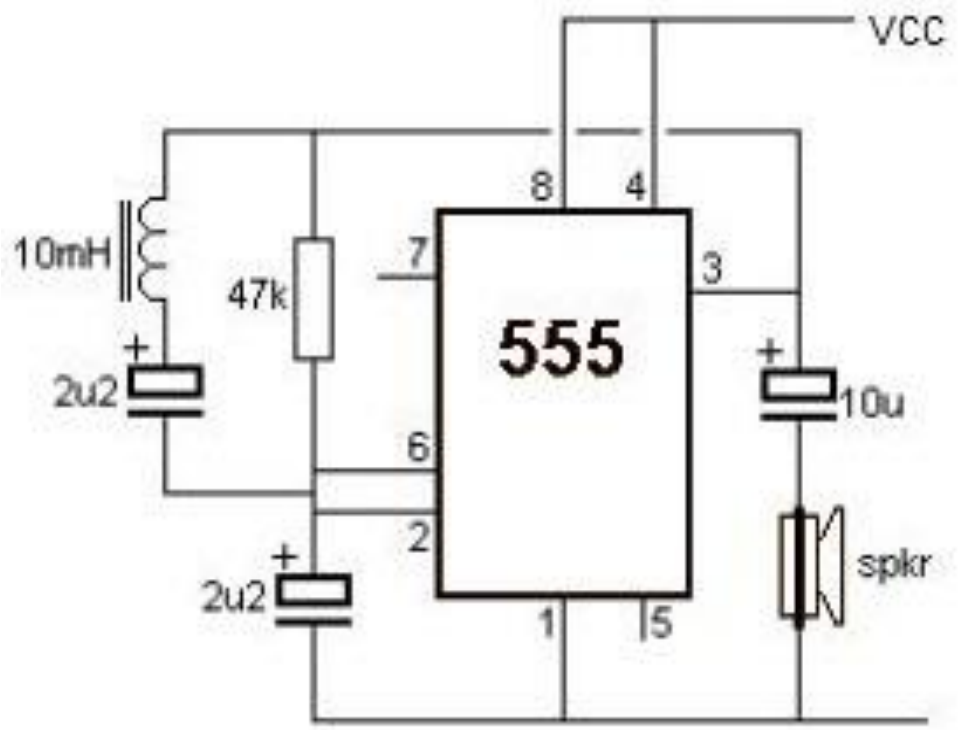

Fig 4(a): Circuit diagram of metal detector using IC555

The project done is a metal detector using the 555 IC .The main components of the circuit includes the IC and the coil that acts as the inductor. The connections made are depicted in the above fig 4(a).

- The first and the important step in constructing this circuit is the making of the coil that acts as the inductor.
- The coil is made using enameled copper wire, this copper coil was made by winding it in such a manner that it has 10cm diameter and the number of turns is 160.
  The coil formed is an air core coil and the inductance is around 10mH.
- The circuit connection is made as per the circuit given above and the coil is used in place of the 10mH inductor shown.
- Now on connecting the circuit to the source(battery), current flows through the coil. When this current flows through the inductor, a magnetic field that is proportional to this flow of current is developed around it.
- Because of the inductance, ic 555 will vibrate at a specific frequency in the normal state and because of this there is a light signal that is being fed to the trigger pin of the IC.
- Because of this signal being fed, buzzer makes some audible sound initially.
- Now when the metal is brought near the coil, the magnetic field senses this. This changes the magnetic field than what it was before because the current also changes.

Hence the inductance of the coil increases, the capacitor starts charging quickly, thereby feeding the trigger pin of the IC.

- This change in the inductance will result in change in the duty cycle of the output pulse which goes to the buzzer.
- Because of this change in frequency of oscillator we can observe the change in tone of the buzzer.
- So to sum it up:
  1) Normal sound of the buzzer indicates no metal.
  2) Abnormal sound of the buzzer indicates that a metal is detected.

CHAPTER 05

HARDWARE DESCRIPTION:

- **Capacitors** (10uF, 2.2uF)
- **Resistors** (47k)
- **Coil Inductor** (10mh, formed by an air coil of around 160 turns of copper wire)
- **9V Battery**
- **555 timer IC**
- **8 ohm Buzzer**
- **Breadboard**
- **Jumper wires**
- **Connecting wires.**

1. 555 TIMER IC :

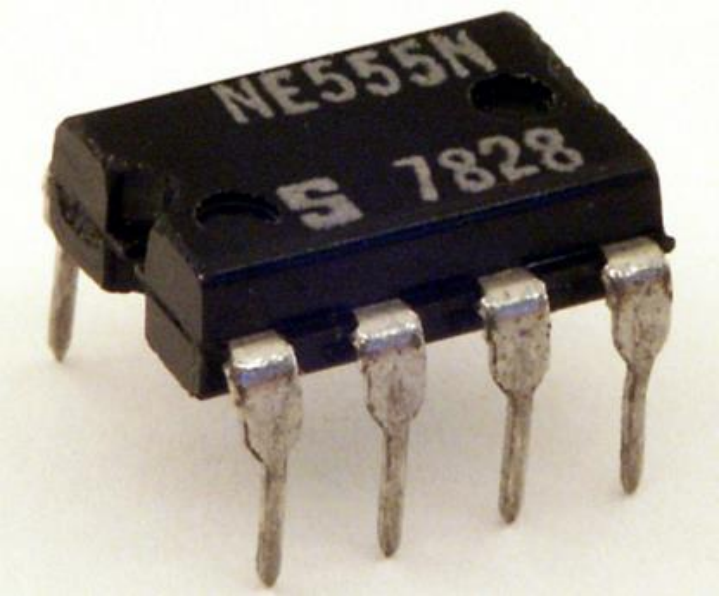

Fig 5(a): Picture of the 555 IC

This IC is the major component of the project.

The picture of the 555 timer is shown in the fig 5(a) above. It is a commonly used to design many circuits to produce types of output waveforms; these ICs an integral part of most electronics project. This was an IC that was invented by Signetic Corporation and it was called as NE555 timer. These ICs are used as astable, monostable and bistable multivibrators in, DC-DC converters, analog frequency meters, voltage regulators, digital logic probes, temperature controlled and measurement devices.

The arrangement followed in the IC is the dual inline arrangement with for pins in each line (on each side) thereby having 8 pins in total. Therefore it is an 8 pin IC having ground and vcc source. The IC 555 timer is a type of chip used in different applications like an oscillator, pulse generation, timer. The creation of this timer can be done by opting various electronic and electrical components like resistors, transistors, diodes and a flip flop.

The operating range of this IC ranges from 6-12 V DC supply. The functional parts of the 555 timer IC include flip-flop, voltage divider and comparators. The main function of this IC involves generating an accurate timing pulse.

In the monostable mode, the delay of this IC is controlled by the external components like a resistor and capacitor. The two resistors and one capacitor control the duty cycle and frequency in the astable mode.

555 Timer IC Pin Configurations

- **Diagram depicting the pin nos and its details:**

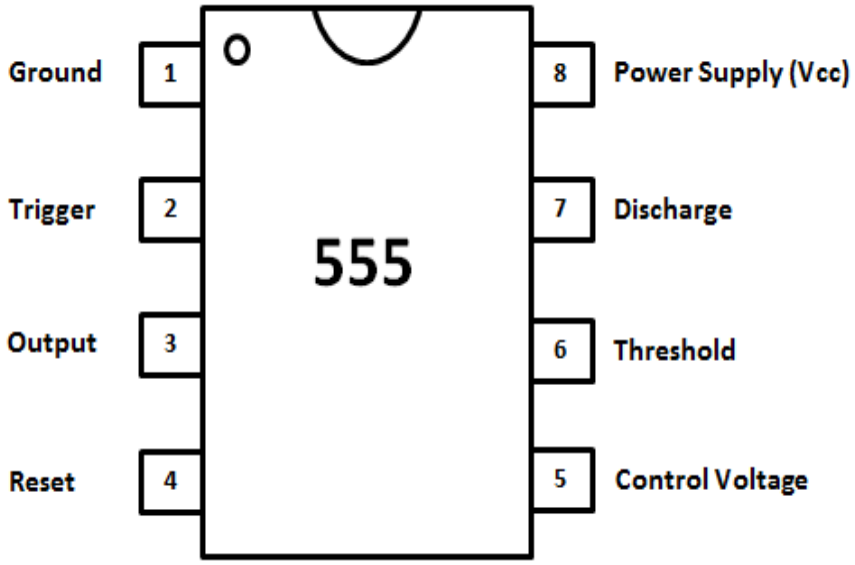

Fig 5(b): Pin diagram of the 555 IC

The 555 timer IC consist of 8-pins where each pin has some different function as can be referred from the above fig 5(b). The pin configuration of this IC is given below:

- **GROUND PIN**

The pin 1 is a GND pin which is used to supply a zero voltage to the IC.

- **TRIGGER PIN**

The Pin-2 is a trigger pin which converts the FlipFlop from set to RST (reset). The output of the timer depends on the amplitude of the external pulse which is applied to the trigger pin.

- **OUTPUT PIN**

The Pin-3 is an output pin. (in this circuit the output signal from this pin is passed to the buzzer). This is the pin where load is connected. It can be used as source/sink and drive up to 200mA current.

- **RESET PIN**

The Pin-4 is a RST pin. The negative pulse is applied to this pin to disable or reset and false triggering can be avoided by connecting this pin to VCC**.**

- **CONTROL VOLTAGE PIN**

The Pin-5 is the control voltage pin used to control the pulse width of the output waveform and also the levels of threshold and the trigger. On applying external voltage to this pin, the output waveform will be modulated.

- **THRESHOLD PIN**

The Pin-6 is the threshold pin, when the voltage is applied to threshold pin, it contrasts with a reference voltage. The set state of the FF depends on the amplitude at this pin.

- **DISCHARGE PIN**

The Pin-7 is the discharge pin, when the output of the collector discharges a capacitor between the intervals, then it toggles the output from high to low.

- **SUPPLY TERMINAL**

The Pin-8 is the voltage supply pin which is used to supply the voltage to the IC with respect to the ground terminal. This is being connected to VCC.

Inside structure of the IC:

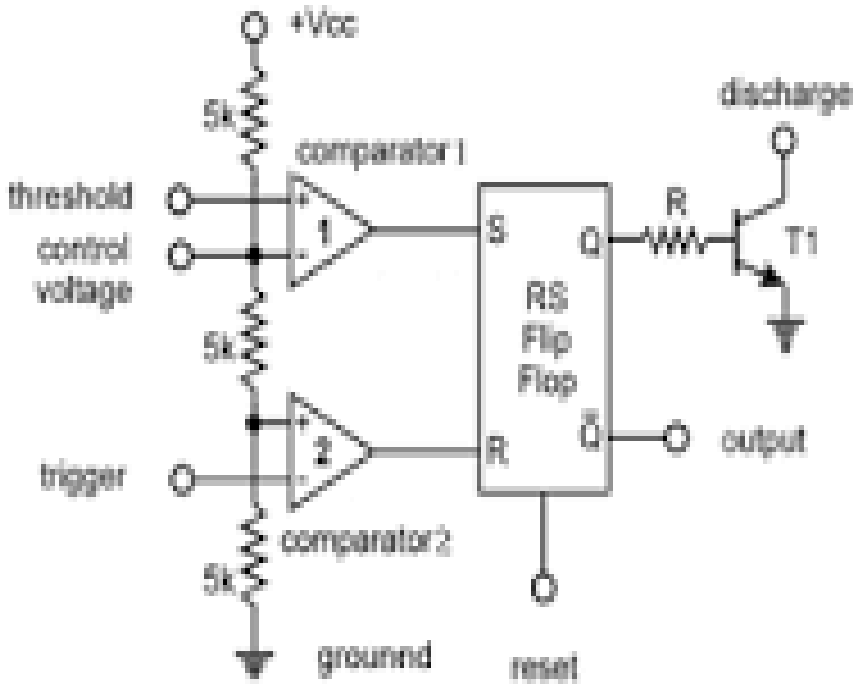

Fig 5(c): Circuit depicting inner IC structure

The above picture depicts the inner structure of the IC 555 , the components inside it and way they are placed.

- As can be seen above, it consists of four resistors in total , out of which three of them are 5K Ohm resistors thereby giving the IC its name “555 IC”. It also contains 2 comparators, an SR flip flop, a discharge transistor and an output stage.
- There is a voltage divider circuit that is formed which consists of the three identical resistors that help in creating reference voltages at 1/3 and 2/3 of the voltages that is supplied.
- The comparators used here are basically operational-amplifiers used in the comparator operation. They are used to compare two analog input values(voltages) that are appied to positive which is the non-inverting terminal and to the negative which is the inverting terminal.
- This is in such a way that when the input value of voltage applied at the non-inverting terminal is greater than that applied to the inverting terminal, the comparator gives an output that is 1.

- Similarly, when the input value of the voltage applied at the inverting terminal is greater than that applied to the non-inverting terminal; the comparator gives an output that is 0.
- The negative (inverting input) terminal of the first comparator has been connected to the control pin while the positive (non-inverting input) terminal has been connected to the threshold pin.
  The negative (inverting input) terminal of the second comparator has been connected to the trigger pin while the positive (non-inverting input) terminal has been connected to the 1/3 reference voltage of the voltage divider.
- So these three pins those being: control, threshold and trigger, manage the output that is being fed to the set(S) and reset(R) inputs of the SR flip flop that is present.
- When set input is 1 and the reset input is 0, the flip flop gives us an output 1; similarly when the set input is 0 and the reset input is 1, the flip flop gives an output 0. In addition to this the flip flop can be put in the reset mode by using the external reset pin. This is the pin that overpowers the two inputs thereby in this way; the whole timer can be rest at any time.
- As can be seen in the diagram above, the output of the flip flop that is present has been connected to the transistor that connects the discharge pin to the ground.

Operating Modes of 555 Timer IC

The IC 555 timer operates in three modes, they being; astable mode, monostable mode and bistable mode. Each mode of operation has been represented with a circuit diagram and their respective output.

Astable Mode Operation:

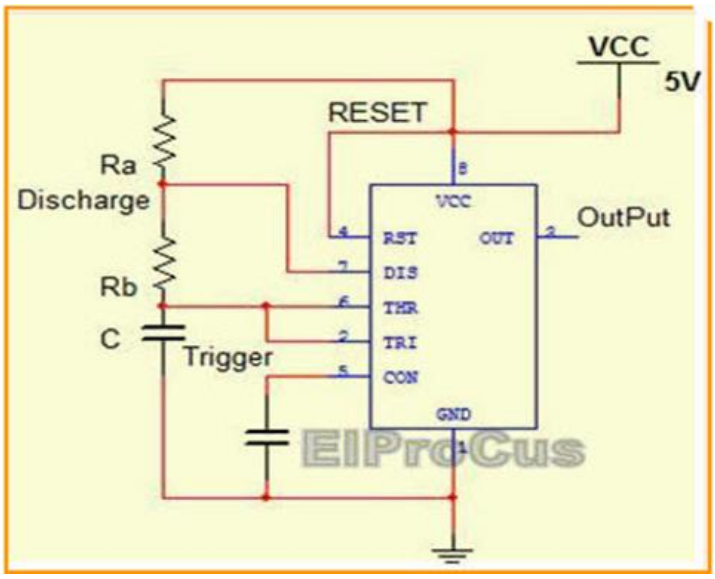

Fig 5(d): Circuit diagram of astable mode of IC

In this mode, the 555 timer acts as an oscillator that produces square waves. The frequency of the wave can be altered by changing the values of two resistors and a capacitor connected to the chip. In this mode, the output cycles go on and off periodically. Here the charging and discharging of the capacitors depends on a specific voltage. The circuit diagram of the 555 timer in astable mode is shown in the fig 5(d). The voltage on being applied to the below circuit, charges the capacitors continuously through two resistors and pulses are generated continuously. In the following circuit the pins 2 & 6 are shorted together for re-activation the circuit. When the o/p trigger pulse is high, then capacitor in the circuit totally discharges. Long time delays are obtained by using the higher values of the resistors and capacitors being used.

Monostable Mode Operation

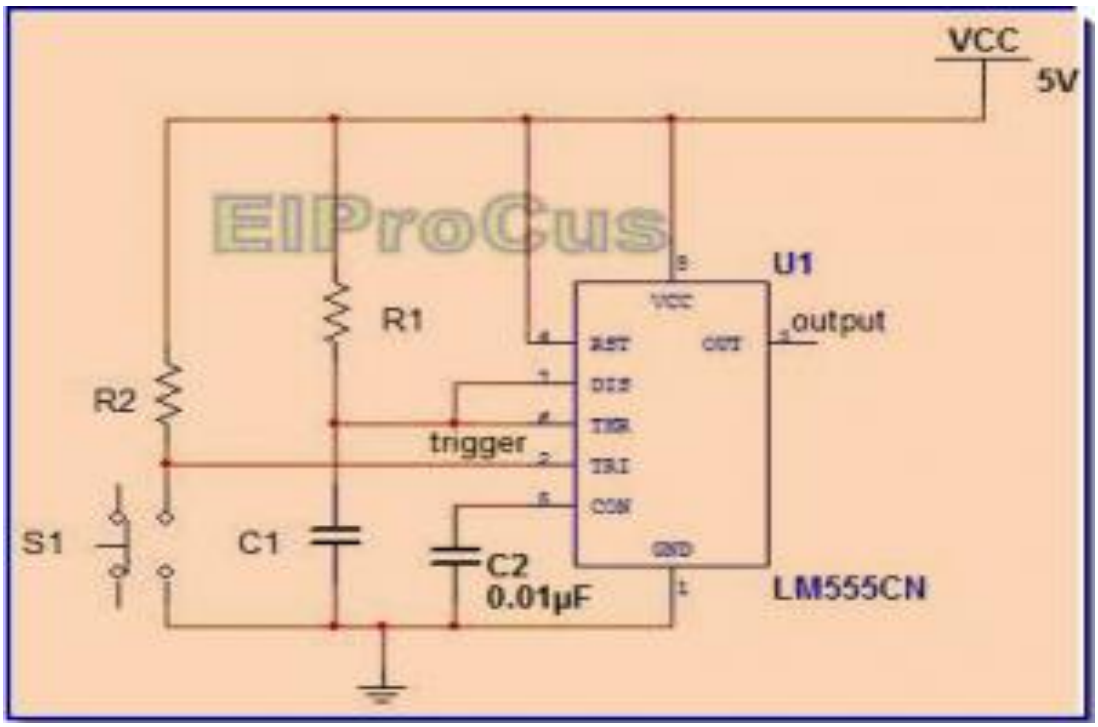

Fig 5(e): Circuit diagram of monostable mode of IC

The circuit as shown in fig 5(e) generates single pulse on getting an indication from the input of the trigger button in this mode. The pulse is sometimes called as one-shot pulse.

This trigger pulse starts a timing cycle, which causes the output to change its state at the time of timing cycle and continues in the second state which is decided by the time constant of the capacitor and resistor until it returns to its original state. It will continue in this state until another i/p signal is received. When both the transistor and capacitor are shorted then this state is called as a stable state. When the voltage goes below at the second pin of the 555 ic, the output becomes high and this high state is called as the quasi stable state. The Pulse duration depends on the values of the resistor and capacitor. When an activating pulse is applied to the i/p of the circuit through a push button, then the capacitor gets charge and the timer circuit extends a high pulse, then it remains high until capacitor totally

discharges. When it is necessary to enhance the time delay, then higher rate of capacitor and resistor are required.

Bistable Mode Operation

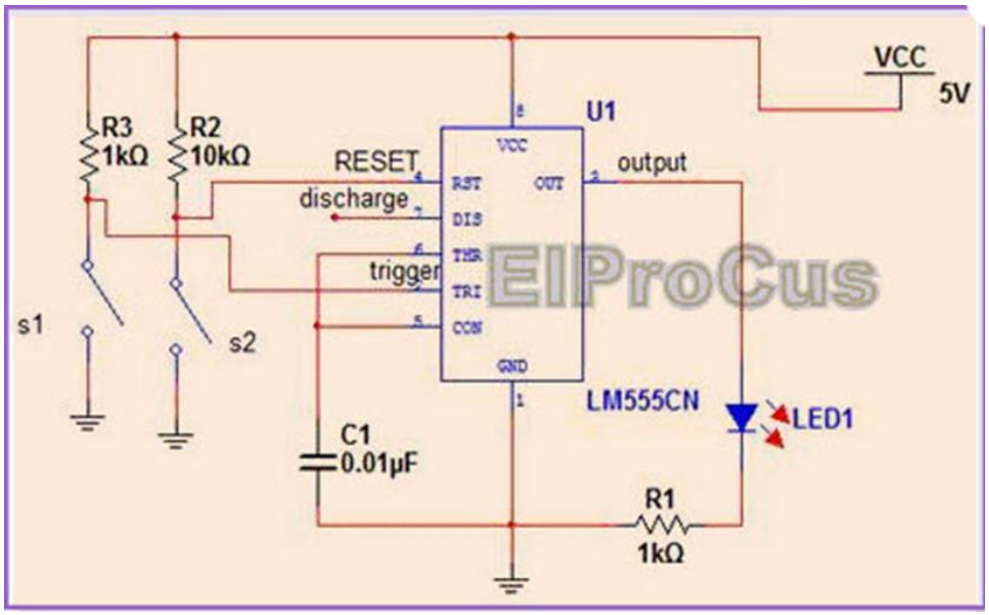

Fig 5(f): Circuit diagram of bistable mode of IC

This mode called the bistable mode has two stable states: high and low. This state is also called the Schmitt trigger. The circuit diagram is as per the given fig 5(f).When the input of trigger (trigger input) is taken as low, the output of the circuit goes to the high state. The reset input on being low, the output of the circuit goes into the low state. When configured, pulling the trigger momentarily to ground acts as asset and transitions the output pin to the vcc. Pulling the reset input to ground acts as reset and transitions the output pin to the ground. No timing capacitors are required in a bistable mode configuration. Pin 7 discharge is left unconnected or maybe used as an open collector output. The output signals of low and high state signals are controlled by reset and activating the input pins, not by the charging and discharging of the capacitors.

2.**Resistor** :

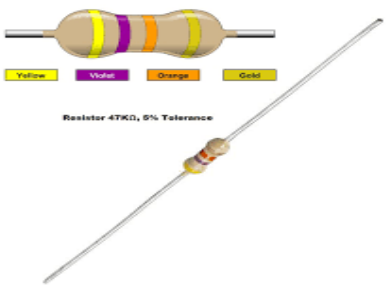

Fig 5(g): Picture of 47K resistor

The metal detector circuit constructed makes use of a 47K resistor.

These components called resistors are circuit components that exhibit electrical resistance when incorporated in the circuit. They are passive devices, this is so because they contain no source but just attenuate the voltage or current that passes through them.

Attenuation results in electrical energy being lost in the form of heat because the resistor resists the flow of electrons through it. There is a potential difference that is required between the two terminals of a resistor for current to flow. This potential difference compensates for the energy that is lost. These resistors when used in DC circuits, the voltage drop across them are measured across the two terminals.

The various types of the resistors that exist are the linear devices that produce a voltage drop across themselves when an electrical current flow through them since they obey Ohm's Law and different values of resistance produces different values of voltage or currents.

3.Capacitor

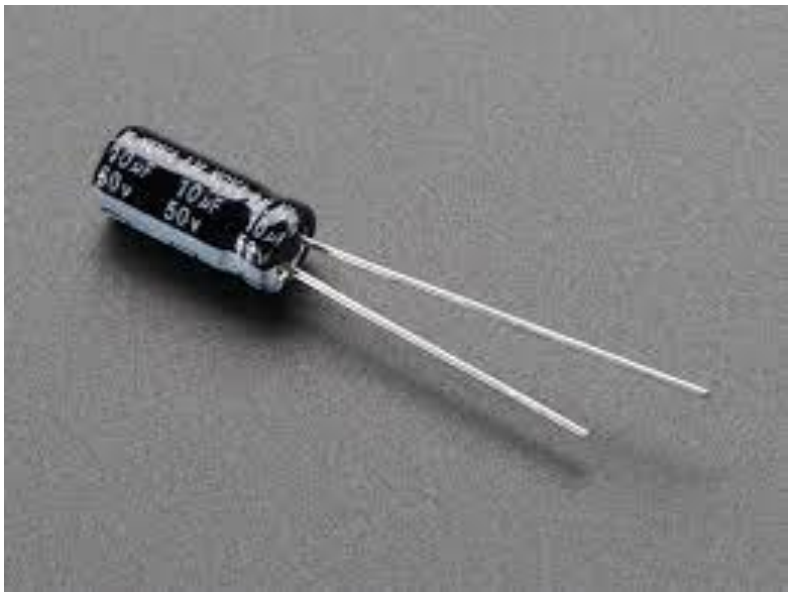

Fig 5(h): Picture of electrolyte capacitor

The capacitors used in this circuit are polarized electrolytic capacitors of 2uF and 10uF.

These components called capacitors are those devices that store electric charge. They possess the property called capacitance which is the amount of electric charge that is stored in the capacitor at voltage of one volt. These devices are made of two conductors called plates , separated by a dielectric material. The plates get accumulated with the electric charges when they are connected to the power source. One of the plates has positive charge while the other accumulates negative charge.Farad (F)is the unit in which capacitance is measured. The capacitor short circuit in alternating current circuits and disconnects current in direct current circuits.

4.**Buzzer :**

Fig 5(i): Picture of 8 ohm resistor

The buzzer or beepers also called as speakers sometimes are audio signaling devices that produce sound when signal passes through it.

It is a piezoelectric buzzer with an integrated oscillator; it is simply the assembling in a single housing; a piezoelectric transducer and an electronic control. Everything is then supplied with a simple dc voltage between 3 and 20 volts, and requires a current of 10 and 30mA. The implementation of such a buzzer becomes as easy as using a electrochemical buzzer. The picture of the buzzer is shown in fig 5(i).

An 8 ohm buzzer is used in this circuit to alert the detection of any metal object.

5.**Battery :**

Fig 5(j): Picture of 9 volt battery

The battery used in this circuit is a nine volt battery as shown in fig 5(j).

The batteries are the source that powers the circuits. There are many types of batteries, but the ones used here are those that have a rectangular prism shape with rounded edges along with a polarized snap connected to the top of it. The two terminals (positive and ground) of the battery are attached to the ends of the snap connector;these terminals will be used in the circuit for connection purposes. This battery is used in the circuit because the ic needs around 6 to 12 volts.

6.Coil (Inductor) :

fig 5(k): Air core coil

Fig 5(l):Ferrite core coil

Inductors are one of the important components used in this circuit. the figure 5(K) shown above is an air core coil and the figure 5(l) is a ferrite core coil. They are also passive components that store electric energy in form of magnetic energy. The inductor used in this circuit is an air core inductor. It

consists of a copper coil made by winding 160 turns of copper wire. When electricity flows into this coil, magnetic field will be generated. These inductors are also called as coil, choke or reactor. Inductors block AC while allowing DC to flow because it only resists change in current.

7. Breadboard:

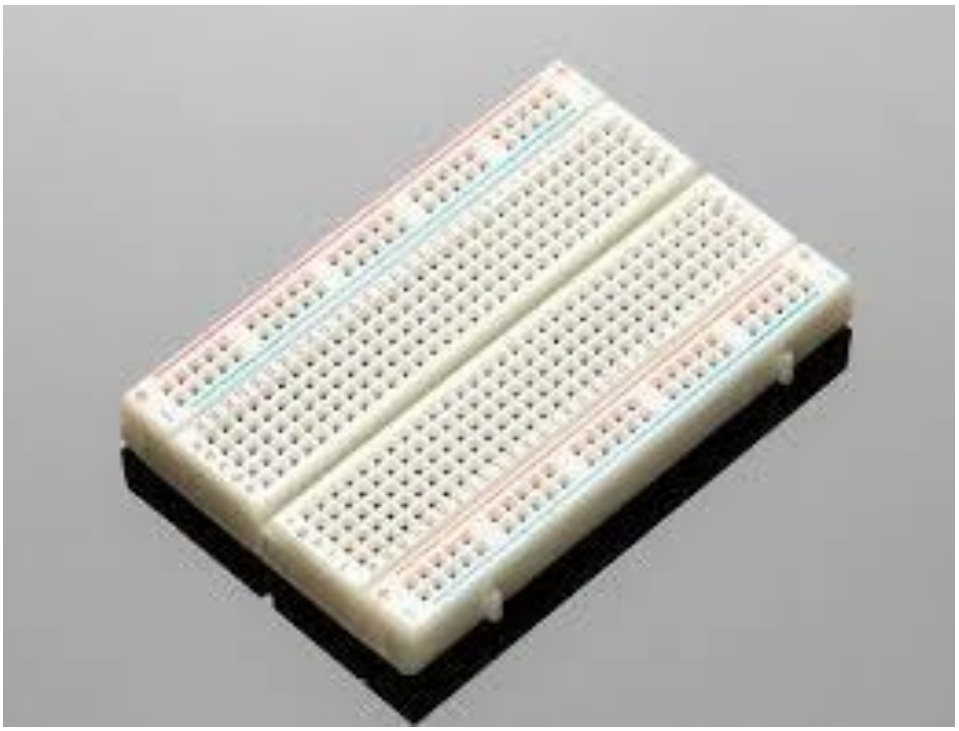

Fig 5(m): Picture of breadboard

The breadboard represented in fig 5(m) is a base used for constructing circuits on the base.

This breadboard that the picture depicts is a solderless breadboard also called as the terminal array board.These are the boards that are required for the prototyping of various electronic systems ranging from analog to digital circuits and also complete CPU. These are made white plastic, solderless material.

Since it is a board that does not require soldering (solderless) it is a reusable board and it becomes much easy to use for circuit design,for the creation of temporary prototypes and for the purpose of experimenting. On usage of other boards like stripboard, pcb with similar prototyping , the boards cannot be used for experimenting as it is not reusable. And this is one of the reasons why these solderless boards are popular amongst the students in usages

pertaining to circuits and technological constructions. In this project, breadboard serves as a base to house the various equipments used such as resistors, 555 ic, capacitors.

8. Jumper Wires:

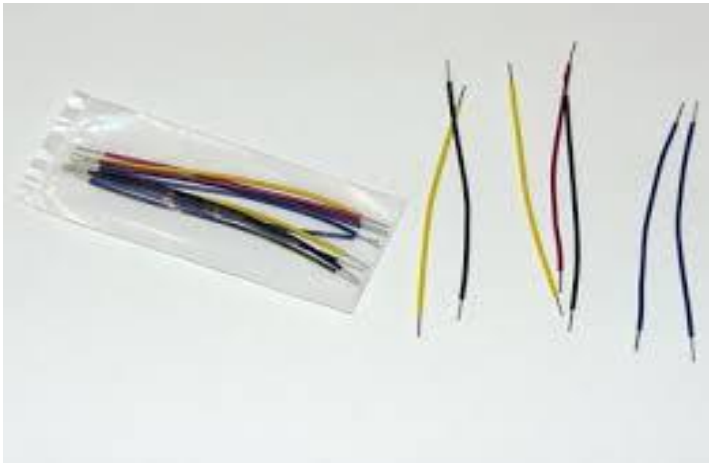

Fig 5(n): Picture of jumper and connecting wires

The wires shown in the figure 5(n) are the connecting wires and also the jumper wires. They are primary elements used in circuit construction that help you connect one part of a component to another.

There are various types of jumper wires but the type that is used in this circuit construction is male wires. These jumper wires and connecting wires have connector pins at their respective ends, and these ends enable them to be used to connect two points to another point without having the need to use soldering. They are used on breadboards at the time of building circuits on them . They are used with breadboards and other tools of prototyping since it is easier to make connections and make the necessary changes or alterations on the occurrence of any wrong connections. The similar facts apply to the connecting wires that have been used as well.

These above listed components are the ones that have been used for making the circuit.

CHAPTER 06

RESULTS

The metal detector consists of a search coil which senses the presence of the metal and increases the inductance and overall impedance of the detecting loop. The current flow increases , and the capacitor gets charged rapidly hence feeding the trigger pin of the IC. The output is obtained from pin 3 which is passed to the load buzzer and a change in the tone of the buzzer is being obtained:

- Normal tone of the buzzer indicates the absence of metal.
- Abnormal tone (change in tone) of the buzzer indicates the presence of the metal nearby.

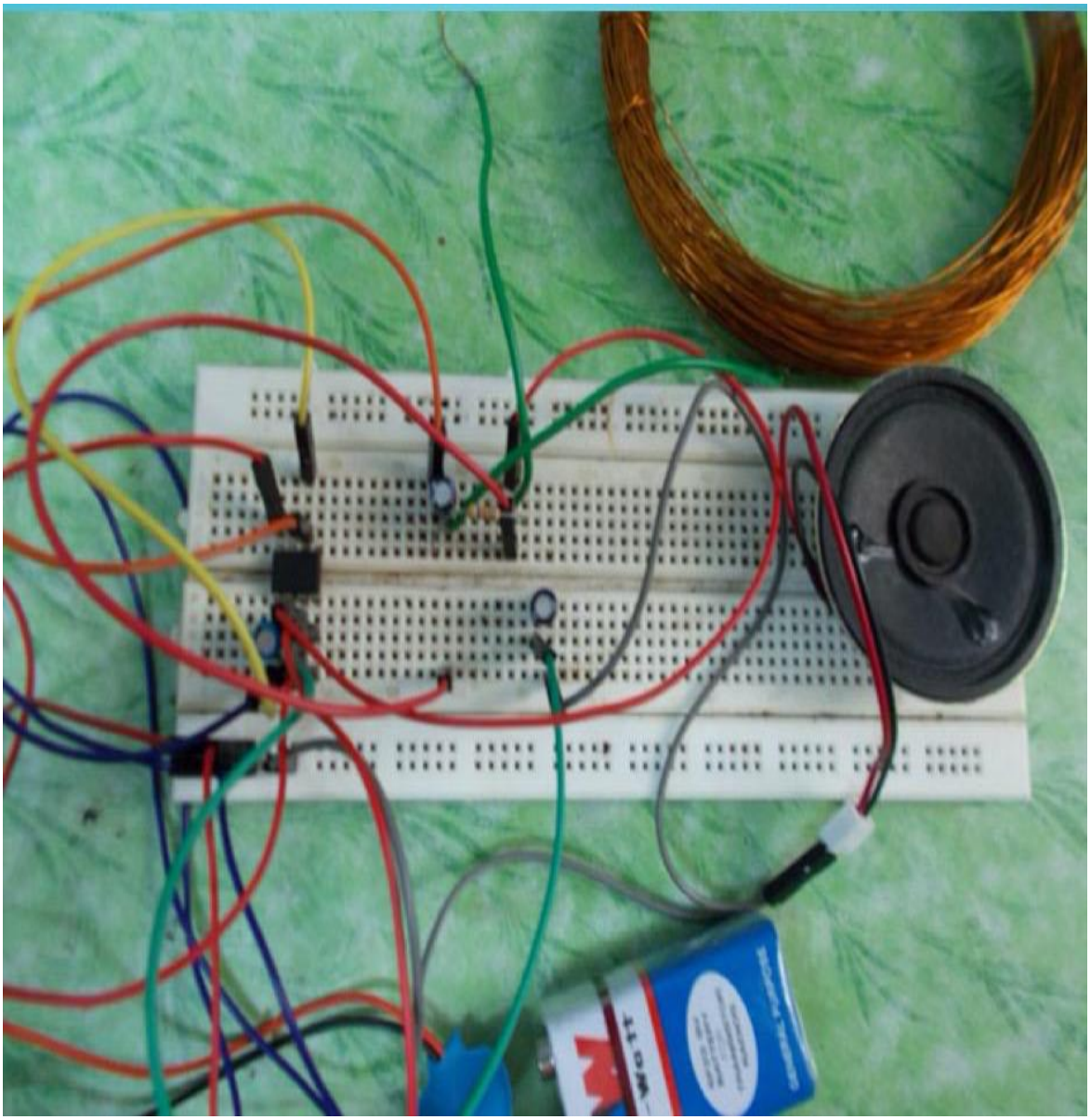

Fig 6(a): Picture of project

CHAPTER 07

DISCUSSIONS

- Nowadays, metal detectors can pinpoint metals very accurately and hence they have become tools that are indispensable in the field of mining, engineering, military and mineralogy.

- From the 19th century models that were crude , there was a person who brought about the transition to modern detectors and that was Gerhard fisher during the year 1930's and he got his metal detector patented.

- Designs that were being incorporated in the detectors used these days were more convenient than those used in the earlier days.

- To detect the metals those that are present under the ground , resonating coils were used in the designs .

- Electromagnetic induction is used by the metal detectors of the modern day design to detect the presence of the metals.

  But the model being constructed here is a basic model which when observed, the following observations can be made.

- On testing the constructed metal detector, it was found that :

  1) The buzzer buzzes with low frequency when no metal is near the coil.

  2) The above observation is because there is no metal nearby but there is a light current passed to the ic which results in the sound of the buzzer.

  3) The sound frequency of buzzer increases when a metallic object is brought near the search coil and the sound frequency of the Buzzer increases when the metal is very close to the search coil.

  4) This happens because the moment a metal is placed near the search coil of the buzzer, the magnetic field near the coil changes, thereby there is a change in the inductance and also the current. Thereby, the capacitor charges fast and signal is fed to the ic hence we observe the corresponding outputs.

     This is an agreement with principles of electromagnetic.

- The search coil's field is more concentrated at its centre and the field decreases with distance from its centre.

- The frequency of oscillation is determined by resonance frequency of parallel- tuned circuit.

- We observe that the metallic effect of the objects does increase with its size and distance between the metallic object and center of the search coil decreases. This happens because the field becomes more concentrated.

- Generally, the size of a search coil is about 9.5"-11.5" in diameter. However, the search coil used in the project is smaller in size(around 11cm diameter) because power is small and high power is required to use larger search coils.

CHAPTER 08

CONCLUSIONS

A metal detector was successfully constructed using a IC 555 timer.
The IC 555 timer being a circuit which is integrated has its applications in a variety of oscillator,timers and oscillator applications. It is used to generate time delays as an oscillator and as a flip-flop element.

The change on the field appears as the sound frequency of buzzer varies. This detector detects metallic objects around it.

The advantages of the detector are:

1) Since the detector is constructed using an IC 555 timer, its circuit is comparatively easier.
2) The metal detector is compact and has been developed by considering the need of a low-cost metal detector.

The limitations of the detector are :

1) It cannot differentiate between several types of metals.
2) The detector detects certain types of metals (which include steel,iron,magnets,aluminium, large amounts of copper and gold).
3) The detection region is small.

FUTURE WORKS

There are many updates that could be applied in future, to this metal detector made using IC 555 timer to solve the limitations of this detector and get detector that is more efficient to use.

Possible modifications are :

1) Increasing the detection region of the metal detector. This can be obtained using high power to supply to the circuit.

2) Use Headset as an indicator, this also needs power to be increased.

3) Update the detector to let it determine the type of metals it detects and another technology is used to accomplish this.

CHAPTER 09

FUTURE SCOPE

The metal detectors have a wide range of scope as seen below:

- Microchips can be used to enhance these detectors. The commonly used chip used by the metal detectors is the 7400 logic. These are incorporated with tiny pins which when fed with signals controls the metal detectors.

- Metal detectors with detection region increased will be used for better metal detectors.

- Lately, they can be widely used by improving them with the usage of the 18 pin IC, which is a better chip that can allow an individual to detect objects upto a few more inches away. Individuals familiar with electronics can design one in their garages by accumulating some of those chips from the radio shacks and use them in assembling them into a metal detector to be able to search for the same thing.

- Will be widely used in the security detection system market.

- Will be used to develop an efficient algorithm to improve accuracy of metal detector.

APPENDIX A

FLOWCHART OF WORKING MECHANISM

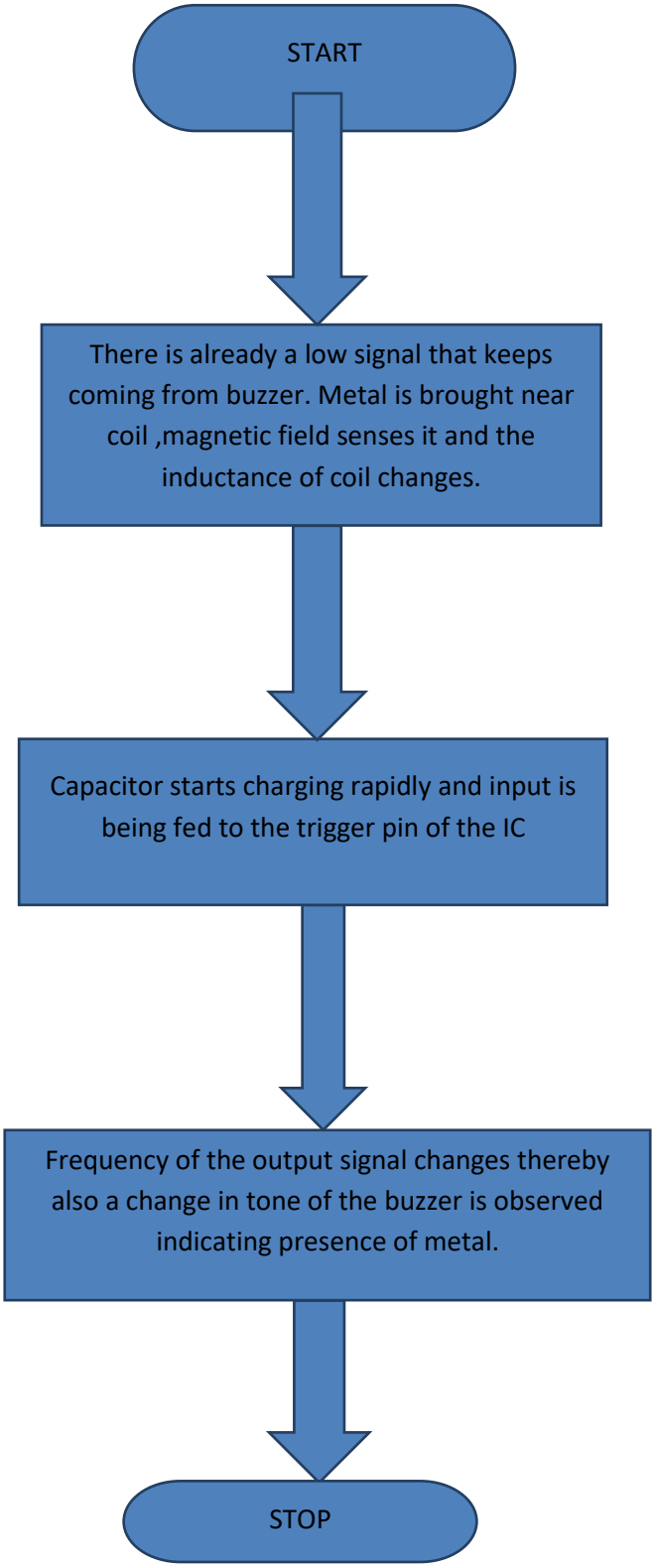

Fig A(a): Flowchart of working mechanism

APPENDIX B

FLOWCHART SHOWING THE STEPS OF MAKING THE COIL

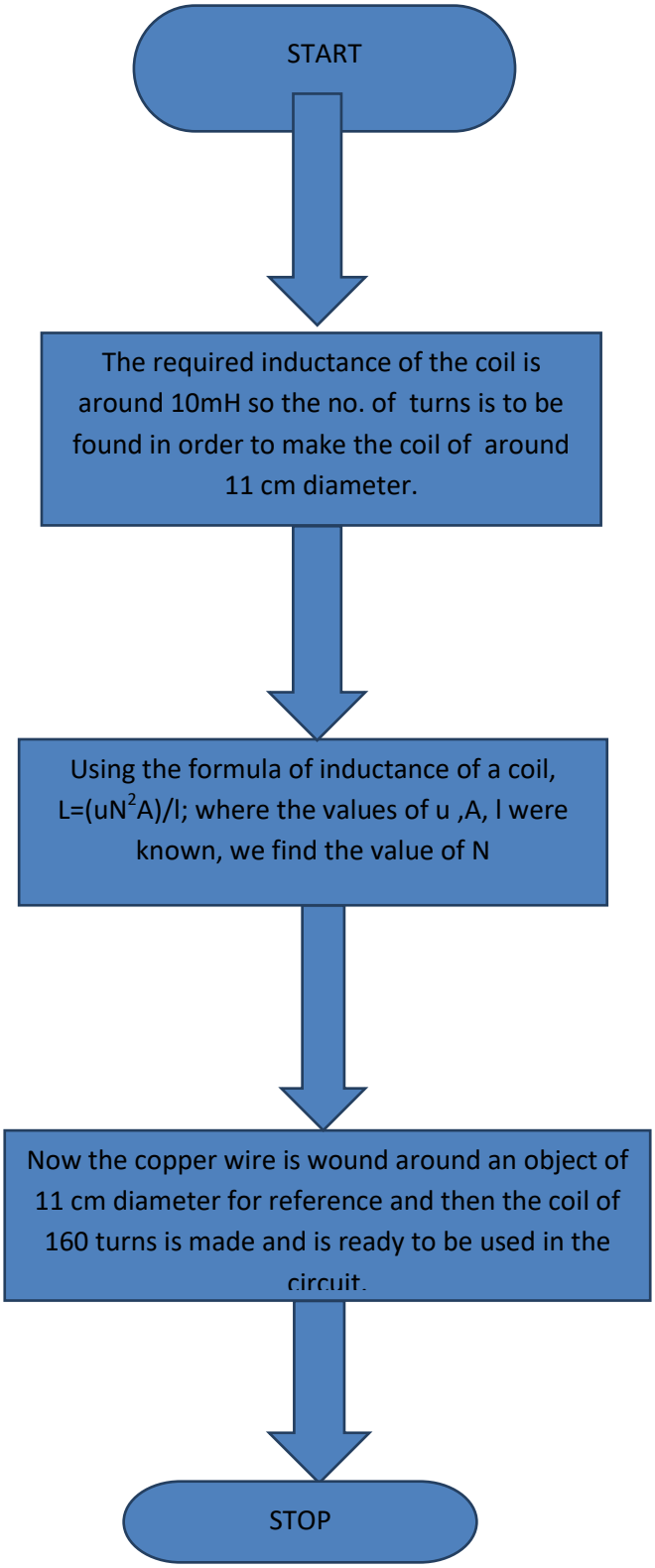

Fig A(b): Flowchart of making of the coil

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