Small Area Signal Blocker(SASB)

MINI PROJECT REPORT

submitted by

ANJALI SAJEEVAN MDL19EC025

JOHN THARIAN MDL19EC065

UNNIKRISHNAMENON N MDL19EC122

VISHNUMAYA S UNNI MDL19EC124

to

the APJ Abdul Kalam Technological University
in partial fullfillment of the requirements for the award of the Degree

of

Bachelor of Technology
in
Electronics and Communication Engineering

Department of Electronics Engineering

Model Engineering College

Thrikkakara

August 2022

Department of Electronics Engineering
Model Engineering College
Thrikkakara

BONAFIDE CERTIFICATE

This is to certify that the Mini Project entitled

Small Area Signal Blocker(SASB)

Submitted by:

UNNIKRISHNAMENON M

REG NO: MDL19EC122

is a bonafide account of the work done by him under our supervision

Dr.Jaya V L	**Dr. Mini M G**
Mini Project Co-ordinator	**Head of the Department**

Acknowledgement

In the onset I thank God almighty for his countless blessings through out my seminar.

I would like to express my thanks to Principal, **Dr. Jacob Thomas V**, for providing me all the necessary facilities.

I would also like to thank Mini Project co-ordinator **Dr. Jaya V L** ,Professor for her valuable help and support. I am highly obliged to her for all the valuable suggestions and guidance she provided.

Last but not the least I thank all my classmates who always have been a great support and courage.

ABSTRACT

This report represents the design, implementation and testing of mobile phone signal jammer. The designed jammer was successful in jamming 2G and 3G signals as will be shown in the report later. Nowadays, mobile (or cell) phones are becoming essential tools in our daily life. In India various cell phone carriers are available. Needless to say, the wide use of mobile phones could create some problems as the sound of ringing becomes annoying or disrupting. This could happen in some places like conference rooms, law courts, libraries, lecture rooms, and even examination halls. To address these problems we have prototyped a device that can block all Radiofrequency signals over a stipulated area, Small Area. One way to stop these disrupting ringing is to install a device in such places which will inhibit the use of mobiles, i.e., make them obsolete. Such a device is known as cell phone jammer.

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FPGAs	Field-Programmable Gate arrays

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Chapter 1

INTRODUCTION

Relevant and important backgroundtopics will be highlighted in this section. Mobile jammers are used to prevent mobile phones from receiving or transmitting signals with the base station. Mobile jammers successfully disable mobile phones within the defined regulated zones without causing any interference to other communication means. Mobile jammers can be used in practically any location, but are used in places where a phone call would be particularly disruptive like temples,libraries, hospitals, cinema hall, school and colleges etc.

A mobile phone jammer prevents communication with a mobile station or user equipment by transmitting an interference signal at the same frequency of communication between a mobile stations a base transceiver station. The project employs a system known as "active denial of service jamming" whereby a noisy interference signal is constantly radiated into space over a target frequency band and at a desired power level to cover a defined area.

1.1 Problem Statement

A cell phone jammer is an instrument used to prevent cellular phones from receiving signals from base stations. When used, the jammer effectively disables cellular phones. These devices can be used in practically any location, but are found primarily in places where a phone call would be particularly disruptive because silence is expected. Some students use their cell-phones in lecture rooms, labs and in Exam rooms; therefore jammer cellphones must be used.

1.2 Objective

The main objective of this project is to design a cell phone jammer circuit that can temporarily block signal in any mobile phone in a designated area. The project involves the design and development of cell phone jammers to block all the cell phones within the designated area, this device will disrupt cellular communication with respect to the following:

- Operates in the 900MHz band
- It has a less than one meter effective blocking radius.

Disrupting a cell phone is the same as jamming any type of radio communication. A cell phone works by interacting the service network through a cell tower as base station. Cell towers divide a city into small areas or cells. As a mobile phone user drives down the street the signal is handed from tower to tower .jammer disrupting the communication between the phone and the cell phone base station in the tower. It's called denial-of-service attack. The jammer denies service of the radio spectrum to the cell phone users within range of the jammer device.

1.3 Scope

As in most Asian countries, signal blockers of various kinds, are not available. Thus, restaurants, shops, theatres, cinemas, financial institutions and others, install blockers in order that customers or employees do not use the terminal within its facilities. The issue of mobile signal blocker has been treated at different times by the GSMA and have covered different aspects of their use, from regulatory aspects to the security implications. An important case, we see with great concern are questions about the limitations of mobile services in prisons in Honduras, Guatemala and other countries in the region. Although use in prisons is not a new practice, this approach has not yet been in the debates of the GSMA. Operators of mobile networks made large investments to provide coverage and capacity by installing radio base stations. Therefore, the indiscriminate use of blockers affect these investments because customers cannot make use of mobile services in the ranges of these blockers. To this end, this document has been agreed with industry, and other supranational bodies GSMA to provide a common position including the implications for the end user, which can be shared with telecommunications ministries and regulators. Cell phone jamming devices can be used originally for law enforcement and the military to interrupt communications by criminals and terrorists.

Chapter 2

LITERATURE SURVEY

Several papers were reviewed to gather information on the following concepts behind antenna design.

2.1 Literature Review

The insights gained from referring to the list of papers have been mentioned here in this section.

[1] Eyhab Ahmed Authman Altaher, Mohammed Isam Eldeen Hamed Nasr Eldeen, Wisal Eid Abd Arrahman Eid, "Jammer Cellphone" published in 2020 is a research paper on Jamming devices which designed a jammer designed to work at GSM 900 and GSM 1800 in order to disrupt the signals of the three well-known carries in Sudan (Zain, MTN (Ariba), Sudani). Practical model was not completed, however theoretical development of IF and RF section was successfully completed with a well-researched block diagram.

[2] Diana Starovoytova Madara, Edwin Ataro and Simiyu Sitati, "Design and Testing of a Mobile-Phone-Jammer" project paper highlights the design of a simple, low-cost mobilephone-jammer and aims to present a solution for the problem of inappropriate-use of the cell-phones in restricted and prohibited-areas. The aim of the project which was to build a simple-mobile-phone-jammer is achieved. Further and more deeper-research is needed to produce more-sophisticated and better-jamming-devices, as to not affect the other base station transmission systems.

[3] David Rana, Shivam Sharma,, Dinesh Adhikari3 and Rakesh Pandey, "Cellphone Jammer using 555 timer", paper is designed and implemented for cell phone jammer using 555 IC. The jammer device generates RF signals in the same frequency in which cell phone works. Jammer jams

the transmitted radio signal by the antenna and block the cell phone on an effective area. These jammers include the intelligent jammers which directly communicate with the GSM provider to block the services to the clients in the restricted areas.

[5] Dr K Rameshbabu, Mr Misay.Mangisthu, Mr. Mogos, Birhanu, Wondosen In presented a project, its controlling this mobile jammer by means of PIC16F77 microcontroller IC. The device is able to jam the cell phone carriers. The effective jamming range is around 22 meters. For Microcontroller section, PIC, LCD, RTC, oscillator, relay and buttons were used and the common RF and IF sections were also combined to form the entire circuit.

[6] Nsikan Nkordeh, Iwu C. Lawson, Francis Idachaba, Ibinabo Bob-Manuel wrote a paper,"Design and Implementation of a Dual Band Mobile", a mathematical analysis of frequency jamming was done using a QPSK-modulated signal. The jammer system was built using VCO (PMB2110) processor which generates signal in the frequency range of GSM900 and DCS1800.

[7] Ahmed A. Thabit, "Design and Implementation of a CellPhone Jammer", paper focused on a system which uses LCD together with the Arduino to display a message and more fans (4 fans) that provide more cooling for the system. The designed system obtained the good results what we need to jam signals for dual band GSM 900,1800and 3G within a very short time reach to 30 sec.

[8] Mladen D. Mileusnić, Predrag M. Petrović, Branislav R. Pavić, Verica B. Marinković-Nedelicki, Vladimir S. Matić, and Aleksandar V. Lebl, "An investigation of New GSM systems" paper presents a new method for jamming of GSM communications. The aim is to decrease voice connection quality, thus disabling users to understand each other, while keeping established connections. The jamming method parameters depend on the algorithm characteristics implemented in SACCH frame.

Sl No.	YEAR	TITLE	AUTHOR	SOURCE	FINDINGS OF THE STUDY
1	2020	Jammer Cell Phone	Eyhab Ahmed Authman Altaher, Mohammed Isam Eldeen Hamed Nasr Eldeen, Wisal Eid Abd Ar-rahman Eid	Sudan University of Sciences and Technology College of Engineering	This jammer designed to work at GSM 900 and GSM 1800 in order to disrupt the signals of the three well-known carries in Sudan. Research ended with theoretically developing the intermediate frequency (IF) and radio frequency (RF) sections of this research.
2	2016	Design and Testing of a Mobile-Phone-Jammer	Diana Starovoytova Madara, Edwin Ataro and Simiyu Sitati	iistc.org	Further research is needed to produce more-sophisticated and better-jamming-devices, as to not affect the other base station transmission systems.
3	2017	Cell Phone Jammer using 555 Timer IC	David Rana, Shivam Sharma,, Dinesh Adhikari3 and Rakesh Pandey	International Journal on Emerging Technologies (Special Issue NCETST-2017)	These jammers include the intelligent jammers which directly communicate with the GSM provider to block the services to the clients in the restricted areas.
		Cell Phone			Technique of

Sl No.	YEAR	TITLE	AUTHOR	SOURCE	FINDINGS OF THE STUDY
5	2018	Design and Implementation of Mobile Jammer with Prescheduled Time Duration	Dr K Rameshbabu, Mr Misay.Mangisthu, Mr. Mogos, Birhanu, Wondosen	International Journal of Advanced Research in Computer and Communication Engineering	The device consisted of 3 main components including a microcontroller section, RF section and IF section. Unable to find the components required for the RF section.
6	2016	Design and Implementation of a Dual Band Mobile Phone Jammer	Nsikan Nkordeh, Iwu C. Lawson, Francis Idachaba, Ibinabo Bob-Manuel	iaeng.org	A mathematical analysis of frequency jamming was done using a QPSK-modulated signal.
7	2019	Design and Implementation of Cell Phone Jammer	Ahmed A. Thabit	arpnjournals.org	This system used LCD together with the Arduino to display a message and more fans (4 fans) that provide more cooling for the system.
8	2019	An Investigation of a New GSM Systems Jamming Technique without Existing Connections Disruption	Mladen . Mileusnić, Predrag M. Petrović, Branislav R. Pavić, Verica B. Marinković-Nedelicki, Vladimir S. Matić, and Aleksandar V. Lebl	scindeks.ceon.rs, telfor journal	It is based on the behaviour of SACCH frame, fire code and the implemented criteria in it. With constant jamming, necessary emission power as well as radiation level are decreased.

Chapter 3

SYSTEM OVERVIEW AND DESIGN

This section explains the system block diagram , device block diagram, flow chart, algorithm and the design used in the project.

3.1 Methodology

Jammers disable cell service by emitting radio waves at the same frequencies as mobile phones at a powerful enough level to cause the two signals to interfere and cancel each other out.
Cell phones become useless as a result of the interference this generates in their communication with cell towers. By transmitting the same radio frequencies that cell phones use, signal jammers operate similarly to radio jammers. As a result, a cell phone call cannot be made because of the interference it causes.
There are three main important circuits. When they are combined together, the output of that circuit will work as a jammer. The three circuits are: RF amplifier, Voltage Controlled Oscillator, Tuning circuit. This circuit is used as the basis for the final circuit that is currently undergoing design. The final circuit will include the Node mcu and relay modules.

3.2 System Overview

We can use multiple jamming devices together in a building such that the entire system can be handled by a single user through their software interface. Consider a user is in room A and wants to control two mobile jammers which are kept in two separate rooms. Let us call the jammers device 1 and device 2.

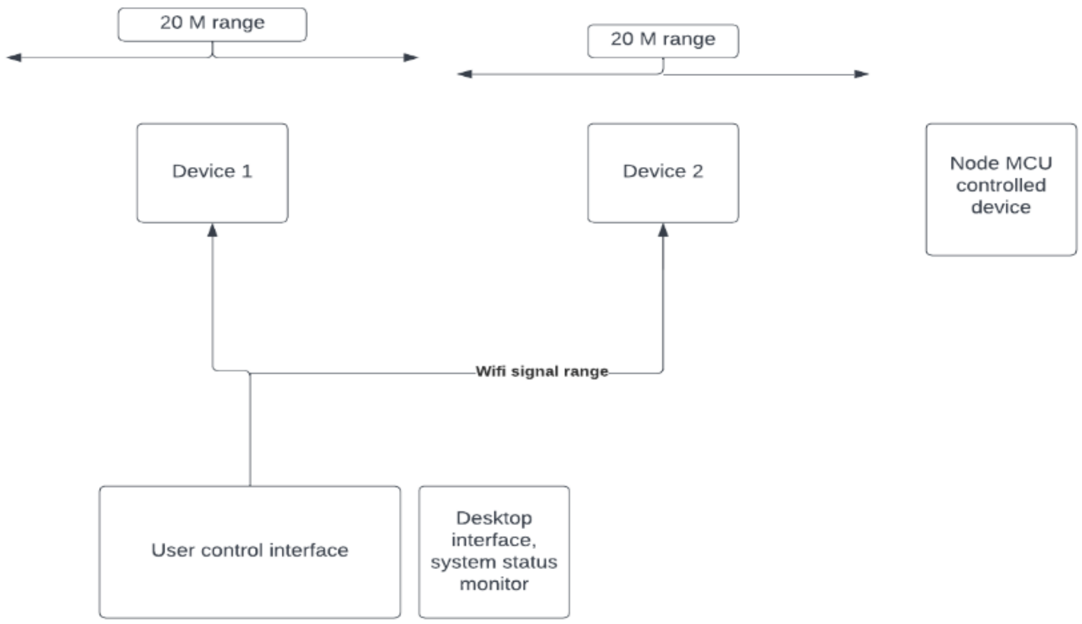

Figure 3.1: System Overview

3.3 Device Block Diagram

Fig 3.1 shows the block diagram of a single device in our system. This diagram consists of a power supply, voltage controlled oscillator, RF amplifier, Antenna, and a tuning circuit.

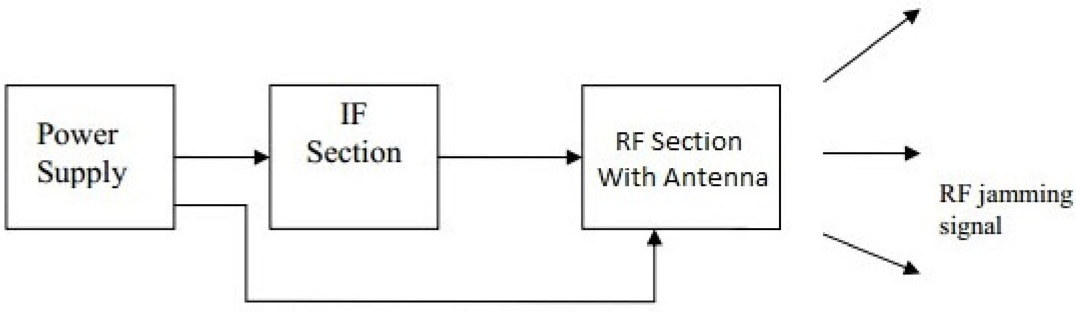

Figure 3.2: Device Block Diagram

Node MCU Controlled device: Circuit is remotely triggered using node mcu

Software: Front end design for user to control and monitor the device.

RF Amplifier: The RF amplifier boosts the frequency generated by the tuned circuit. The frequency generated by the tuned circuit and the noise signal generated by the capacitors is combined, amplified and transmitted.

Antennae: Suitable antenna type used to transmit the generated signal.

Tuning circuit: Used to fine tune the required signal in order for amplification and transmission.

3.4 Jammer Flowchart

Jammer Flowchart is shown in the figure 3.4.
The flowchart explains the flow of working of our jammer device.

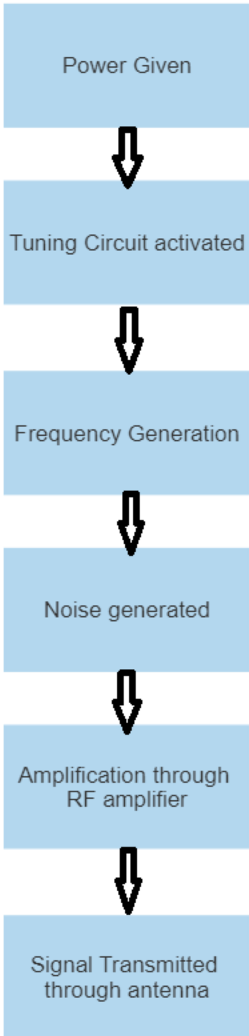

Figure 3.3: Jammer Flowchart

3.5 Algorithm

The figure 3.4 explains the software algorithm of the project.

3.6 Circuit Design

The design equations required to the complete working of our circuits has been explained in this section. This includes the timer design equations, tuning circuit design equations, and LED design equations.

555 Timer Design:
The 555 timer IC has three modes of operation- Astable, Monostable and Bistable. Here the circuit is designed in such a way that the 555 timer works in Astable mode of operation.

The charging time for the capacitor can be found as follows: Tc=0.693 * (Ra + Rb) * C

For discharging time, the following equation can be used: Td=0.693 * Rb * C

The output frequency can be calculated as follows: F=1.44 / (Ra + 2 * Rb) * C

The following equation shows the output frequency for 50 percent duty cycle: F=1.44 / (Ra + Rb) * C

Tuning Circuit Frequency: In order to increase the frequency from the tuning circuit we need to consider the working of LC circuit.
Increase the inductor capacitor circuit components value for increasing the frequency F= 1/ (2*pi*sqrt (L*C))

LED Design Equations: Here the led is used to indicate whether the device has switched on or off. The led cannot be directly given to the power

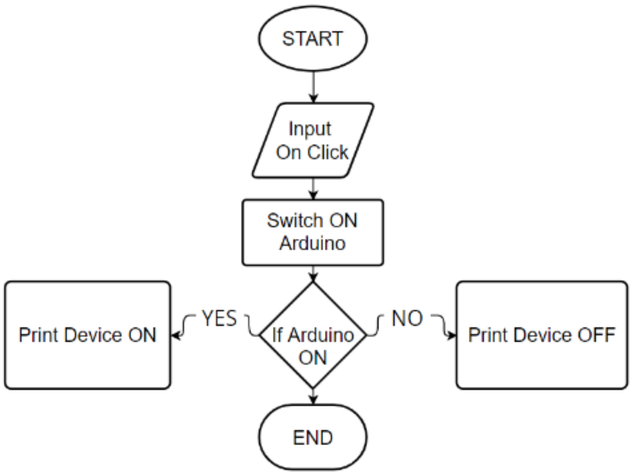

Figure 3.4: Software Algorithm

supply as an led cannot handle that much voltage and current and will be destroyed. Therefore we have to connect an appropriate resistor in series to the led so that the led receives the proper voltage and current.
(Vbattery-Vled)/Iled= R

3.7 Experimental Setup

The experimental setup of our circuits implemented for 2G and 3G signals has been discussed in this section.

3.7.1 Circuit Diagram

Figure 3.7.1 represents the circuit diagram for 2G signal jammer.

For any jammer circuit, remember that there are three main important circuits. When they are combined together, the output of that circuit will work as a jammer. The three circuits are RF amplifier, Voltage controlled oscillator, and Tuning circuit. So the transistor Q1, capacitors C4 and C5 and resistor R1 constitute the RF amplifier circuit. This will amplify the signal generated by the tuned circuit. The amplification signal is given to the antenna through C6 capacitor. Capacitor C6 will remove the DC and allow only the AC signal which is transmitted in the air. When the transistor Q1 is turned ON, the tuned circuit at the collector will get turned ON. The tuned circuit consists of capacitor C1 and inductor L1. This tuned circuit will act as an oscillator with zero resistance.

This oscillator or tuned circuit will produce the very high frequency with minimum damping. The both inductor and capacitor of tuned circuit will oscillate at its resonating frequency.

The tuned circuit operation is very simple and easy to understand. When the circuit gets ON, the voltage is stored by the capacitor according to its

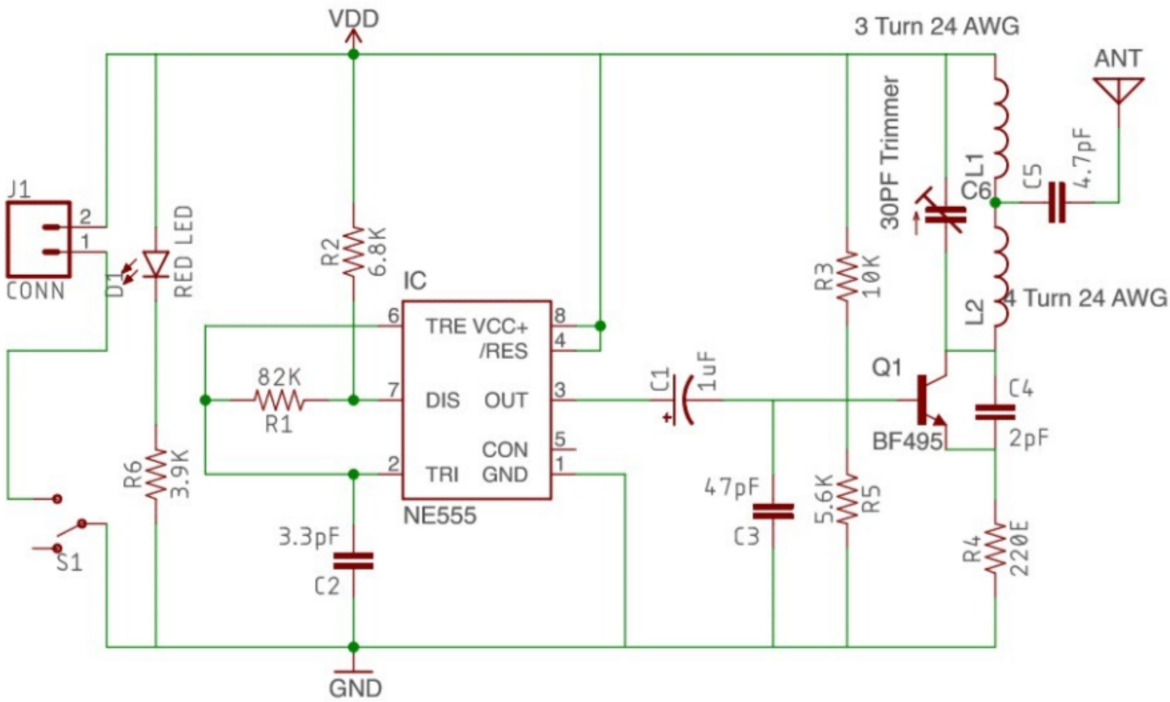

Figure 3.5: Experimental Setup

capacity. The main function of capacitor is to store electric energy. Once the capacitor is completely charged, it will allow the charge to flow through inductor. We know that inductor is used to store magnetic energy. When the current is flowing across the inductor, it will store the magnetic energy by this voltage across the capacitor and will get decreased, at some point complete magnetic energy is stored by inductor and the charge or voltage across the capacitor will be zero.

The magnetic charge through the inductor will decreased and the current will charge the capacitor in opposite or reverse polarity manner. Again after some period of time, capacitor will get completely charged and magnetic energy across the inductor will be completely zero. Again the capacitor will give charge to the inductor and becomes zero. After some time, inductor will give charge to capacitor and become zero and they will oscillate and generate the frequency.

This circle run upto the internal resistance is generated and oscillations will get stop. RF amplifier feed is given through the capacitor C5 to the collector terminal before C6 for gain or like a boost signal to the tuned circuit signal. The capacitors C2 and C3 are used for generating the noise for the frequency generated by the tuned circuit. Capacitors C2 and C3 will generate the electronic pulses in some random fashion (technically called noise).

The feedback back or boost given by the RF amplifier, frequency generated by the tuned circuit, the noise signal generated by the capacitors C2 and C3 will be combined, amplified and transmitted to the air.

3.7.2 3G Circuit Diagram

Fig 3.6 represents the circuit diagram of 3G signal jammer

The working is similar to the 2G circuit working.

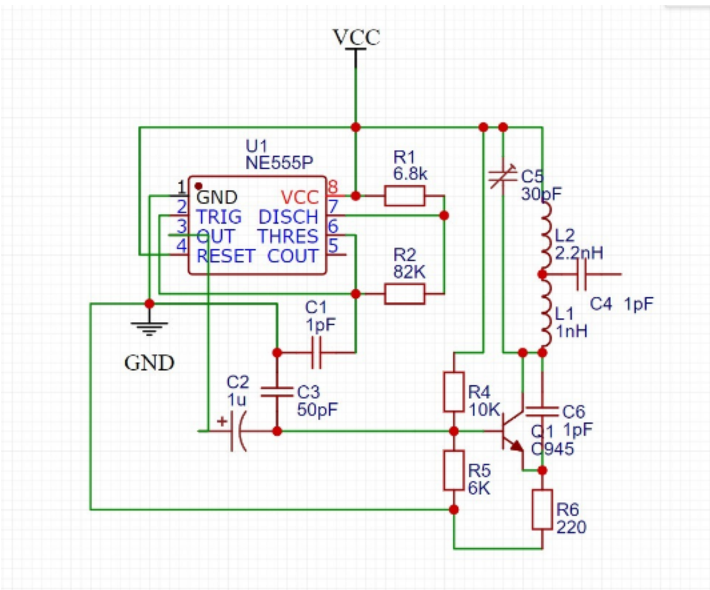

Figure 3.6: 3G Circuit Diagram

3.8 Feasibility Study

In this part of the report, feasibility study of our project is discussed under three categories. The three main categories are economic feasibility, social feasibility, and technical feasibility.

The Economic Feasibility of the project gave the conclusions that the system offers low maintenance cost and the system is cost effective.

The Social Feasibility of the project gave the conclusions that this system avoids malpractices in educational institutions, and this system provides privacy for VIP and their events. The system also offers global influence.

The Technical Feasibility of the project gave the conclusions that the access to components are easier and the system has covered the optimised usage of RF technology The system is simple and compact. The system is long-lasting and self sustaining, and have easy usage of the user interface.

Chapter 4

IMPLEMENTATION AND RESULT

This chapter discusses about the implementation process of the jammer circuit. This project have designed the circuit for 2G mobile signal jammer, implemented the same on a breadboard, tested and noted down the results. After that necessary modifications were made in the design for a 3G mobile signal jammer.

4.1 Simulation

LT spice is a spice based analog electronics circuit simulator computer software. The project circuit was simulated using this software. LTspice provides schematic capture to enter an electronic schematic for an electronic circuit, an enhanced SPICE type analog electronic circuit simulator, and a waveform viewer to show the results of the simulation.
The simulation for the project has been carried out in LT Spice for the study of circuits. The simulated output of the designed circuit is as shown below.

4.2 2G Implementaion

The breadboard level implementation of 2G signal jammer is shown below. The circuit was successfully implemented. The prototype when tested was able to minimize the strength of the 2G signal.

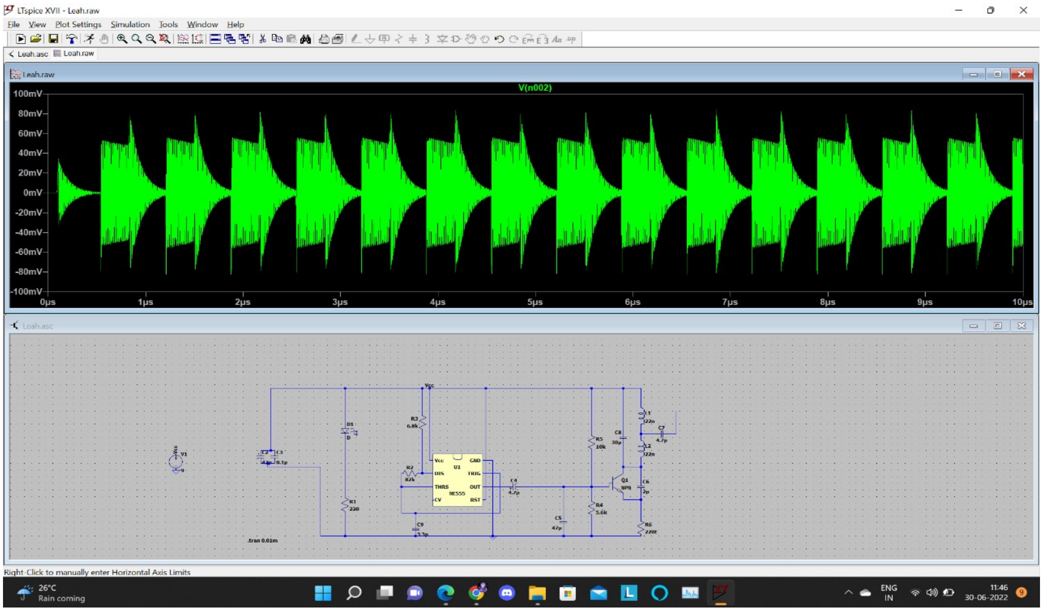

Figure 4.1: LT Spice Simulation

4.3 3G Implementation

The breadboard level implementation of 3G signal jammer is shown below. On modifying the design of the 2G signal jammer by changing the values of the inductors and capacitors The circuit was successfully implemented. The prototype when tested was able to minimize the strength of the 3G signal.

4.4 Result

Successfully wired and completed the implementation of 2G and 3G Jammer circuits within the period of time provided for our project. Also completed the integration of our hardware and software circuit.

The user is able to control and monitor the jamming device through the graphical user interface we built using HTML/CSS and JavaScript. By

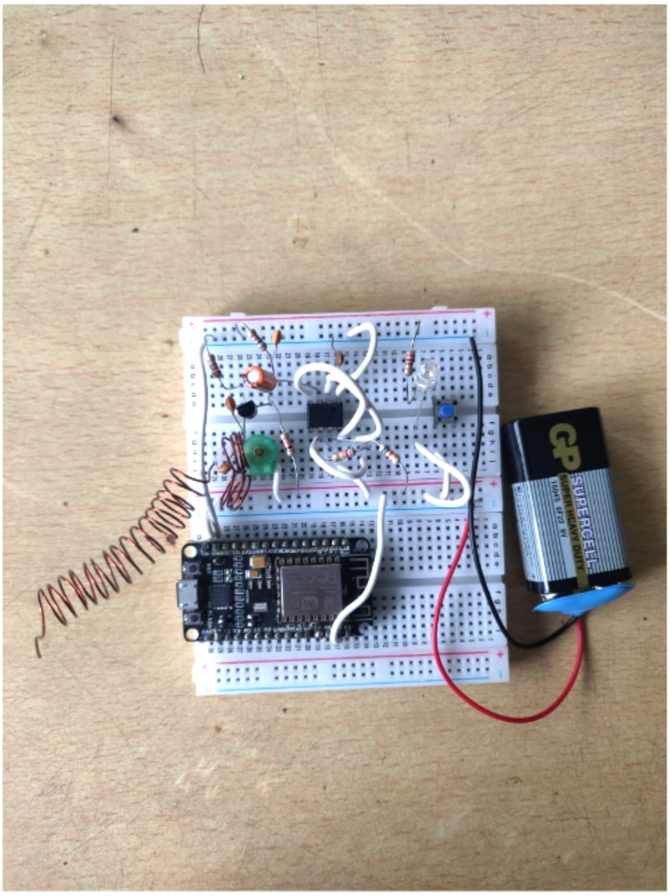

Figure 4.2: 2G Implementation

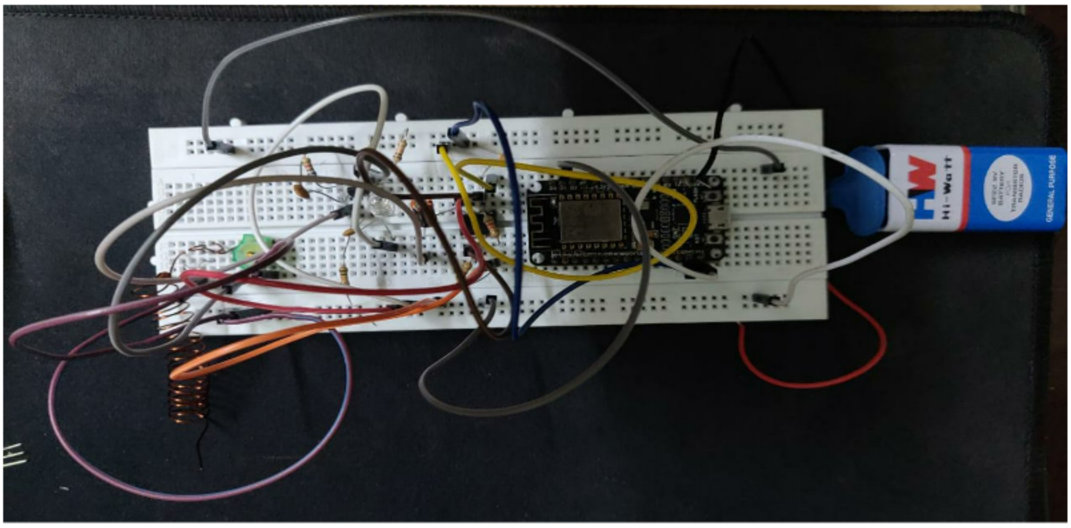

Figure 4.3: 3G Implementation

switching the device ON through the interface, the LED lights up indicating that the jamming device is switched ON and in the functional mode. Similarly, by switching it OFF through the interface, the LED turns OFF the light, indicating that the jamming device is turned back OFF.

Chapter 5

CONCLUSION

In this chapter we summarize the project report. We started of with the idea development, followed by circuit design, system specifications, component specification, feasibility study and finally implementation.

5.1 Summary

The main objective of the project was to design a cell phone jammer circuit with hardware part with high flexibility and minimum cost and making it available for use by the consumers. The signal jammer restricts access to mobile use in specified areas. It can be used prevent sensitive information in classified areas such as Parliaments, high priority defence meetings and international conferences. The most interesting feature of the jammer is that it is simple, cheap, efficient and easily deployable in suitable places. We searched for components that are needed for building this device, and specified the main components. For RF section, we needed one VCO's that operate at the needed bands, one power amplifier, and one antenna.

5.2 Applications

This session discusses various applications of our project.

- **Gas stations, the air entertainment station, the fuel depot and the flammable explosive chemical warehouse, the refinery, the petrified factory and so on need safety to protect the place:** May avoid changing suddenly the detonation which the signal radiative generation Static electricity spark but causes, the fire. Posting the prohibition to dial the handset sign, does not have the initiative, this kind of accident all has the appearance in many national gas stations, in order to safeguard these important situations the security to be supposed to take the precautionary measure.

- **Governments, enterprise's each kind of conference room:** May avoid the handset ting disturbs and answers when the telephone breaking the leader to speak but interrupts its person to hold a meeting.
- **Armies, public security department's important conference rooms:** Might avoid the attending personnel divulging the military and the government using the handset is secret, at present the new spy science and technology, already used the handset interception, the monitor environment sound, therefore to important conference place, it is necessary to take effective also of security the initiative.
- **Hospitals:** Might avoid the goon machine-hour but causing doctor to the hospital precision instrument equipment disturbance to misdiagnose, has delayed the rescue patient, as well as was surgery doctor to answer the handset telephone disturbance attention, underwent the surgery to doctor to the patient to be extremely disadvantageous.
- **Courts:** May avoid the handset ting the disturbance, maintains the court conference site the dignity and the sacredness.
- **Libraries, New Bookstore:** May avoid the handset ting and answer the telephone the noise, builds to study in a peaceful environment
- **Theatres:** As the upscale recreation area, eliminates the handset ting noise to be possible to maintain the audience to appreciate the program of interest.
- **Tests places, examination centre:** May cease the examinee, monitor an exam the personnel to cheat using the modern communication facilities.

- **Schools classrooms and training organization classroom:** May avoid the hand setting and answers when the handset telephone to attend class student's disturbance.
- **Instead fears the unit:** Locking goal of tendency by handset telecontrolled bomb.
- **Coast defences unit:** May prevent the seacoast smuggling member who discloses secret information using the handset, effectively attacks smuggling criminal offender's smuggling.
- **The jail, detains the place:** Prevents the criminal, the news media, the visit personnel, the prison tube does not collude with according to the stipulation inside and outside, forms conspires to get the story straight.
- **Temples, Mosques and Churches:** May eliminate the handset signal noise, by maintaining the religious place solemn and respectful.

5.3 Future scope

A proof of concept can be applied to 4G and 5G networks with respect to mobile jammer devices. With this circuit diagram range of the mobile jammer devices can be extended by adjusting the design of the antenna. We can also integrate a timer to this jammer, which provides the working of jammer under a certain period of time only such that we can switch it on at a certain point and then it automatically stops working after a set period of time. Multiple device support can also implemented by connecting more than one jammer to the system. This helps users to use multiple jammers through a single system at a time. This can be used to in a building where several rooms need a system for jammers. Along with this, advanced designs can be implemented for military use.

5.4 Advantages

This system of mobile jammer circuits have several advantages. The best advantage is that the components required for this device is easily available at almost all the places. The next best advantage is that, the expenses and cost of maintaining the jammer device is very low compared to the standard price ranges available. We can provide security to V.I.P's from the anti-social elements.By using cell phone jammers we can maintain law and order for maintaining peace. By cell phone jammers we can't disturb other people in the public places like restaurants, shopping places. It is very necessary to use cell phone jammers in naxal feared places. This helps the authorities to work their duty softly. By using cell phone jammers in the vehicles, we can overcome accidents problem which is very helpful to the people. It can also be used in religious institutions like churches, temples, mosques, etc. to maintain silence and decorum.

5.5 Drawbacks

The main drawback of this system is that we were not possible to block 4G and 5G signals. We can also increase the range in our future systems by redesigning the antenna. We also encountered with another disadvantage of having low transmission power. Another drawback with mobile jammers is that some people may feel inconvenience. Since jammers block all signals, important and emergency calls will also be blocked.

5.6 Legality Issues

Department of Telecommunications (DoT), Ministry of Communications, on 1st July, 2022 issued an advisory to the general public on the proper use of Wireless jammer and booster/repeaters (https://dot.gov.in/spectrummanagement/advisory-proper-use-wireless-jammer-a nd-boosterrepeater)
n As per Department of Telecommunications, Jammers come under the

purview of Indian Wireless Telegraphy Act 1933 (IWTA 1933) and the Act lays down that license is required for possession and use of jammers. Under FTDR Act 1992, Jammers are restricted items and license is required from DGFT for importing jammers into India. The license is granted in consultation with the O/o Secretary (Security), Cabinet Secretariat.
n It has been stated that the use of cellular signal jammer, GPS blocker or other signal jamming device is generally illegal, except specifically permitted by Government of India.
n However, recently, there has been an increasing demand for portable cell phone jammers.
n We should mention that this project, presented in this report, is solely done for educational purposes.

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Chapter 6

APPENDIX

6.1 System Specifications

LM 555 Timer

The 555 timer IC was first introduced around 1971 by the Signe tics Corporation as the SE555/NE555 and was called "The IC Time Machine" and was also the very first and only commercial timer IC available. It provided circuit designers with a relatively cheap, stable, and user-friendly integrated circuit for both constable and actable applications. Since this device was first made commercially available, a myriad of novel and unique circuits have been developed and presented in several trade, professional, and hobby publications. The past ten years some manufacturers stopped making these timers because of competition or other reasons. Yet other companies, like NTE (a subdivision of Philips) picked up where some left off.

Although these days the CMOS version of this IC, like the Motorola MC1455, is mostly used, the regular type is still available, however there have been many improvements and variations in the circuitry. But all types are pin-for-pin plug compatible. In this tutorial the 555 timer is examined in detail along with its uses, either by itself or in combination with other solid state devices. This timer uses a maze of transistors, diodes and resistors and for this complex reason a more simplified (but accurate) block diagram is used to explain the internal organizations of the 555.

All IC timers rely upon an external capacitor to determine the off-on time intervals of the output pulses. It takes a finite period of time for a capacitor (C) to charge or discharge through a resistor (R). Those times are clearly defined and can be calculated given the values of resistance and capacitance.

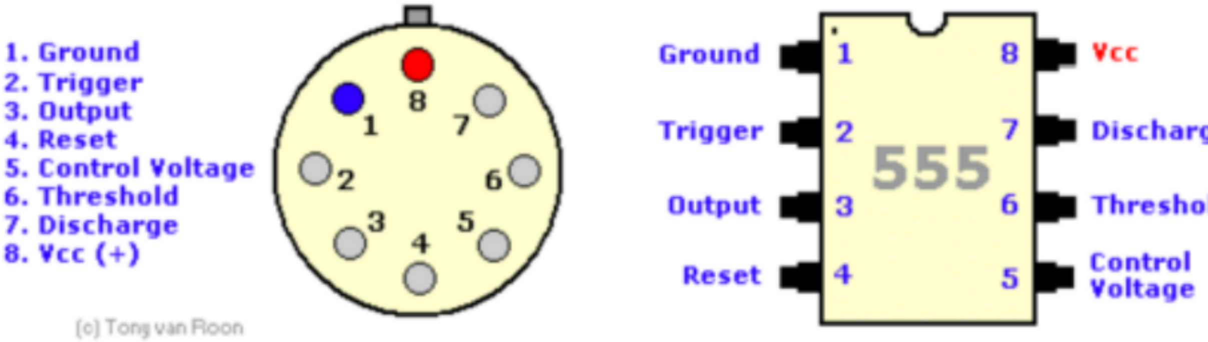

Figure 6.1: 555 Timer Pin Diagram

The basic RC charging circuit is shown in fig. 4. Assume that the capacitor is initially discharged. When the switch is closed, the capacitor begins to charge through the resistor. The voltage across the capacitor rises from zero up to the value of the applied DC voltage. The charge curve for the circuit is shown in fig. 6. The time that it takes for the capacitor to charge to 63.7constant (t). That time can be calculated with the simple expression: t = R X C.

Definition of Pin Functions

Refer to the internal 555 schematic of Figure

Pin 1 (Groud): The ground (or common) pin is the most-negative supply potential of the device, which is normally connected to circuit common (ground) when operated from positive supply voltages.

Pin 2 (Trigger): This pin is the input to the lower comparator and is used to set the latch, which in turn causes the output to go high. This is the beginning of the timing sequence in monostable operation. Triggering is accomplished by taking the pin from above to below a voltage level of 1/3 V+ (or, in general, one-half the voltage appearing at pin 5). The action of the trigger input is level-sensitive, allowing slow rate-of-change waveforms, as well as pulses, to be used as trigger sources. The trigger pulse must be of shorter duration than the time interval determined by the external R and C. If this pin is held low longer than that, the output will remain high until the trigger input is driven high again.

One precaution that should be observed with the trigger input signal is that it must not remain lower than 1/3 V+ for a period of time longer than the timing cycle. If this is allowed to happen, the timer will retrigger itself upon termination of the first output pulse. Thus, when the timer is driven in the monostable mode with input pulses longer than the desired output pulse width, the input trigger should effectively be shortened by differentiation.

The minimum-allowable pulse width for triggering is somewhat dependent upon pulse level, but in general if it is greater than the 1uS (micro-Second), triggering will be reliable. A second precaution with respect to the trigger

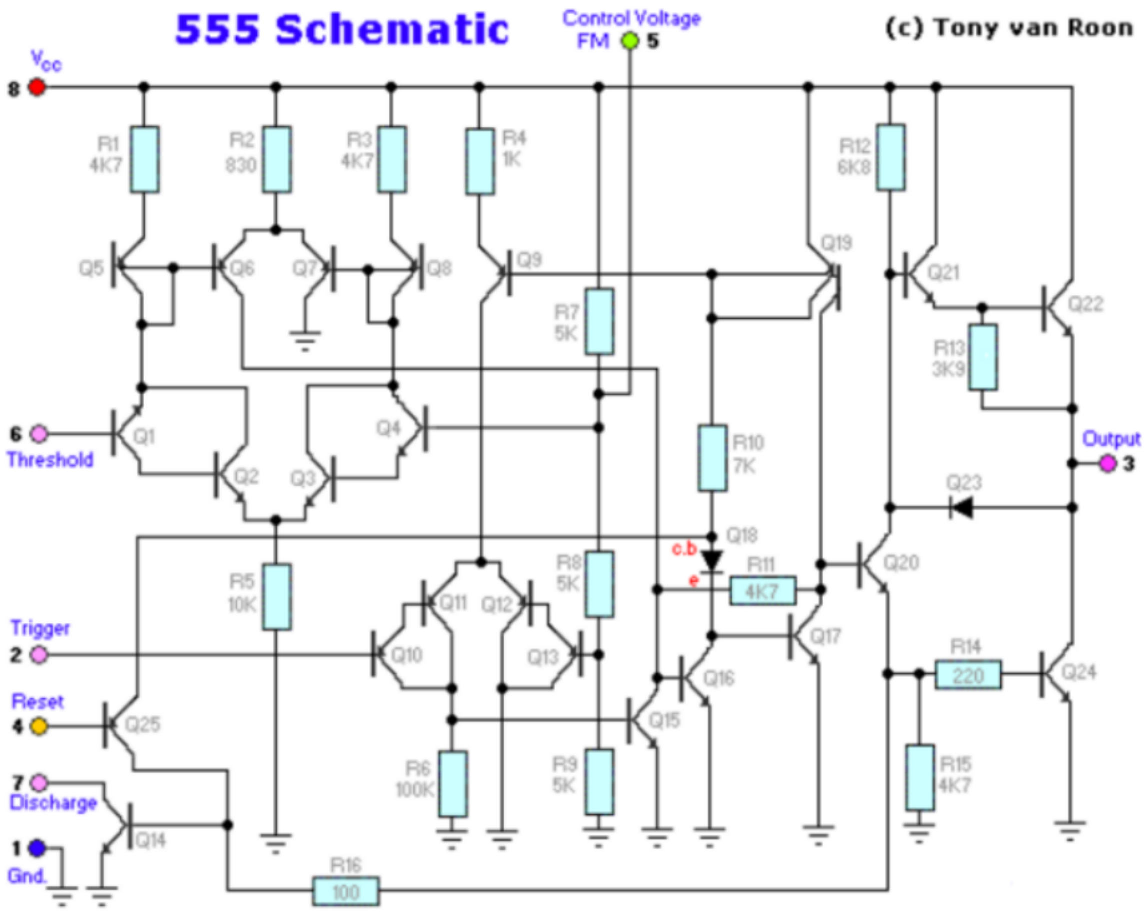

Figure 6.2: 555 Timer Schematic Diagram

input concerns storage time in the lower comparator. This portion of the circuit can exhibit normal turn-off delays of several microseconds after triggering; that is, the latch can still have a trigger input for this period of time after the trigger pulse. In practice, this means the minimum monostable output pulse width should be in the order of 10uS to prevent possible double triggering due to this effect. The voltage range that can safely be applied to the trigger pin is between V+ and ground. A dc current, termed the trigger current, must also flow from this terminal into the external circuit. This current is typically 500nA (nano-amp) and will define the upper limit of resistance allowable from pin 2 to ground. For an astable configuration operating at V+ = 5 volts, this resistance is 3 Mega-ohm; it can be greater for higher V+ levels.

Pin 3 (Output): The output of the 555 comes from a high-current totem-pole stage made up of transistors Q20 - Q24. Transistors Q21 and Q22 provide drive for source-type loads, and their Darlington connection provides a high-state output voltage about 1.7 volts less than the V+ supply level used. Transistor Q24 provides current-sinking capability for lowstate loads referred to V+ (such as typical TTL inputs). Transistor Q24 has a low saturation voltage, which allows it to interface directly, with good noise margin, when driving currentsinking logic. Exact output saturation levels vary markedly with supply voltage, however, for both high and low states. At a V+ of 5 volts, for instance, the low state Vce(sat) is typically 0.25 volts at 5 mA. Operating at 15 volts, however, it can sink 200mA if an outputlow voltage level of 2 volts is allowable (power dissipation should be considered in such a case, of course). High-state level is typically 3.3 volts at V+ = 5 volts; 13.3 volts at V+ = 15 volts. Both the rise and fall times of the output waveform are quite fast, typical switching times being 100nS.

The state of the output pin will always reflect the inverse of the logic state of the latch, and this fact may be seen by examining Fig. 3. Since the latch itself is not directly accessible, this relationship may be best explained in terms of latch-input trigger conditions. To trigger the output to a high condition, the trigger input is momentarily taken from a higher to a lower level. [see "Pin 2 - Trigger"]. This causes the latch to be set and the output to go high. Actuation of the lower comparator is the only manner in which the output can be placed in the high state. The output can be returned to a low state by causing the threshold to go from a lower to a higher level [see "Pin 6 - Threshold"], which resets the latch. The output can also be made to go low by taking the reset to a low state near ground [see "Pin 4 - Reset"]. The output voltage available at this pin is approximately equal to the Vcc applied to pin 8 minus 1.7V.

Pin 4 (Reset): This pin is also used to reset the latch and return the output to a low state. The reset voltage threshold level is 0.7 volt, and a sink current of 0.1mA from this pin is required to reset the device. These levels are relatively independent of operating V+ level; thus the reset input is TTL compatible for any supply voltage.
The reset input is an overriding function; that is, it will force the output to a low state regardless of the state of either of the other inputs. It may thus be used to terminate an output pulse prematurely, to gate oscillations from "on" to "off", etc. Delay time from reset to output is typically on the order of 0.5 µS, and the minimum reset pulse width is 0.5 µS. Neither of these figures is guaranteed, however, and may vary from one manufacturer to another. In short, the reset pin is used to reset the flip-flop that controls the state of output pin 3. The pin is activated when a voltage level anywhere between 0 and 0.4 volt is applied to the pin. The reset pin will force the output to go low no matter what state the other inputs to the flip-flop are in. When not used, it is recommended that the reset input be tied to V+ to avoid any possibility of false resetting.

Pin 5 (Control Voltage): This pin allows direct access to the 2/3 V+ voltage-divider point, the reference level for the upper comparator. It also allows indirect access to the lower comparator, as there is a 2:1 divider (R8 - R9) from this point to the lower-comparator reference input, Q13. Use of this terminal is the option of the user, but it does allow extreme flexibility by permitting modification of the timing period, resetting of the comparator, etc. When the 555 timer is used in a voltage-controlled mode, its voltage-

controlled operation ranges from about 1 volt less than V+ down to within 2 volts of ground (although this is not guaranteed). Voltages can be safely applied outside these limits, but they should be confined within the limits of V+ and ground for reliability.
By applying a voltage to this pin, it is possible to vary the timing of the device independently of the RC network. The control voltage may be varied from 45 to 90of the output pulse independently of RC. When it is used in the astable mode, the control voltage can be varied from 1.7V to the full Vcc. Varying the voltage in the astable mode will produce a frequency modulated (FM) output. In the event the control-voltage pin is not used, it is recommended that it be bypassed, to ground, with a capacitor of about 0.01uF (10nF) for immunity to noise, since it is a comparator input. This fact is not obvious in many 555 circuits since I have seen many circuits with 'no-pin-5' connected to anything, but this is the proper procedure. The small ceramic cap may eliminate false triggering.

Pin 6 (Threshold): Pin 6 is one input to the upper comparator (the other being pin 5) and is used to reset the latch, which causes the output to go low. Resetting via this terminal is accomplished by taking the terminal from below to above a voltage level of 2/3 V+ (the normal voltage on pin 5). The action of the threshold pin is level sensitive, allowing slow rate-of-change waveforms.
The voltage range that can safely be applied to the threshold pin is between V+ and ground. A dc current, termed the threshold current, must also flow into this terminal from the external circuit. This current is typically 0.1µA, and will define the upper limit of total resistance allowable from pin 6 to V+. For either timing configuration operating at V+ = 5 volts, this resistance is 16 MW For 15 volt operation, the maximum value of resistance is 20 MW.

Pin 7 (Discharge): This pin is connected to the open collector of a NPN transistor (Q14), the emitter of which goes to ground, so that when the transistor is turned "on", pin 7 is effectively shorted to ground. Usually the timing capacitor is connected between pin 7 and ground and is discharged

when the transistor turns "on". The conduction state of this transistor is identical in timing to that of the output stage. It is "on" (low resistance to ground) when the output is low and "off" (high resistance to ground) when the output is high.
In both the monostable and astable time modes, this transistor switch is used to clamp the appropriate nodes of the timing network to ground. Saturation voltage is typically below 100mV (milli-Volt) for currents of 5 mA or less, and off-state leakage is about 20nA (these parameters are not specified by all manufacturers, however).
Maximum collector current is internally limited by design, thereby removing restrictions on capacitor size due to peak pulse-current discharge. In certain applications, this open collector output can be used as an auxiliary output terminal, with current-sinking capability similar to the output (pin 3).

Pin 8 (V+): The V+ pin (also referred to as Vcc) is the positive supply voltage terminal of the 555 timer IC. Supply-voltage operating range for the 555 is +4.5 volts (minimum) to +16 volts (maximum), and it is specified for operation between +5 volts and + 15 volts. The device will operate essentially the same over this range of voltages without change in timing period. Actually, the most significant operational difference is the output drive capability, which increases for both current and voltage range as the supply voltage is increased. Sensitivity of time interval to supply voltage change is low, typically 0.1are special and military devices available that operate at voltages as high as 18 V.

ESP8266

The ESP8266 is a low-cost Wi-Fi microchip, with built-in TCP/IP networking software, and microcontroller capability, produced by Espressif System in Shanghai, China.

Processor: L106 32-bit RISC microprocessor core based on the Tensilica Diamond Standard 106Micro running at 80 MHz

Memory: 32 KiB instruction RAM 32 KiB instruction cache RAM

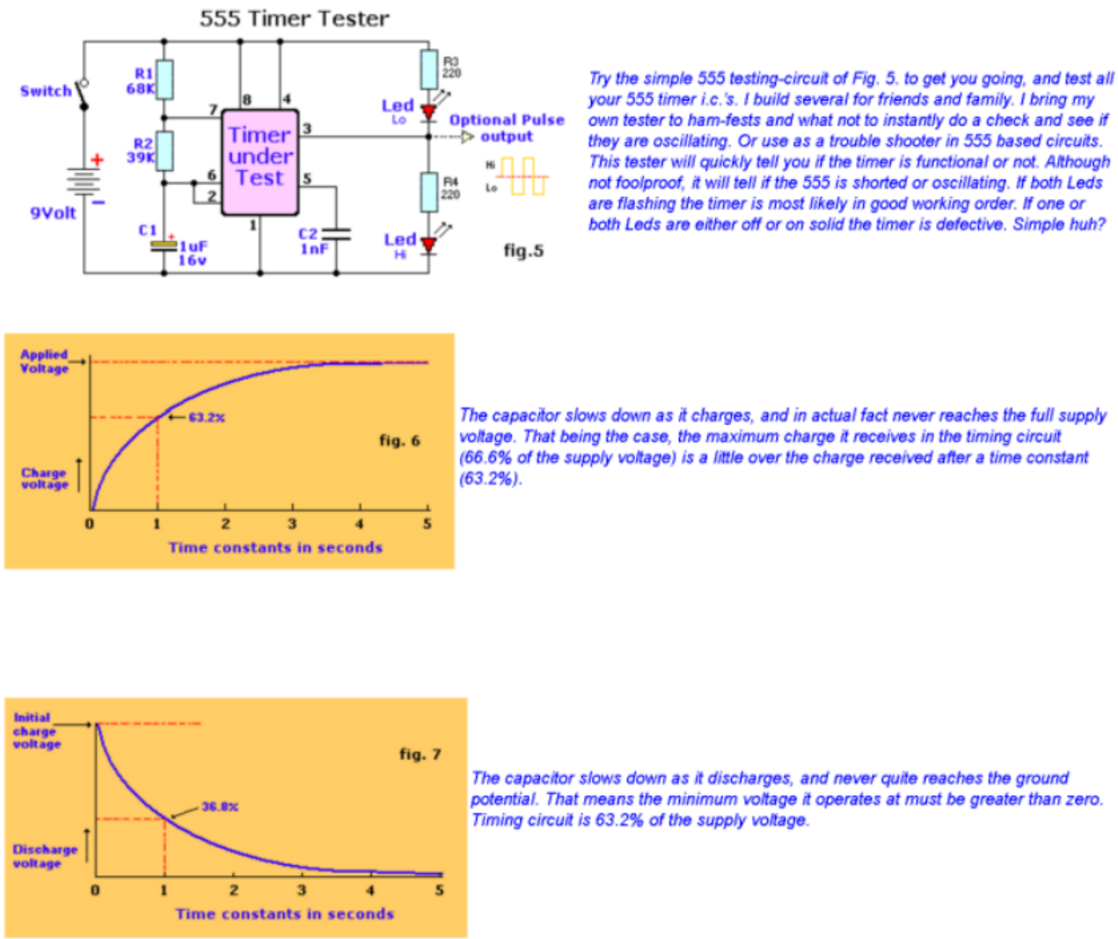

Figure 6.3: 555 Timer Tester

Figure 6.4: ESP8266-IC

80 KiB user-data RAM 16 KiB ETS system-data RAM

External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)

IEEE 802.11 b/g/n Wi-Fi Integrated TR switch, balun, LNA, power amplifier and matching network WEP or WPA/WPA2 authentication, or open networks

17 GPIO pin Serial Peripheral Interface Bus (SPI) I²C (software implementation) I²S interfaces with DMA (sharing pins with GPIO) UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2 10-bit ADC (successive approximation ADC) Pinout of ESP8266 The pinout is as follows for the common ESP-01 module: GND, Ground (0 V) GPIO 2, General-purpose input/output No. 2 GPIO 0, General-purpose input/output No. 0 RX, Receive data in, also GPIO3 VCC, Voltage (+3.3 V; can handle up to 3.6 V) RST, Reset CH$_PD, Chippower-downTX, Transmitdataout, alsoGPIO1$

6.2 Code

Code for Node MCU Remote Trigger and Web Page is given in this section.

include ¡ESP8266WiFi.h¿

// Replace with your network credentials const char* ssid = "group1"; const char* password = "unni12345";

// Set web server port number to 80 WiFiServer server(80);

// Variable to store the HTTP request String header;

// Auxiliar variables to store the current output state String output5State = "off";

// Assign output variables to GPIO pins const int output5 = 5;

// Current time unsigned long currentTime = millis(); unsigned long startingTime = currentTime; unsigned long minute = 0; unsigned long seconds = 0; // Previous time unsigned long previousTime = 0; // Define timeout time in milliseconds (example: 2000ms = 2s) const long timeoutTime = 2000;

Figure 6.5: ESP-01 Module

//new code

// Set your Static IP address IPAddress local$_IP(192, 168, 1, 4); ////SetyourGatewayIP$

void setup() Serial.begin(115200); // Initialize the output variables as outputs pinMode(output5, OUTPUT); // Set outputs to LOW digitalWrite(output5, LOW);

// Connect to Wi-Fi network with SSID and password Serial.print("Connecting to "); Serial.println(ssid); WiFi.begin(ssid, password); while (WiFi.status() != WL$_CONNECTED)delay(500); Serial.print(".");$

// new code

// Configures static IP address // if (!WiFi.config(local$_IP, gateway, subnet))//Serial.p$

"); $Serial.println(WiFi.localIP()); server.begin();$

void loop() WiFiClient client = server.available(); // Listen for incoming clients

if (client) // If a new client connects, Serial.println("New Client."); // print a message out in the serial port String currentLine = ""; // make a String to hold incoming data from the client currentTime = millis(); previousTime = currentTime; while (client.connected() currentTime - previousTime ¡= timeoutTime) // loop while the client's connected currentTime = millis(); if (client.available()) // if there's bytes to read from the client, char c = client.read(); // read a byte, then Serial.write(c); // print it out the serial monitor header += c; if (c == ") // if the byte is a newline character // if the current line is blank, you got two newline characters in a row. // that's the end of the client HTTP request, so send a response: if (currentLine.length() == 0) // HTTP headers always start with a response code (e.g. HTTP/1.1 200 OK) // and a content-type so the client knows what's coming, then a blank line: client.println("HTTP/1.1 200 OK"); client.println("Content-type:text/html"); client.println("Connection: close"); client.println();

// turns the GPIOs on and off if (header.indexOf("GET /5/on") ¿= 0) Serial.println("GPIO 5 on"); output5State = "on"; digitalWrite(output5, HIGH); else if (header.indexOf("GET /5/off") ¿= 0) Serial.println("GPIO 5 off"); output5State = "off"; digitalWrite(output5, LOW);

// Display the HTML web page client.println("¡!DOCTYPE html¿¡html¿"); client.println("¡head¿¡meta name=v̈iewportc̈ontent=ẅidth=device-width, initialscale=1̈¿"); client.println("¡link rel=ïconḧref=d̈ata:,̈¿"); // CSS to style the on/off buttons // Feel free to change the background-color and font-size attributes to fit your preferences client.println("¡style¿html font-family: Helvetica; display: inline-block; margin: 0px auto; text-align: center;"); client.println(".button background-color: 195B6A; border: none; color: white; padding: 16px 40px;"); client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;"); client.println(".button2 background-color: 77878A;¡/style¿¡/head¿");

// Web Page Heading client.println("¡body¿¡h1¿Group 1 Mini Project¡/h1¿"); client.println("¡div¿Unnikrishna Menon M, John Thariyan, Anjali Sajeevan, Vishnumaya Unni¡/div¿¡div¿S6 ECE-B¡/div¿"); // Display current state, and ON/OFF buttons for GPIO 5 client.println("¡p¿Jammer - State " + output5State + "¡/p¿"); // If the output5State is off, it displays the ON button if (output5State=="off") client.println("¡p¿¡a href=̈/5/on̈¿¡button class=b̈uttoṅ¿ON¡/button¿¡/a¿¡/p¿"); startingTime = 0; minute = 0; seconds = 0; else client.println("¡p¿¡a href=̈/5/off̈¿¡button class=b̈utton button2̈¿OFF¡/button¿¡/a¿¡/p¿"); minute = (millis() - startingTime)/60000; seconds = (millis() - startingTime)/1000; client.println("¡center¿¡div id=m̈ainstopwatcḧ¿¡div class=m̈ainTime¿¡span id=m̈ainminutë¿"+String(minute)+"¡/span¿"); client.println("¡span id=m̈ainsecond̈¿"+String(seconds)+"¡/span¿"); client.println("¡center¿¡span¿MIN¡/span¿ ¡span¿SEC¡/span¿¡/center¿"); client.println("¡/body¿¡/html¿");

// The HTTP response ends with another blank line client.println(); // Break out of the while loop break; else // if you got a newline, then clear currentLine currentLine = ""; else if (c != '̊') // if you got anything else but a carriage return character, currentLine += c; // add it to the end of the currentLine // Clear the header variable header = ""; // Close the connection client.stop(); Serial.println("Client disconnected."); Serial.println("");

6.3 Gantt Chart