

POLITEKNIK SEBERANG PERAI

ARDUINO BASED MOBILE PHONE DETECTOR

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PENGISTIHARAN

Di sini saya mengistiharkan bahawa laporan ini adalah berdasarkan hasil kerja saya sendiri dengan bantuan maklumat daripada sumber-sumber yang diberitahu di dalam pengakuan. Saya juga mengistiharkan hasil projek saya ini tidak pernah dihasilkan oleh mana-mana pelajar lain serta dari institusi pengajian yang lain.



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Abstract

Many students are caught copying in their exams and using mobile phone in class or in lecture class. An Arduino based mobile phone detector could reduce the number of students who are copying and prevent the usage of mobile phones in class. Our objectives are to avoid the usage of mobile phones during examinations and lectures and to detect mobile phones in a range of 30-40 meters. Methodology used in this Arduino based mobile phone detector is that an antenna that detects signal between 0.9 to 3GHz. Then the signal level is transmitted to the resistor. The resistor then transmit the signal obtained by the antenna to the microcontroller in the Arduino which is programmed to sound the buzzer when signal from a mobile phone is detected. The circuit operation is 9V DC. When an active mobile phone is placed near the antenna, the detector was able to detect the signal and give output of the buzzer and LED.

Abstrak

Ramai pelajar ditangkap meniru dalam peperiksaan mereka dan menggunakan telefon bimbit di dalam kelas atau di dalam kelas kuliah. Sel pengesan telefon berasaskan Arduino boleh mengurangkan bilangan pelajar yang menyalin dan mengelakkan penggunaan telefon bimbit di dalam kelas. Objektif kami adalah untuk mengelakkan penggunaan telefon bimbit semasa peperiksaan dan kuliah dan untuk mengesan telefon bimbit dalam pelbagai 30-40 meter. Kaedah yang digunakan dalam pengesan telefon bimbit berasaskan Arduino ini adalah bahawa antenna yang mengesan isyarat antara 0.9 kepada 3GHz. Kemudian tahap isyarat yang dihantar kepada perintang. Perintang kemudian menghantar isyarat yang diperolehi oleh antenna ke mikropengawal dalam Arduino yang diprogramkan untuk bunyi buzzer apabila isyarat dari telefon mudah alih dikesan. Operasi litar adalah 9V DC. Apabila telefon bimbit yang aktif diletakkan berhampiran antenna, pengesan itu dapat mengesan isyarat dan memberi output daripada buzzer dan LED.

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LIST OF ABBREVIATION

LED - Light Emitted Diode

Chapter 1

Introduction

1.1 Introduction

Examinations are one of the common element in college. As we know, the usage of mobile phones are strictly prohibited in the exam halls whatsoever. In fact, few colleges require their students to keep their phones outside the hall or will be collected by the invigilator and will be given back to the students thereafter. But there are a few students who are still using mobile phones secretively during exams. They use the mobile phones to surf the web for answers or to get notes about their respective subjects of the current examination.

1.2 Problem Statement

- a) Students of Polytechnic Seberang Perai are caught using phones to copy during exams and also during important lectures.

1.3 Objectives

- a) To detect active mobile phone signals around a radius of 30-40 meters range and avoid the usage of mobile phones during examinations and classes.

1.4 Scope and Limitation Of Project

The radius range of this detector is around 30-40 meters. Hence this may be used in DTK 6A class room or even in our JKE classrooms. Our scope is to create a detector which will be used in lecture rooms and also examination rooms, so that it can detect all the signals from GSM till 4G mobile phones of the students.

1.5 Conclusion

In a nutshell, the Arduino based mobile phone detector is designed to detect active mobile mobile phones from students as they enter the lecture room or as they enter the exam room. Nevertheless, this project will give a great impact to examiners who are examining the examination room in hunting down students who are using their mobile phones during exam.

Chapter 2

Literature Review

2.1 Introduction

Literature review is based on the findings and the concept of mobile phone detector which were invented before. There are a few aspects which is important and should be looked into before inventing a mobile phonedetector.

2.2 Concept

There are several models of mobile phones in the market nowadays. With a blink of an eye, a new and improved mobile phone will be released into the market serving us with the latest function and applications to help an individual's daily life tasks. Few of our famous mobile phones are 2G, 3G and 4G. The frequency of a 2G is GSM 900 MHz till 1800 MHz. Whereas a 3G phone has a frequency of UMTS 900 MHz till 2100 MHz. Finally a 4G phone as a frequency of LTE 850 MHz till 2600 MHz. An Arduino based mobile phone detector would be just nice to detect these mobile phone models because it can detect 0.9 till 3GHz of frequency.

2.3 Inventions

2.3.1 Cellbusters Mobile phone Detector

Invented By: Cellbusters.INC.

Based on the research paper by Cellbusters.INC.(2008) Cellbuster's cellular phone detector provides continuous monitoring for cellular phones and has a voice alert that tells the user to shut their phone off if detected. The Cellbuster only receives and doesn't transmit, making it great for areas sensitive to cellular phone usage. It will also detect phones that are in standby mode

.Cellbuster's mobile phone detector features :

- a) Detect and prevent unauthorized cellular phone usage
- b) Detects analog and digital cellular phones CDMA, TDMA, GSM, and PCS/PCN types
- c) Range adjustment
- d) Audio alert asks cellular phone users to switch off their phone 10
- e) Red alert light flashes brightly to attract attention

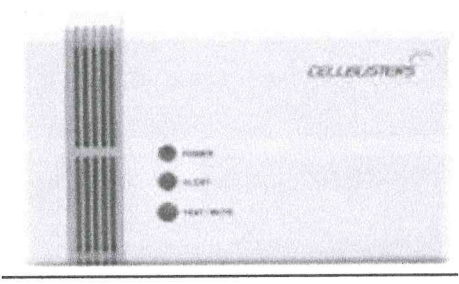


Figure 2.1: Cellbuster's Mobile phone Detector (Ref: Cellbusters.com)

Test 1 - Outside Faraday Cage at Home with Cellular Phones Turned On

- a) Called one phone from the other and left on for 5 minutes - detector didn't activate
- b) Texted one phone from the other - detector didn't activate
- c) Detector doesn't appear to work in public area with the sensitivity set high or low
- d) Detector activated randomly and generally not during a phone call

Cellbuster's mobile phone detector doesn't work very well and it is questionable that the detector works at all. Using this device in a public area the detector just randomly went into alarm and didn't indicate where to go or what to do. Testing indicates that the Cellbuster's mobile phone detector doesn't work as advertised.

2.3.2 Centralized Mobile Detection in Examination Hall Using ArduinoDuemilanove (ATmega328)

The detector was created by Jawad Ahmad Dar, MTECH Final Year which is able to detect both incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases. An ordinary RF detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones. The transmission frequency of mobile phones ranges from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. So a circuit detecting gigahertz signals is required for a mobile detector. Here the circuit uses a 0.22 μ F disk capacitor (C3) to capture the RF signals from the mobile phone. The lead length of the capacitor is fixed as 18 mm with a spacing of 8 mm between the leads to get the desired frequency. The disk capacitor along with the leads acts as a small gigahertz loop antenna to collect the RF signals from the mobile phone. Op-amp IC CA3130 (IC1) is used in the circuit as a current-to-voltage converter with capacitor C3 connected between its inverting and non-inverting inputs. It is a CMOS version using gate-protected p-channel MOSFET transistors in the input to provide very high input impedance, very low input current and very high speed of performance. The output CMOS transistor is capable of swinging the output voltage to within 10 mV of either supply voltage terminal. Capacitor C3 in conjunction with the lead inductance acts as a transmission line that intercepts the signals from the mobile phone. This capacitor creates a field, stores energy and transfers the stored energy in the form of minute current to the inputs of IC1. This will upset the balanced input of IC1 and convert the current into the corresponding output voltage. Capacitor C4 along with high-value resistor R1, keeps the non-inverting input stable for easy swing of the output to high state.

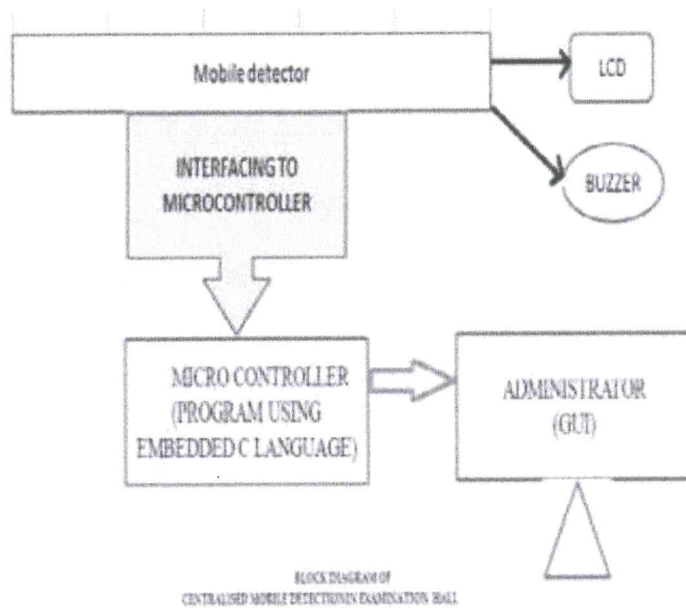


Figure 2.2: Block Diagram Of Centralized Mobile Detector (Ref: www.ijser.org/researchpaper)

Test 1 – Inside Kurukshetra University Exam Hall

Figure 2.2 above shows a block diagram of a centralized Mobile Detector. As with this device we can track those students who misuse mobile phones in examination hall, but the question is how we come to know which one(student) misuses that is we have to determine the exact location of student his position in examination hall. For this we have to make use of channels to let mobile detectors to move freely, channels can be installed either on roof or on floor once any student misuses his mobile phone detector stops at that position and returns that position/location to system administrator. Channels can be installed on the roof/floor of E-hall, as shown below. p1, p2, p3--p17 represent different positions that can be traced

2.4 Conclusion

As a conclusion, a mobile phone detector couldn't function well in public areas because its covers a wide range of area. A mobile phone detector will be able to work in a secluded or a small area or range. The most suitable place to test or use it will be a room or a small hall. It works better when the range is reduced to ensure the user knows the exact student which is using the mobile phone.

Chapter 3

Methodology

3.1 Block Diagram

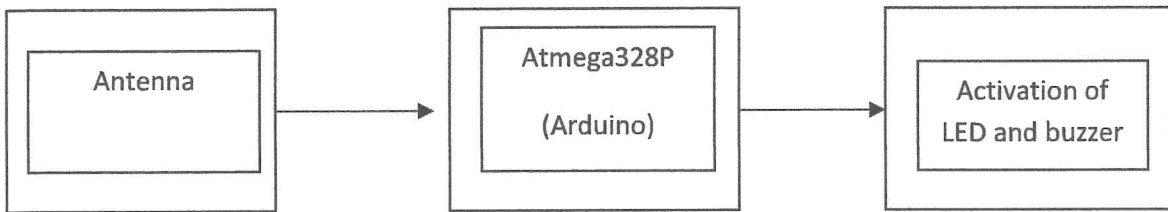


Figure 3.1: Block Diagram Of Circuit Working Principle

Working Principle:

Figure 3.3 above shows a block diagram of circuit principle. The working principle of this circuit is quite simple. When we dial a number or send an SMS or MMS through our mobile phone or even when our cell is on standby mode our mobile phone generate RF signal to connect to its nearest mobile phone tower, the antenna detects these RF signals which will be received by the Atmega328P microcontroller in the Arduino. The Arduino is programmed to create a high pitch of sound in the 8 ohm buzzer in the detector, thus activating the light to let the user know there is an active mobile phone found in the student.

3.2 Introduction

Methodology can be the ‘analysis of the principles of methods, rules, and postulates employed by a discipline’, ‘the systematic study of methods that are, can be, or have been applied within a discipline’ or ‘a particular procedure or set of procedures’.

Methodology includes a collection of theories, concepts or ideas as they relate to a particular discipline or field of inquiry. Methodology refers to more than a simple set of methods, rather it refers to the rationale and the philosophical assumptions that underlie a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers.

Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully. If some error occurs it can make a project probably could not operate or do not look neat and perfect.

Before the project finish, various process needs to be done according to proper procedures to ensure that projects do not have any problems. Among the measures of the work done in preparing this project are:

- a) Process of designing circuit.
- b) Circuit board trace
- c) Soldering process in circuit board.
- d) Troubleshoot circuit
- e) Programming the Arduino

3.2.1 Risk Of Etching

- a) There is a risk of injuries due to the chemicals involved.
- b) The quality of the results depends on several factors which you won't be able to master completely the first time. This can be somewhat compensated by using good machinery.
- c) There is the problem of waste disposal. Toxic chemicals require a proper disposal service.

3.2.2 Safety

Since the work involves dangerous chemicals and power tools, we will need to take the necessary safety precautions:

- a) Wear safety equipment during the whole process - gloves, protection glasses, and an apron
- b) Work near an emergency eyewash station, a first aid box and a phone .
- c) Familiarize yourself with the proper use of all equipment and tools in the lab - if you are unsure of anything, ask a supervisor of the project.

3.2.3 Etching Process

Etching is the process of using acid to remove coppers that not need on the PCB (Printed Circuit Board). This acid is Acid Ferric Chloride III. Acid Ferric Chloride III is used to remove that coppers.

The steps of the etching process are:

- a. Print the schematic onto photo paper and cut it with the same size of PCB board.
- b. Wipe the PCB board with a scorching pad and apply alcohol on it

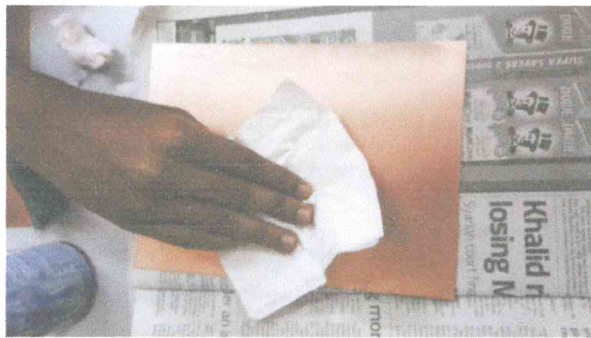


Figure 3.2.3.1 :Cleaning Of Etching Board

- c. Paste the etching circuit onto photo paper with PCB Board using Laminating machine.

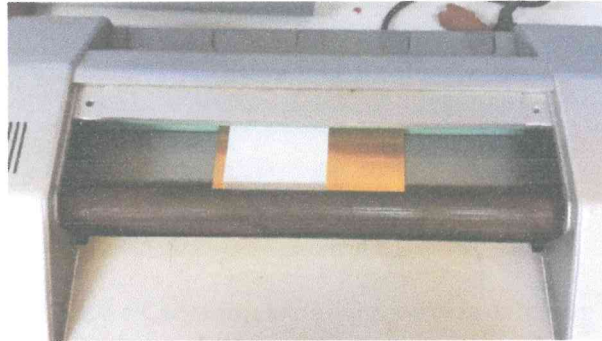


Figure 3.2.3.2: Lamination Of Circuit On Etching Board

- d. It's to make PCB paper joined with board.
- e. Repeat the process takes about 6-7 times.
- f. Wash the PCB board in cool water and remove the photo paper. The print will be on the PCB board. Touch up the lines with M-letting. Put in the machine filled with Acid Ferric Chloride III for 4 minutes.



Figure 3.2.3.3 :Removal Of Copper On Etching Board

g. Wash off the excess Acid Ferric Chloride III under tap water

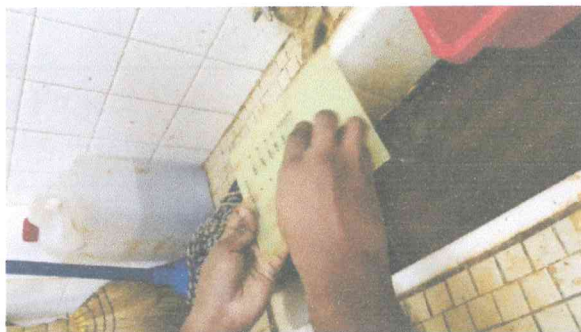


Figure 3.2.3.4 : Cleaning Of Chemical On Etching Board

h. Drill desired holes on the PCB board for the components



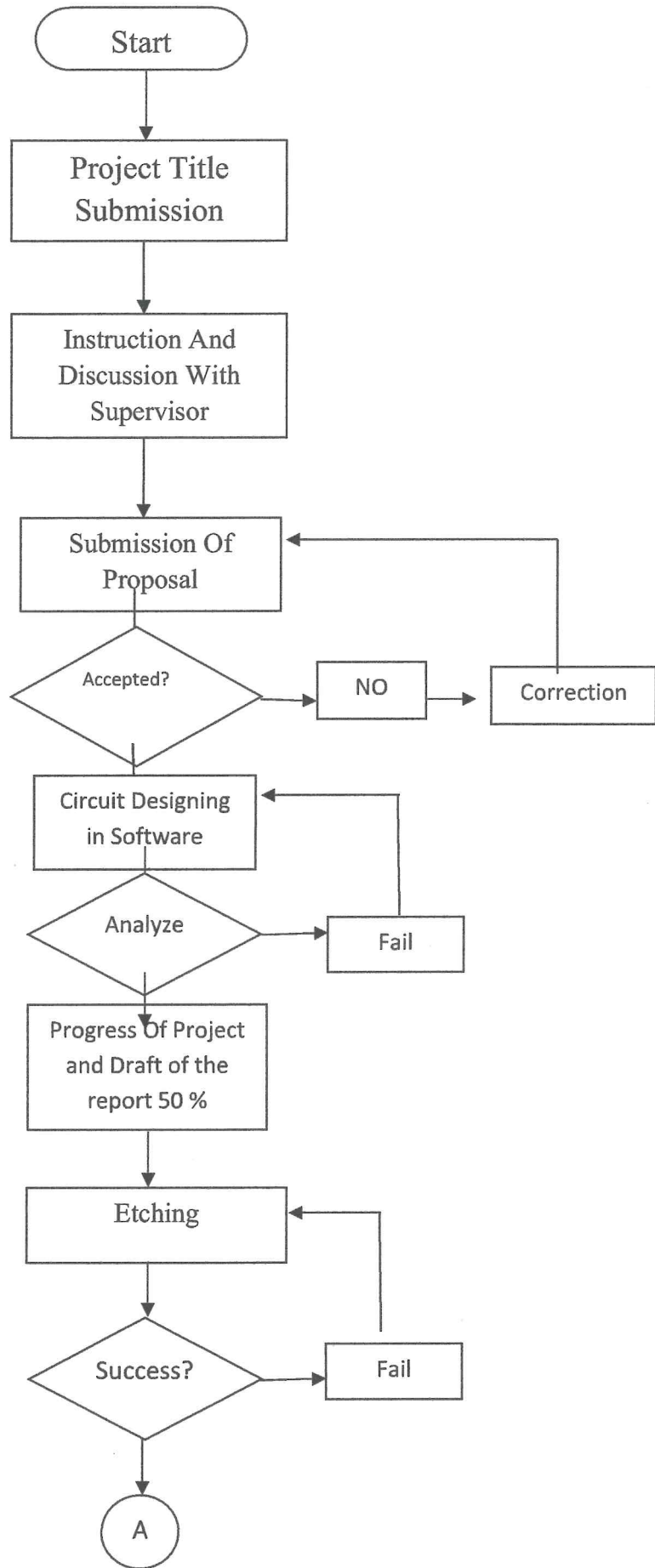
Figure 3.2.3.5 : Cleaning Of Etching Board

I. Insert the components and solder the bottom part.



Figure 3.2.3.6 :Soldering Of Components On Etching Board

3.3 Flowchart Of Project 1 & 2



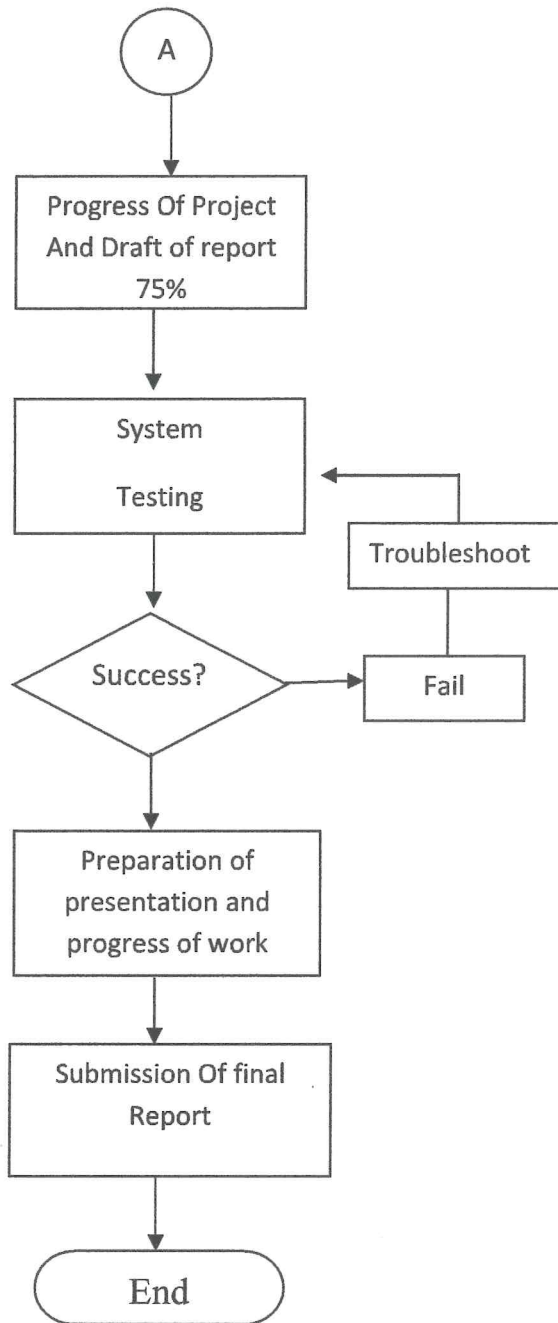


Figure 3.3 Flowchart Of Project

Chapter 4

Findings & Analysis

4.1 Introduction

The findings and analysis of the project is the project in terms of theory or writing of the functionality and usability of the component's operation related to the project. In addition, it is necessary to explain the results or the results obtained after carrying out a project implemented works well or not.

4.2 Testing at Home

When the circuit is tested at our home, the LED starts to blink non-stop. The buzzer and led is activated by the encoded signal at our home although all our mobile phones are not active (calling or messaging) This result shows that radius range of the Mobile phone detector is higher. It may be caused of the encoded signals outside our house.

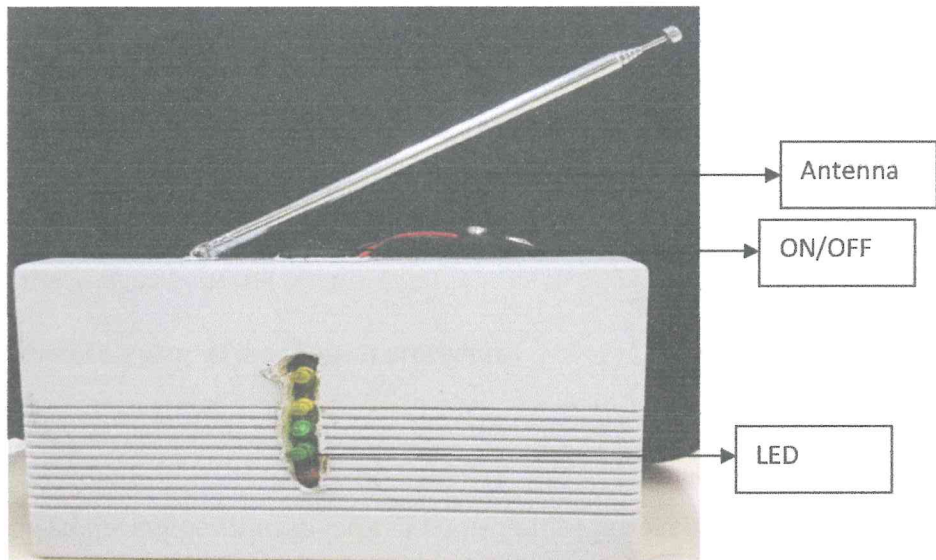
4.3 Testing at Housing area

When the circuit is tested in our housing area, the LED starts blinking again non-stop. Our housing area is full encoded signal due to the mobile phone usage, Data sage, WIFI usage of our neighbours. This shows that the radius range of our project is around parameter we expected it to function.

4.4 Testing At Football Field In New Housing Area

When the circuit is tested in the field, there was no output from the LED and sound from the buzzer. This shows that there is no active mobile phones in this area.

4.5 User Manual Of Arduino Based Mobile Detector



How To Use?

1. Switch On the device
2. Place it near a secluded place away from Electromagnetic Waves
3. LED activates when a mobile phone is detected based on its range. (Red being the nearest and Yellow being the furthest)
4. Device operates on 9V battery

Chapter 5

Conclusion

5.0 Suggestion

Project is a subject where it lets the student to be tested by creating and ability to doing their projects by themselves. Below are some suggestions that can we gave to help people who doing their project.

- a) Before starting all work, ensure the circuit is working. Test of breadboard
- b) Survey the availability of the components
- c) Next, schedule a plan of the projects procedures

In conclusion, we hope so the suggestions given will be useful for producing projects of “Arduino Based Mobile Detector” that is better and having more quality in future.

5.1 Conclusion

As a conclusion, the Arduino based mobile detector was a success. After testing, it was able to detect mobile phones. There was an output of the buzzer and LED. Our panel of judges was satisfied with our project although there were little mistakes in our circuit diagram. We gained a lot of knowledge from the project we are doing which is Arduino Based Mobile phone Detector and the working principle of the circuit. During our research of this project, we gained a lot of knowledge on programming Arduino and electromagnetic frequencies in which our Project is specialized in. Besides, we also got the chance to apply the skills and knowledge that we acquired in our previous semesters such as reading and understanding the circuits, connecting circuits, analysing circuit, improving circuits, analysing block diagram, analysing components and many more.

Besides that, we like to show our deepest gratitude to our Supervisor Pn. Syuhaila Binti Mustafa for always being there, giving ideas, supporting and guiding us throughout the completion of our project. Other than that, we also like to thank our Supervisor for correcting our mistakes as well as being ready to meet us despite her busy schedule.

In the process of completing our project, it was quite difficult because after many obstacles and problems that we faced although we planned thoroughly. For example, we had to do our etching about 4 times till we succeeded. Our project did not turn out as initially planned, but after brainstorming and carrying out more researches, we modified our project and executed it towards completion. Perhaps one day, with God's grace, our project can be marketed and become one of the most renowned Arduino based mobile phone detector.