A MOBILE PHONE JAMMER SYSTEM USING GSM900 FREQUENCY

Report submitted to

Kampala International University in partial fulfillment

Of the requirement for the award of the degree

Of

Bachelor of Science

In Telecommunication engineering

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APPROVAL

I have read and hereby recommend this project report titled **a mobile phone jammer system using GSM900 frequency** for acceptance by Kampala International University in partial fulfillment of the requirements for the award of the degree of Bachelor of Science in Telecommunications Engineering of Kampala International University.

Signature .... Date ....

Prof. Jang Chol U

ACKNOWLEDGEMENT

Our sincere gratitude go to our dear supervisor Prof. Jang Chol U who encouraged and guided us with the best approach on how to come up with this project report.

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DECLARATION

We hereby declare that this project report with a project title Global System for Mobile Communications (GSM) mobile phone jammer is our original and no any other institution has ever presented it in partial fulfillment of the requirement for the award of degree of Bachelor of Science in Telecommunications Engineering

Signature……………………………………..   Date……………………………..

Okello Walter

Signature……………………………………..   Date………………………………

Mohamed Daud

ABSTRACT

Due to technological advancement in the mobile phone industry, mobile phones have become a very vital communication device today with number of end user applications embedded. For instance; Games, online videos, e-commerce, social media like Facebook, whatsapp, twitter, to mention but a few. This has resulted to the use of mobile phones everywhere which become disruptive while praying, studying, in meeting, in court room, driving, examination rooms, etc.

The main purpose of this project was to design and build a system that can block the use of mobile phone by transmitting radio waves of the same frequencies as that of the mobile phone causing interference between mobile phone and the Base Transceiver Station, hence the mobile phone displays "NO NETWORK" on the screen so that it can be installed in places where the use of mobile phone is not required. Although different cellular systems process signals differently, all cell-phone networks use radio signals that can be interrupted or interfered. GSM technology used in digital cellular system and PCS-based systems, operates in the 900-MHz, 1800-MHz and WCDMA 2100 bands in Europe and Asia and in the 1900MHz band in the United States are some of the mobile phone networks. Jammers can broadcast on any mobile network frequency and are effective against WCDMA, GSM and DCS. This project discussed the design and development of GSM Mobile jammer which can avail the solution to problems stated earlier.

To come up with the above system, we carried out researches that enabled us to attain appropriate designs and there after the design, we were able to construct/build different parts of the system and interconnect them as one unit. Finally the system was tested for functionality, results were arrived at which fulfilled the concept of jamming by releasing same frequency as the one from BTS.

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ABBREVIATION

ITU	International Telecommunications Union
GSM	Global System for Mobile Communications
MTN	Mobile Telephone Network
UTL	Uganda Telecom Limited
BTS	Base Transceiver Station
UCC	Uganda communication Commission
RF	Radio Frequency
IF	Intermediate Frequency
MTS	Mobile Telephone Services
IMTS	Improved Mobile Telephone System
AMPS	Advanced Mobile Phone System
TDMA	Time Division Multiple Access
CDMA	Code Division Multiple Access
EMF	Electromagnetic Field
SNR	Signal-to-Noise ratio
DOS	Denial-Of-Service
VCO	Voltage Controlled Oscillator
AC	Alternating Current
DC	Direct Current
FM	Frequency Modulation

CHAPTER ONE:

1.0 Introduction

GSM is an acronym defined by International Telecommunication Union (ITU) as "Global System for Mobile communications". It is a digital technology that mobile telecommunications industry uses to provide mobile communication networks.

Here in Uganda there are many Telecommunication companies that use the GSM network for example; MTN, ORANGE, AIRTEL, UTL, etc. These therefore create the wide use of mobile phones and these could create some problems as the sound of ringing becomes annoying or disrupting. This can happen in some places like conference rooms, court room, libraries, lecture rooms and mosques. One way to stop these disrupting ringing/use of mobile phones is to install a device in such places which disallows/inhibits the use of mobile phones, i.e., make them unreachable. Such a device is known as a **GSM mobile phone jammer** which is basically an electronic countermeasure device.

A GSM signal jammer is a device which transmits same Radio Frequencies of high power as the mobile phone hence disrupting communication between mobile phones and the Base Transceiver Station (BTS). The transmission of same frequencies by the GSM signal jammer device creates interference between the mobile phones and the (BTS) resulting into no signal situation and this is known as "Denial of service Attack".

This device consists of three main sections which include; the power supply, the Intermediate Frequency section and the Radio Frequency section. Of which each of these sections was discussed into details as we shall see later on.

1.1 Background

Communication jamming devices were first developed and used by military. This interest comes from the fundamental objective of denying the successful transport of information from the sender (tactical commanders) to the receiver (the army personnel), and vice-versa. Nowadays, mobile (or cell) phones are becoming essential tools in our daily life.

The technology behind the GSM mobile phone jammer is quite simple. The jamming device broadcasts an RF signal in the frequency range reserved for cell phones that interfere with the cell phone signal, which results in a "no network available" display on the cell phone screen. All phones within the effective radius of the jammer shall be silenced. It should be mentioned that GSM mobile phone jammers are illegal devices in most countries. According to the Uganda communication commission (UCC), "the manufacturing, importation, sale, or offer for sale, of devices designed to block or jam wireless signal transmissions is prohibited". On the other hand, all the equipment that is intended for use in public radio and telecommunication networks, provided it meets national regulations and requirements, is granted what is known as Type Approval. Type approval of radio and telecommunications equipment in Uganda is defined as one of the functions of the Uganda Communications Commission under the Communications Act, Cap 106 Laws of Uganda and the regulations made there under (specifically the UCC Regulations of 2005). However our project does not meet the national regulations and requirements. We should therefore take into account that this project was solely presented/ done for educational purpose in Kampala International University. There is **no** intention to manufacture or sell such devices in UGANDA, or elsewhere.

1.2 Problem Statement

Due to the advanced improvement on technology, mobile phones have become a very vital communication device today with number of end user applications embedded. For instance; Games, online videos, e-commerce, social media like Facebook, whatsapp, twitter, to mention but a few.

This has resulted to the use of mobile phones everywhere which become disruptive while praying, studying, in meeting, in court room, driving, examination rooms, etc. It was therefore necessary to take appropriate precaution to mitigate the short comings of mobile phones in these places.

1.3 Main objective

To design and come up with a system that would block the use of mobile phone by transmitting radio waves of the same frequencies as that of the mobile phone causing interference between mobile phone and the Base Transceiver Station, hence the mobile phone displays "NO NETWORK" on the screen.

1.4 Specific objectives:

- To build a power supply that will distribute power to other parts of the system for operation.
- To construct the Intermediate Frequency section which helps to generate the tuning frequency signal to be fed in the RF-section.
- To construct the Radio Frequency section which helps to generate RF signal that would create interference with signal from BTS so as to block transmission between mobile phone and BTS.
- To integrate different sub-systems above to form one single system, that is the GSM mobile phone jammer device.

1.5 Scope

This project was designed and constructed for educational purpose only as a partial fulfillment of the requirements for the award of a Bachelor degree in Telecommunications engineering from Kampala International University. No commercial interest was attached to this work as was explained earlier.

The length of time that was taken to come up with this project was from Jan 2015 to July 2015.

In this project we used Global System for Mobile communications (GSM) frequency Band of 900-MHz and we only considered only the down-link frequencies since it uses less power compared to the up-link frequencies.

Some parts of our design were also modified from the existing design to make us achieve our objectives.

1.6 Significances

If this project is put into public consumption it can be useful in the following ways;

- can be able to maintain the complete silence in library and lecture hall

- Can also avoid fraud in examination hall and disturbances in class rooms through the use of mobile phones.
- It can provide complete calm and peaceful atmosphere in places like Hospitals Church, Mosques, court rooms and many others.

1.7 Justification

In the older technology, more expensive measures against cell phones, such as Faraday cages, which were mostly suitable as built in protection for structures. They were originally developed for law enforcement and the military to interrupt communications by criminals and terrorists. Some were also designed to foil the use of certain remotely detonated explosives.

We designed and constructed a system that can consume less power and covers small distance, this is because the system is only meant for our educational purpose and not for commercial purpose or for public consumption. The system is also cheaper and easier to use.

1.8 The report outline

This section is meant to give us the overview of the content of this report. It gives us a brief description the chapters and their contents. This project consists of five chapters as seen below;

Chapter one

It consists of the introduction, background, problem statement, objectives of the project, scope of the project and justification.

In this project, introduction section gives the insight of the GSM mobile phone jammer system and it intends to make reader of this project quickly capture the details of the entire project.

The background is more so like introduction but other details literatures are included.

The problem statement here gives the problem this project is meant to solve. The objective is divided into main and specific objectives. It gives what is required at the end of the project.

The scope of a project is to give the range and coverage of the project activities and where the project output can be applicable.

And justification section is meant to explain how important the project can be to a society.

Chapter two

This chapter is about the literature review. It explains the history of the mobile phone jammer system, the strengths and weaknesses of the existing system. It also talks about the current system which is our system, its strengths and weaknesses.

Chapter three

This is a methodology chapter which explains into details a step by step process on how the project was the project activities were carried out right from the beginning up to the end.

Chapter four

This chapter captures the results got from carrying out different tests, and therefore subjected into discussion.

Chapter five

This chapter is meant to draw conclusion of the entire project, it states whether the project has achieved its primary objectives or not. It also gives the recommendation on what should be done on a project as far as the future works are concerned.

CHAPTER TWO:

LITERATURE REVIEW

2.0 Introduction

A literature review is an account of what has been published on a topic by credited scholars and researcher. The purpose of this is to convey to the reader what knowledge and ideas have been established on a topic and also to point out their strengths and weaknesses. In other words a literature review must be defined by a guiding concept (e.g. project objective, problem statement etc.).

This chapter discusses more about the review of literature of GSM mobile phone jammer. It discusses about the previous history and the present work about this project. The literature review in this paper is based on Internet, journal, books, and articles.

2.1 History of GSM mobile phone jammer

The rapid proliferation of mobile phones at the beginning of the 21st century to nearly ubiquitous status eventually raised problems, such as their potential use to invade privacy or contribute to academic cheating. In addition, public backlash was growing against the disruption brought about due to increased use of mobile phones introduced in daily life.

The initial measures taken against this mobile phones disruption includes Faraday cages, which are mostly suitable as built in protection for structures. They were originally developed for law enforcement and the military to interrupt communications by criminals and terrorists. Some were also designed to foil the use of certain remotely detonated explosives. The civilian applications were apparent, so over time many companies originally contracted to design jammers for government use switched over to sell these devices to private entities. Since then, there has been a slow but steady increase in their purchase and use, especially in major metropolitan areas.

The disadvantages with the Faraday cages are that they are expensive, and require manual operator.

The old mobile phone systems that used with Faraday cages include;

2.1.1 Mobile Telephone Service (1946- 1984)

This system was introduced on 17th of June, 1946. Also known as mobile Radio telephone Service. This was the founding father of the mobile phone. This system required operator assistance in order to complete a call. These units do not have direct dial capabilities.

2.1.2 Improved Mobile Telephone System (1964-present)

This system was introduced in 1969 to replace MTS. IMTS is best known for direct dial capabilities. A user was not required to connect to an operator to complete a call. IMTS units have a keypad or dial similar to what you will find on a home phone.

2.1.3 Advanced Mobile Phone System (1983-2010)

This system was introduced in 1983 by Bell Systems; the phone was introduced by Motorola in 1973 and released for public use in 1983 with the Motorola 8000. Advanced Mobile Phone System (AMPS) also known as **1G** is an improvement of IMTS.

2.2 Our project/current technology

GSM mobile phone jammer devices were an alternative to more expensive Faraday cages.

GSM is an acronym for Global System for Mobile communications. It accounts for about 70% of the global mobile market. GSM uses time division multiple access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA).

2.3 How a GSM mobile phone Jammer works

Jamming devices overpower the cell phone by transmitting a signal on the same frequency as the cell phone and at a high enough power that the two signals collide and cancel each other out. Cell phones are designed to add power if they experience low-level interference, so the jammer must recognize and match the power increase from the phone. Cell phones are full-duplex devices which mean they use two separate frequencies, one for talking and one for listening simultaneously. Some jammers block only one of the frequencies used by cell phones, which has the effect of blocking both. The phone is tricked into thinking there is no service because it can receive only one of the frequencies. Less complex devices block only one group of frequencies, while sophisticated jammers can block several types of networks at once to head off dual-mode or tri-mode phones that automatically switch among different network types to find an open signal. Some of the high-end devices block all frequencies at once and others can be tuned to specific frequencies.

To jam a cell phone, all you need is a device that broadcasts on the correct frequencies. Although different cellular systems process signals differently, all cell phone networks use radio signals that can be interrupted. GSM, used in digital cellular operates in the 900-MHz and 1800-MHz bands in Europe and Asia and Africa in the 1900-MHz (sometimes referred to as 1.9-GHz) band in the United State. Old- fashioned analogue cell phones and today's digital devices are equally susceptible to jamming. Disrupting a cell phone is the same as jamming any other type of radio communication. A cell phone works by communicating with its service network through a cell tower or base station. Cell towers divide a city into small areas, or cells. As a cell phone user drives down the street, the signal is handed from tower to tower.

A jamming device transmits on the same radio frequency as the cell phone, which is 900MHz, thereby disrupting the communication between the phone and the cell-phone base station in the town**.** This is called a denial-of-service attack. The jammer denies service of the radio spectrum to the cell phone users within range of the jamming device.

Mobile phones communicate with a service network through BTSs/cell towers. BTSs are placed in specific places to provide services to small areas. As a mobile phone is moved between these areas, the towers pass the signals. A GSM mobile phone jammer transmits on the same airwaves/frequencies that mobile phones do. When the jammer is activated, it is able to disrupt the signal between the mobile phone and the nearest tower. Because the GSM mobile phone jammer and the mobile phone use the same frequency, they effectively cancel the other signal.

2.4 Jamming Techniques

There are several ways to jam an RF device. The three most common techniques can be categorized as follows:

2.4.1 Spoofing

In this kind of jamming, the device forces the mobile to turn off itself. This type is very difficult to be implemented since the jamming device first detects any mobile phone in a specific area, then the device sends the signal to disable the mobile phone. Some types of this technique can detect if a nearby mobile phone is there and sends a message to tell the user to switch the phone to the silent mode (Intelligent Beacon Disablers).

2.4.2 Shielding Attacks

This is known as TEMPEST or EMF shielding. This kind requires closing an area in a faraday cage so that any device inside this cage cannot transmit or receive RF signal from outside of the cage. This area can be as large as buildings, for example.

2.4.3 Denial of Service

This technique is referred to DOS. In this technique, the device transmits a noise signal at the same operating frequency of the mobile phone in order to decrease the signal-to-noise ratio (SNR) of the mobile under its minimum value. This kind of jamming technique is the simplest one since the device is always on. Our device will be of this type.

2.5 Definition of terms

2.5.1 Capacitors

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store electrical energy temporarily in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e. an insulator that can store energy by becoming polarized). The conductors can be thin films, foils or sintered beads of metal or conductive electrolyte, etc. The nonconducting dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, vacuum, paper, mica, oxide layer etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

2.5.2 Intergrated circuit

An integrated circuit or monolithic integrated circuit (also referred to as an IC, a chip, or a microchip) is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon. This can be made much smaller than a discrete circuit made from independent electronic components. ICs can be made very compact, having up to several billion transistors and other electronic components in an area the size of a fingernail. The width of each conducting line in a circuit can be made smaller and smaller as the technology advances

2.5.3 Inductors

An inductor, also called a coil or reactor, is a passive two-terminal electrical component which resists changes in electric current passing through it. It consists of a conductor such as a wire, usually wound into a coil. When a current flows through it, energy is stored temporarily in a magnetic field in the coil. When the current flowing through an inductor changes, the time-varying magnetic field induces a voltage in the conductor, according to Faraday’s law of electromagnetic induction, According to Lenz's law *the direction of induced e.m.f is always such that it opposes the change in current that created it.* As a result, inductors always oppose a change in current, in the same way that a flywheel oppose a change in rotational velocity. Care should be taken not to confuse this with the resistance provided by a resistor.

2.5.4 Resistors

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

2.5.5 Battery

An electric battery is a device consisting of two or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell has a positive terminal, or cathode, and a negative terminal, or anode. The terminal marked positive is at a higher electrical potential energy than is the terminal marked negative. The terminal marked positive is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, Electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work.

2.5.6 Transistors

A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

2.5.7 Jumper wires

A jump wire, is a short electrical wire with a solid tip at each end (or sometimes without them, simply "tinned"), which is normally used to interconnect the components in a breadboard. PE: among others, they are used to transfer electrical signals from anywhere on the breadboard to a point where they are required.

2.5.8 Circuit boards

A printed circuit board (**PCB**) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PCBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer (outer and inner layers). Multi-layer PCBs allow for much higher component density. Conductors on different layers are connected with plated-through holes called vias. Advanced PCBs may contain components - capacitors, resistors or active devices - embedded in the substrate. A breadboard is a construction base for prototyping of electronics.

2.5.9 Solder wire

Solder is a fusible metal alloy used to join together metal workpieces and having a melting point below that of the workpiece(s). Soft solder is typically thought of when solder or soldering is mentioned, with a typical melting range of 90 to 450 °C (190 to 840 °F). It is commonly used in electronics, plumbing, and assembly of sheet metal parts. Manual soldering uses a soldering iron or soldering gun. Alloys that melt between 180 and 190 °C (360 and 370 °F) are the most commonly used. Soldering performed using alloys with a melting point above 450 °C (840 °F) is called 'hard soldering', 'silver soldering', or brazing.

2.5.10 Multisim software for circuit design

NI Multisim (formerly MultiSIM) is an electronic schematic capture and simulation program which is part of a suite of circuit design programs, along with NI Ultiboard. Multisim is one of the few circuit design programs to employ the original Berkeley SPICE based software simulation. Multisim was originally created by a company named Electronics Workbench, which is now a division of National Instruments. Multisim includes microcontroller simulation (formerly known as MultiMCU), as well as integrated import and export features to the Printed Circuit Board layout software in the suite, NI Ultiboard. NI Multisim is a powerful schematic capture and simulation environment that engineers, students, and professors can use to simulate electronic circuits and prototype Printed Circuit Boards (PCBs). Multisim is widely used in academia and industry for circuits education, electronic schematic design and SPICE simulation.

Multisim was originally called Electronics Workbench and created by a company called Interactive Image Technologies. At the time it was mainly used as an educational tool to teach electronics technician and electronics engineering programs in colleges and universities. National Instruments has maintained this educational legacy, with a specific version of Multisim with features developed for teaching electronics. We therefore used multisim as a software to aid our simulation.

2.5.11 Soldering gun

A soldering gun is an approximately pistol-shaped, electrically powered tool for soldering metals using tin-based solder to achieve a strong mechanical bond with good electrical contact. The tool has a trigger-style switch so it can be easily operated with one hand. The body of the tool contains a transformer with a primary winding connected to mains electricity when the trigger is pressed, and a single-turn secondary winding of thick copper with very low resistance. A soldering tip, made of a loop of thinner copper wire, is secured to the end of the transformer secondary by screws, completing the secondary circuit. When the primary of the transformer is energized, several hundred amperes of current flow through the secondary and very rapidly heat the copper tip. Since the tip has a much higher resistance than the rest of the tubular copper winding, the tip gets very hot while the remainder of the secondary warms much less. A tap on the primary winding is often used to light a pilot lamp which also lights the workpiece.

2.5.12 Solderless breadboard

A modern solderless breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called tie points or contact points. The number of tie points is often given in the specification of the breadboard.

The spacing between the clips (lead pitch) is typically 0.1 in (2.54 mm). Integrated circuits (ICs) in dual in-line packages (DIPs) can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.

2.5.13 Digital multimeter

A multimeter or a multitester, also known as a VOM (Volt-Ohm meter or Volt-Ohm-milliammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter would include basic features such as the ability to measure voltage, current, and resistance. Analog multimeters use a microammeter whose pointer moves over a scale calibrated for all the different measurements that can be made. Digital multimeters (DMM, DVOM) display the measured value in numerals, and may also display a bar of a length proportional to the quantity being measured. Digital multimeters are now far more common but analog multimeters are still preferable in some cases, for example when monitoring a rapidly varying value.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

A methodology is a system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline.

It can also be defined as a set of ideas or guidelines about how to proceed in gathering and validating knowledge of a subject matter. Different areas of science have developed very different bodies of methodology on the basis of which to conduct their research. It can be said that a methodology provides a guide for carrying out some or all of the following activities;

- Probing the empirical details of domain of phenomena
- Discovering explanation of surprising outcomes or patterns.
- Identifying entities or forces.
- Establishing patterns
- Providing predictions
- Using empirical reasoning to assess hypotheses and assertions

This chapter describes step by step procedures that have been taken so as to come up with final output expected to achieve the project objectives. The chapter is divided into two phases; that is phase 1 and phase 2. Each phase has got number of activities that were carried out within the proposed project time frame. Below are the subdivisions of the methodology chapter;

3.1 Phase 1:

This is the initial stage of our activities under this chapter and it is the starting point of the whole methodology process. In this context, the logical flow of tasks was taken as very vital.

In our phase one of the methodology activities like review of the literature, planning of tasks and research and consultation were carried out.

3.1.1 Review of Literature

In the discipline of any project activity, it is very important to always review the literature. This is to help us keep the project's objective up to date. It was therefore important for us to revisit the literature which therefore enabled us to extract some of the key issues that we needed at our finger tips.

We looked at the existing system, their strength and weaknesses. We also took into consideration what modification we were supposed to do so that at the end we are able to meet our objective. At this point considerations were made for low power design that is 9V dc power supply which is cheaper, easier to use and eventually meets the objective of our project.

3.1.2 Planning of tasks

After reviewing the literature, we had to draw a systematic plan of action which helped us on how, where and when to execute each and every activity. The components of this plan of action include;

Research

Through research, we were able to dig deep on our project. For example we understood its operation, what should be done to make it work and all what we required so as to achieve the objective of the project.

Design

This is also another activity we had in our plan of action. Under design, factors like the cost of the components, behavior each component in the circuit, adjustment and modification of the existing design, time needed to complete the design were all put under consideration as we shall see details in the appendices of this report. Other components of this plan of action include; system implementation, system testing and others which we were able to carry out all.

3.2 Phase 2:

This is a very important section in our project. It gives the detailed design and the principle of operation of this project. It is from this section that we were able to obtain results and draw conclusion

3.2.1 System Design

As we stated earlier, this mobile phone jammer device consists of three main sections namely;

The power supply; in our power supply section we used a DC voltage source of 9V. This is because our 555 timer IC uses a voltage source with the range of 4.5V to 16V and is able to produce a reasonable output, for this case we are able to generate a frequency of 7.09MHz from 9V.

The IF section; we used IC 555 timer instead of a triangle wave generator. We chose this IC (555 timer) because of its voltage range (4.5V to 16V) which is capable of producing the noise signal that is good enough to be amplified. We also chose the 555 timer IC because of its low cost and availability in the market.

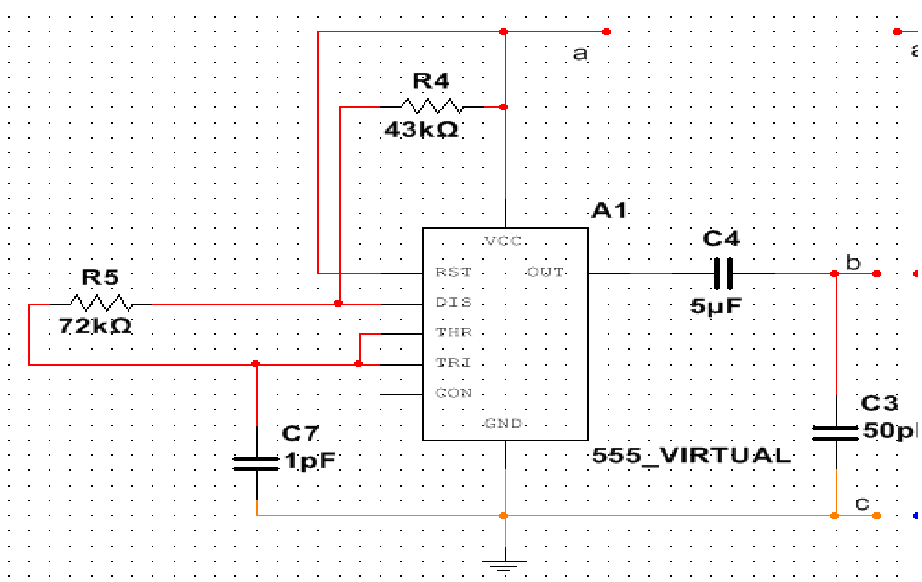

Figure 1 IF-section

The RF section

This section is a very vital part of our project. It is where we were able to obtain our jamming signal. Our design is such a simple one, instead of using the Voltage controlled oscillator to generate the RF signal; we chose to use a high frequency transistor since they are cheaper than the VCO integrated circuit.

Below is the design of the RF-section and the power supply inclusive.

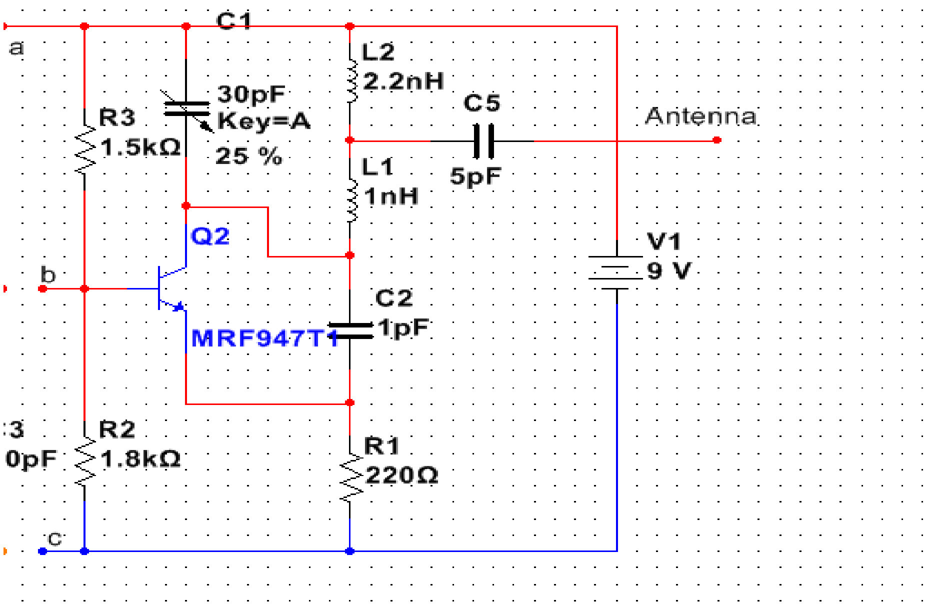

Figure 2 RF section

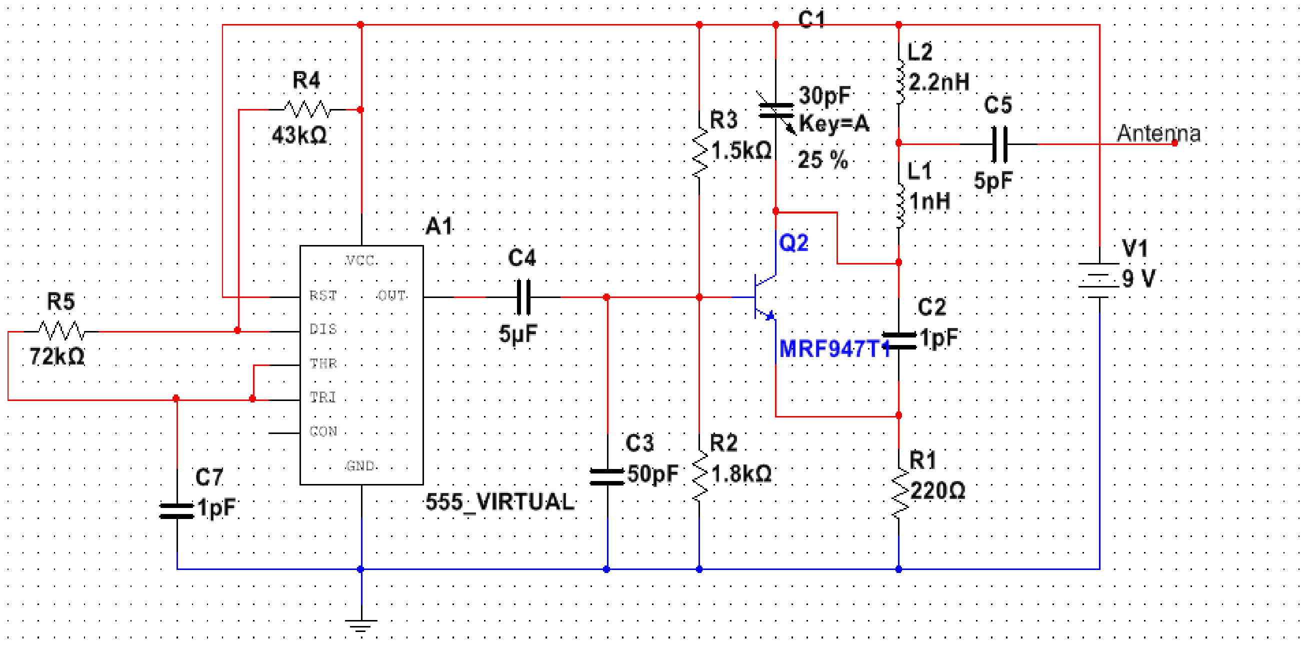

Figure 3 A complete schematic diagram of a mobile phone jammer system

3.3 The IF-section

It consists of the 555 timer IC, two resistors, three capacitors of which details are seen below

3.3.1 IC 555 timer

IC 555 timer is a one of the most widely used IC in electronics and is used in various electronic circuits for its robust and stable properties. It works as square-wave-form generator with duty cycle varying from 50% to 100%.

Duty cycle is a proportion of time during which a component, device, or a system is operated. It can be expressed as a ratio or percentage.

Duty cycle = on time/total time * 100%

Oscillator and can also provide time delay in circuits. The 555 timer got its name from the three 5k ohm resistor connected in a voltage-divider pattern which is shown in the figure below. A simplified diagram of the internal circuit is given below for better understanding the full internal circuit consists of over more than 16 resistors, 20 transistors, 2 diodes, a flip-flop and many other circuit components. IC 555 timer is a well-known component in the electronic circles but what is not known to most of the people is the internal circuitry of the IC and the function of various pins present there in the IC.

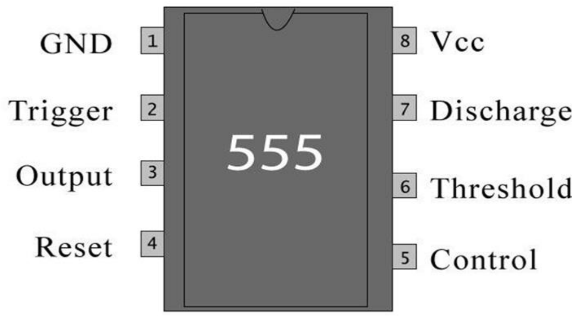

Figure 4 IC 555 timer

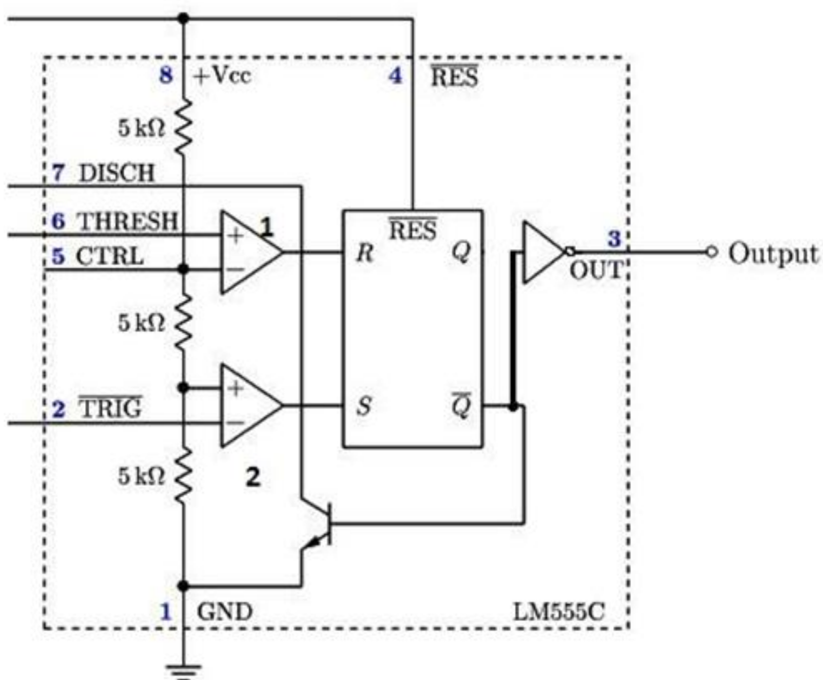

Figure 5 Internal structure of the IC 555 timer

Table 1: Showing function of different pins of IC 555 timer

PIN NO.	PIN NAME	INPUT/OUTPUT	FUNCTION
1	GND	INPUT	Provides zero voltage rails to the integrated circuit to divide the supply potential between the 6.8kΩ and 82kΩ resistors.
2	TRIGGER	INPUT	The trigger input is used to set the output of the Flip-Flop to HIGH state by applying a voltage equal to or less than $V_{in}/2$.
3	OUTPUT	OUTPUT	It is the output PIN of the IC connected to the Q-bar of the Flip-Flop.
4	RESET	INPUT	This PIN is used to reset the output of the Flip-Flop regardless of the initial condition of the Flip-Flop. It is an active LOW PIN so it is connected to HIGH state to avoid noise interference. Most of the time is connected to supply voltage unless reset operation is required
5	CONTROL VOLTAGE	INPUT	It's connected to the inverting input. It's used to override the inverting voltage to change the width of the output signal irrespective of the RC timing network. Control voltage input to control charging and discharging of external capacitor
6	THRESHOLD	INPUT	This PIN is connected to the non-inverting input of the first comparator. The output of the comparator is high when the threshold voltage is more than $(2/3)V_{in}$ thus resetting the output "Q" of the Flip-Flop from high to Low.

7	DISCHARGE	INPUT	This PIN is used to discharge the timing capacitors (capacitor involved in the external circuit to make the IC behave as a square wave generator) to ground when the output of PIN 3 is switched to low.
8	VCC	INPUT	This PIN is used to provide IC with the supply voltage for the functioning and carrying of the different operations to be fulfilled by the 555 timer.

Determination of R_4, R_5 and the output of the 555 timer from a calculator

Method 1

By using astable oscillator calculator

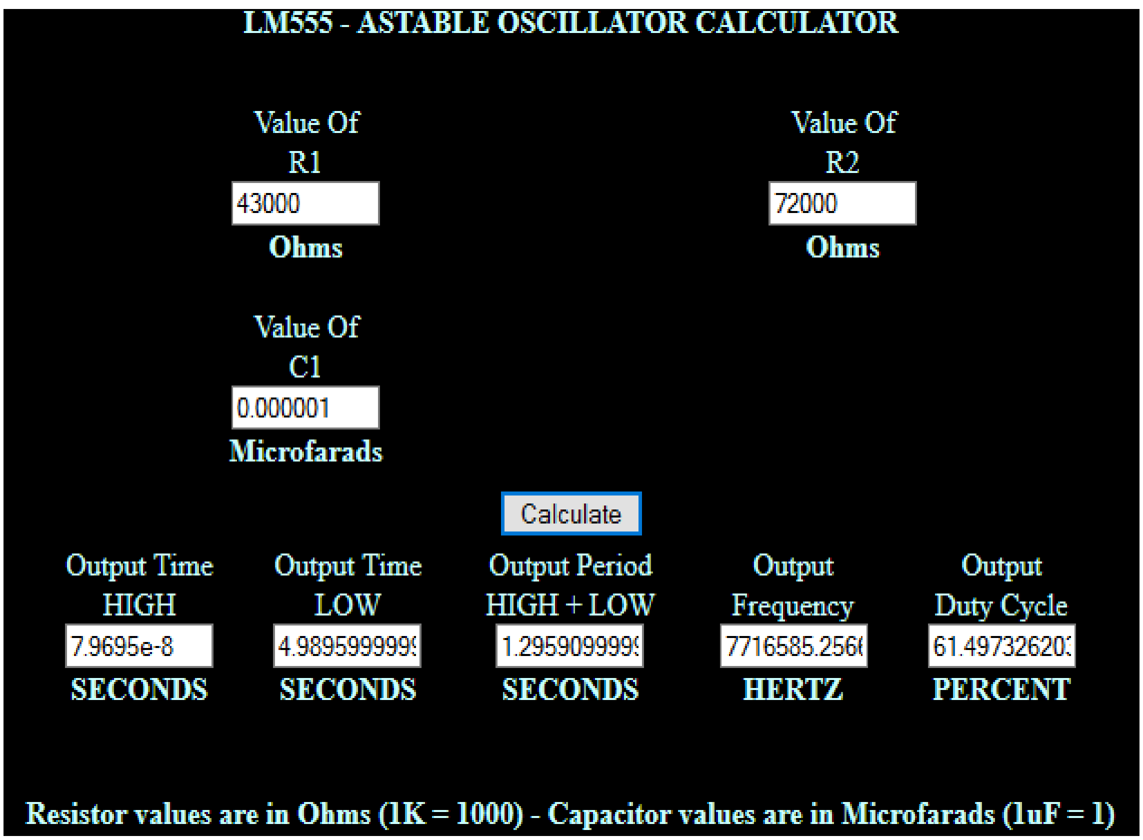

Figure 6 Astable oscillator calculator

Method 2

By using the formula of 555 Oscillator Frequency Equation

t_1 – capacitor charge "ON" time is calculated as:

$t_1 = 0.693(R_4+R_5)\ C_7$

$t_1 = 0.693(43000+72000)*1x10^{-6}$

= 0.079695 = **80ms**

t_2 – capacitor discharge "OFF" time is calculated as:

$t_2 = 0.693 \times R_5 \times C_7$

$t_2 = 0.693 \times 72000 \times 1x10^{-6}$

= 0.049896 = **50ms**

Total periodic time (T) is therefore calculated as:

$t_1 + t_2$ = 80ms + 50ms = **130ms**

The output frequency, f is therefore given as:

$F = \frac{1}{T}$

$F = \frac{1}{130ms}$ = 0.0076923 = **7.72MHz**

Duty cycle = $\frac{R4+R5}{(R4\ +2R5)} = \frac{43000+72000}{(43000+2x72000)} = \frac{115000}{187000}$ = **0.61 = 61%**

changing the values of R4 and R5

a) Increasing the values of R4, R5 it gives us a longer period of time and higher percenatge of duty cycle and lower frequency than the expected output values.

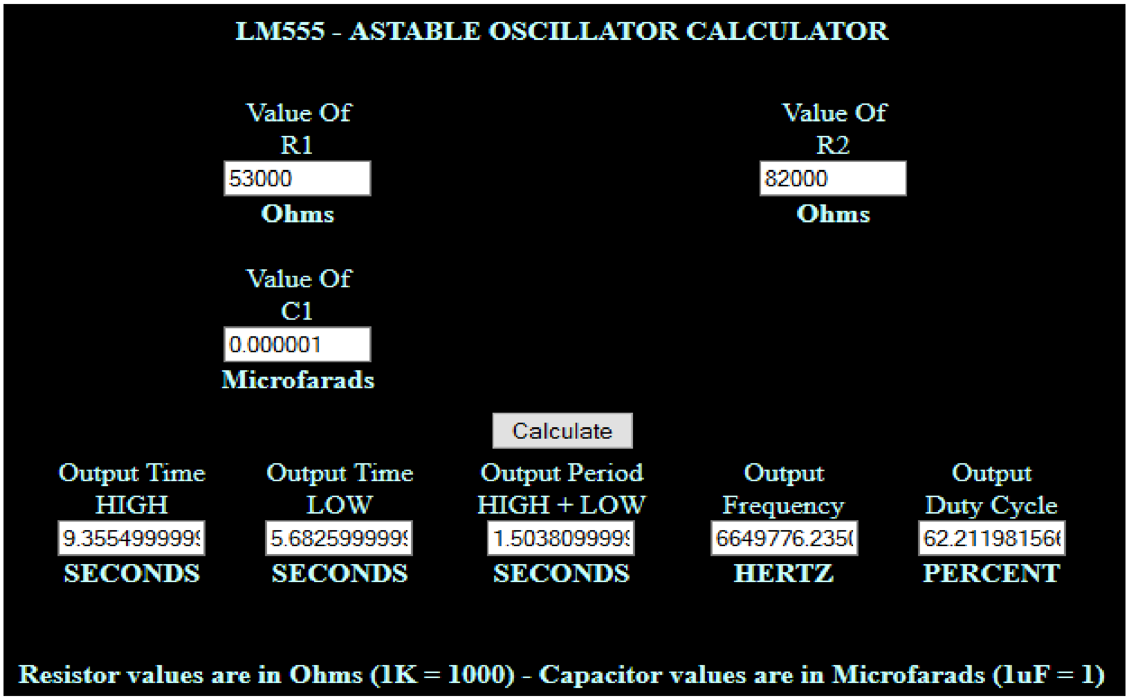

Figure 7 increasing the values of R4 and R5

b) Decreasing both the values of R4 and R5 it gives us a short period of time and small percentage of duty cycle and higher frequency than the output values we were expecting.

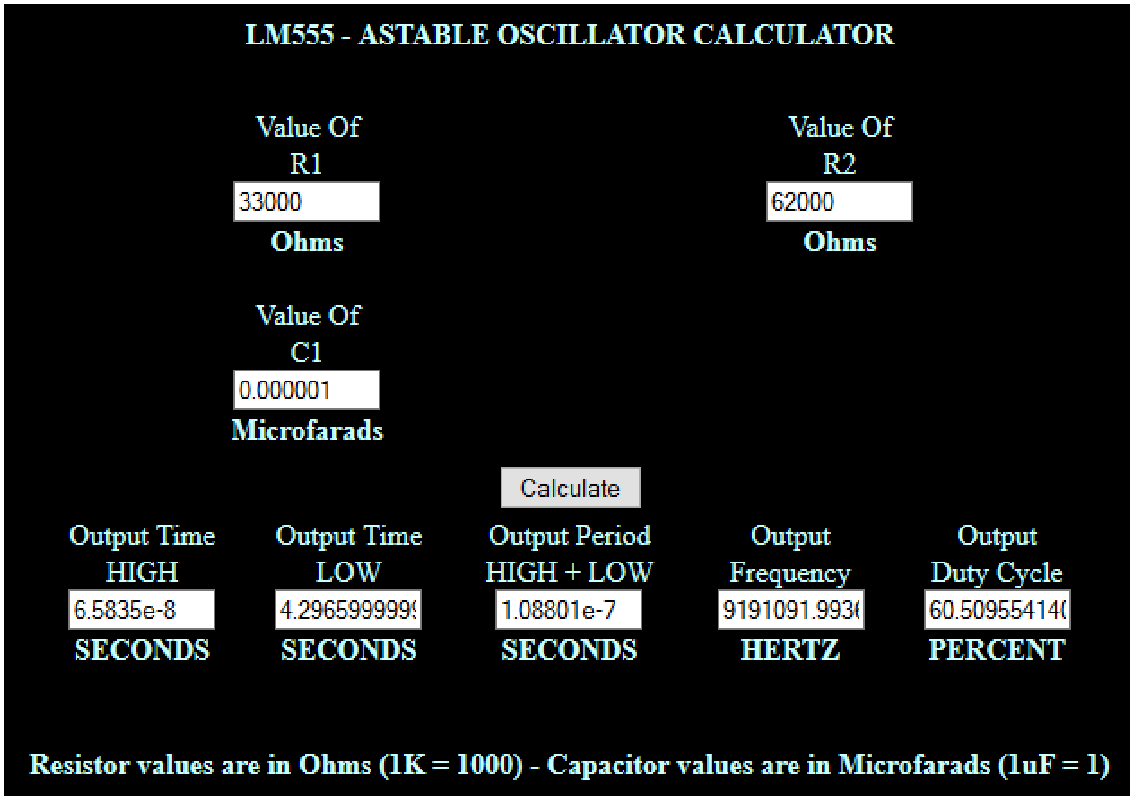

Figure 8 decreasing the values of R4 and R5

3.3.2 The IC 555 time operating modes

Astable mode

It is also known as self-triggering or free running mode. It has no stable state. It has two quasi stable states that automatically changes from one to another. It changes from high to low state and low to high state without any trigger input after pre determine time. This mode is used to generate square wave oscillations, clock pulse, PWM wave etc.

Monostable mode

It is also known as single shot mode. It has one stable state and one quasi stable state. It jumps into quasi stable state from stable state when trigger input is applied and comes back to stable state after pre determine time automatically. It is used in generating pulses, time delay etc.

Bistable mode

It is also known as flip-flop mode. It has both stable states. Two different trigger inputs are applied to change the state from high to low and low to high. It is used in automatic switching applications, to generate pulse of variable time.

Astable mode

In astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R4 is connected between VCC and the discharge pin (pin 7) and another resistor (R5) 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 C7 is charged through R4 and R5, and discharged only through R5, since pin 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.

The change of state from high to low and low to high results into generation of squire wave; in this case we called it noise signal. This noise signal is of value 7.09MHz.

The noise signal is therefore coupled to the next section by C4 capacitor. Capacitor C3 is used to store excess charge and releases it when necessary.

3.4 The RF- section

This section consists of transistor, variable capacitor, antenna, inductors, biasing resistors and capacitors. The RF-section is very importance to this project simply because it is where the final output is obtained from. The operation of the section components are described below.

3.4.1 Transistor MRF947T1

This transistor uses a potential divider network to bias the transistor base. The power supply Vcc and the biasing resistors R2 and R3 set the transistor operating point to conduct in forward active mode.

With no signal current flow into the base, no collector current flows (transistor is in cut-off) and the voltage on the collector is the same as the supply voltage Vcc.

A signal current into the base causes a current to flow in the collector which causes voltage drop across it hence collector voltage drops.

The direction of change of collector voltage is opposite to the direction of change on the base, in other words, the polarity is reversed thus the common emitter configuration produces a large frequency amplification (frequency swings around 900MHz)

R2 and R3 values

We were able to calculate the value of R2 and R3 from the MRF947T1 transistor Datasheet which gave us the maximum range of the collector-emitter voltage (max = 10V) we carried our calculation from.

Table 2: MRF947T1 transistor Datasheet

Parameter	Maximum Value
Collector-Base voltage	20V
Collector- emitter voltage	10V
Emitter-Base voltage	1.5V
Transition frequency	8000MHz

After testing different values of emitter voltage from the above range, we found that 5.86V was giving us preferable output frequency.

Give, emitter voltage = V_E = 5.86V;

V_E =5.86v

V_{R2}= V_{RE} + V_{BE}

= 5.86 + 0.7

=6.56V

$I_B = I_c/\beta$

For NPN transistor, the amplifier gain is given by $\beta = 100$.

Implying;

I_b= 35mA / 100

But current through I_{R2} is 10 times the current through I_b, hence;

$I_{R2} = 10 * I_b$

= 10 * 0.35

= 3.5mA

I_{R2} = 0.35mA

$R_2 = V_{R2}/I_{R2}$

= 6.56V / 3.5mA

= 1.8KΩ

$V_{R3} = V_{CC} - V_B$

$I_{R3} = I_{R2} + I_b$

= $3.5*10^{-3} + 0.35*10^{-3}$

= 3.85mA

$R_3 = V_{R3} / I_{R3}$

= $5.86 / 3.85*10^{-3}$

= **1.5kΩ**

Determination of the efficiency and class of operation of MRF947T1 transistors

Using voltage division

Voltage through R2 is given by

$$VR2 = \left(\frac{R2}{R2+R3}\right) \times Vcc$$

Where;

Vcc = 9V power supply

VR2 = Voltage through resistor R2

$$VR2 = \left(\frac{1.8}{1.8 + 1.5}\right) \times 9$$

$$VR2 = \frac{1.8}{3.3} \times 9 = 4.9V$$

$$Efficiency = \frac{P_{OUT}}{P_{DC}} \times 100\%$$

From our simulated output current I_{dc} through the transistor =25.1mA

$$But\ P_{dc} = V_{cc} \times I_{dc} = 9 \times 25.1 \times 10^{-3} = 225.9mW$$

$$P_{OUT} = IV = 29.2 \times 10^{-6} \times 8.89 = 25.9mW$$

Therefore;

$$Efficiency = \frac{25.9mW}{225.9mW} \times 100\% = \mathbf{11.5}\%$$

The maximum theoretical efficiency of class-A amplifier is 50%. This amplifier having efficiency of 11.5% implies that it is a class-A amplifier. It conducts current throughout the entire cycle (360^0) of input signal.

Resistor R3 is connected to the Vcc and the positive terminal (base) of the transistor hence forward biasing the transistor.R3 also regulate the amount of current entering the base of the transistor. R1 made to be small so as to allow large voltage gain at the output of the transistor hence high frequency. C2 is a DC blocking capacitor (it blocks the dc components and allows AC signal to pass through).

3.4.2 Variable capacitor

A variable capacitor is a capacitor whose capacitance may be intentionally and repeatedly changed mechanically or electronically. Variable capacitors are often used in L/C circuits to set the resonance frequency, e.g. to tune a radio (therefore it is sometimes called a tuning capacitor or tuning condenser), or as a variable reactance, e.g. for impedance matching in antenna tuners. A variable capacitor is a special type of capacitor, most commonly used for tuning radios, which allows the amount of electrical charge it can hold to be altered over a certain range, measured in a unit known as farads. Regular capacitors build up and store an electrical charge until it's ready to use. While a variable capacitor stores the charge in the same fashion, it can be adjusted as many times as desired to store different amounts of electricity. Since the most common use for the variable capacitor is in the tuning mechanisms of radios and older TV sets, it often goes by the name tuning capacitor or variable tuning capacitor.

When altering a variable capacitor, the user is actually changing its capacitance. Capacitance means the amount of energy the capacitor can store. A bigger capacitance means more stored energy. This energy is measured in farads, but because a variable capacitor typically has a very small capacitance, a smaller unit known as a **pico-farad** is used instead.

Having seen all these characteristics of a variable capacitor, we selected 30pf which was able to tune our frequency to a desirable range that is around 900MHz.

3.4.3 The inductors L1 and L2

An inductor connected to a capacitor forms a tuned circuit, which acts as a resonator for oscillating current. Tuned circuits are widely used in radio frequency equipment such as radio transmitters and receivers, as narrow band pass filters which help to select a single frequency from a composite signal, and in electronic oscillators to generate sinusoidal signals.

These inductors connected in series with a capacitor to provide discrimination against unwanted signals and also to maintain a constant current. Another reason for connecting these two inductors is to remove Low-frequency signals when they are passed through these inductors. And therefore, High-frequency signals that pass through the capacitor (high pass) and are sent to the output.

Calculation of inductance value

Method 1: using formula

$$L = \frac{d^2 + n^2}{18d + 40l}$$

Where L = inductance in micro henrys

D = coil diameter in inches

l = coil length in inches

N = number of turns

From here can estimate these values and be able to calculate the value of the required parameter.

A much simpler method is the calculator method we used in our project and is illustrated in method 2.

Method 2: using inductor calculator

This is a calculator that allowed us to enter the different values of the inductor parameter and automatically calculates the inductance value.

d (coil diameter in inches)	3	(inches)
l (coil length in inches)	5.2	(inches)
n (number of turns)	8	
Calculate Inductance		
L (Inductance)	2.19847	(uH)

Figure 9 Calculation of inductance L1 using inductance calculator

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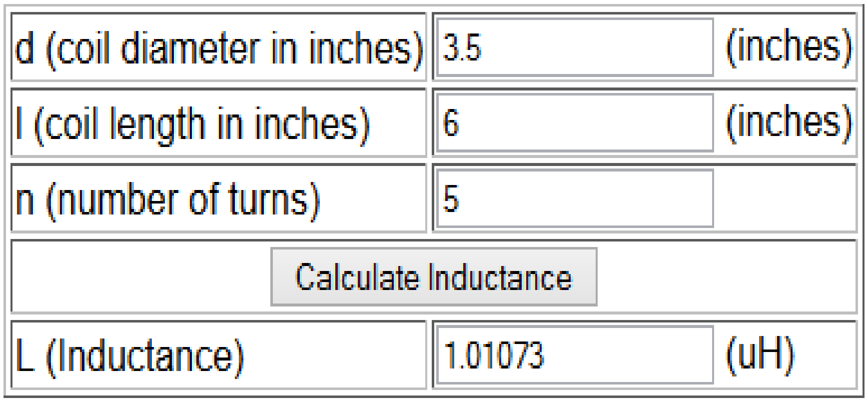

Figure 10 Calculation of inductance L2 using inductance calculator

From the calculator we were able to obtain the approximate value of L_1 and L_2. Note that in a practical environment, it is very difficult to obtain the exact value of an inductor and this why we are talking of the approximate values.

Charging and discharging inductor

When the current through an inductor is increased, the voltage drops/reduces and opposing the direction of electron flows, acting as a power load. In this condition the inductor is said to be *charging*, because there is an increasing amount of energy being stored in its magnetic field. Note the polarity of the voltage with regard to the direction of current:

Conversely, when the current through the inductor is decreased, it drops a voltage aiding the direction of electron flow, acting as a power source. In this condition the inductor is said to be *discharging*, because its store of energy is decreasing as it releases energy from its magnetic field to the rest of the circuit. Note the polarity of the voltage with regard to the direction of current.

When the inductance of the inductor is increased it also increases the strength of magnetic field of the current passing through the circuit and when it's decreased the inductance of the inductor it also decreases the strength of magnetic field of the current on the circuit.

Note that if either the frequency or the inductance is increased, the overall inductive reactance value of the coil will also increase. In other words, as the frequency increases and approach the infinity, the inductor reactance and its impedance will also increase toward infinity acting like an open circuit hence there is a direct proportionality between the value of the inductor and the frequency value.

3.5 The Antenna

As it is well known in every radio signal transmission or reception there must be an antenna attached to the transmitter, here too we used monopole antenna since the radiation pattern is Omni-directional.

Omnidirectional antenna is known for its capability of radiating/transmitting signal in all direction that is 360 degree. We chose this antenna type so as to jam any mobile phone close to this jamming device at any angle.

Another reason for choosing this type of antenna was its impedance matching ability with the impedance of other transmission system hence optimal power transfer.

Table 3: Summary of components and their functionality

Power supply		
1	9V battery	Supply power to the entire parts of the circuit for system functionality.
The IF-section		
1	IC 555 timer	Simply generates the noise signal to be amplified so as to interfere with the signal from the BTS to mobile phone.
2	R4 and R5 resistors	Used to charge the capacitor C7. The capacitor C7 is discharged only through R5 since PIN 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.
3	C7 capacitor	Stored charge of the 555 timer
4	C4 capacitor	The function of this capacitor here is to couple the generated noise signal that is the 7.09MHz frequency to the section where it can be amplified and forwarded to the next stage.
5	C3 capacitor	Storing excess charge and releases when necessary
The RF-section		
1	MRF947T1 transistor	This transistor was selected because of its capability of amplifying high frequency up to 8000MHz
2	Inductors	Form a tuned circuit, which acts as a resonator for oscillating current. Tuned circuits are widely used in radio frequency equipment such as radio transmitters and receivers, as

		narrow band pass filters which help to select a single frequency from a composite signal
3	Variable capacitor	Used for tuning/ varying frequency so as to obtain appropriate range
4	R2 and R3	Are used for biasing the MRF497T1 transistors and regulating current that enter the base of the transistor.
5	Capacitor C2	Blocks DC components and allows AC signal to pass through.
6	Resistor R1	Known as the load resistor, it is where the output from the transistor is obtained. The value is made small for high voltage gain.
7	Capacitor C5	Used to remove the ripples from output signal before passing to the antenna
8	Antenna	Is used here to radiate the radio wave having the same frequency as that of the mobile phone so as to interfere with the BTS signal.

3.7 Components/tool and equipment

Capacitors

Intergrated circuit

Inductors

Resistors

Battery

Transistors

Jumper wires

Circuit boards

Solder wire

Multisim software for circuit design

Soldering gun

Solderless breadboard

Digital multimeter

CHAPTER FOUR

TESTING, RESULTS AND DISSCUSSION

4.0 Introduction

This chapter describes how the design was put into test from which outputs were obtained and finally discussion about these output were made.

4.1 TESTING

In this context testing is the act of examining the output of a system so as to determine how well or faulty it works. After the completion of our circuit construction we subjected the schematic circuit into test. We carried out test by simulation at two main distinct stages;

4.1.1 Stage one

This stage is known to be the IF-section of the system and therefore, the main intension is to obtain its output.

At this stage we wanted to find out if our noise signal has been generated by the IC 555 timer. From the National instrument circuit design 12 (Multisim) software, we used a measurement probe for simulating the output results shown below. Timer output when the variable capacitor is set at 25%.

Table 4: Output from the IC 555 timer

PARAMETER	VALUE
V	9V
V(P-P)	9V
V(rms)	7.05V
V(dc)	5.55V
I	5.65mA
I(P-P)	931mA
I(rms)	261mA
I(dc)	140mA
FREQUENCY (constant)	7.09MHz (constant value)

4.1.2 Stage two

This stage is the RF-section of the system and the test result intended to obtain the final output frequency at the antenna. As in stage one, we use the same software (Multisim) measurement probe to produce the result below.

Table 5: Final output at the Antenna

PARAMETER	VALUE
V	9.19V
V(p-p)	365mV
V(rms)	9V
V(dc)	9V
I	9.19pA
I(p-p)	0A
I(rms)	9.00pA
I(dc)	9.00pA
FREQUENCY(varying)	±900MHz

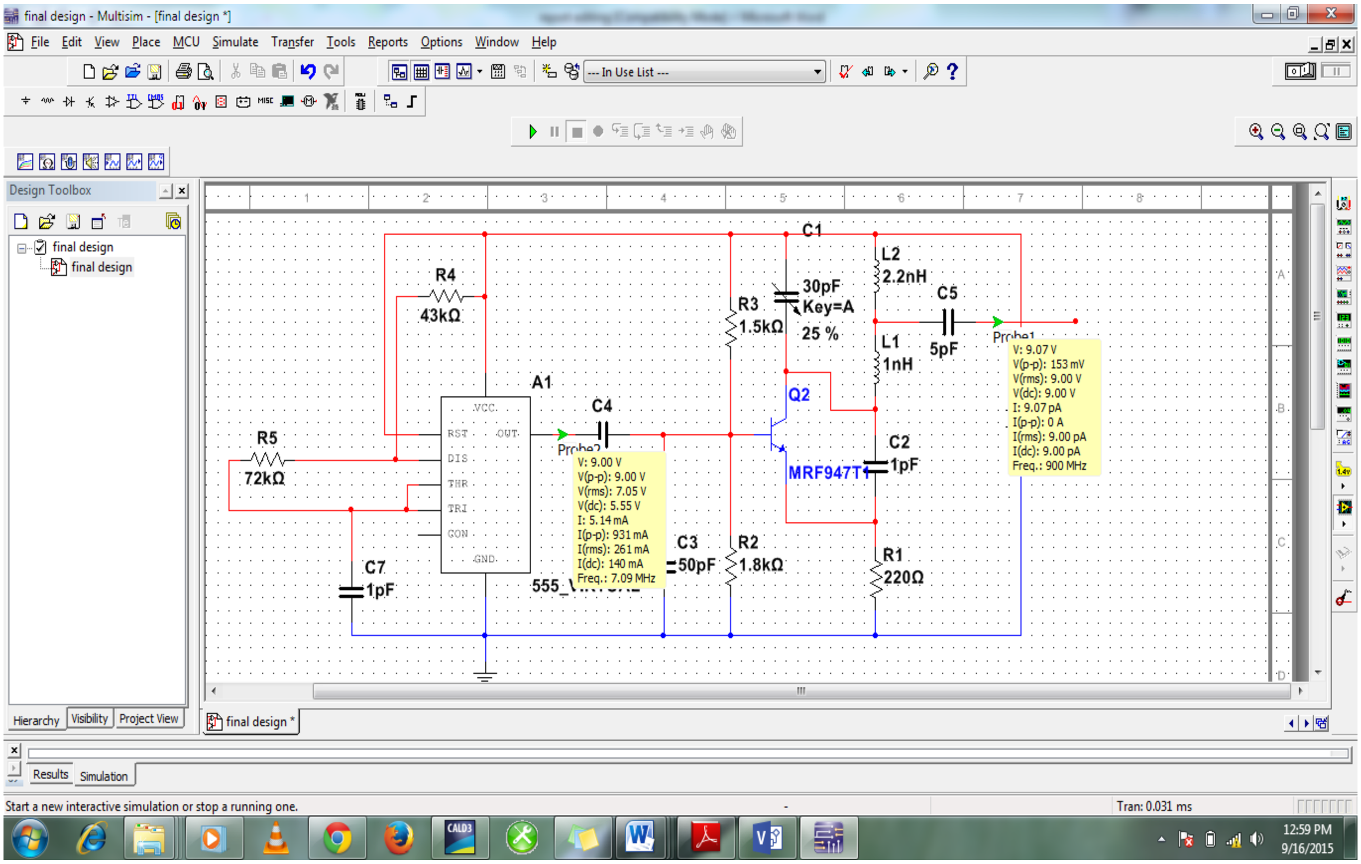

Figure 11 Screenshot of showing the output of the IC 555 and the antenna

4.2 DISCUSSION

During our calculation for the value of the noise signal output from the 555 timer, we found the output frequency to be 7.72MHz

The output from simulation was quite amazing since our 555 timer was able to generate a stable frequency known as a noise signal of 7.09MHz. This result deviates from the calculated result (7.09MHz) slightly. This deviation happens because the behavior of passive components at high frequency is not ideal.

We also realized that this frequency (7.09MHz) is far much lower than the required frequencies of around 900MHz.

We used high frequency transistor (MRF974T1) which was able to amplify/boost the 7.09MHz (output) of the 555 timer up to around 1.2GHz.

We used variable capacitor of 30pf to adjust the preferable range of this amplified frequency.

We noticed, as we reduce the percentage of variation, the final output frequency increases and the higher we increase the percentage of variation the lower the final output frequency becomes.

We also noticed that the preferable percentage value of the capacitor was at around 0% to 25%. This is because these percentage values of the capacitor give the output frequency values that are slightly below 900MHz and slightly above 900MHz hence covering our downlink transmission frequency of GSM 900.

CHAPTER FIVE:

CONCLUSION AND RECOMMENDATION

5.0 CONCLUSION

Today there is expeditious growth in technology, for example in mechanical industry, building and construction industry, food supplement industry, medical industry, sport industry, electrical and electronics industry to mention but a few, it is therefore of no doubt that every technology has got its advantages and disadvantages.

With no exception, mobile phone communications has become one of the leading forms of communications with its ever growing technology. For instance; they can support Games, online videos, e-commerce, video conferencing social media like Facebook, whatsapp, twitter, to mention but a few. All these have made mobile phones to be used everywhere which become disruptive in some places like churches, Mosques, meeting place, court room, road use, examination rooms, etc.

Therefore the main objective of this project was design and build a system that can block the use of mobile phone in such places where their use are not required by transmitting radio waves of the same frequencies as that of the mobile phone causing interference between mobile phone and the Base Transceiver Station, hence the mobile phone displays "NO NETWORK" on the screen.

Specifically, the project aimed at;

- Designing and building a power supply that would distribute power to other parts of the system for operation.
- Designing and constructing the Intermediate Frequency section which helps to generate the tuning frequency (noise) signal
- Designing and constructing the Radio Frequency section which helps to generate RF signal that would create interference with signal from BTS so as to block transmission between mobile phone and BTS.
- Integrating different sub-systems to form one single system, that is the GSM mobile phone jammer device.

After carrying out all the activities according to the designed time frame for the entire project cycle toward the achievement of our project objectives we were able to achieved the following;

- Instead of designing and constructing a power supply that would distribute power to other parts of the circuit which was more costly, we opted to use an alternative which is cheaper and can give the required voltage to the entire circuit and that is 9V battery.
- We also modified the RF-section by calculating the value of the biasing resistors R2 and R3, the value of the inductor L_1 and L_2 and also by choosing appropriate values of other components like capacitors and antenna which gave us desired output frequency.
- We integrated the IF-section and the RF-section together with the power supply section so as to come up with one system known as a **mobile phone jammer system**

After the integration of all the parts and coming up with one system, we subjected the system testing for functionality and the test results showed that we were able to generate;

- A stable noise signal of 7.09MHz from the IF-section.
- A final output frequency that varies above and below 900MHz from the antenna.

This implies that we have achieved the objective of generating a radio wave of the same frequency as that of the mobile phone operating in a GSM900 network.

However, the above was a simulated (software) results. Our intension was to come up with a real hardware system but due to lack of components availability, the objectives of this project were partially met.

5.1 RECOMMENDATION

Jamming mobile phones or interfering with communication frequencies is illegal in most countries including Uganda. The sole idea of this project was for education purpose and not to put its consumption in public or for commercial purpose.

However, if at one point the use of this device is legalized in our country, the citizens must respect the terms and conditions of its use. That is to say the device must be used strictly and only where it is supposed to be used.

Accessibility of the requirements for constructing the schematic diagrams for this device was not possible. This is because of its limited use worldwide and therefore, most markets do not support the sale of these components since the customers are very few. This means the operation of our system only stopped at a software stage since we could not come up with the hardware parts during this project cycle.

But we would like to assure everyone that this project can work perfectly given all the required components is available.

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APPENDICES:

Band Number	Symbols	Frequency Range
4	VLF	3 to 30 kHz
5	LF	30 to 300 kHz
6	MF	300 to 3000 kHz
7	HF	3 to 30 MHz
8	VHF	30 to 300 MHz
9	UHF	300 to 3000 MHz
10	SHF	3 to 30 GHz
11	EHF	30 to 300 GHz
12	THF	300 to 3000 GHz

Table of ITU Radio Frequency Bands

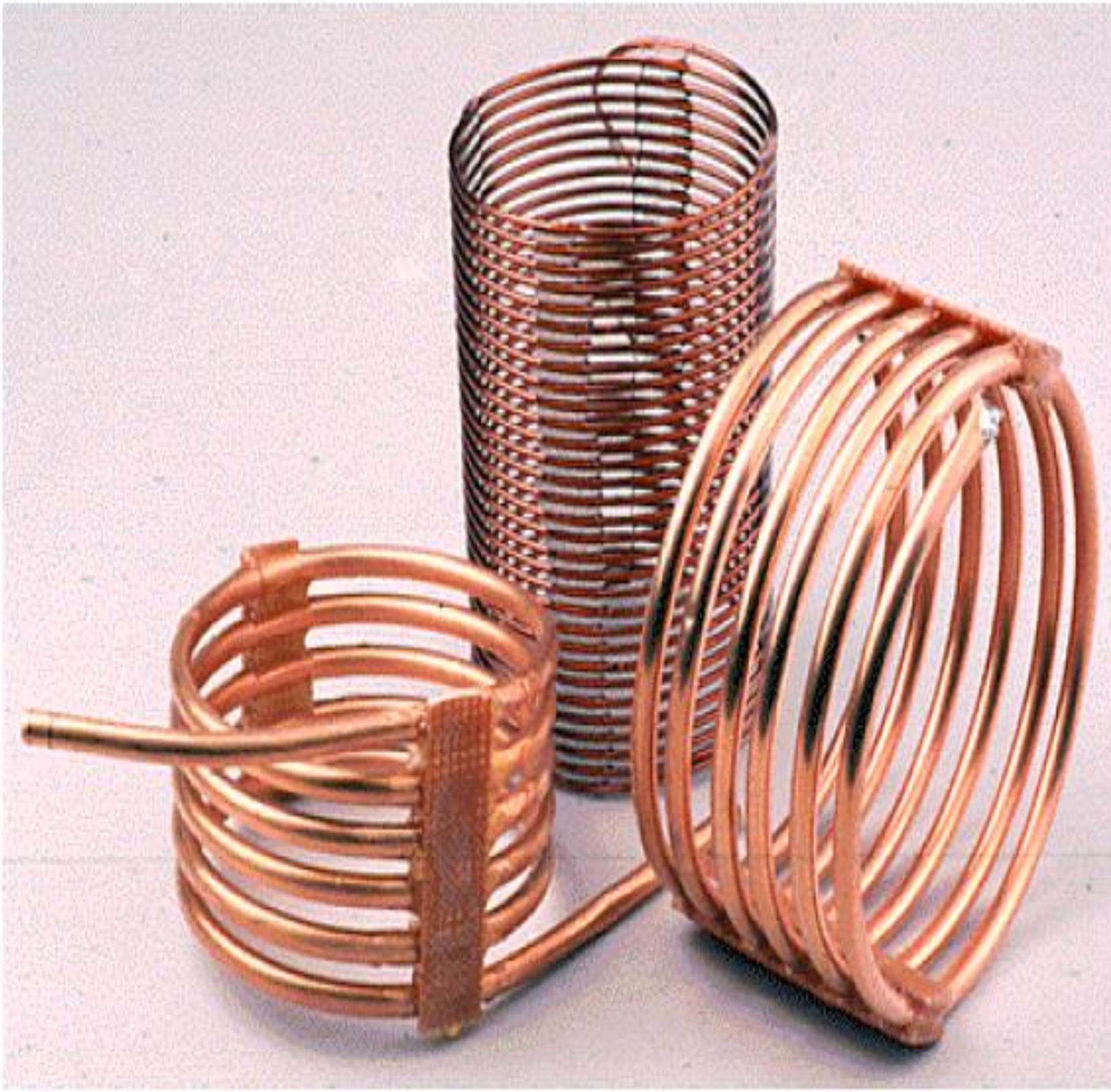

Figure: air-dielectric inductors

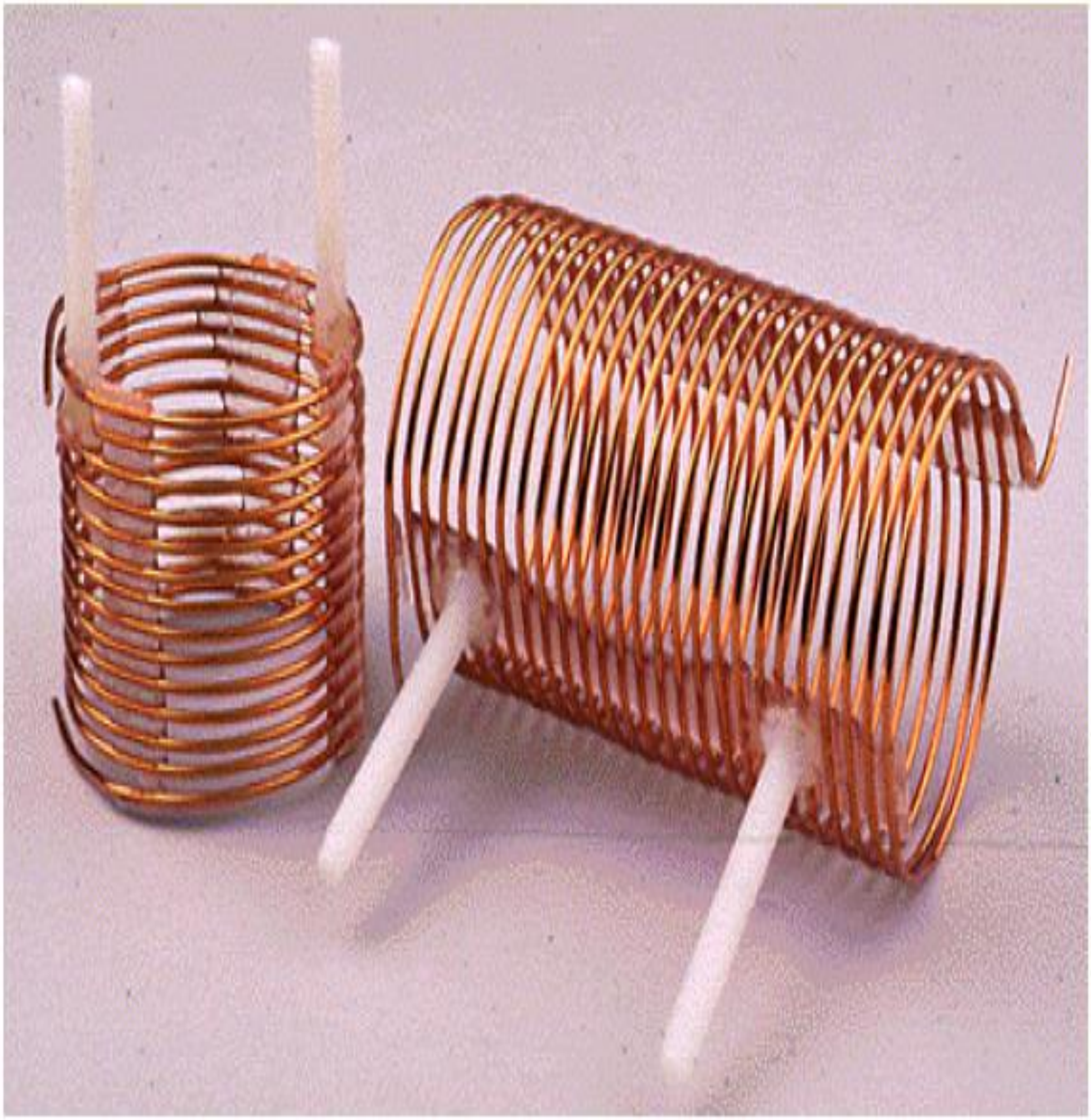

Figure: flat-head nylon bolts attached to the coils with epoxy.

Figure: wire and spacing line are simultaneously wound on a form.

ESTIMATED BUDGET FOR THE PROJECT

NO.	Component	Quantity	Unit price UGX	Total price UGX
1	Voltage controlled Oscillator	1	200,000	200,000
2	circuit Board	2	6,000	12,000
3	Breadboard	2	13,000	26,000
4	Connecting wire	2 meters	2,500	5,000
5	Power Switch	1	5,000	5,000
6	Fuse	1	3,000	3,000
7	Soldering Lead	1 meter	6,000	6,000
8	Soldering Iron	1	20,000	20,000
9	LEDs	5	500	2,500
10	Step down transformer	1	20,000	20,000
11	Diode	10	500	5,000
12	Resistors	25	500	12,500
13	Capacitors	23	500	11,500
14	555 timer	1	20,000	20,000
15	Integrated Circuits(ICs)	10	3,000	30,000
16	Monopole antenna	1	75,000	75,000
17	Radio receiver antenna	1	75,000	75,000
18	Power amplifier	1	100,000	100,000
19	Digital multi-meter	1	35,000	35,000
20	Wire cutter	1	5,000	5,000
21	**Grand Total**			**668,000**

TIME FRAME

NO	ACTIVITY	2014				2015							
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	Review of Literature												
2	Research and consultation												
3	Planning of tasks												
4	Proposal writing												
5	Proposal Presentation												
6	System design and construction												
7	System testing												
8	System implementation												
9	Final report writing												
10	Presentation of final report												