`FAST DETECTION OF MOBILE PHONES IN THE EXAMINATION HALLS, CLASSROOMS AND DOMITORIES OF YEJI SENIOR HIGH TECHNICAL SCHOOL USING GSM TECHNOLOGY.

By

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DECLARATION

I hereby declare that this submission is my own work towards the MTECH and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

This thesis is dedicated to my children Matilda Bimmy, Millicent Bilbia, Yempaab Joshua and Prince Meedi.

Abstract

This work involves the design and development of a digital signal detector which is capable of detecting incoming and outgoing signals from mobile phones. The presence of an activated mobile phone can be detected by this handy, pocket-size mobile signal detector from a distance of one and a half meters, which could be used in preventing the use of mobile phones in examination halls, classrooms, confidential rooms etc. The circuit can detect the incoming and outgoing calls, text messages, and video transmission even if the mobile is kept in the silent mode. The moment the gadget detects Radio Frequency (RF) transmission signal from an activated mobile phone, it starts sounding a beep alarm and the Light Emitting Diode (LED) blinks. The alarm continues until the signal transmission ceases. The circuit is assembled on a general purpose PCB as compact as possible.

The completed design circuit is analyzed using a multsm software, oscilloscope and multimeter to measure the output voltages across various components when there is or no signal. The results obtained shows how efficient this device can serve the purpose of which it was designed. Officials from West African Examination Council (WAEC) will benefit from the study, since it has been their ambition to stop examination malpractices in Ghana. The study will add up knowledge, both theoretical and practical aspect of electrical and electronic students.

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CHARPTER ONE

1.0 INTRODUCTION

School systems in Ghana face a challenge pertaining to the regulation of cell phone use by students in schools. There are drawbacks and benefits for cell phone use. School administrators, teachers, parents, and students continue to struggle with policies on cell phone use in schools since a complete ban is no longer universally accepted as best policy.

In January 2014, A Deputy Director at the Teacher Education Division of the Ghana Education Service, Rev Emmanuel K. Dadebo, called for a review of the ban on the use of mobile phones by students in second cycle schools.

According to Rev Emmanuel K. Dadebo, since technology was an integral part of the curriculum, steps should rather be taken to ensure that the challenges confronting students' use of the device were addressed for them to derive the huge benefits.

"Whether we like it or not, we are in a digital age and there are great opportunities that abound to students using mobile phones in this 21st century," Rev Dadebo stated.

Speaking on the second day of the 65th annual New Year School and Conference at the University of Ghana, Legon, Rev Dadebo said, because secondary schools do not have adequate computers connected to the Internet, students should rather be guided to use their phones to support their studies.

http://www.graphic.com.gh/news/education/review-ban-on-use-of-mobile-phones.html

The confiscation of cell phones, an initial reaction by school administrations, has been very controversial. Some schools confiscate phones from students and do not return them whiles other schools may keep them until the end of the term. In either case, parents are notified that their children have violated the school policy on the use of cell phones during school hours. Although such confiscation policies were approved by school boards, some angry students and parents still resent the policy. Disrupting class with texting, playing video games, inappropriately using the photography feature, or receiving calls can affect students' class participation as well as their grades. Not all parents want the schools to control phone use. Some parents prefer that they be the ones to have control over their children's cell phone use instead of having schools set the rules. Scheduling and safety are the main reasons parents want their children to have access to cell phones during school hours. Many parents recognize the distractions cell phones can create in the classroom and are also concerned about mobile access to inappropriate content. According to Very Rev. S.N.N. Ollennu in annual congress of West African Examination Council (WAEC), 2013 report of the council, at the Ghana National Office (HNO), announced that, effective 2014, all invigilators for any of the WAEC examinations had been banned from using mobile phones at examination centres during the performance of examination duties, and in addition to the above, WAEC had introduced metal detectors at the various examination centres. Rev Ollenu said other measures put in place included the revision of the rule for bringing mobile phones into examination halls.

Candidates caught with mobile phones in the exams hall will have their results cancelled. (https://www.ghanabusinessnews.com/2013/11/19/waec-bans-invigilators-from-using-mobile-phones-at-exam-centres/)

Daily graphic 2015 page 16 revealed that Private candidates in the West African Senior School Certificate Examination (WASSCE) have resorted to the use of mobile phones to cheat during examinations. Accordind to Mrs Agnes Teye-Cudjoe, Senior Public Relations Officer of the West African Examinations Council (WAEC), who disclosed this to the Junior Graphic, said such candidates normally communicate with their colleagues by texting, while others use the phones to get help from friends who were not in the exam hall. She said this malpractice was also detected in the Basic Education and Certificate Examinations (BECE) 2015, as four candidates had their subject results cancelled because they were caught with mobile phones in the examination halls. Junior Graphic 2015,pages 16,17, recalling how a staff of WAEC, Mr Asare Minako, was staff to death, because candidates could not enter exam halls with their mobile phones during the 2006 private Senior Secondary School Certificate Examination (SSSCE). "WAEC views this as a serious examination malpractice and will not compromise on it. Any candidate caught in the exam hall with a mobile phone will have that particular paper cancelled," https://www.ghanabusinessnews.com/2013/11/19/waec-bans-invigilators-from-using-mobile-phones-at-exam-centres/"

Mrs Teye-Cudjoe said, for instance that in 2011, as many as 282 candidates were caught with mobile phones in the examination hall while in 2012, 171 candidates were caught with mobile phones. http://www.graphic.com.gh/news/education/waec-to-cancel-entire-results-of-candidates-found-with-phones.html

This rampant abuse has led some tutors to ban phones during tests and/or during all classes. One teacher in Yeji Senoir High School informed students that if he even saw a phone during a test, the owner would receive an automatic zero, whether the phone was in use or not.

According to Rev.Dadebo Cell phones have definitely become fixtures in present-day life for most people. Phones continue to be upgraded with extraordinary technology that makes them even more attractive and engaging.

Schools all across the nation are faced with or have had to address students carrying and using cell phones in school. Even with school policies in place against students having cell phones with them during the school day, schools continue to discipline students for infractions of the rules and defend the policy with parents.

Cell phones are essentially mobile computers, with most featuring texting, digital photography, video capabilities, and calculators. Some phones are able to access online dictionaries and other resources. While texting certainly can be very disruptive and distracting in many situations, there may be advantageous uses for texting in school. Eric Tigerstedt

Imagine several student groups within a class or library, each group working collaboratively yet separately from the other groups. Texting might be used to quietly share information, ask and answer questions, indicate next steps, and even communicate with the teacher without audibly disrupting the work of the other groups.

With the research capabilities, students may quickly access information they need for the task they are completing.

In addition to the argument that students should be allowed to carry cell phones for emergency purposes, there well may be an argument for actually using cell phone technology within the classroom. Cell phone companies advertise their phones' latest and greatest capabilities all the time. Computers are wonderful educational tools; perhaps cell phones can also be. Dr.Lennart Hardel

1.1 Background of the Study

Detecting concealed cell phone in classrooms and testing facilities will improve the level of concentration in the class, reduce examination malpractices in the country. Today the cell phone is an ideal way to get information into the examination hall, it is done either by text or by goggling the required information. In other cases, it is important to prevent leakage of the details of the examination. Cell phones can be used covertly to send or receive information. Cellular phone is a valuable weapon in the armory of those who need to guard the integrity of examination. Zone protector is a powerful and discrete device that constantly scans for cell phone activity and other user selected radio frequency (RF) transmission. It helps to guard against unauthorized attempt to obtain answers or transmit information from an examination hall. .

http://www.graphic.com.gh/news/education/waec-to-cancel-entire-results-of-candidates-found-with-phones.html

As part of efforts to help stem the problem of examination malpractices in the country, the West Africa Examination Council (WAEC) is to introduce the use of metal detectors to check on students who use electronic devices such as mobile phones and electronic calculator to cheat during exams. . http://www.graphic.com.gh/news/education/waec-to-cancel-entire-results-of-candidates-found-with-phones.html

1.2 Effects of Using Cell Phone in the Classroom

Using a cell phone in the classroom is the main cause for students' failure and also some students' privacy will be compromised. Y.Yang and H.Sharif

When students use cell phone inside a class, they spend all their time in typing messages to each other or watching videos instead of concentrating on teacher's lectures. In addition, they record videos and take photos of teachers and students for negative purpose.

Although, the cell phone is a useful device, a large number of students use them as

the main course of destruction in the classroom. During a lesson, students who use cell phones will get distracted, and also they waste their time instead of paying attention in the classroom.

Consequently, they will score low grade (.SalfordBRUN and Eberhardt). Not only students who use their cell phones in the class will get distracted, but also the rest of the students in the class will be influenced by student who uses cell phones in the classroom. Some students distract other students by texting or sending messages to them, so they cannot concentrate on the classroom lessons. Another factor that, can cause distraction during teaching and learning is the ringtone.

When cell phone rings during a lesson, it usually interrupts teacher's ideas and makes him upset, and also waste part of class time; using cell phone in the classroom is not appropriate concept and also it decreases the learning capacity for students.

Though cell phone is a useful device, a huge number of students use it to invade both teachers and students privacy by recording videos or taking photo. Students are curious, therefore, they would like to record videos or take photos to their teachers especially when they carry out adverse behaviors such as getting angry, saying bad words, or sleeping inside their class. Moreover, these students alter these videos by adding comments and post them on face book or YouTube .In this case, the teachers will lose their students respect and also they will be frustrated because their privacies are invaded. Finally, using cell phone has negative consequences on both teachers and students in class. Therefore, a cell phone detector should be used to restrain students from using their cell phones inside classroom so that they concentrate on their studies rather than spending their time in texting message and invading other student's privacy.

1.3 Problem statement

It has become obviously clear in the country that, students in the various institutions. "Basic schools, Second Cycle Schools and Tertiary now uses phones in their classrooms and school compound, which generally has effect on quality education, nurture indiscipline among students and promotes exam malpractices in both internal and external examinations. In some cases metal detectors are passed over students to ascertain the presence of cellular phones but some phone are made of purely plastic and ceramic materials which cannot be detected by metal detectors. The existing phone detectors cannot detect cellular phones when they are switch off. To prevent all the above mentioned activities by students, a circuit to detect a cellular phones on students, whether the cell phone is in the audible, silent, on standby or switch off mode is required.

1.4 Purpose of the Study

The main objective of the project is

1. To design a circuit to detect Mobile phones which are in active mode, silent mode, in examination hall and Classrooms.
2. To use local materials for easy construction
3. To build a mobile detector to locate a phone within one and half radius.
4. To outlining system wiring, installation, maintenance and troubleshooting procedures for the system designed in objective one (1) above.

1.5 Hypothesis

1. The phone detector will greatly reduce examination malpractices and will enhance the level of student's concentration in the classroom since they will not keep phones that distract their attention.

2. Detection and location of phone's source using this circuit would be more effective than the metal detector only.

1.6 Significance of the Study

The success of the study will reduce the usage of mobile phones by students in the classrooms, dormitories, and examination halls, thereby reducing examination malpractices and enhancing quality in education. Officials from West African Examination Council (WAEC) will benefit from the study, since it has been their ambition to stop examination malpractices in Ghana. The study will add up knowledge, both theoretical and practical aspect of electrical and electronic students.

1.7 Limitation of the study

Testing instrument needed for the software simulation is very difficult to acquire, for example the national instruments simulation software "multisim". Unfortunately does not have the precision pulse generator, hence, making it difficult to simulate the signal path of the circuit.

CHAPTER TWO

LITERATURE REVIEW

2.1 Existing Cellular Phone Detectors

The following literature survey for this project consists of various papers on phone detectors and signal receivers and transmission systems published in the IEEE, IJAREEIE and *IECEC* conferences and the journals.`

Fioreze, M., dos Santos Junior, S., & Hönnicke, M. G. (2016). Estimate the cellular phone RF peak output power with a simple experiment? *In their report,* Cellular phones are becoming increasingly useful tools for students. Since cell phones operate in the microwave bandwidth, they can be used to motivate students to demonstrate and better understand the properties of electromagnetic waves. However, since these waves operate at higher frequencies (L-band, from 800 MHz to 2 GHz) it is not simple to detect them. Usually, expensive real-time high frequency oscilloscopes are required. Indirect measurements are also possible through heat-based and diode-detector-based radiofrequency (RF) power sensors. Another didactic and intuitive way is to explore a simple and inexpensive detection system, based on the interference effect caused in the electronic circuit of TV and PC sound speakers, and to try to investigate different properties of the cell phones' RF electromagnetic waves, such as its power and modulated frequency. This manuscript proposes a trial to quantify these measurements, based on a simple Friis equation model and the time constant of the circuit used in the detection system, in order to show it didactically to the students and even allow them also to explore such a simple detection system at home.

R. Sukthankar, M. Covell and S. Baluja, "Physical and virtual cell phone sensors for traffic control: Algorithms and deployment impact," *2016 IEEE Sensors Applications Symposium (SAS)*, Catania, 2016, pp. 1-6. doi: 10.1109/SAS.2016.7479882. In this report decades of research have been directed towards improving the timing of traffic lights. The ubiquity of cell phones among drivers has created the opportunity to design new sensors for traffic light controllers. These new sensors, which search for radio signals that are constantly emanating from cell phones, hold the hope of replacing the typical induction-loop sensors that are installed within road pavements. A replacement to induction sensors is desired as they require significant roadwork to install, frequent maintenance and checkups, are sensitive to proper repairs and installation work, and the construction techniques, materials, and even surrounding unrelated ground work can be sources of failure. However, before cell phone sensors can be widely deployed, users must become comfortable with the passive use of their cell phones by municipalities for this purpose. Despite complete anonymization, public privacy concerns may remain. This presents a chicken-and-egg problem: without showing the benefits of using cell phones for traffic monitoring, users may not be willing to allow this use. In this paper, we show that by carefully training the traffic light controllers, we can unlock the benefits of these sensors when only a small fraction of users allow their cell phones to be used. Surprisingly, even when there is only small percentage of opted-in users, the new traffic controllers provide large benefits to all drivers.

Subhash, A. P. (2016). *MOBILE DETECTION, ALARMING AND REPORTING SYSTEM* (Doctoral dissertation, Savitribai Phule Pune University).

This work involves the design and development of a digital signal detector which is capable of detecting incoming and outgoing signals from mobile phones. The presence of an activated mobile phone can be detected by this handy, pocket-size mobile signal detector from a distance of one and a half meters, which could be used in preventing the use of mobile phones in examination halls, confidential rooms etc. The circuit can detect the incoming and outgoing calls, text messages, and video transmission even if the mobile is kept in the silent mode. The moment the gadget detects Radio Frequency (RF) transmission signal from an activated mobile phone, it starts sounding a beep alarm and the Light Emitting Diode (LED) blinks. The alarm continues until the signal transmission ceases. The circuit is assembled on a general purpose PCB as compact as possible and enclosed in a small box.

S. Baluja, M. Covell and R. Sukthankar, "Approximating the Effects of Installed Traffic Lights: A Behaviorist Approach Based on Travel Tracks," *2015 IEEE 18th International Conference on Intelligent Transportation Systems*, Las Palmas, 2015, pp. 2205-2212. doi:

10.1109/ITSC.2015.356. In their report, decades of research have been directed towards improving the timing of existing traffic lights. In many parts of the world where this research has been conducted, detailed maps of the streets and the precise locations of the traffic lights are publicly available. Continued timing research has recently been further spurred by the increasing ubiquity of personal cell-phone based GPS systems. Through their use, an enormous amount of travel tracks have been amassed -- thus providing an easy source of real traffic data.

Scott, N. W. (2011). Study of cellular phone detection techniques. This report studies techniques for detecting cellular phones. It examines existing technology currently available on the open market, an existing design that utilizes mostly discrete components, and a design approach using a down converter in conjunction with a band pass filter.

They examine the existing technologies available on the open market and discussed. These technologies are not adequate, because they are inaccurate and expensive.

Y. Li, F. Naeimipoor and A. Boukerche, "Video dissemination protocols in urban vehicular ad hoc network: A performance evaluation study," *2014 IEEE Wireless Communications and Networking Conference (WCNC)*, Istanbul, 2014, pp. 2611-2616. doi: 10.1109/WCNC.2014.6952820. In their report, Video dissemination over vehicular networks is an attractive technology which supports many novel applications. However, it is a great challenge to analyse the performance of video dissemination protocols due to highly dynamic topology and stringent requirements of applications. In this paper, we evaluate five existing robust video dissemination protocols in urban scenarios. We evaluate three routing protocols and two error resilience protocols. We also modify the frame coding technique for better performance. The results, more specifically, show that only one of the three routing protocols fulfils the general quality requirements. As for the error resilient techniques, we find that our modified frame coding approach performs better than the original one in four aspects. The results also indicate that the video coding scheme guarantees reliable video qualities.

N.Sarmah, Y. Yang, H. Sharif, Y. Qian, "Performance Analysis of Mobile Ad-Hoc Routing Protocols By Varying Mobility, Speed And Network Load", University of Nebraska-Lincoln, July 2014. They reported that, one of the most promising network that has emerged from the technology world is the mobile ad-hoc network or MANET. It is a type of multi-hop network. Wireless by nature, MANETs do not have a specific network infrastructure. In their research, the results from previous work are taken into account for comparison and a wide analysis is made to carve out the most efficient routing algorithm under various mobility scenarios. All the major proactive and reactive routing protocols viz. Destination sequenced distance vector (DSDV), Optimized Link State Routing (OLSR), Dynamic Source Routing (DSR) and Ad-hoc On-demand Distance Vector (AODV) protocols are compared in three different phases - mobility, speed and network load. Simulation results show that dynamic source routing protocol (DSR) performs the best in small networks while ad-hoc on demand distance vector (AODV) routing protocol performs the best in medium and large networks. Although OLSR fails to cope with the level of AODV, it can be a superior protocol having demonstrated comparable performance to AODV and its proactive nature of routing packets.

Mills, M. (2013). Mobile Devices and Multitasking in the Classroom. In R. McBride & M. Searson (Eds.), *Proceedings of Society for Information Technology & Teacher Education*

International Conference 2013 (pp. 3757-3758). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

This study focuses on the effect that mobile device integration in classrooms has on student focus and achievement. Studies point to a distinction between multitasking and what has been termed as "simultaneous partial attention," that is, the act of paying minimal simultaneous attention to many sources of information. The goal is to understand this distinction to effectively design instructional activities that integrate mobile devices in a productive way that engages students and fosters academic achievement rather than becoming a distraction. This study in progress aims to classify mobile device integration activities and strategies into low and high cognitive load to determine the impact of each on student focus and achievement.

Proc Natl "Universal mobile electrochemical detector designed for use in resource-limited applications" Acad Sci U S A. 2014 Aug 19; 111(33): 11984–11989. Published online 2014 Aug 4. doi: 10.1073/pnas.1405679111. This paper describes an inexpensive, handheld device that couples the most common forms of electrochemical analysis directly to "the cloud" using any mobile phone, for use in resource-limited settings. The device is designed to operate with a wide range of electrode formats, performs on-board mixing of samples by vibration, and transmits data over voice using audio—an approach that guarantees broad compatibility with any available mobile phone (from low-end phones to smartphones) or cellular network (second, third, and fourth generation). The electrochemical methods that we demonstrate enable quantitative, broadly applicable, and inexpensive sensing with flexibility based on a wide variety of important electro analytical techniques (chronoamperometry, cyclic voltammetry, differential pulse voltammetry, square wave voltammetry, and potentiometry), each with different uses. Four applications demonstrate the analytical performance of the device: these involve the detection of (*i*) glucose in the blood for personal health, (*ii*) trace heavy metals (lead, cadmium, and zinc) in water for in-field environmental monitoring, (*iii*) sodium in urine for clinical analysis, and (*iv*) a malarial antigen (*Plasmodium falciparum* histidine-rich protein 2) for clinical research. The combination of these electrochemical capabilities in an affordable, handheld format that is compatible with any mobile phone or network worldwide guarantees that sophisticated diagnostic testing can be performed by users with a broad spectrum of needs, resources, and levels of technical expertise.

V. Saatchi and Z. Tavakoli, "Design and implementation of a high dynamic range c band down-converter," *Progress In Electromagnetics Research Letters*, Vol. 31, 25-33, 2012. Doi: 10.2528/PIERL12012010. A technique that expands dynamic range (DR) of frequency down-converters in the C band frequency is presented. Primary characteristics of down-converter are evaluated to confirm that it can be used in microwave receivers. The C band down-converter is carried out by the combination of RF mixers, band pass inter digital filter, and X band comb line filter which are designed entirely for this project. Attainment of the perfect receiver is the final purpose of this paper, and a method that causes 72 dB dynamic range, high tangential signal sensitivity and fine gain flatness is used for achieving the mentioned purpose. These efforts improve the dynamic range about 19 dB and gain flatness about 3.07 dB.

Y. Le Guillou *et al.*, "Highly integrated direct conversion receiver for GSM/GPRS/EDGE with on-chip 84-dB dynamic range continuous-time ΣΔ ADC," in *IEEE Journal of Solid-State Circuits*, vol. 40, no. 2, pp. 403-411, Feb. 2005. doi: 10.1109/JSSC.2004.841036. This paper describes a highly digitized direct conversion receiver of a single-chip quadruple-band RF transceiver that meets GSM/GPRS and EDGE requirements. The chip uses an advanced 0.25-μm BiCMOS technology. The I and Q on-chip fifth-order single-bit continuous-time sigma-delta (ΣΔ) ADC has 84-dB dynamic range over a total bandwidth of ±135 kHz for an active area of 0.4 mm^2. Hence, most of the channel filtering is realized in a CMOS IC where digital processing is achieved at a lower cost. The systematic analysis of dc offset at each stage of the design enables to perform the dc offset cancellation loop in the digital domain as well. The receiver operates at 2.7 V with a current consumption of 75 mA. A first-order substrate coupling analysis enables to optimize the floor plan strategy. As a result, the receiver has an area of 1.8 mm^2.
J. Yang, R. W. Brodersen and D. Tse, "Addressing the Dynamic Range Problem in Cognitive Radios," *2007 IEEE International Conference on Communications*, Glasgow, 2007, pp. 5183-5188. doi: 10.1109/ICC.2007.857. The report talks about discrepancy between perceived spectrum shortage from the FCC allocation map and the actual abundance of available spectrum is a motivation for Cognitive Radios, which locate and transmit in the unused or lightly used bands. If a digital approach is taken to provide the necessary radio flexibility to exploit this sparsity, there is a challenging dynamic range requirement in the analog to digital conversion, since there are large interfering signals which are effectively in-band and cannot be removed by fixed RF pre-filtering. Using a mixed analog digital system architecture which uses multiple low accuracy ADCs with

digital adaptive filters, it is possible to increase the effective dynamic range of the input by subtracting off the unwanted signals in the time domain.

Zheng Shenghua, Xu Dazhuan and Jin Xueming, "A new receiver architecture for smart antenna with digital beamforming," 2005 IEEE International Symposium on Microwave, Antenna, Propagation and EMC Technologies for Wireless Communications, Beijing, 2005, pp. 38-40 Vol. 1. doi: 10.1109/MAPE.2005.1617841 Smart antennas are regarded as the key solution to increasing the spectral efficiency and improving the system performance in wireless communications. The high speed analog to digital converter (ADC) and digital signal processor (DSP) make the smart antenna with digital beam forming (DBF) a reality. In conventional N-element array receiving system, each element has its own RF/IF channel and ADC. In this paper, a novel smart antenna receiver with digital beam forming is proposed. The essential idea is to realize the digital beam forming receiver based on band pass sampling of multiple IF signals. The proposed system reduced receiver hardware from N IF channels and N ADCs to one IF channel and one ADC using a heterodyne RF circuitry and a multiple band pass sampling receiver. In this scheme, the sampling rate of the ADC is much higher than the summation of the N times of the signal bandwidth. The local oscillator produces different local frequency for each RF channel. The receiver architecture is presented and the simulation of band pass sampling of multiple signals is given.

J.-H. Bae, W.-K. Choi, J.-s. Kim, G.-Y. Choi, and J.-S. Chae, "Study on the demodulation structure of reader receiver in a passive RFID environment," *Progress In Electromagnetics Research*, Vol. 91, 243-258, 2009. Doi: 10.2528/PIER09021103. In this paper, we present a demodulation structure suitable for a reader receiver in a passive Radio Frequency identification (RFID) environment. In a passive RFID configuration, undesirable DC-offset phenomenon may appear in the baseband of the reader receiver. As a result, this DC-offset phenomenon can severely degrade the performance of the extraction of valid information from a received signal in the reader receiver. To mitigate the DC-offset phenomenon, we propose a demodulation structure to reconstruct a corrupted signal with the DC-offset phenomenon, by extracting useful transition information from the corrupted signal. It is shown that the proposed method can successfully detect valid data from a received signal, even when the received baseband signal is distorted with the DC-offset phenomenon.

N. Khaddaj Mallat, E. Moldovan, and S. O. Tatu, "Comparative demodulation results for six-port and conventional 60 GHz direct conversion receivers," *Progress In Electromagnetics Research*, Vol. 84, 437-449, 2008. Doi: 10.2528/PIER08081003. Two 60 GHz homodyne receivers dedicated for high-speed short-range communication systems are presented in this report. The receivers are based on six-port and conventional (anti-parallel diodes) mixers, respectively. Comparative bit error rate results, function of local oscillator power, phase, and frequency shift over the operating bandwidth, are presented and discussed.

2.2 Cellular Phone Technology

Martin Cooper of Motorola made the first publicized handheld mobile phone call on a prototype Dynatac model on April 4, 1973. This is a reenactment in 2007.

A handheld mobile radio telephone service was envisioned in the early stages of radio engineering. In 1917, Finnish inventor Eric Tigerstedt filed a patent for a "pocket-size folding telephone with a very thin carbon microphone". Early predecessors of cellular phones included analog radio communications from ships and trains. The race to create truly portable telephone devices began after World War II, with developments taking place in many countries. The advances in mobile telephony have been traced in successive "generations", starting with the early "0G" (zeroth generation) services, such as Bell System's Mobile Telephone Service and its successor, the Improved Mobile Telephone Service. These "0G" systems were not cellular, supported few simultaneous calls, and were very expensive.

The Motorola DynaTAC 8000X. First commercially available hand held cellular mobile phone, 1984. (http://en.wikipedia.org/wiki/File:DynaTAC8000X)

The first handheld mobile cell phone was demonstrated by Motorola in 1973. The first commercial automated cellular network was launched in Japan by Nippon Telegraph and Telephone in 1979. This was followed in 1981 by the simultaneous launch of the Nordic Mobile Telephone (NMT) system in Denmark, Finland, Norway and Sweden Richtel (2012). Several other countries then followed in the early to mid-1980s. These first-generation (1G) systems could support far more simultaneous calls, but still used analog technology.

In 1991, the second-generation (2G) digital cellular technology was launched in Finland by Radiolinja on the GSM standard. This sparked competition in the sector as the new operators challenged the incumbent 1G network operators.

Ten years later, in 2001, the third generation (3G) was launched in Japan by NTT DoCoMo on the WCDMA standard. T Foerde and Poldrack (2006)his was followed by 3.5G, 3G+ or turbo 3G enhancements based on the high-speed packet access (HSPA) family, allowing UMTS networks to have higher data transfer speeds and capacity.

By 2009, it had become clear that, at some point, 3G networks would be overwhelmed by the growth of bandwidth-intensive applications, such as streaming media Foerde and Poldrack (2006) consequently, the industry began looking to data-optimized fourth-generation technologies, with the promise of speed improvements up to ten-fold over existing 3G technologies. The first two commercially available technologies billed as 4G were the WiMAX standard, offered in North America by Sprint, and the LTE standard, first offered in Scandinavia by TeliaSonera.

All mobile phones have a variety of features in common, but manufacturers seek product differentiation by adding functions to attract consumers. This competition has led to great innovation in mobile phone development over the past 20 years. The common components found on all phones are:

A battery, providing the power source for the phone functions.

An input mechanism to allow the user to interact with the phone. The most common input mechanism is a keypad, but touch screens are also found in most smart phones.

A screen which echoes the user's typing, displays text messages, contacts and more. Basic mobile phone services to allow users to make calls and send text messages.

All GSM phones use a SIM card to allow an account to be swapped among devices. Some CDMA devices also have a similar card called a R-UIM. Individual GSM, WCDMA, iDEN and some satellite phone devices are uniquely identified by an International Mobile Equipment Identity (IMEI) number. Low-end mobile phones are often referred to as feature phones, and offer basic telephony. Handsets with more advanced computing ability through the use of native software applications became known as smart phones.

Several phone series have been introduced to address specific market segments, such as the RIM BlackBerry focusing on enterprise/corporate customer email needs, the Sony-Ericsson 'Walkman' series of music/phones and 'Cyber-shot' series of camera/phones, the Nokia N series of multimedia phones, the Palm Pre, the HTC Dream and the Apple iPhone.

2.3 Cellular Phone Features

Bluetooth is a secure wireless protocol that operates at 2.4GHZ.The protocol uses a master slave structure and is very similar to having a wireless USB port on cellular phone. Devices like a printer, keyboard, mouse, audio device, and storage devices can be connected wirelessly. This features is mainly used for hands free devices but can also be used for file transfer of pictures, music and other data. Universal serial bus (USB) is a way for cellular phones to connect to a computer for data transfer. This features is very similar to Bluetooth for a cellular phone with the exception of using a cable.

It can also be used to transfer pictures, music and other data. Cameras on cellular phones are a very popular features that was added in the last 15years.In recent years, high resolution cameras have become a standard feature.

Most Cellular phones will come with at least a two mega pixel camera and the more expensive phone can be as much as 8mega pixel. GHzWCDMA direct-conversion transceiver," *IEEE J. Solid- State Circuits*, Vol. 39, No. , 871-884, 2004. doi:10.1109/JSSC.2004.827792

2.4 Cellular Phone Communication Standards

Currently the three main technologies used by cellular phone providers are 2G, 3G, and 4G. Each generation of technology uses a different transmission protocol. The transmission protocols dictate how a cellular phone communicates with the tower. Some examples are: frequency division multiple access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA), global system for mobile communications (GSM), CDMA2000, wideband code division multiple access (WCDMA), and time-division synchronous code-division multiple access (TD-SCDMA). All of these protocols typically operate in the 824 - 894 MHz band in the United States. Some protocols, such as GSM (depending on the provider) will use the 1800 - 2000 MHz band. Figure 1.2 below shows a diagram of band range frequency.

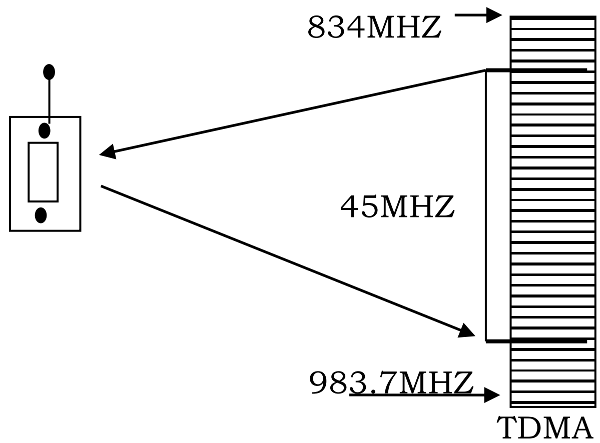

Figure 1.2 Time Division Multiple Access

To provide a good example of how a cellular phone transmission works, take a look at Diagram 1 which shows how TDMA works. Each phone call uses a different frequency within the 45 MHz bandwidth. TDMA is normally used for analog transmissions and is capable of digital transmission. Koh, K.-J., M.-Y. Park, C.-S. Kim, and H.-K. Yu, "Sub harmonically pumped CMOS frequency conversion (up and down) circuits for 2-GHzWCDMA direct-conversion transceiver," *IEEE J. Solid- State Circuits*, Vol. 39, No. 6, 871-884, 2004. doi:10.1109/JSSC.2004.827792

2.5 Secure Facilities

Many businesses such as psychiatric hospitals, correctional facilities, Pharmaceutical companies, government facilities build security fortresses that shield their money making information from getting to the general public. These facilities have many computers that houses the valuable information and are not connected to the Internet. Generally, access is restricted by guards with metal detectors and electronic devices are not allowed in or out without proper approval.

In every secure facility it is hard to ensure that employees and visitors aren't violating the policies. The only way to ensure that someone is not carrying a cellular phone is to search everyone as they enter and exit. This requires a great deal of manpower and most companies cannot afford that level of security. Therefore a mobile phone detector will help solve this problem, even if the phone is on silent mode.

2.6 Cellular Phone Detectors Available Today

The two most popular cellular phone detectors available on the market today are produced by Berkeley Varitronics Systems and Mobile Security Products. These companies produce the wolfhound cell phone detector and Cell buster respectively.

2.7 Berkeley Baritronic System Wolfhound cell Phone Detector

The above detector will detect pcs, CMA, GSM, and cellular bands using RF signatures. Indeed it has the ability to directionally find or determine or locate cellular phones that are close to it The Wolfhound, according to the advertisement, it is capable of detecting phones that are in silent mode, actively using voice or transmitting. By 'Wolfhound cell phone detector,' 'Berkeley Veritronic System, 2010 Features (Wolfhound cell phone detector) By 'Wolfhound cell phone detector,"Bekeley Veritronic System, 2010

The Wolfhound appears to be great way to detect cell phones, but practically may randomly detect cell phone communications in the area and not necessarily the device that initiate it off.

A number of quotes from Berkeley Varitronics System advertisement simply this;

"It took only two hours to find four (4) cell phones that are either in use at the time or hidden in the prison cells. On vibration mode readily to take calls" By 'Wolfhound cell phone detector,"Bekeley Veritronic System, 2010 and "With only 25 – 30 minutes of operations the device can detect many cell phone and identify the positions which led the team to find at last 10 mobile phones".

These two quotes attest to the fact that, their devices is picking up transmissions in the area, but it does not show that they were directly from the cellphone in the area or phone at all. At the bottom of their advertisement reads "standby mode (autonomous registration) varies from base station to base station with phones typically registering between once every 2min to up to 20minutes. This time varies greatly based upon carriers, distance from base stations and individual handset manufacturer's standards" 'Wolfhound cellphone detector. http://www.cellbusters.com.

Continuous monitoring for cellular phones and has a voice alert that tells the user to shut their phone off if detected, US Department of Energy, October 2007. The cell buster only receives and does not transmit, making it good for areas sensitive to cellular phone usage. It will also detect phones that are in silent mode. 'Cell buster Cell phone detector," Cell busters INC.2004.

2.8 Cell buster cell phone detector features.

This phone detector sounds like it would work wonderfully for keeping students from bringing their cellphone to examination hall and classrooms. However, the advertisement is not honest. It does not tell you that a cellphone may take up to 15 more minutes to detect if it is in silent mode and that the phone need to be on. Furthermore, just like the Wolfhound, it does not provide any assurance that it would not detect random transmissions in the vicinity EVI Technology. http://www.cellbusters.com/

To show how inaccurate the existing cell phones are, a further review on cell buster's detector, a cell buster detector was borrowed from a local business man and tested, using two LGVXIIOOOOGSM cellular phones, this cellular phone detector tested extensively US Department of Energy October 2007.

Cell busters does not work as advertised. To get an idea of the component required to a detector, detailed studies was conducted and the result is as follows, it was found out that cell busters most used some digital signal processing to identify the signal characteristics of a cellular phone. According to the article, cell phones in the correctional area are used to operate criminal enterprise, harass victims and plan uprisings. Their problem is monitoring and locating cellular phones in a correctional facility.

http://www.cellbusters.com/zone-detector-the-ultimate-in-cell-phone-detection/

2.9 Cell Phone Detection Techniques

This study examines detecting cellular phones when a person is entering the examination hall, classroom or in the dormitory. This study requires measuring cell phones electromagnetic properties and determines an identifiable signature.

Measuring the RF spectrum around 240 – 400MHZ. (Outside the cellular phone bond) shows the most potential. Detecting and locating cell phone in correction facilities,"

EVI Technology, LLC 2007. U.S. Department of Energy (DOE) contractor recommends developing a cellular phone detector by measuring the RF Spectrum. Spurious emissions from cellular phones are monitored and recorded when the phone is in standby or transmitting. Using this method has some advantages. No external signal required for detecting the phone. The band of frequencies is limited by the federal communication commission (FCC) and are likely to be used by most manufacturers.

The system could potentially detect more than cell phone. The system could potentially detect cell phone even when they are off. This method should work on future generations of cell phones.

2.10 Biological effects of using cell phone

According to a new study, electromagnetic radiation from cellular phones may affect bone strength. Men who wear their cell phone on the right side of their belts were found to have reduced bone mineral content and bone mineral density in the right hip.

Researchers measured the bone strength at the left and right hip in two groups of healthy men, half of whom did not use cell phones and half of whom carried their cell phone in a belt pouch on the right side. Their hip bones were assessed using a test called dual-energy x-ray absorptiometry. http://healthimpactnews.com/2011/important-information-on-the-biological-effects-of-cell-phones-and-wireless-technologies/

In 2011, the director of the National Institute on Drug Abuse published a paper in *JAMA* reporting that 50 minutes of cell phone use by people altered glucose metabolism in the part of the brain closest to where the cell phone antennas were located. http://www.the-scientist.com/?articles.view/articleNo/32648/title/Opinion--Cell-Phone-Health-Risk

2.11 Thermal effects

One well-understood effect of microwave radiation is dielectric heating in which any dielectric material (such as living tissue) is heated by rotation of polar molecules induced by the electromagnetic field. In the case of a person using a cell phone, most of the heating effect will occur at the surface of the head, causing it temperature to increase by a fraction of a degree. The brain's blood circulation is capable of disposing of excess heat by increasing local blood flow.

Swedish researchers from Lund University (Salford Brun, Persson, Eberhardt, and Malmgreen) have studied the effects of microwave radiation on the brain, they found a leakage of albumin into the brain through a permeated blood- brain barrier. Prof Leszczynskn of Finland's radiation and nuclear safety authority found that, at the maximum legal limit for mobile radiation, one protein in particular, HSP27 was affected.

HSP27 played a critical role in the integrity of the blood – brain bearier. In 2006 a large Datch group's study about the connection between mobile phone use and cancer incidence was published.

Wiemels, J., Wrensch, M., & Claus, E. B. (2010). Epidemiology and etiology of meningioma. Journal of Neuro-Oncology, 99(3), 307–314. http://doi.org/10.1007/s11060-010-0386-3 The International Journal of Epidemiology published a combined data analysis from a multinational population – based case – control study of glioma and meningioma, the most common types of brain tumor.

In 2007 Dr. Lennart Hardel, from Orebo University in Sweden reviewed published epidemiological paper 2 Cohort studies and '16' case control studies) and found that: Cell phone users had an increased risk of malignurt gliomas. Link between cell phone use and a higher rate of a croustic neuromas. One hour of cell phone use per day significantly increases tumor risk after ten years or more.

"https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health

2.12 Non-thermal effects

The communications protocols used by mobile often result in low-frequency pulsing of the carrier signal. Whether these modulations have biological significance has been subjected to debate. Barnet S. have argued that so – called "non-thermal effects" could be reinterpreted as a normal cellular response to an increase in temperature.

The German biophysicist Roland Classer has argued that there are several thermo receptor molecules in cells, and that they activate a cascade of second and third messenger systems, gene expression mechanism and production of heat shock proteins in order to defend the cell against metabolic cell stress caused by heat.

Other researchers believe the stress proteins are unrelated to thermal effects, since they occur for both extremely low frequency (ELF) and radio frequencies RF which have very different energy level. Another study published 2011 by the Journal of the

American Medical Association conducted using fluorodeoxyglucose injections and position emission tomograph concluded that exposure to radio frequency signal waves within parts of the brain closest to the cell phone antenna resulted in increased levels of glucose metabolism, but the clinical significance of this finding is unknown. https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health

2.13 Blood – brain barrier effect

Swedish researchers from Lund University (Salford, Brun, Person, Everhandt and Malmgren) have studied the effects of microwave radiation on the rat brain. They found a leakage of albumio into the brain through a permeated blood-brain barrier.

This confirms earlier work on the blood – brain barrier by Allan Frey, Oscar and Hawkins, and Albert and Kerns. Professor Lesczyski of Finland's radiation and nuclear safety authority found that, at the maximum legal limit for mobile radiation, one protein in particular, HSP27, was affected. HSP27 played a critical role in integrity of the blood – brain barrier. In 2006 a large Danish groups study about the connection between mobile phone use and cancer incidence was published.

https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health

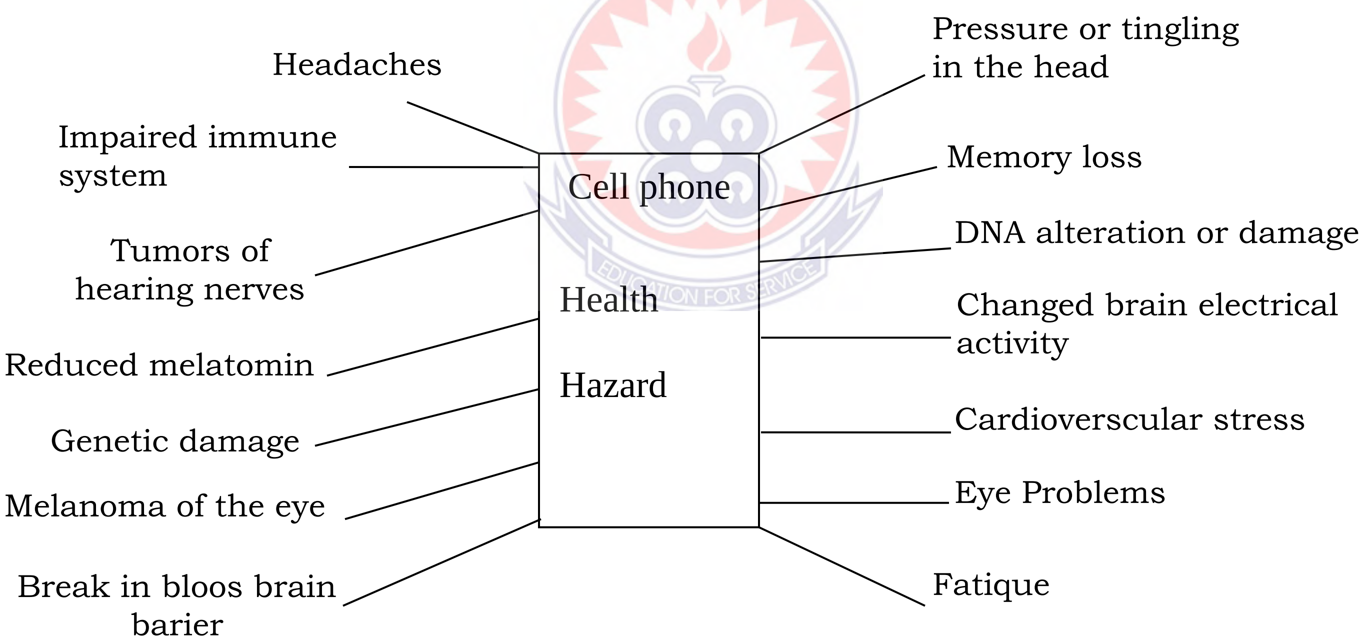

Figure 2**.1 "Effect of long Exposure to Mobile P**hones

2.14 Cognitive effects

A 2009 study examined the effects of exposure to radiofrequency radiation (RFR) emitted by standard GSM cell phones on the cognitive functions of humans. The study confirmed longer (slower) response times to a spatial working memory task when exposed to RFR from a standard GSM cellular phone placed next to the head of male subjects, and showed that longer duration of exposure to RFR may increase the effects on performance, Right-handed subjects exposed RFR on the left side of their head on average had significantly longer response times when compared to exposure to the right side and sham-exposure.

https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health.

2.15 Electromagnetic hypersensitivity

Some users of mobile handsets have reported feeling several unspecific symptoms during and after its use; ranging from burning and tingling sensations in the skin of the head and extremities, fatigue, sleep disturbances, dizziness, loss of mental attention, reaction times and memory retentiveness, headaches, malaise, tachycardia (heart palpitations), to disturbances of the digestive system. Reports have noted that all of these symptoms can also be attributed to stress and that current research cannot separate the symptoms from nocebo effects. https://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health.

CHAPTER THREE

METHODOLOGY

An ordinary RF detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones due to the high frequency at which it transmit and huge energy that it gives out.

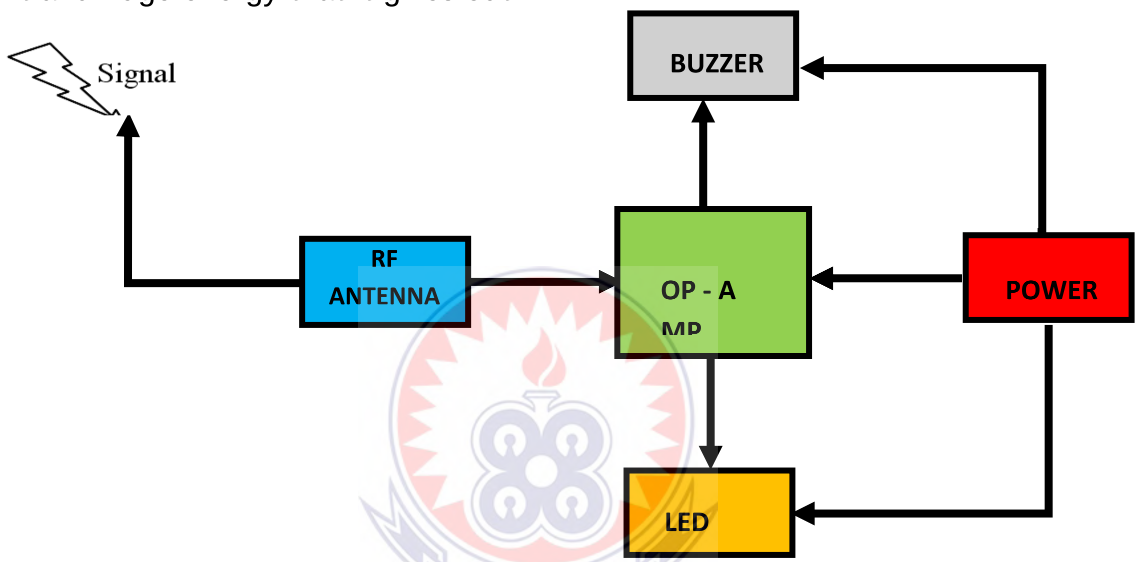

Figure 3.1 Block Diagram of the Mobile Phone Detector

The construction of this pocket size mobile phone signal detector is so simple and not expensive. For the construction to be understood and appreciated a more detailed description of the design is required using the block diagram.

The design consists of four stages as shown in the block diagram.

1. The sensor stage
2. The power stage
3. Operational Amplifier (Op-Amp) stage
4. Response stage

From the above block diagram, once the RF antenna receives wireless signal after the circuit has been powered by a 9 Volts dc battery, the operational Amplifier CA3130 amplifies the received signal which in turn triggers the buzzer and makes the LED to flicker when signal is detected.

3.1 Principle of Operation

The figure below shows how the circuit works

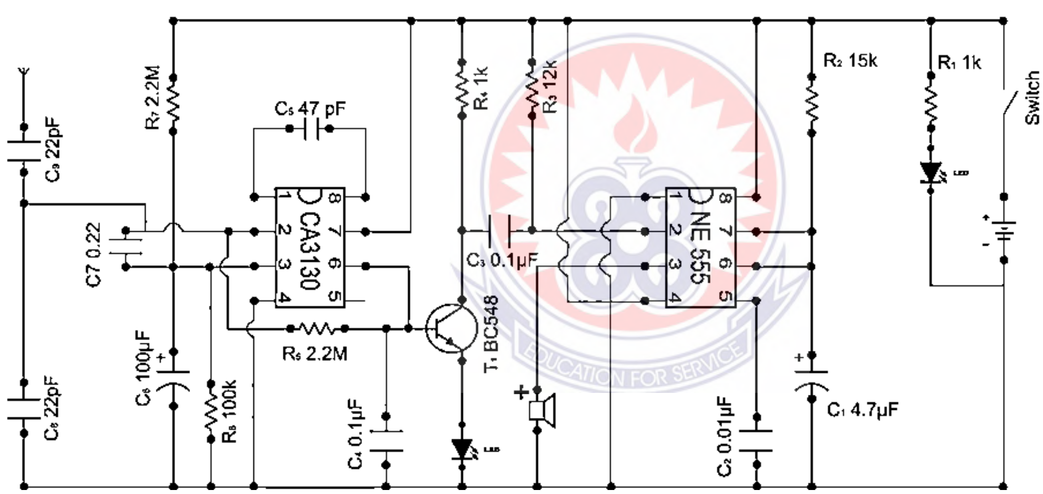

Figure 3.2 Circuit Diagram of the Mobile Phone Detector

The transmission frequency of mobile phones ranges from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. A circuit detecting gigahertz signals is required for a mobile bug. Here, the circuit uses a 0.1µF disk capacitor (C2) as shown in figure 3.2 above 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 (U1), in figure 3.2, is used in the circuit as a current-to-voltage converter with capacitor C3 connected between its inverting and non-inverting inputs.

Capacitor C2 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 U1. This will upset the balanced input of U1 and convert the current into the corresponding output voltage. Capacitor C1 along with high-value resistor R1 keeps the non-inverting input stable for easy swing of the output to high state. Resistor R2 provides the discharge path for capacitor C1. Feedback resistor R3 makes the inverting input high when the output becomes high. Capacitor C3 is connected to R5 and 'null' inputs (pin 6) of U1 for phase compensation and gain control to optimize the frequency response.

When the cell phone detector signal is detected by C2, the output of U1 becomes high and low alternately according to the frequency of the signal .This makes the LED to flicker through resistor R4 connected to the output pin 7 of the U1,which in turns triggers the buzzer.

3.2 Construction of Bread Board

The construction was first done on a bread board as shown in figue 3.3, before been transferred on to a PCB. The Op- Amp IC chip (U1) was placed on board straddling the channel. The orientation of the chip was noted after which the variable resistor was then placed with the pins on separate rows. The center pin of the variable resistor (R5) is connected to pin 6 of the IC, and top and bottom pins to the bottom rows of the board. The bottom two rows are where the battery will be connected. One capacitor (C3) is inserted between the middle and top pins of the variable resistor. Pin 4 of the IC is connected to the bottom left row. Several other locations will use this connection for ground (Negative battery terminal).

A 6.8 Mohms resistor (R2) and a capacitor (C1) is connected between pin 3 and pin 4 of the IC. Pin 4 is connected to ground. A capacitor (C2) is then connected between pin3 and pin 2 of the IC. A 6.8 Mohms resistor (R1) is connected between pin 3 of the IC and bottom pin of the variable resistor. A wire is needed to make this connection. The bottom pin of the variable resistor is connected to the battery positive terminal. A 6.8 ohms (R3) is also connected between pin 1 and pin 2 of the IC. As shown in figure 3.3 below.

A wire is used to connect pin 1 and pin 5 of the IC. One leg of the 1 Kohms (R4) is connected to pin 7 of the IC. The other leg of the LED is connected to pin 8, and the short leg to the row above pin 8 (the row where one of the 1K ohms resistor leg is connected). A wire is connected to the bottom right row to the long leg of the LED (pin 8). One end of a long wire (antenna) is connected to pin 2 of the IC. The black wire of the battery is connected to the bottom left of the board while the red wire of the battery is connected to the bottom right row of the board.

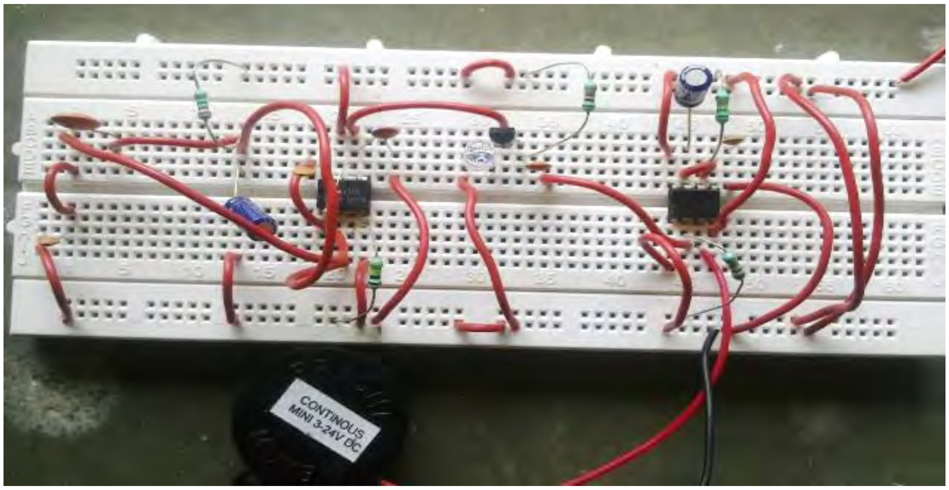

Figure 3.3 Components connected on a breadboard

3.3 Construction of a PCB

A printed circuit board (PCB) is a self-contained module of interconnected electronic component found in devices from common beepers, or pagers, and radios to sophisticated radar and computer systems. The circuit is formed by a thin layer of conducting material deposited or printed on the surface of an insulating board known as the substrate. Individual electronic components are placed on the surface of the substrate and soldered to the interconnecting circuit. Figure 3.4 shows the simulated drawing.

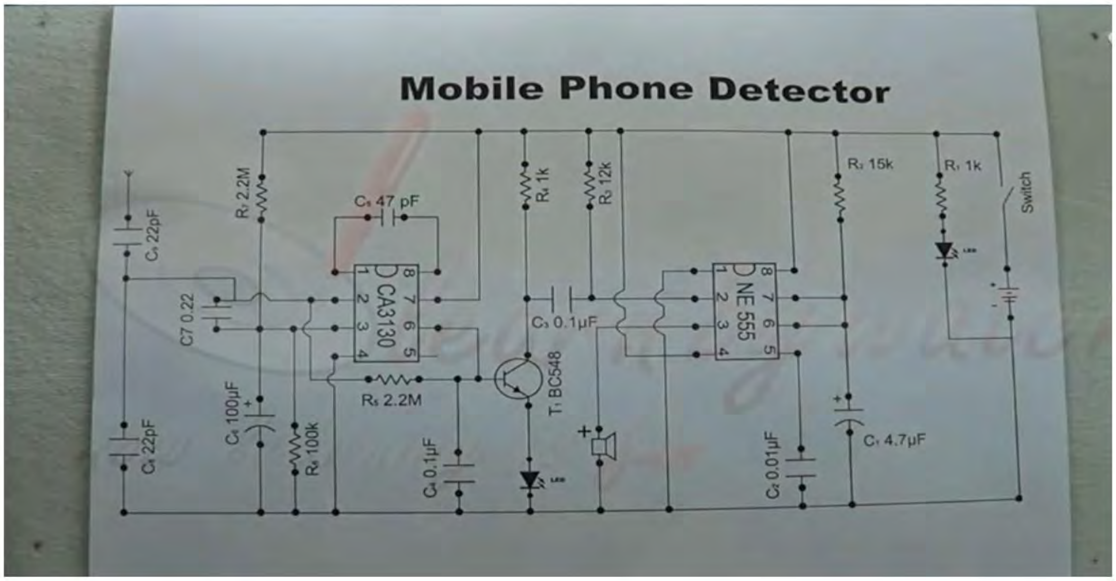

Figure 3.4. The circuit diagram on A4 sheet

The design of the circuit in figure 3.5 is redrawn onto a PC board showing the conducting circuit paths and positions of each component.

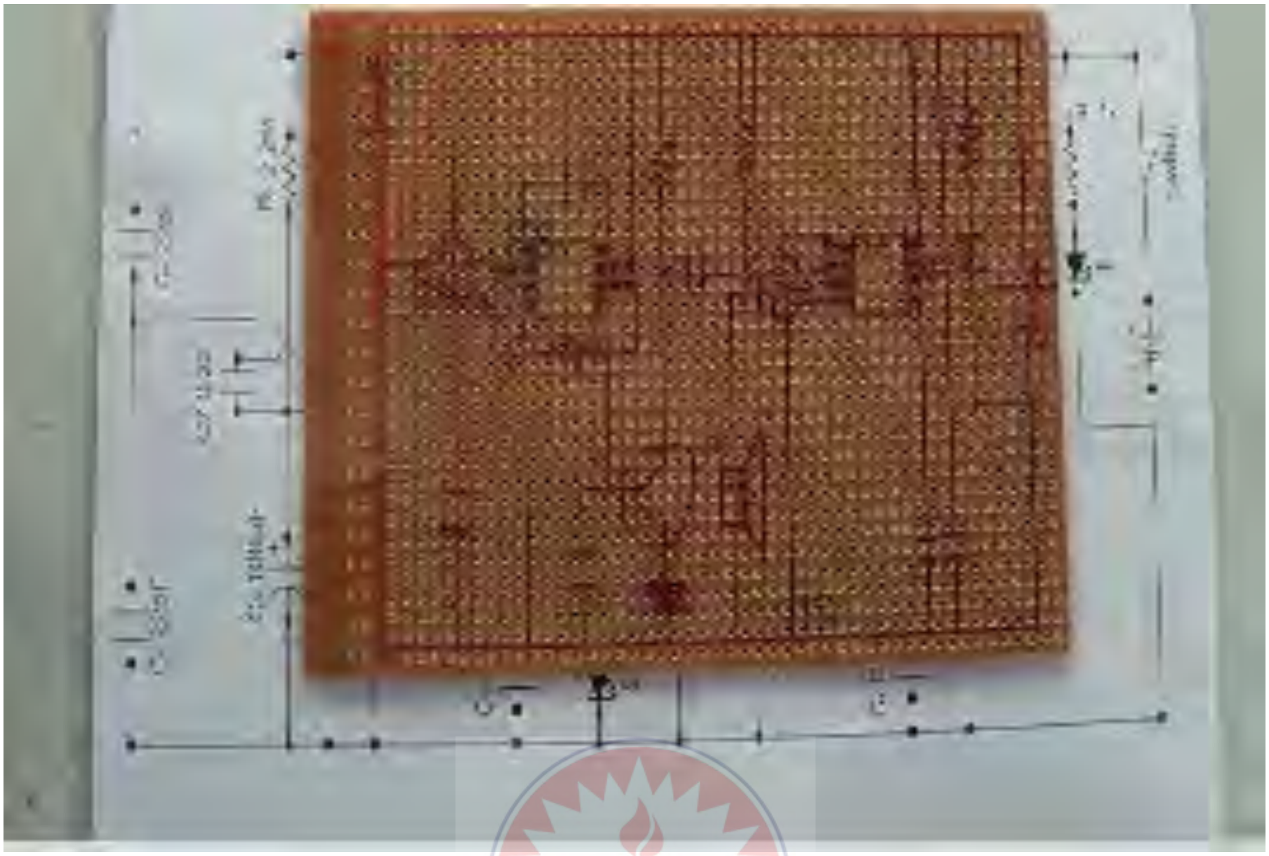

Figure 3.5. The circuit diagram on A4 sheet

Figure 3.6 and 3.7 , indicates how the electronic components are fixed and connected on the bread board.

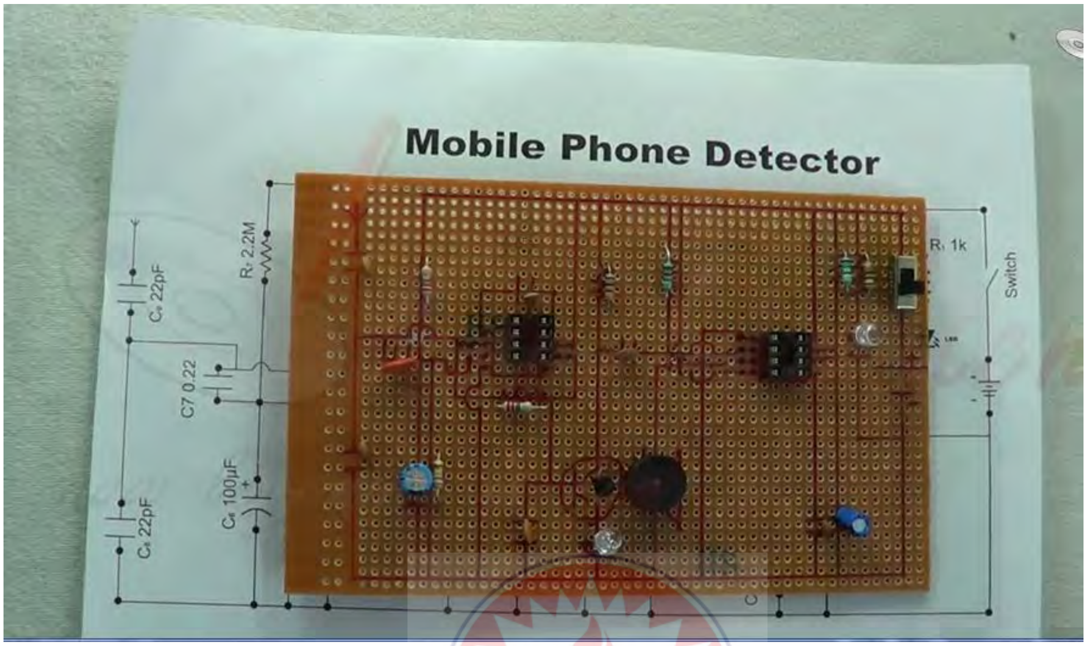

Figure 3.6. The electronic components fixed on the bread board

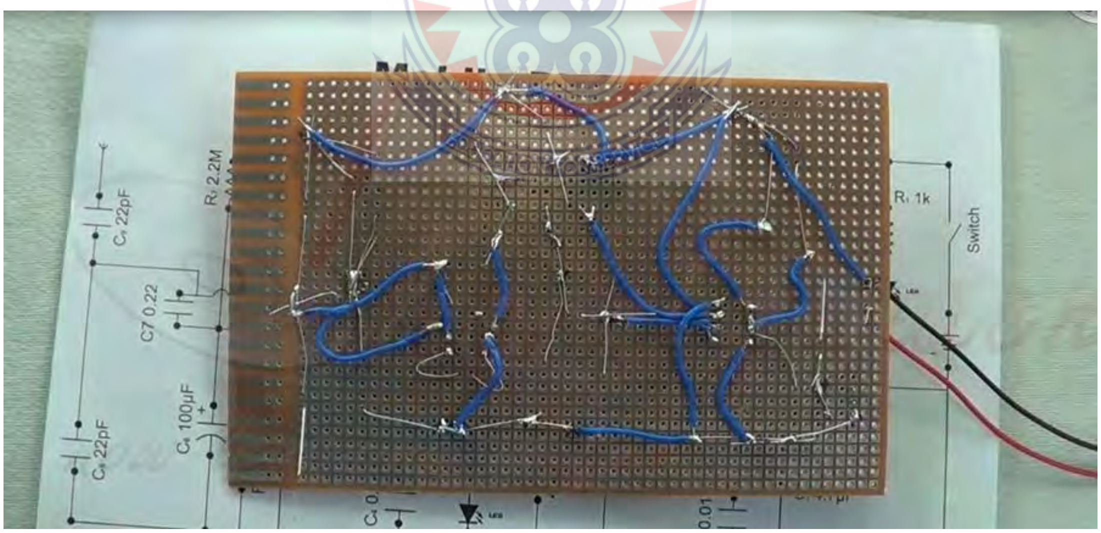

Figure 3.7. The electronic components connected on the bread board

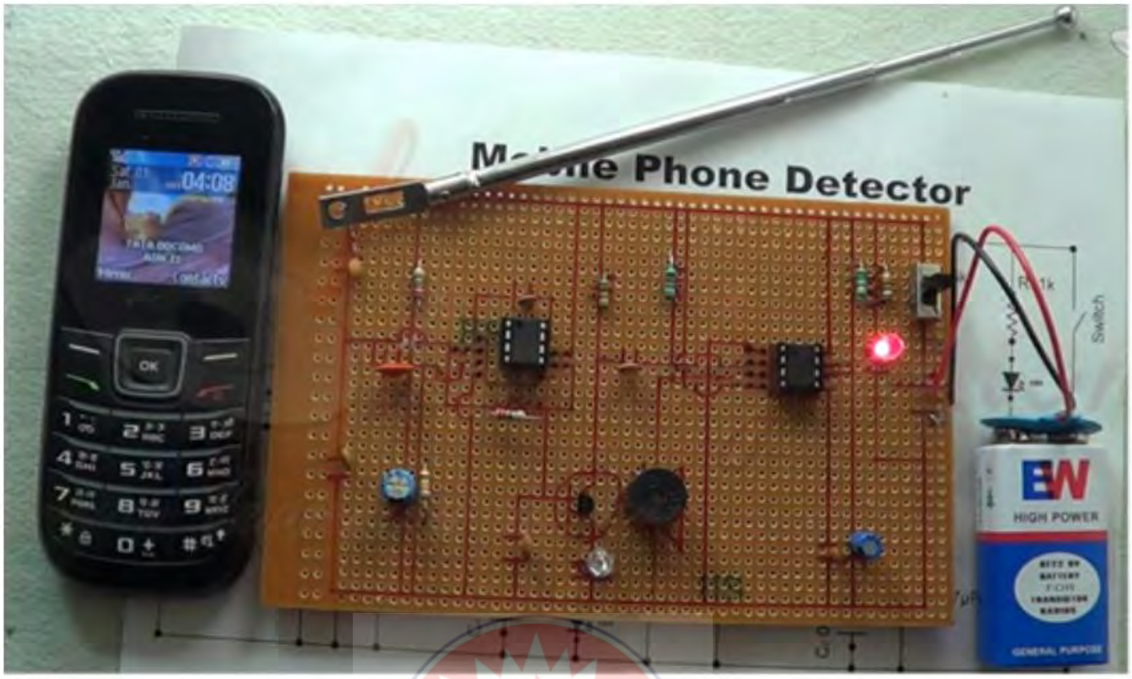

Figure 3.8. Completed mobile phone detector

CHAPTER FOUR

DESIGN ANALYSIS

4.0 Testing and Expected Result

The design was tested with a multism software and proven by taking readings of each components before the signal detector detects an active phone and when it does not. Three tests were conducted using a spectrum analyzer and signal generator. The finished project was also tested using a mobile phone.

The tests were done using a signal generator and spectrum analyzer connected respectively to the input and output. The first test was carried out to check if the Op-Amp CA3130 could amplify the received signal, the second test was on how the LED worked in conjunction with the buzzer and the last test was to see how bright and loud the LED and buzzer could be when the circuit receives signal from the signal generator. At the end of these tests, the detector is found to be working as expected with high efficiency.

The components' voltage values were taken using a multimeter and given in Table 4.1.

It could be deduced from the table that, there is a constant value for each component when there is no signal or activated mobile phone near the detection range. The reason for this is not farfetched as the battery supplies the voltage, it goes through the circuit across each component. The voltage across the LED and buzzer is not sufficient enough to produce an alert as the rating to produce a sound from the buzzer is 3 Volts to 24 Volts while that of the LED is 1Volt to 3 Volts.

S/N	COMPONENTS	VOLTAGE (V) (WHEN NO SIGNAL)	VOLTAGE (V) (WHEN THERE IS SIGNAL)		
1	BUZZER	1.28	3.5	2.75	1.78
2	LED	0.54	1.9	1.05	0.92
3	C3	2.89	2.61	2.51	1.52
4	C1	3.00	2.75	2.61	2.01
5	C2	0.19	0.15	-	-
6	CA3130	6.32	5.80	5.72	5.62

When an activated phone is brought in detection range, the voltage across each component either increases or drops. There is a fluctuating voltage drop across the capacitors (C1, C2, and C3) and the Op-Amp CA3130 as the signal is received by the antenna. The fluctuation is due to the irregularity of the signal because it is a sine wave. The voltage across the buzzer fluctuates increasingly between the values of 3.5 Volts to 1.78 Volts and only comes up with a sharp sound at 3.5 Volts but with a faint sound at 2.75 Volts and no sound at 1.78 Volts. The voltage across the LED also increases and fluctuates as the signal comes and goes, but only come up at a voltage of 1Volt and above.

The moment the bug detects RF transmission signal from a mobile phone, it starts sounding a beep alarm and the LED blinks as shown in Figure 4.1 below. The alarm continues until the signal transmission ceases.

4.1 Testing of the Completed Circuit

For the mobile test a Nokia mobile phone was turned on and a phone call was placed with the detector nearby. It was noticed that once the call was made and the detector detects the signal, the LED comes up along with the sound but later stops even when the call was not aborted.

After much troubleshooting, it was discovered that, the wire used for antenna was weak and a better wire was used and the circuit was working effectively and efficiently.

Figure 4.1. Completed mobile phone detector

The completed circuit tested with oscilloscope. The sine wave produced indicate the efficiency of the circuit.

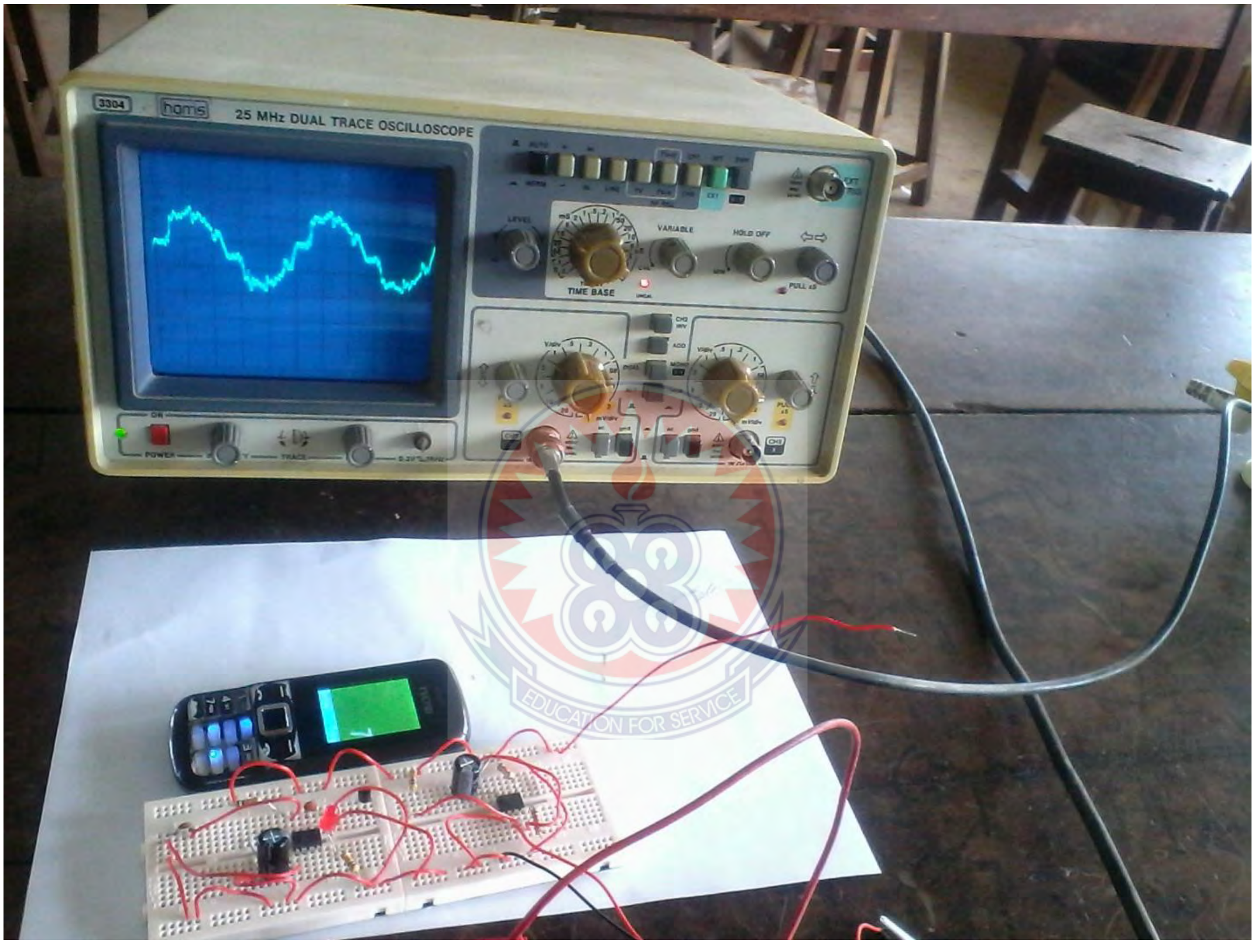

Figure 4.2. Testing the circuit with oscilloscope.

4.2 Simulation analysis

Simulation Parameters Figure 4.3 show the generated radio frequency signal, the power spectrum and the average time signals respectively as captured on Multism. This represents the output waveform of the device when there is mobile signal transmission.

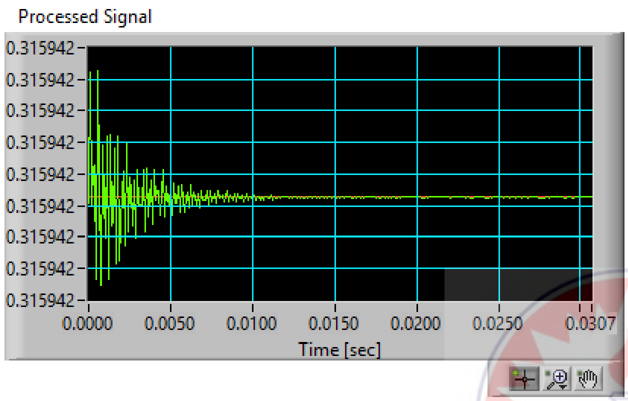

Fig 4.3 (a) Average time signal

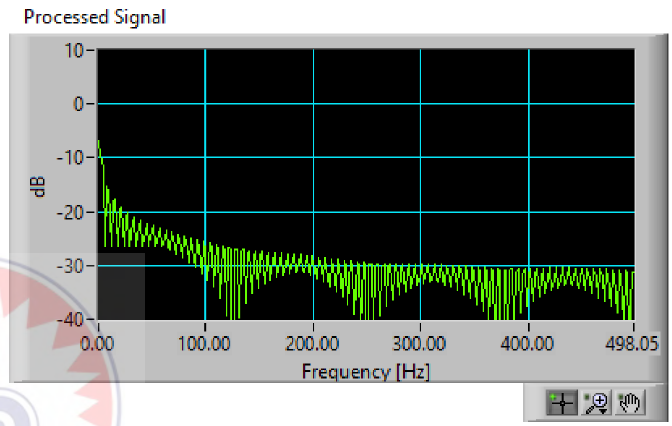

Fig 4.3 (b) Auto power spectrum

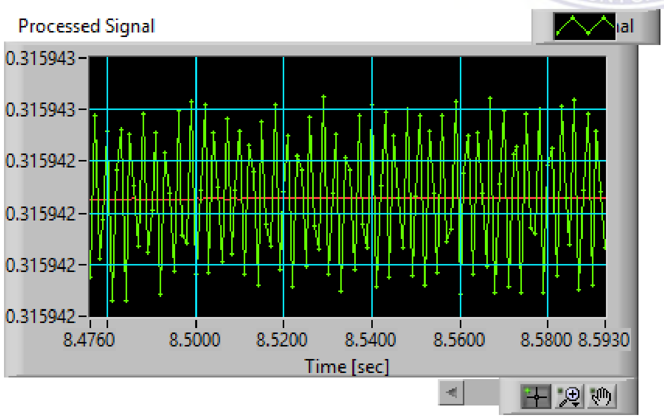

Fig 4.3 (c) Average time signal

4.3 Design Conclusions

As a conclusion, this project has successfully detected the mobile phones when it is located at particular area such as examination halls, classrooms and lecture halls. But the problems for this design is that it can only sense the frequency of the mobile phones, it cannot detect how many of mobile phones been used.

However, by detecting the presence of the mobile phones, it can alert the users to silent or switch off their mobile phones within those particular areas. By designing this project, it can be used to help the management system in Yeji Senior High School in preventing the usage of mobile phones in Class rooms, Dormitories and examination halls. This design can help to prevent the noise interruption and maintain a peaceful environment to all students in the classrooms and examination halls.

This RF detector circuit also can help to discipline the students from using the mobile phone in the prohibited areas.

CHARPTER FIVE

CONCLUSION AND RECOMMENDATION

Cellular phone technology is gaining new data capabilities very rapidly. New features like Bluetooth, high resolution cameras, memory cards, and Internet make them ideal for getting data in and out of examination rooms and other secure facilities. A cellular phone uses many different transmission protocols such as FDMA or CDMA.

These protocols dictate how a cellular phone communicates with the tower. Typically cellular phones in Ghana operate between 824 - 894 MHz. Many examination bodies depend on keeping information protected and build fortresses that called depot to protect examination questions from leaking. Currently the only way to ensure that no one is bringing a cellular phone into a examination room is to search everyone entering and exiting.

This requires a lot of manpower and money to implement. The existing technology available does not accurately detect cellular phones in classroom and examination hall. Detectors like the Wolfhound or Cell busters sit in the entrance of Classroom and examination hall and randomly detect cellular phones or devices in the area. A better technique for accurately detecting cellular phones is needed. The first signal detection technique, a design from circuit-projects.com was built and tested.

This technique utilizes two antennas that are tuned to 900 MHz. The antennas resonate at this frequency and the signal is then demodulated.

After demodulation, the signal is amplified and sent to a pair of headphones for monitoring. After building the circuit projects design using wire wrap, two conclusions were made. Using wire wrap at these frequencies changes the impedance of the circuit and BNC connectors make a much better connection. With this new information an even better design was conceived. The second signal detection technique, a design utilizing a down converter in conjunction with a band pass filter was built and tested. A VCO at 800 MHz and an 800MHz antenna is fed into the down converter. The VCO frequency is then subtracted from the cellular phone signal coming in around 832 MHz.

This produces an output from the down converter around 32 MHz which is sent to a band pass filter with a pass band of 29 -35 MHz leaving just the 32MHz signal. It can then be converted to a digital output using an analog to digital converter. This design was built and tested in the lab and proven.

Multism simulation software. Lab results show that a down converter and VCO circuit works, but requires a finely tuned band pass filter which can cost a lot of time and money. Therefore computer simulation results proved that this design will work with an effective band pass filter. This technique, if fully implemented would greatly improve cellular phone detection technology. Schools and Examination bodies would save money on security and save money by not allowing any examination information to leak out.

5.1 Suggestion and Recommendation for Future Work.

This project has been developed and implemented. However, it can be improved to target more advance and better application in the next stage of research. For future improvement, there are several suggestions stated below:

Another sensor design can be develop to detect how many phones available in that particular zone/area. Increase the range of the detection area (range can be widen).

ERENCECES

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