SOUND DETECTOR CIRCUIT

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***Abstract*—**A sound detector circuit has been developed which is capable of detecting sound waves. Microphone of high sensitive is used to detect sound and coupled with an op-amp to amplify the signal amplitude and combined with a output like speaker , buzzer, led. The sound detector is verified and able to detect within 6 meters area from where it is setup.

***Keywords*—**Detector, Integrated circuit, Signal Detection, Signal processing, Amplification.

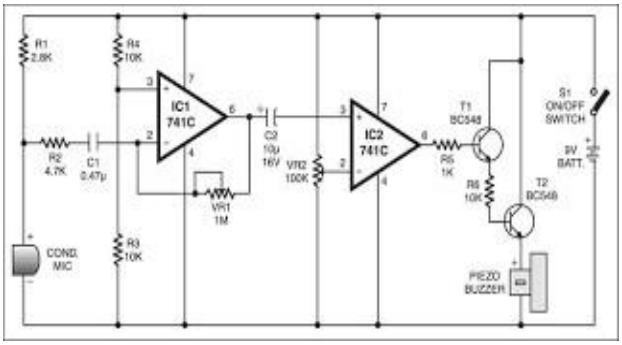
I. INTRODUCTION

A. With the advancement of processing technology of integrated circuits(ICS),a sound detector circuit is designed to detect sound when we unable to sense anything around us.It is designed for security generation[1].The heart of the circuit is op-amp 741 which is used in order to sense the vibrations of sound wave condensor microphone[2].The circuit output becomes high each time as sound is detected;otherwise it is in low level.You can use it in simple robots for sound responding.This circuit recognize human voice as a common sound(you can't use it for sound recognition).

Basic Sound Detector

II. BASIC THEORY

Our implemented project circuit diagram is given below



The circuit works in 3 stages:

- The microphone stage
- The amplification stage
- The comparator stage

1.Microphone stage

The microphone receive the sound and then convert it into electrical signal A battery(9v) source is connected to microphone to power it (though a resistor)

2.Amplification stage

This stage amplifies the signal. The amplifier used is (LM324N) which used as non-inverting amplifier. A battery(9v) source is connected in order to power.

3.Comparator stage

The comparator changes the output level if the amplified signal is higher than reference voltage [3]. So, when amplified sound crosses 0.45v thresholds the comparator will go high and turn on the LED.

Working

Once the microphone detects the sound wave vibrations the op-amp can convert it into electrical

signals. The output of the microphone is input to pin2 of IC1(LM741)via a coupling capacitor C1then the signal get amplified and sent to IC2(LM741).The non-inverting pin3 of IC2 receives input from amplified output signal of IC1 through another capacitor C2.In the same way ,an inverting pin2 of IC2 fetches input signal from a reference voltage via voltage controller.

At the final stage, IC2 output is fed as triggering input pulse to Darlington pair transistors T1 and T2. A piezo-buzzer which is connected at the end of transistor T2 i.e., at the emitter terminal. The component which is responsible for producing beep sound at the end of operations followed throughout the entire circuit[4]. To attain maximum possible gain of IC1 and sensitivity of IC2, adjust the values of respective potentiometer. Fix the piezo-buzzer at a place where people can hear and sense at an appropriate place where you need continuous monitoring.

III. COMPONENTS And DESCRIPTION

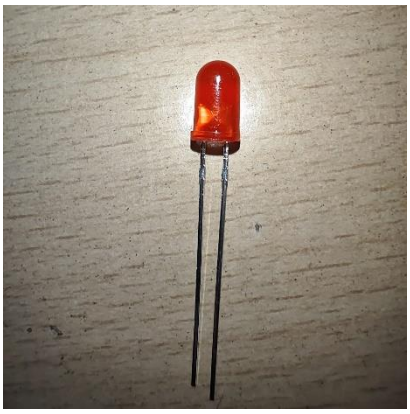
Components List:

Component	Specification	Quantity
Resistors	R1=2.8Kohm ,R2=4.7K ohm,R3=R4=R5=10K ohm,R5=1K ohm.	06
Capacitor	C1=0.47UF (ceramic disc) C2=10UF (Electrolytic)	02
Potentiometer	VR1=1M ohm, VR2=100K ohm	
Transistor	T1, T2=BC548	02
Operational Amplifier	IC1, IC2=LM741C	02
Battery	9V	01
switch	--	01
Piezo Buzzer	--	01
Condenser Microphone	--	01
LED	--	01
Breadboard	--	01
Connecting wires	--	--

DESCRIPTION

1. LED

Light Emitting Diode (LED) is a semiconductor device having heavily doped p-n junction and based on the amount of doping and semiconductor material used and LED will emit a light at a particular spectral wavelength when connected in forward biased. When LED is connected in forward biased condition the minority carriers in p-type(electrons) and n-type(holes) are sent from p to n and n to p respectively which increases the concentration of minority carriers at the junction. The recombination of excess minority carriers with majority carriers at the junction releases energy in the form of photons. If we increase forward biased voltage the intensity of light increases and reaches a maximum

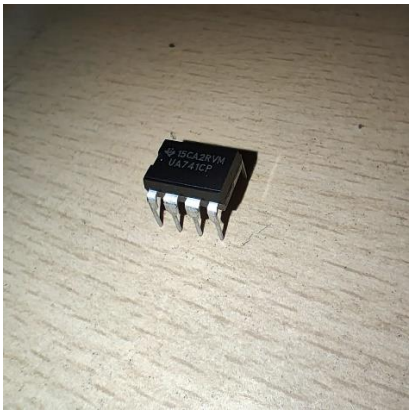


2. IC-741 (Op-Amp)

The 741 Op Amp IC is a monolithic integrated circuit, comprising of a general purpose Operational Amplifier. It was first manufactured by Fairchild semiconductors in the year 1963. The number 741 indicates that this operational amplifier IC has 7 functional pins, 4 pins capable of taking input and 1 output pin.

IC 741 Op Amp can provide high voltage gain and can be operated over a wide range of voltages, which makes it the best choice for use in integrators, summing amplifiers and general feedback applications. It also features short circuit protection and internal frequency compensation circuits built in it. This Op-amp IC comes in the following form factors:

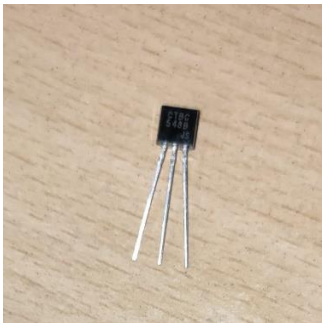
8 Pin DIP Package
TO5-8 Metal can package
8 Pin SOIC



3. BC548 (n-p-n Transistor)

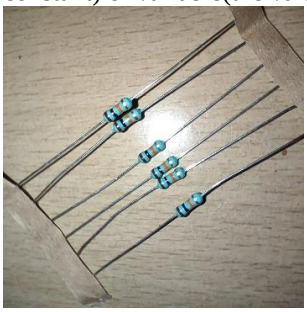
BC548 is a NPN transistor so the collector and emitter will be left open (Reverse biased) when the base pin is held at ground and will be closed (Forward biased) when a signal is provided to base pin. BC548 has a gain value of 110 to 800, this value determines the amplification capacity of the transistor. The maximum amount of current that could flow through the Collector pin is 500mA, hence we cannot connect loads that consume more than 500mA using this transistor. To bias a transistor we have to supply current to base pin, this current (IB) should be limited to 5mA.

When this transistor is fully biased, it can allow a maximum of 500mA to flow across the collector and emitter. This stage is called Saturation Region and the typical voltage allowed across the Collector-Emitter (V-CE) or Base-Emitter (VBE) could be 200 and 900 mV respectively. When base current is removed the transistor becomes fully off, this stage is called as the Cut-off Region and the Base Emitter voltage could be around 660 mV.



4. Resistors

A resistor opposes the flow of current through it. The value of Resistance of a material can be determined using the ohm's law which states that the "the current through a conductor between two points is directly proportional to the voltage across the two points at constant temperature. A resistor can be of two types-Fixed(value of resistor remains constant) or variable(the value of a resistor can be changed



eg:potentiometer,rheostat,preset). In this project we have used 3 fixed resistor of values 10K ohm, 100 ohm, 220 ohm and a variable resistor of 10K ohm.

5. Microphone

A microphone is an electronic device that is used to capture sound waves and convert them into electrical signals that can be processed by other electronic equipment. It is a type of transducer
that converts sound waves into electrical signals.
The operation of a microphone is based on the principle of acoustic-to-electric transduction, where sound waves in the air create vibrations in a diaphragm or other sensing element. These vibrations are then converted into an electrical signal through the use of a transducer, such as a coil or capacitor.

The electrical signal produced by a microphone can be amplified and processed by other electronic equipment, such as mixers, amplifiers, or digital signal processors. Microphones can be connected to electronic equipment using a variety of interfaces, such as XLR, 1/4-inch, or USB connectors.

6. Buzzer

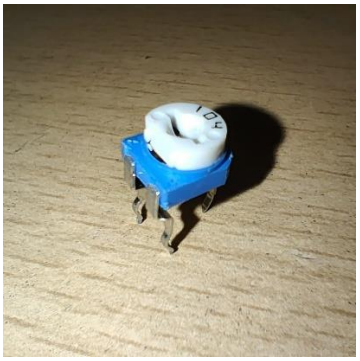
Buzzers are electric sounding device and are powered by DC voltage.They can be categorised as piezo buzzer or electromagnetic buzzer.in our circuit we have use electromagnetic buzzer which consists of an oscillator,solenoid coil,magnet,vibration diaphragm and a housing.The current will be driven through the coil of wire and cause the vibrating disk to be attracted to it .the movement of disk produces the sound.

7. Battery

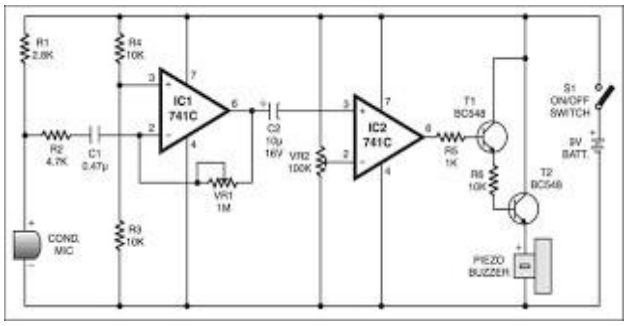
An electric battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. In our experiment we are using 9V battery.

8. Variable Resistance

A variable resistor is a resistor of which the electric resistance value can be adjusted. A variable resistor is in essence an electro-mechanical transducer and normally works by sliding a contact (wiper) over a resistive element. When a variable resistor is used as a potential divider by using 3 terminals it is called a potentiometer. When only two terminals are used, it functions as a variable resistance and is called a rheostat. Electronically controlled variable resistors exist, which can be controlled electronically instead of by mechanical action. These resistors are called digital potentiometers.



IV. Design



The design is commprised of three parts:microphone,amplifier,comparator.

As soon as microphone catches signal it is converted into electrical signal through the R2 resistor and C1 capacitor,chosen to be 4.7K and 0.47uf unavailablity of 0.47uf ceramic capacitor led us to use two 0.22uf capacitor in parallel.

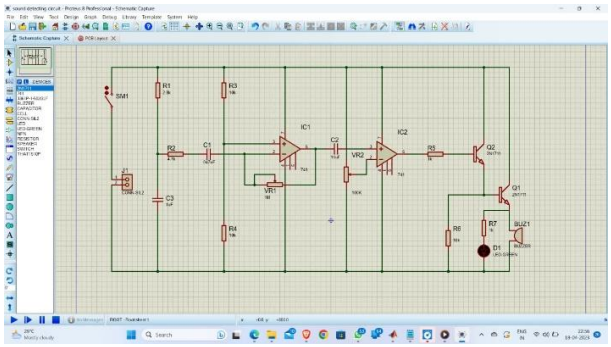
IC1 is used to amplify the input signal,as the input signal in mv so we need gain in range of 1000 so VR1 is selected to 1M and the input is given to the invertting terminal so the gain of the op-amp:

Gain=-Rf/R1

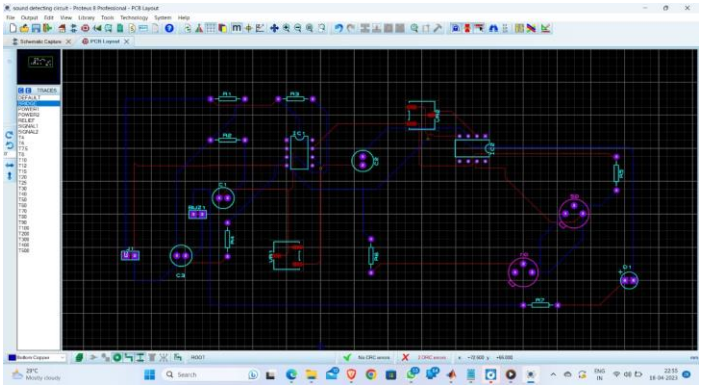
C2 is a DC biasing capacitor chosen to 10uf electrolytic capacitor.

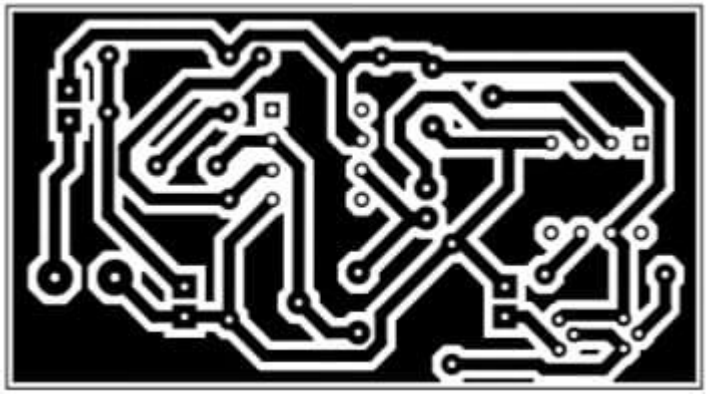
IC2 is used as a comparatorwhich compares the voltage and gives logic 1 as the IC1 gives output further used to run the buzzer on 9v.

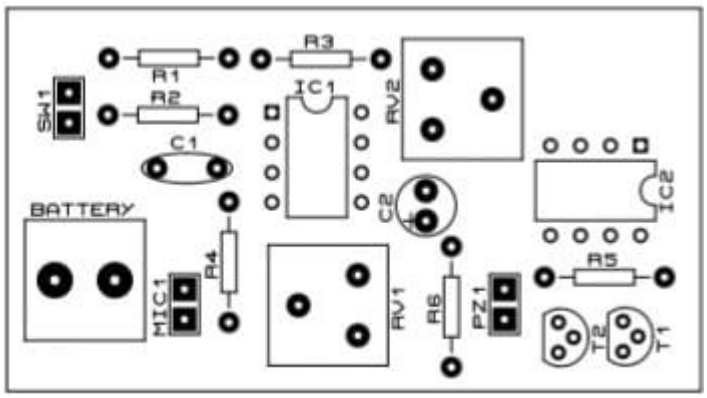
PROTEUS SCHEMATIC:



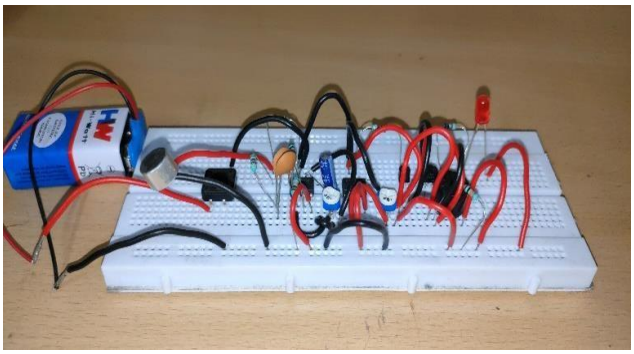
PCB DESIGN:







CIRCUIT:



V. APPLICATION

- This can be used as security system for home/office.
- The system can be used as a clapping switch.
- The system can be used as a spy circuit i.e., Voice recorder.

VI. CONCLUSION

Through this term project. We got a lot of concepts relating to modern electronic security system, doorbells .We got fully command over op-amps when treating as op-amp and as a comparator. We got how gain is produced through amplification and how the reference voltage changes the intensity of output is affected.

VII. ACKNOWLEDGMENT

- First of all, we would like to our course coordinator shri. Dr. Jignesh N.Sarvaiya Almighty for giving us the chance and the courage to carry out this project. Although the it is not carried on PCB(wire board) but we have achieved this on bread board.
- Secondly, we would like to thank our supervisors for all the support and guidance.

VIII. REFERENCE

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