A project report
on

CELLPHONE DETECTOR

Submitted by

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Sec - 2, Batch -02

II/IV BACHELOR OF TECHNOLOGY

IN

Electronics and Communication engineering

(SEMESTER-III)

ANALOG ELECTRONIC CIRCUIT DESIGN (18 EC 2103)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Koneru Lakshmaiah Education Foundation

VADDESWARAM-522 502

October 2019

K L UNIVERSITY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that Mr./Ms. **N.Satish** bearing Univ. Regd. No **180040132** respectively of section 2 studying B. Tech in **ELECTRONICS AND COMMUNICATION ENGINEERING** has satisfactorily completed project in the semester - I during the academic year 2019 – 2020.

Signature of Course Instructor **Signature of Course Coordinator**

Signature of HOD

ACKNOWLEDGEMENT

I express great pleasure for me to express my gratitude to our honourable President **Sri. Koneru Satyanarayana**, for providing the opportunity and platform with facilities in accomplishing the project based laboratory. I express the sincere gratitude to our Dean Academics **Dr. N. VENKAT RAM** for his administration towards my academic growth.

I express sincere gratitude to our Head of the department of ECE **Dr. M. SUMAN** for his leadership and constant motivation provided in successful completion of our academic semester. I record it as my privilege to deeply thank for providing me the efficient faculty and facilities to make my ideas into reality.

I express my sincere thanks to my course coordinator **Mr. K. GOPI RAM** and my project supervisor **Mr. K. UDAY KIRAN** for his novel **association** of ideas, encouragement, appreciation and intellectual zeal which motivated me to venture this project successfully.

I am pleased to acknowledge the indebtedness to my lab technicians who devoted themselves directly or indirectly to make this project success.

Last but not the least I express my deep gratitude and affection to my parents who stood behind us in all our endeavours.

N.Satish 180040132

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ABSTRACT

The most common electronic equipment used now-a-days is Cell Phone. With advancement in communication technology, the requirement of cell phones has increased dramatically. As Integrated and Nano technology keeps on increasing the size of upcoming technology becomes more and more simple. This includes the smart phones, hence detection of the data transmitted through smart phones is becoming a hectic task. This cell phone detector provides a simple circuit to detect the presence of an activated cell phone by detecting radio frequency signals.

Cell phone detector basically works by detecting the radio frequency that are in its permissible range. Cellphone detector restricts the data transmission by detecting the radio frequency signals and alerts us through LED and BUZZER. It helps in prohibiting the usage of smart phones in certain places where cell phone usage is banned or not allowed.

Its applications involve in maintaining secrecy and eradicating leakage of information in confidential meetings and in high alert military situations. It is also helpful to take act against piracy and prohibits video transmission in movie theatres and auditoriums. It also disables the usage of mobiles in examination halls. This project can be further developed by increasing its range of sensibility towards radio frequency signals and by interfacing it through a display and by applying Wi-Fi module we can monitor the usage of mobiles anywhere and at any time.Hence this cell phone detector has a wide variety of applications. It’s such an awesome device

which can be obtained through a low investment. Its price is much nominal when compared to its applications

INTRODUCTION

Cell Phone Detector is a circuit that can sense the presence of any activated cell-phone nearby and gives an indication of activated cell-phone near around of it.

Basically Cell-phone detector is a Frequency Detector or a Current to Voltage Converter Circuit which catches frequencies about 0.8 - 3.0GHz (Mobile band frequencies).

RL tuned circuit (Resistor–Inductor circuit) is not suitable for detecting the RF signals in Giga Hertz range.

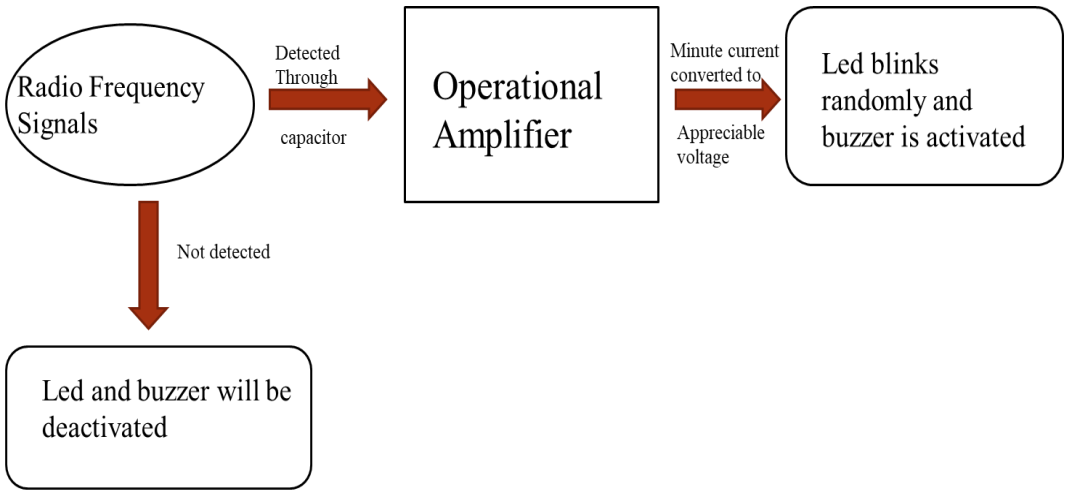
This Mobile Detector Circuit can detect incoming/outgoing calls, messaging, video transmission and any SMS or GPRS uses within the range of 1 meter.

This circuit is very useful to detect Cell-phones at Cell-phone restricted places like Exam halls, meeting rooms, hospitals etc.

It is also useful in detecting the unauthorized use or spying using hidden Cell Phone.

It can detect the RF Transmission from the Mobile Phone and triggers Buzzer to produce beep sound, even if the phone is kept on Silent mode and this alarm continues beeping till the presence of RF signals.

ARCHITECTURE OF THE PROJECT:-



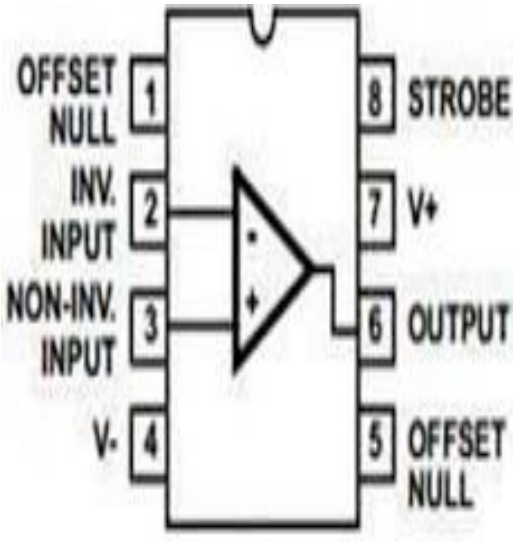
Working of cellphone detector through flow chart

Components Required:

In this project we have used the operational amplifier and transistors along with the jumping wires and the resistors ,capacitors and details list of the hard ware components are

- Operational amplifiers
- Resistors
- Capacitors
- Transistors
- Jumper wires
- Bread board

1. Operational amplifiers

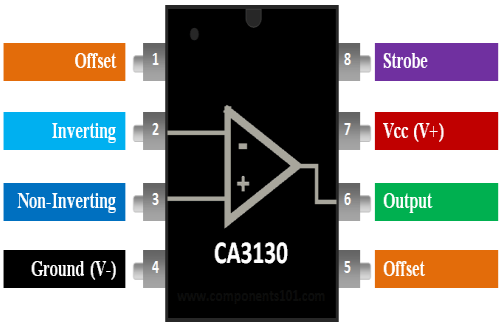


- An **operational amplifier** (often **op-amp** or **opamp**) is a DC-coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output.

- In this configuration, an op-amp produces an output potential (relative to circuit ground) that is typically hundreds of thousands of times larger than the potential difference between its input terminals.
- Operational amplifiers had their origins in analog computers, where they were used to perform mathematical operations in many linear, non-linear, and frequency-dependent circuits.
- The popularity of the op-amp as a building block in analog circuits is due to its versatility.
- By using negative feedback, the characteristics of an op-amp circuit, its gain, input and output impedance, bandwidth etc. are determined by external components and have little dependence on temperature coefficients or engineering tolerance in the op-amp itself.
- Op-amps are among the most widely used electronic devices today, being used in a vast array of consumer, industrial, and scientific devices. Many standard IC op-amps cost only a few cents in moderate production volume.
- However, some integrated or hybrid operational amplifiers with special performance specifications may cost over US$100 in small quantities. Op-amps may be packaged as components or used as elements of more complex integrated circuits.
- The op-amp is one type of differential amplifier. Other types of differential amplifier include the fully differential amplifier (similar to the op-amp, but with two outputs).
- The instrumentation amplifier (usually built from three op-amps), the isolation amplifier (similar to the instrumentation amplifier, but with tolerance to common-mode voltages that would destroy an ordinary op-

amp), and negative-feedback amplifier (usually built from one or more op-amps and a resistive feedback network).

CA3130



CA3130 is an Op-amplifier with hybrid features i.e. combines the advantage of both Bipolar and CMOS. This op-amp is used where fast-switching (high bandwidth) as well as low power consumption is required. It has high input impedance and can be used with electrical guitars, high-impedance sensors and signal sources.

2. Resistors

(2.2M ohm,1k ohm,100k ohm)

- A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.
- High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators.
- Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.
- Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment.
- Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.
- The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude.
- The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

3. Capacitors

2.2 nF, 100nF, 100uF, 1uF.

- A **capacitor** is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.
- The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit.
- The capacitor was originally known as a **condenser** or **condensator**.
- This name and its cognates are still widely used in many languages, but rarely in English, one notable exception being condenser microphones, also called capacitor microphones.

- The physical form and construction of practical capacitors vary widely and many types of capacitor are in common use.

- Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium.
- A conductor may be a foil, thin film, sintered bead of metal, or an electrolyte. The nonconducting dielectric acts to increase the capacitor's charge capacity.
- Materials commonly used as dielectrics include glass, ceramic, plastic film, paper, mica, air, and oxide layers. Capacitors are widely used as parts of electrical circuits in many common electrical devices.
- Unlike a resistor, an ideal capacitor does not dissipate energy, although real-life capacitors do dissipate a small amount. (See Non-ideal behavior When an electric potential, a voltage, is applied across
- The terminals of a capacitor, for example when a capacitor is connected across a battery, an electric field develops across the dielectric, causing a net positive charge to collect on one plate and net negative charge to collect on the other plate.
- No current actually flows through the dielectric. However, there is a flow of charge through the source circuit.
- If the condition is maintained sufficiently long, the current through the source circuit ceases. If a time-varying voltage is applied across the leads of the capacitor, the source experiences an ongoing current due to the charging and discharging cycles of the capacitor.

- The earliest forms of capacitors were created in the 1740s, when European experimenters discovered that electric charge could be stored in water-filled glass jars that came to be known as Leyden jars.
- In 1748, Benjamin Franklin connected a series of jars together to create what he called an "electrical battery", from their visual similarity to a battery of cannon, which became the standard English term electric battery.
- Today, capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass.
- In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies.
- In electric power transmission systems, they stabilize voltage and power flow. The property of energy storage in capacitors was exploited as dynamic memory in early digital computers.

4.Trasistors:

- A transistor is a device that regulates current or voltage flow and acts as a switch or gate for electronic signals. Transistors consist of three layers of a semiconductor material, each capable of carrying a current.

- The transistor was invented by three scientists at the Bell Laboratories in 1947, and it rapidly replaced the vacuum tube as an electronic signal regulator.

- A transistor regulates current or voltage flow and acts as a switch or gate for electronic signals. A transistor consists of three layers of a semiconductor material, each capable of carrying a current.

- A semiconductor is a material such as germanium and silicon that conducts electricity in a "semi-enthusiastic" way. It's somewhere between a real conductor such as copper and an insulator (like the plastic wrapped around wires).

- The semiconductor material is given special properties by a chemical process called *doping*. The doping results in a material that either adds extra electrons to the material (which is then called *N-type* for the extra negative charge carriers) or creates "holes" in the material's crystal structure (which is then called *P-type* because it results in more positive charge carriers).

-

- The transistor's three-layer structure contains an N-type semiconductor layer sandwiched between P-type layers (a PNP configuration) or a P-type layer between N-type layers (an NPN configuration).

- A small change in the current or voltage at the inner semiconductor layer (which acts as the control electrode) produces a large, rapid change in the current passing through the entire component.

- The component can thus act as a switch, opening and closing an electronic gate many times per second. Today's computers use circuitry made with complementary metal oxide semiconductor (CMOS) technology. CMOS uses two complementary transistors per gate (one with N-type material;

- The other with P-type material). When one transistor is maintaining a logic state, it requires almost no power.

- Transistors are the basic elements in integrated circuits (IC), which consist of very large numbers of transistors interconnected with circuitry and baked into a single silicon microchip.

1.) BC547 - NPN Transistor

- **Introduction to BC547.** It is basically an NPN bipolar junction transistor (BJT). The word transistor is a combination of two words, **transfer** and **resistor.**

- So, the basic purpose of transistor is transfer of resistance. A transistor is normally used for amplification of current.

- The larger current at the emitter and collector can be controlled by the small amount of current at the base. BC547 can be used commonly for amplifiers and switches.

- Similar to all the other transistors BC547 has also three terminals e.g. collector terminal, base terminal and emitter terminal respectively. The amount of current flowing from base to the emitter controls the amount of the current flowing through the collector.

- BC547 is usually used for amplification and switching purposes. Its maximum current gain is around 800. A fixed DC voltage is required for its proper operation in desired region.

- Proper voltage supply is known as biasing. BC547 is biased in a way that it is partially on for all the applied inputs, for the amplification purpose. The input signal is amplified at the base and then transferred to the emitter.

- **BC547** is an NPN Bipolar Junction Transistor. Mostly it is used for the switching purpose as well as for amplification purposes.

- Similar to the other transistors BC547 is also used for the amplification of current.

- The smaller amount of current at the base is used to control the larger amount of currents at collector and emitter as well.

- Its basic applications are switching and amplification. The transistor, BC 547 is shown in the figure below.

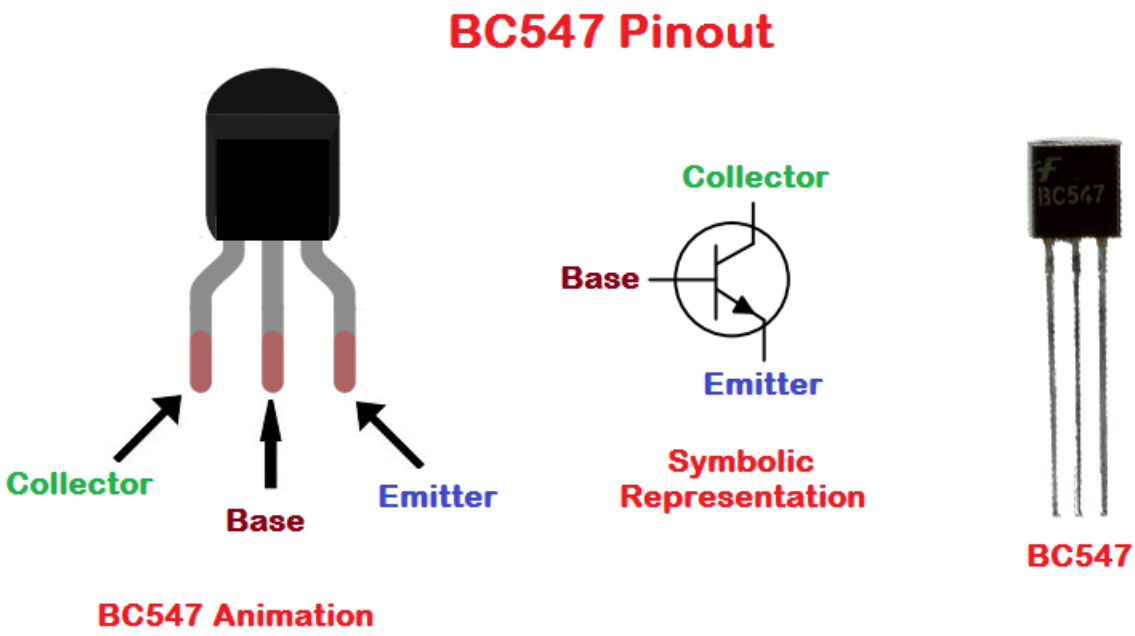
1. BC547 Pinout

- BC 547 has three pins in total similar to the other bipolar junction transistors.
- All of these three pins i.e. collector, base and emitter along with symbol are shown in the table given below.

BC547 Pinout		
Pin No	**Pin Name**	**Symbol**
1	Collector	C
2	Base	B
3	Emitter	E

2. BC547 Pins Configuration

- The properly labeled pin configuration diagram of BC 547 along with its animation is shown in the figure given below.



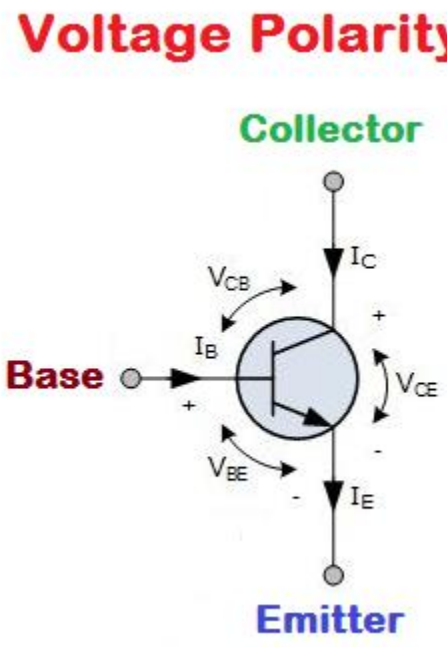
- From the figure shown above, you can see the properly labeled animation of BC 547, its symbolic representation and the real BC 547 for the better understanding of the user.

3. BC547 Working Principle

- When the input voltage is applied at its terminal, some amount of current starts to flow from base to the emitter and controls the current at collector.

- The voltage between the base and the emitter (VBE), is negative at the emitter and positive at the base terminal for its NPN construction.

- The polarity of voltages applied for each junction is shown in the figure below.



4. BC547 Ratings

- The current, power and voltage ratings of BC547 along with their values and System International (SI) units are provided in the table shown below.

BC547 Ratings		
Parameters	**Values**	**Units**
Collector emitter voltage (V_{CEO})	65	V
Collector base voltage (V_{CBO})	80	V
Emitter base voltage (V_{EBO})	6	V
Power dissipation at collector (P_D)	500	mW
Collector current (I_C)	100	mA
Storage temperature (T_{STG})	65 to 150	°C
Operating temperature (T_O)	150	°C

- Moreover, the storage temperature as well as operating temperature for the transistor BC 547 is also given in the table shown above.

5. BC547 Thermal Characteristics

- The thermal characteristics associated with BC 547 are provided along with typical values, in the table shown below.

BC547 Thermal Characteristics			
Sr. No	**Characteristics**	**Value**	**Units**
1	Junction to case thermal resistance	83	°C/W
2	Junction to ambient thermal resistance	B	°C/W

6. BC547 Applications

- There are a lot of applications associated with BC547, a few of the major applications are given below.
- BC547 can be used for switching purposes.
- We can also use it for the amplification purposes

2.) BC557 - PNP Transistor

BC 557 (Pack of 5)

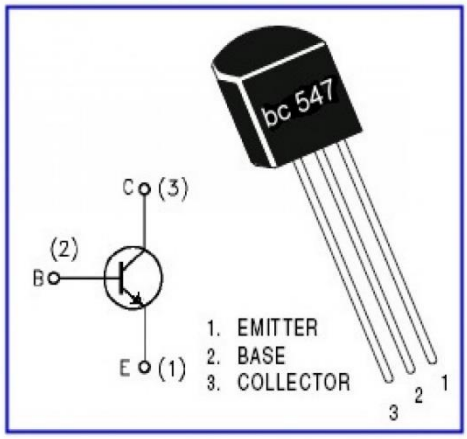
The **BC557 transistor** is a silicon PNP low power transistor used for both amplifier and switching purposes.

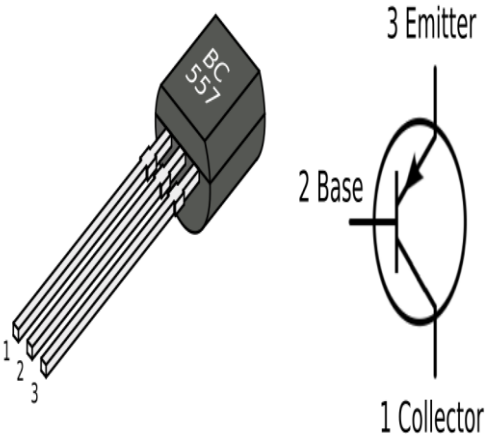
Features of BC557 NPN General Purpose Transistor:

- Type: BC 557.
- Collector–Emitter Voltage VCEO: –45Vdc.
- Collector–Base Voltage VCBO : –50Vdc.
- Emitter–Base Voltage VEBO: –5.0 Vdc.
- Collector Current — Continuous IC : –100 ma dc.
- Total Device Dissipation @ TA = 25°C.
- Operating and Storage Junction.
- Temperature Range: –55 to +150 °C.

Applications of BC557 NPN General Purpose Transistor:

- DIY projects.
- Electrical/Electronic mini or major projects.
- Amplifier purposes.
- Switching purposes.

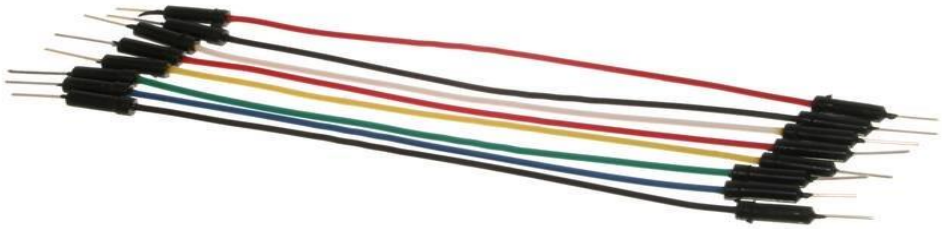




- Jumper wires

  Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

- **What Do the Colors Mean?**



- Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one.

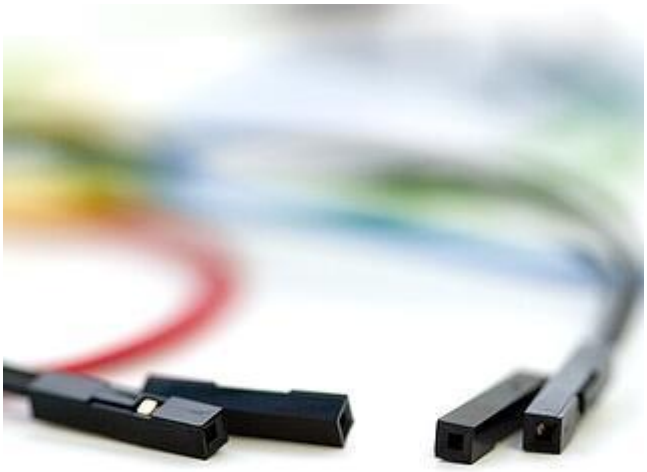
- But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

- **Make Your Own Jumper Wires**

- While jumper wires are easy and inexpensive to purchase, it can also be a fun task to challenge students to make their own. Doing so requires insulated wire and wire strippers.

- However, beware that it is important not to nick the wire when stripping off the insulation

- **Types of Jumper Wires**



- Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female.

- The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.

- -to-male jumper wires are the most common and what you likely will use most often. When connecting two ports on a breadboard, a male-to-male wire is what you'll need.

    - Try out jumper wires with the SIK v4.0

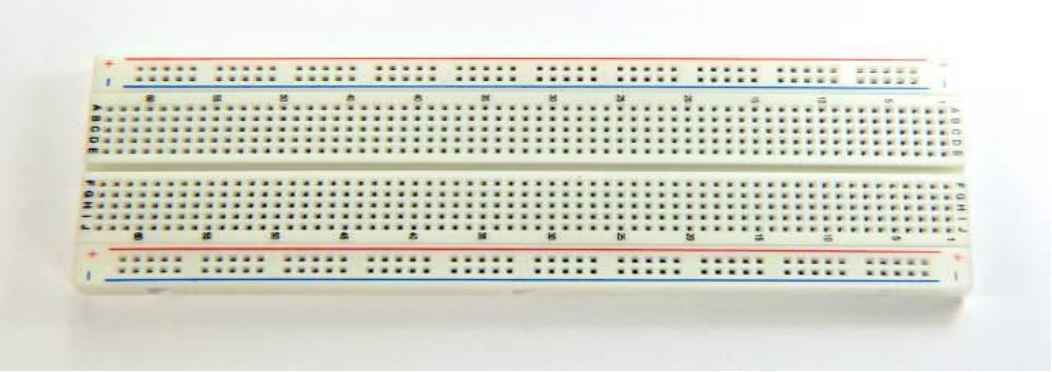
- **Alligator Clips**

- Alligator clips, which consist of two spring metal clips connected by wire, are actually just fancy jumper wires.

- Their unique connection point (they can be clipped on instead of inserted into) allow alligator clips to be used in a variety of situations that would get a little awkward with a traditional jumper wire.

- One of the most common uses for alligator clips in education is with the Makey Makey, though they can also be used to connect the ports on a LilyPad board as well as for a number of other applications.

- Bread board
    - A breadboard is a solderless device for temporary prototype with electronics and test circuit designs.
    - Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.
    - The breadboard has strips of metal underneath the board and connect the holes on the top of the board.
    - The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally.
    - split in the middle while the remaining holes are connected vertically.



Working :-

- The Op-amp part of the circuit acts as the RF Signal Detector while Transistor part of the circuit act as the indicator.
- The capacitors collection along with the antenna are used to detect RF Signals when a cell phone makes (or receives) a phone call or sends (or receives) a text message.
- Working of Mobile Detector is simple. Two 100nF capacitors (C2 and C3), in parallel, are used for detecting RF signal from Mobile Phone.
- These capacitors are working as loop antenna for the system.

- When there is any call or SMS then capacitors in parallel detect the data transmission frequencies or RF signal and output of op-amp goes high or low (fluctuating) due to generated current at the input side of op-amp.
- Due to these fluctuations, LED turns on and off through NPN transistor according to the signal's frequency.
- Now PNP transistor is also triggered with the same frequency and buzzer starts beeping until data transmission gets finished.
- If you are not familiar with working of Op-amps then learn more about Op-amps here.
- Op-Amp reads the signals by converting the rise in current at input to voltage at output and the LED will be activated.
- 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. 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.
- Output of this op-amp is connected at the base of NPN transistor namely BC547 through a 1k resistor and a LED is connected at its emitter for indication.
- A buzzer is also used for sound indication by using a PNP transistor namely BC557. And a 9 volt battery is used for powering the circuit. Rests of connections are shown in the Circuit Diagram below.

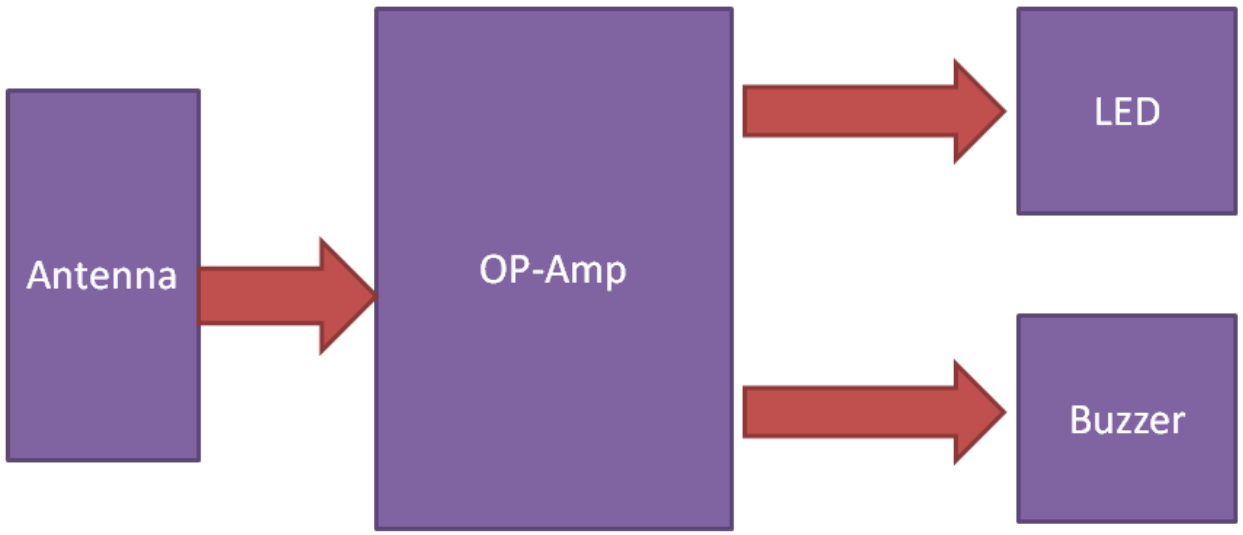
- This circuit has electromagnetic pickup stage and amplification stage then output alert stage, first thing we need to place the low power dual operational amplifier IC LM358 with proper bias and we need only one operational amplifier from IC LM358 and left open other.
- Antenna to be connected to the Inverting input with Variable Resistor feedback path. Non inverting input pin placed between R2 and C3 capacitorOutput from the operation amplifier connected to the base terminal of Q1 transistor and buzzer, LED are connected at the emitter pin.

- The circuit uses a 0.22μF disk capacitor to capture the RF signals from the mobile phone. This part should be like an aerial, so the capacitor is arranged as a mini loop aerial. In short with this arrangement the capacitor works like an air core with ability to oscillate and discharge current. The output of transistor is within 10 mV of either supply voltage terminal. The lead inductance acts as a transmission line that intercepts the signals from the mobile phone. An ordinary RF detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones that's why circuit detecting gigahertz signals is required for a mobile bug.

- Op-amp is used in the circuit is act as a comparator. It may come with MOSFET inputs and bipolar output. The input contains MOSFET transistors to provide very high input impedance very low input current. It has high speed of performance and suitable for low input current application. Hence the result is in very low input current and very high speed of performance. It is used in applications like ground referenced single supply amplifiers, fast sample hold amplifiers, long duration timers etc.

- IC-555 is a highly stable controller capable of producing accurate timing pulses. With the monostable operation the time delay is controlled by one external resistor and one capacitor. With an astable operation the frequency and duty cycle are accurately controlled by two external resistors and one capacitor. These are used in applications like precision timing, pulse generation, time delay generation etc.

Block Diagram of Cell Phone Detector:



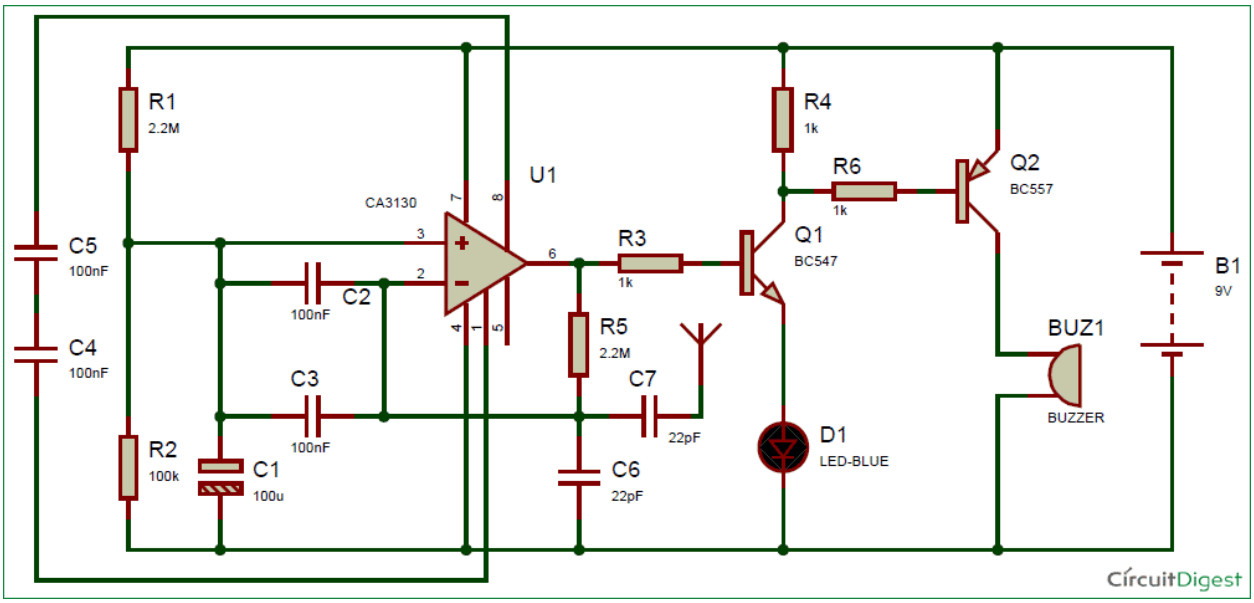
Frequency Range of Detector:

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.

Circuit Diagram :-



Use of Cell Phone Detector:

It is also useful for detecting the use of mobile phone for spying and un-authorized 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.

We are most familiar with cell phone active detectors. The cell phone detectors are mostly hand and pocket-size mobile transmission detectors. It can sense the presence of an activated mobile phone 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

Cell Phone Detector Circuit Applications:

1. This circuit can be used at examination halls, meetings to detect presence of mobile phones and prevent the use of cell phones.
2. It can be used for detecting mobile phones used for spying and unauthorized transmission of audio and video.
3. It can be used to detect stolen mobile phones.
4. It is useful where the use of mobile phone is prohibited like

- Petrol pumps
- Gas station
- Historical places
- Religious places
- Court of laws
- Examination halls
- Spying and unauthorized video transmission
- Military bases
- Hospitals
- Theatres
- Conferences
- Embassies

Advantages:-

1. **The cost effective** :

The cost effectiveness is one of the primary aim as the cell phone detector detector components comprises of only basic resistors, capacitors and operational amplifiers which are of nominal cost.

This circuit also uses transistor and output indication elements are buzzer and led which are easily available and are of low cost.

2.**Availability of components** :

All the components used in this project are easily available and can be find in any of the basic circuitry.

Hence this project is both cost effective and no such component in it is rare and is of low cost.

3.**Security purposes :**

This electronic module can be used in various confidential places like temples, examination halls etc. for security purpose

4.Smaller in size

5.Detection of hidden cell phones

Conclusions:

The mobile phone detector is useful in many ways. Its rather cheap and is in small size making it more comfortable to take it to other places. Its range of detection can be increased by increasing the antenna height.

We can find it more useful to find out the mobile presence at places where mobile phones are not allowed and strictly prohibited.

References

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