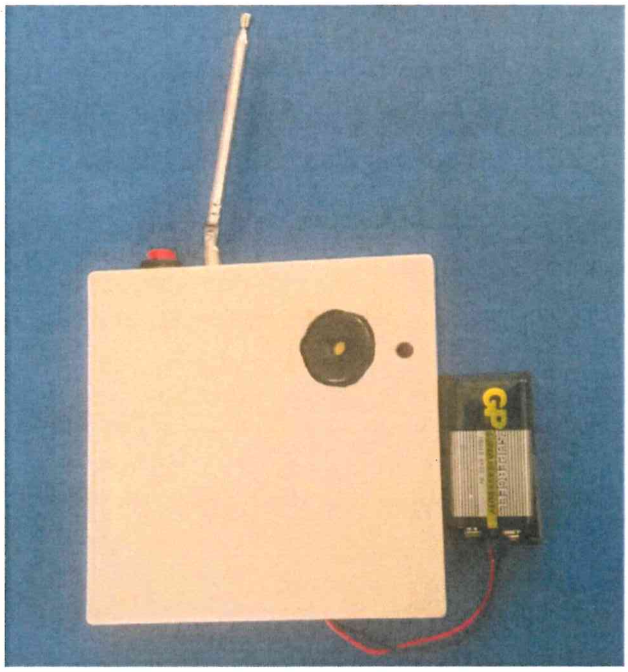
CELL PHONE DETECTOR



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A proposal project submitted in fulfillment of the requirement for the award of the diploma of Electrical Engineering (Communication) Department of Electrical Engineering Polytechnic Seberang Perai (PSP).

Department of Electrical Engineering

June 2016

PROJECT REPORT COMFORMATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged.

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Date : 28/10/2016

Supervisor : ....

Pn.Nasrolayuze binti Md Saad

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Supervisor : ....

Pn.Nasrolayuze binti Md Saad

Content

Acknowledgment

First and foremost I would like to take this opportunity to express my gratitude to everyone who supported me throughout the course of this project. I would like to say a gratitude to our supportive supervisor, Pn.Nasrolayuze binti Md Saad for his aspiring guidance, invaluably constructive criticism and friendly advice during the project work. A sincerely grateful to him for sharing his truthful and illuminating views on a number of issues related to the project.

Other than that, I would like to express gratitude towards my parents, and my colleague for kind encouragement, co-operation and their willingness to help me out which help better in completion of this project.

It would not have been possible without the kind support and help of many individuals and organizations. I would like to extend our sincere thanks to all of them.

Abstract

This Cell Phone Detector contains a very sensitive long distance circuit that can detect the mobile phone signals from 30 to 40 feet away. It is a very useful and can be used to detect cell phones at the places where they are not allowed, for example examination halls, meeting rooms, petrol stations, religious places and etc. The circuit can also be used to detect any spy cell phone or also for finding the lost cell phone when the phone is on vibrate alert. The circuit cannot detect the speech or text message contents; it can only detect the encoded signal sound due to which we can understand that someone is using a cell phone. The circuit is very simple and using very few components, which are CA3140 IC, transistor, LED, three resistors and a buzzer that is optional. The Buzzer can be also removed and use only LED with its 470 Ohms current limiting resistor. Working principle of the circuit is simple, when we dial a number or send an SMS or MMS through our cell phone, then our cell phone will generate an RF signal to connect to its nearest cell phone tower. The two diodes shown in the circuit detects these RF signals which are will be amplified by the CA3140 IC. The output is fed to the transistor, which become switch on and activate the LED and the piezo buzzer. The operating voltage of the circuit is 9 Volt.

Abstrak

Ini pengesan telefon sel mengandungi jarak litar tidak sensitif yang panjang yang boleh mengesan isyarat dari telefon bimbit 30 hingga 40 kaki. Ia adalah sangat berguna dan boleh digunakan untuk mengesan telefon bimbit di tempat-tempat di mana mereka tidak dibenarkan untuk dewan contoh peperiksaan, bilik, stesen minyak, tempat-tempat agama dan ect mesyuarat. Litar ini juga boleh digunakan untuk mengesan mana-mana telefon bimbit pengintip atau juga untuk mencari telefon bimbit yang hilang apabila telefon dihidupkan bergetar amaran. Litar ini tidak dapat mengesan ucapan atau mesej teks kandungan; ia hanya boleh mengesan isyarat bunyi dikodkan kerana yang kita dapat memahami bahawa seseorang menggunakan telefon bimbit. Litar ini adalah sangat mudah dan menggunakan sangat beberapa komponen, yang CA3140 IC, transistor, LED, tiga perintang dan buzzer yang adalah pilihan. The Buzzer boleh juga dikeluarkan dan menggunakan LED dengan semasa mengehadkan perintang 470 ohm itu. prinsip kerja litar adalah mudah, apabila kita mendail nombor atau menghantar SMS atau MMS melalui telefon bimbit kami, telefon bimbit kami akan kemudian menjana isyarat RF untuk menyambung ke menara telefon sel yang terdekat. Kedua-dua diod ditunjukkan dalam litar mengesan isyarat-isyarat RF yang akan dikuatkan oleh IC CA3140. output itu diberi makan kepada transistor, yang menjadi menghidupkan dan mengaktifkan LED dan buzzer piezo. Voltan operasi litar adalah 9 Volt.

Figure **Page**

Chapter 1
Introduction

1.1 Background Project

Cell Phone Detector is useful for detecting the use of mobile phone for spying and unauthorized video transmission. Certain places where use of mobile phones are not allowed like exam hall, temple, offices and theaters, in those places to detect and restrict the use of mobile phones this proposed system is very helpful. This must detect the incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The illegal use of cell phones is a growing and dangerous problem in correctional institutions worldwide. These devices are a significant threat to prison security and circumvent the monitoring processes in prisons, while helping inmates commit new crimes both inside and outside the facility.

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 bug. 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.

When mobile phone is active, it transmits the signal in the form of sine wave which passes through the space. The encoded audio/video signal contains electromagnetic radiation which is picked up by the receiver in the base station. The transmitter power of the modern 2G antenna in the base station is 20-100 watts. The mobile phone transmits short signals at regular intervals to register its availability to the nearest base station. Distance to cellular base station is the most important environmental factor. Generally, the nearer a cellular phone is to a base station or transmitting tower, the weaker will be the signal that needs to come from the phone. Range of frequencies of different categories are, AM radio frequencies between 180 kHz and 1.6MHz,FM radio uses 88 to 180 MHz, TV uses 470 to 854MHz.waves at higher frequencies but within the RF region is called Micro waves. Mobile phone uses high frequency RF wave in the micro wave region carrying huge amount of electromagnetic energy.

1.2 Problem Statement

Recent Statistics shows that many students are copying or trying to copy. 90% of them are bringing smart phones to exam hall to copy or send their answers to their friends. These students create among them a copycat network. If there is a cell phone detector fixed in the exam hall, these bad habits might be stopped. The Cell Phone Detector will detect the RF signals then the LED and buzzer will be lighted up and gives out sound respectively. This device also can be used in any meetings, so people attending the meeting will give their 100 percent in the meeting rather than using their Cell phones.

1.3 Objective (s) your project

- To detects the cell phone signals around a radius of 30-40 feet range.
- To avoid the usage of cell phones during Examination or in any meetings.
- To avoid the usage of cell phones where the use of cell phone is prohibited like Petrol pumps, Gas station, Historical places, Religious places, Military bases, Hospitals, Theatres and Conferences.

1.4 Scope and Limitation Project

The radius range of this detector is around 30-40 meters which is around 10-12 meters. Hence this may be used in class rooms. Our scope is to create a Detector which will be used in big Examination halls, so that it can detect all the signals in these kinds of surroundings and environments. Besides that, with a detector only these Copycat networks can't be stopped entirely. If this Detector combined with a Jammer circuit with a higher radius range, it might be a solution to this problem.

1.5 Significant of Project

There are a lot projects involving Cell Phone Detectors have been done for the past few years. These projects are mostly being done for the radius range around 1 to 1.5 meters. The main significant about our project is that the radius range of the detector is around 10 to 12 meters with the cost that is ten times lower than a Professional Cell Phone Detector. Although Professional Cell Phone Detectors have wider Radius range compared to our Detector, there is still room for improvement that can be done in order to increase the radius range of this Project.

Chapter 2
Literature Review

2.1 Introduction

In this chapter we will discuss the overview of Cell Phone Detector and see its demo circuits. We will also discuss about circuit diagram and description of the circuit diagram. But before we discuss the above we have to know about the previous detection techniques which has been introduced already in the market. The first signal detection technique, an existing design utilizing discrete component is difficult to implement. They are very affordable to construct, but require precision tuning. This design is analyzed and found to be inaccurate. The second signal detection technique, a design using a down converter, voltage controlled oscillator (VCO), and a bandpass filter was investigated for cellular phone detection. The performance of this technique through hardware and computer modeling is discussed and the results are presented. The new system is accurate and a practical solution for detecting cellular phone in a secure facility. A mobile phone (also known as a cellular phone, cell phone, and a hand phone) is a device that can make and receive telephone calls over a radio link while moving around a wide geographic area. It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network. By contrast, a cordless telephone is used only within the short range of a single, private base station. In addition to telephony, modern mobile phones also support a wide variety of other services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography. Mobile phones that offer these and more general computing capabilities are referred to as smart phones.

A cellular network or mobile network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighboring cells, to avoid interference and provide guaranteed bandwidth within each cell. When joined together these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

In a cellular radio system, a land area to be supplied with radio service is divided into regular shaped cells, which can be hexagonal, square, circular or some other regular shapes, although hexagonal cells are conventional. Each of these cells is assigned multiple frequencies ($f_1 - f_6$) which have corresponding radio base stations. The group of frequencies can be reused in other cells, provided that the same frequencies are not reused in adjacent neighboring cells as that would cause co-channel interference. The increased capacity in a cellular network, compared with a network with a single transmitter, comes from the fact that the same radio frequency can be reused in a different area for a completely different transmission. If there is a single plain transmitter, only one transmission can be used on any given frequency. Unfortunately, there is inevitably some level of interference from the signal from the other cells which use the same frequency. This means that, in a standard FDMA system, there must be at least a one cell gap between cells which reuse the same frequency. In the simple case of the taxi company, each radio had a manually operated channel selector knob to tune to different frequencies. As the drivers moved around, they would change from channel to channel. The drivers knew which frequency covered approximately what area. When they did not receive a signal from the transmitter, they would try other channels until they found one that worked. The taxi drivers would only speak one at a time, when invited by the base station operator (this is, in a sense, time division multiple access (TDMA).

Practically every cellular system has some kind of broadcast mechanism. This can be used directly for distributing information to multiple mobiles, commonly, for example in mobile telephony systems, the most important use of broadcast information is to set up channels for one to one communication between the mobile transceiver and the base station. This is called paging. The three different paging procedures generally adopted are sequential, parallel and selective paging. The details of the process of paging vary somewhat from network to network, but normally we know a limited number of cells where the phone is located (this group of cells is called a Location Area in the GSM or UMTS system, or Routing Area if a data packet session is involved; in LTE, cells are grouped into Tracking Areas). Paging takes place by sending the broadcast message to all of those cells. Paging messages can be used for information transfer. This happens in pagers, in CDMA systems for sending SMS messages, and in the UMTS system where it allows for low downlink latency in packet-based connections. In a cellular system, as the distributed mobile transceivers move from cell to cell during an ongoing continuous communication, switching from one cell frequency to a different cell frequency is done electronically without interruption and without a base station operator or manual switching. This is called the handover or handoff. Typically, a new channel is automatically selected for the mobile unit on the new base station which will serve it. The mobile unit then automatically switches from the current channel to the new channel and communication continues.

2.2 Cellular Phone Technology

Cellular Phone Technology is rapidly changing. Features like Bluetooth, USB, high resolution cameras, microphones, Internet, 802.11 wireless, and memory cards added every year. Also, the communication technology a cellular phone uses such as CDMA, GSM, 3G and 4G are rapidly changing.

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 your cellular phone. Device like a printer, keyboard, mouse, audio device, and storage device can be connected wireless. This feature is only use for hands-free devices but can also be used for file transfer of picture, music, and other data. Universal Serial Bus (USB) is a way for cellular phone to connect to a computer for data transfer. This feature is very similar to Bluetooth for cellular phone with the exception of using a cable. On today's cellular phones this feature is mainly used for charging the battery or programming by the manufacturer. It can also be used to transfer picture, music, and other data. Cameras on cellular phones are a very popular feature that was added in the last 10 years. In recent years, high resolution cameras have become a standard feature. Most cellular phones will come with at least a 2 mega pixel camera and the more expensive phones can be as much as 8 mega pixels. Microphones have been featured on cellular phone since they first came out. In the last 10 years the microphones have become dual purpose; now there are programs on the phone that record voice to file such a simple voice recorder or as part of a video. Some cellular phones come with 802.11 wireless built in and allows the phone to connect to any nearby wireless network. This provides an alternate connection method to the Internet and saves money if you are on a limited data plan. Also, connecting with 802.11 is most likely going to provide better throughput than using the cellular phone network. All these features make cellular phone today very versatile. They can connect with almost any storage medium or computer. In the years to come, cellular phones will continue to gain more and more features.

2.4 Cellular Phone Communication Standard

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 Communication (GSM), CDMA2000, wide-band code division multiple access (WCDMA), and time division synchronous code division multiple access (TD-SCDMA). All of these protocols typically operates 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.

2.5 Research on Cell Phone Detectors that already exist.

We did research about the cell detectors that already exist. This will help us in designing our own circuit for our project. Through our research, we found that every cell phone detectors needed an IC OP AMP to amplify the signals received which will be fed through a transistor which act as an switch to activate the Buzzer or LED.

2.5.1 Handy mobile bug

This handy mobile bug or cell phone detector, pocket-size mobile transmission detector or sniffer can sense the presence of an activated mobile cellphone from a distance of one and-a-half meters. So it can be used to prevent use of mobile phones in examination halls, confidential rooms, etc. It is also useful for detecting the use of mobile phone for spying and unauthorized video transmission.

The circuit can detect both the 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.

Cell Phone Detector Circuit Schematic

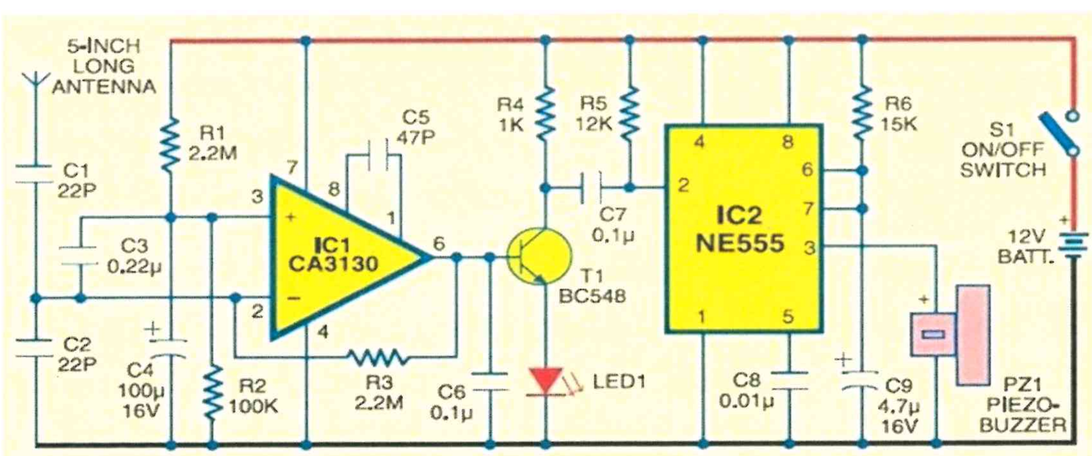

Figure 2a: Cell Phone Detector Circuit

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 bug.

Here the circuit uses a 0.22μF 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. Resistor R2 provides the discharge path for capacitor C4. Feedback resistor R3 makes the inverting input high when the output becomes high. Capacitor C5 (47pF) is connected across 'strobe' (pin 8) and 'null' inputs (pin 1) of IC1 for phase compensation and gain control to optimize the frequency response.

When the cell phone detector signal is detected by C3, the output of IC1 becomes high and low alternately according to the frequency of the signal as indicated by LED1. This triggers monostable timer IC2 through capacitor C7. Capacitor C6 maintains the base bias of transistor T1 for fast switching action. The low-value timing components R6 and C9 produce very short time delay to avoid audio nuisance.

Assemble the cell phone detector circuit on a general purpose PCB as compact as possible and enclose in a small box like junk mobile case. As mentioned earlier, capacitor C3 should have a lead length of 18 mm with lead spacing of 8 mm. Carefully solder the capacitor

2.5.2.2 Circuit Diagram of Cell Phone Detector

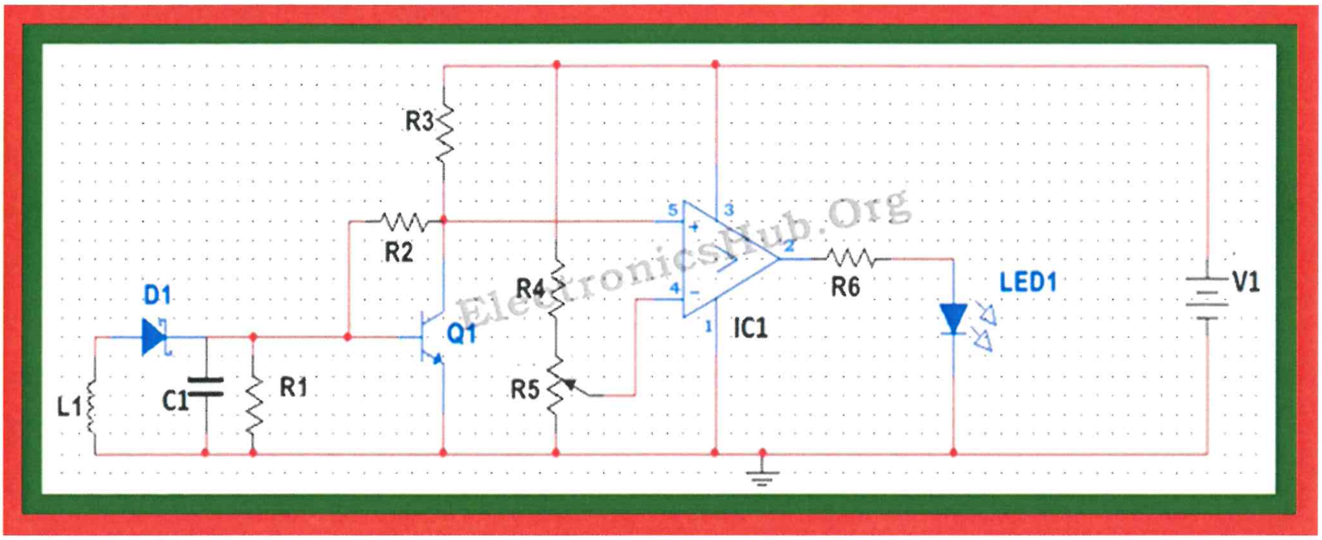

Figure 2b: Mobile Detector Circuit

Circuit Diagram of Cell Phone Phone Detector – ElectronicsHub.Org

Circuit Components:

- V1 = 12V
- L1 = 10uH
- R1 = 100Ohms
- C1 = 100nF
- R2 = 100K
- R3 = 3K
- Q1 = BC547
- R4 = 200 Ohms
- R5 = 100 Ohms
- IC1= LM339
- R6 = 10 Ohms
- LED = Blue LED

2.5.2.3 Detector Circuit Design

The detector circuit consists of an inductor, diode, a capacitor and a resistor. Here an inductor value of 10uH is chosen. A Schottky diode BAT54 is chosen as the detector diode, which can rectify low frequency AC signal. The filter capacitor chosen in a 100nF ceramic capacitor, used to filter out AC ripples. A load resistor of 100 Ohms is used.

2.5.2.4 Amplifier Circuit Design

Here a simple BJT BC547 is used in common emitter mode. Since the output signal is of low value, the emitter resistor is not required in this case. The collector resistor value is determined by the value of battery voltage, collector emitter voltage and collector current. Now the battery voltage is chosen to be 12 V (since maximum open source collector emitter voltage for BC 547 is 45V), operating point collector emitter voltage is 5 V and collector current is 2 mA. This gives a collector resistor of approx 3 K. Thus a 3 K resistor is used as RC. The input resistor is used to provide bias to the transistor and should be of larger value, so as to prevent the flow of maximum current. Here we chose a resistor value of 100 K.

2.5.2.5 Comparator circuit Design

Here LM339 is used as comparator. The reference voltage is set at the inverting terminal using a potential divider arrangement. Since output voltage from the amplifier is quite low, the reference voltage is set low of the order of 4V. This is achieved by selecting a resistor of 200 Ohms and a potentiometer of 330 Ohms. An output resistor of value 10 Ohms is used as a current limiting resistor.

2.5.2.6 Mobile Phone Tracking Circuit Operation

In normal condition, when there is no RF signal, the voltage across the diode will be negligible. Even though this voltage is amplified by the transistor amplifier, yet the output voltage is less than the reference voltage, which is applied to the inverting terminal of the comparator. Since the voltage at non inverting terminal of the OPAMP is less than the voltage at the inverting terminal, the output of the OPAMP is low logic signal. Now when a mobile phone is present near the signal, a voltage is induced in the choke and the signal is demodulated by the diode.

This input voltage is amplified by the common emitter transistor. The output voltage is such that it is more than the reference output voltage. The output of the OPAMP is thus a logic high signal and the LED starts glowing, to indicate the presence of a mobile phone. The circuit has to be placed centimeters away from the object to be detected.

2.5.2.7 Mobile Phone Signal Detection using Schottky Diode

The signal from mobile phone is a RF signal. When a mobile phone is present near the circuit, the RF signal from the mobile induces a voltage in the inductor via mutual induction. This AC signal of high frequency of the order of GHz is rectified by the Schottky diode. The output signal is filtered by the capacitor. Schottky diodes are special diodes formed by combining N type semiconductor material with a metal and are typically low noise diodes, operating at a high frequency. These diodes have a unique property of conducting at a very low forward voltage between 0.15 to 0.45V. This enables the diode to provide high switching speed and better system efficiency. The low noise is due to the very low reverse recovery time of about 100 per sec.

2.5.2.8 Signal Amplifier using BJT

BJT or bipolar junction transistor in its common emitter form is the most common amplifier used. A transistor amplifier works on the fact that the input base current is amplified to the output collector current by a factor of β. Here the emitter is the common terminal. The circuit is biased using a voltage divider circuit formed by combination of two resistors. When a transistor is biased in active region, i.e. the emitter base junction is forward biased and the collector base junction is reverse biased, a small base current results in a larger collector current.

2.5.2.9 LM339 as Comparator

LM339 is a comparator IC containing 4 comparators. Here we are using only one comparator. When the voltage at non inverting (+) terminal is higher than the voltage at inverting terminal, the output voltage goes high. When the voltage at inverting terminal is higher, the output voltage goes low.

2.5.2.10. Cell Phone Detector Circuit Applications

i. This circuit can be used at examination halls, meetings to detect presence of mobile phones and prevent the use of cell phones.

ii. It can be used for detecting mobile phones used for spying and unauthorized transmission of audio and video.

Iii. It can be used to detect stolen mobile phones.

2.5.2.11 Limitations of Mobile Phone Detector Circuit:

i. It is a low range detector, of the order of centimetres.

ii. The Schottky diode with higher barrier height is less sensitive to small signals.

2.6 Components.

2.6.1 CA3140

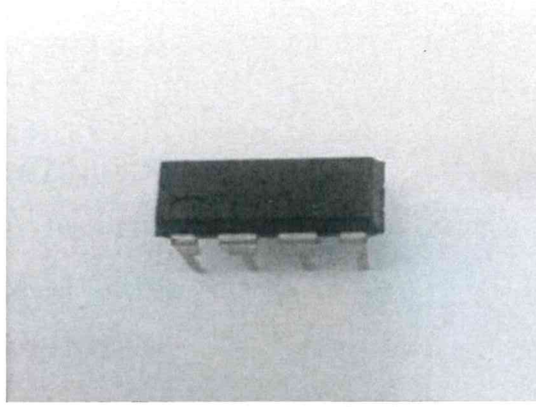

Figure 2c : CA 3140

The CA3140A and CA3140 are integrated circuit operational amplifier that combine the advantages of high voltage PMOS transistors with high voltage bipolar transistors on a single monolithic chip. Because of this unique combination of technologies, this device can now provide designers, for the first time, with the special performance features of the CA3130 CMOS operational amplifier and the versatility of the 741series of industry standard operational amplifiers.

The CA3140A and CA3140 BiMOS operational amplifiers feature gate protected MOSFET (PMOS) transistors in the input circuit to provide very high input impedance, very low input current, and high speed performance. The CA3140A and CA3140 operate at supply voltage from 4V to 36V (either single or dual supply). These operational amplifiers are internally phase compensated to achieve stable operation in unity gain follower operation, and additionally, have access terminal for a supplementary external capacitor if additional frequency roll-off is desired terminals are also provided for use in applications requiring input offset voltage nulling. The use of PMOS field effect transistors in the input stage results in common mode input voltage capability down to 0.5V below the negative supply terminal, an important attribute for single supply applications. The output stage uses bipolar transistors and includes built-in protection against damage from load terminal short circuiting to either supply rail or to ground.

The CA3140 Series has the same 8-lead pinout used for the “741” andother industry standard op amps. The CA3140A and CA3140 are intended for operation at supply voltages up to 36V (±18V).

Features

-MOSFET Input Stage

-Very High Input Impedance (Z_{IN}) -1.5TΩ (Typ.)

-Very Low Input Current (I_I) -10pA (Typ.) at ±15V

-Wide Common Mode Input Voltage Range(VICR)

-Can be Swung 0.5V Below Negative Supply Voltage Rail

-Output Swing Complements Input Common Mode Range

-Directly Replaces Industry Type 741 in Most Applications

2.6.2 2N4401

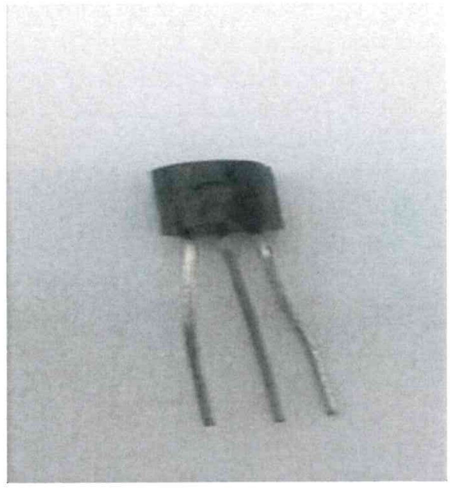

Figure 2d : 2N4401

Absolute Maximum Ratings.

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at TA = 25°C unless otherwise noted.

Symbol	**Parameter**	**Value**	**Unit**
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current-Continuous	600	mA
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55to+150	°C

2.6.3 1N34

Figure 2e : 1N34

The 1N34A Germanium diode is an old standby in electronics. Widely used for detecting the rectifying efficiency or for switching on a radio, TV or stereo etc.

General Specifications

Peak Inv. Voltage(PIV): 60 Volts
Max. Average Rectified Current: 50mA @ 25 deg C
Junction Temperature (TJ): 100 deg C Max.
FWD Voltage Drop(VF): 1.0V @ 5.0 mA
Reverse Current: IR 15uA @ VR 10 volts

2.6.4. Light Emitting Diode (RED)

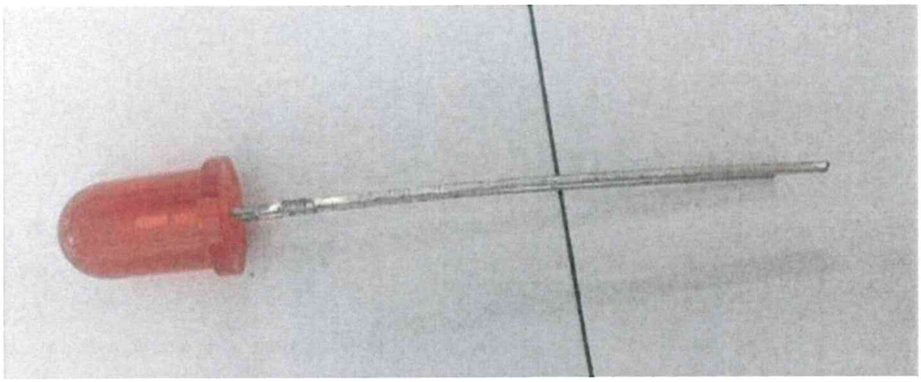

Figure 2f : LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated.When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. An LED is often small in area (less than 1 mm2) and integrated optical components may be used to shape its radiation pattern. Appearing as practical electronic components in 1962,the earliest LED's emitted low-intensity infrared light. Infrared LED's are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LED's were also of low intensity, and limited to red. Modern LED's are available across the visible,ultraviolet, and infrared wavelengths, with very high brightness.

Early LED's were often used as indicator lamps for electronic devices, replacing small incandescent bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays, and were commonly seen in digital clocks. Recent developments in LED's permit them to be used in environmental and task lighting. LED's have many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are now used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes and lighted wallpaper. As of 2015, LED's powerful enough for room lighting remain somewhat more expensive, and require more precise current and heat management, than compact fluorescent lamp sources of comparable output. LED's have allowed new text, video displays, and sensors to be developed, while their high switching rates are also used in advanced communications technology.

2.6.5. Piezo Buzzer

Figure 2g : Buzzer

Buzzer is a mechanical, electro mechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signaling device. A piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button .

There are several different kinds of buzzers. At Future Electronics we stock many of the most common types categorized by Type, Sound Level, Frequency, Rated Voltage, Dimension and Packaging Type. The parametric filters on our website can help refine your search results depending on the required specifications.

The most common sizes for Sound Level are 80 dB, 85 dB, 90 dB and 95 dB. We also carry buzzers with Sound Level up to 105 dB. There are several types available including Electro-Acoustic, Electromagnetic, Electro mechanic, Magnetic and Piezo, among others.

Future Electronics has a complete selection of buzzers from several manufacturers that can be used as an electromagnetic buzzer, piezo buzzer, electro-acoustic transducer, piezo electric transducers or magnetic buzzer for any electric circuit applications. Simply choose from the buzzer technical attributes below and your search results will quickly be narrowed in order to match your specific buzzer application needs.