

TOUCHLESS DOORBELL

A PROJECT REPORT

SUBMITTED IN PARTIAL FULLFILLMENT OF THE

REQUIRMENT FOR THE AWARD OF

Bachelor Of Technology

In

Electronics & Instrumentation Engineering

SUBMITTED BY:

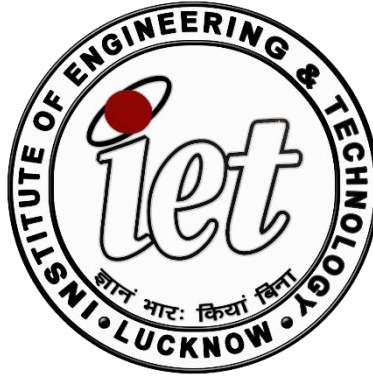
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2021-2022



CERTIFICATE

This is to certify that the project work entitled “ **Touchless Doorbell**” being submitted by students of B.Tech in Electronics & Instrumentation Engineering III Semester **Tanvi Prachandia, Bhawna Singh, Ankur Yadav, KM. Durgavati, Saurabh Tiwari & Aman Kumar** in partial fulfilment of the requirements for the award of Certificate of four years course of **B.Tech in Electronics & Instrumentation Engineering** in Institute of Engineering & Technology, Lucknow, Faculty of Engineering and Technology, **A.P.J. Abdul Kalam Technical University (AKTU)**(formerly UPTU), Lucknow for the academic session 2021-2022 is the record of candidate’s own original work carried out under my supervision and guidance.

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ACKNOWLEDGEMENT

It is a matter of great satisfaction and pleasure that we have completed our project work and report successfully. First and foremost, we offer our gratitude to Almighty God whose blessings have brought success.

We are thankful to our Project Incharge Dr.Prerana & Mr. Nitin Verma for their inspiring motivation, suggestions and guidance in the completion of our project work and report.

We express our deep respect and thank to Dr. Neelam Srivastava, Head of the Department of Electronics Engineering , Institute of Engineering & Technology, Lucknow, Faculty of Engg. & Technology, A.P.J. Abdul Kalam Technical University (AKTU)(formerly UPTU), Lucknow, for providing necessary facilities.

Finally, we are grateful to my parents, family members and my friends who always inspired us and provided every possible help to enable us to reach this stage. There are many other people who helped us and we appreciate their help.

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ABSTRACT

The project is based on the object detecting using the IR sensor. An IR sensor consists of an IR LED and photodiode. Together they are called as Photo - Coupler or Opt-Coupler. Touch less doorbell consists of IR LED, photo diode, resistors, potentiometer, general LED with a buzzer, etc. The sensor operates in such a way that whenever any object comes close to the IR sensor, the buzzer starts beeping and the LED glows. This concept of touch less door bell is very useful in fire engines, Railroad crossings, School bells and Alarms in industrial plants etc. This system is also suitable for securing homes from intruder/ burglar.

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1.INTRODUCTION

1.1 PROJECT INTRODUCTION

Social distancing is the one of the best methods to escape from COVID-19. We strongly recommend to stay at home. But we can't avoid some emergency visits to some homes. When we arrived at infront of a house, first we search the doorbell button/ calling bell button. And press the button. But in this special situation this doorbell button can cause the virus to spread. When some infected person presses the button, the virus holds on that button and when a non-infected person touches this button the virus spread to that person. We can avoid this danger by using the touchless doorbell. The existing doorbell can convert to a touchless doorbell.

1.2 PROJECT OBJECTIVE

- The objective of the project is to build a device with a vibration to electrical transducer that alerts the user when somebody near the door.
- Unlike a traditional door bell, this doorbell plays the ringtone when someone knocks the door.
- It also illuminates an LED to alert the user.
- It is easier to install than the traditional doorbell.
- The user simply installs the battery and mount the device on the door.

2.ELECTRONIC COMPONENTS USED & THEIR SPECIFICATION

2.1 LIST OF COMPONENTS USED

Resistors	(220 ohm, 10k ohm, 100 ohm)
Potentiometer/variable resistor	10k ohm
IR transmitter	
IR receiver	
LED	Red colour
Connecting wires	
Battery/DC source	(4 to 9 volt)
Buzzer	

2.2 PCB CONNECTION:

A zero printed circuit board, or PCB, is used for Electronics and Communication support and "electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated to a non-conductive substrate. The PCB is printed circuit board having circuit made with cooper layer on the plate there are various steps to design a PCB for that the basic thing required is circuit. So, the circuits required for the system



Fig : PCB

2.3 RESISTOR:

A resister is a passive two terminal electrical component that implements electrical resistance is a circuit element. The current through a resister is in direct proportion to the voltage across the resister's terminals. Thus, the ratio of the voltage applied across a resistor's terminals to the intensity of current through the circuit is called resistance.

$V=IR$ Where I is the current through the conductor in units of ampere, V is the potential difference measured across the conductor in units of volts, and R is the resistance of the conductor in units of ohms. More specifically, Ohms law states that the current I flowing through the conductor is directly proportional to the potential difference (v) across its ends provided the physical conditions like temperature, strain etc.

Resistors are common elements of electrical networks and electronic circuits. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nicked-chrome). Resistors are also implemented within integrated circuits, particularly analog devices, and can also be integrated into hybrid and printed circuits.



Fig .Resistors

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.

2.4 INFRARED LED (TRANSMITTER):

An IR LED, also known as IR transmitter, emits infrared rays in the range of 100 nm wavelength. It is made of Gallium Arsenide or Aluminium Gallium Arsenide. They are used along with sensors.

It is a special purpose LED that transmits. Such LEDs are usually made of gallium. IR receivers are commonly used. The appearance is the same as a common LED. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify whether the IR LED is working or not unlike a common LED. To overcome this problem, the camera on a cell phone can be used. The camera can show us the IR rays being emitted from the IR LED in a circuit.



Fig : IR LED (transmitter)

PIN CONFIGURATION:

The IR LED or Infrared LED has polarity i.e. it has a positive and negative pin. The pin which is long is the positive pin (anode) and the pin which is short is the negative pin (cathode) as shown in the above IR LED pin out.

FEATURES:

- High Reliability
- Excessive radiant intensity
- Forward voltage is low
- Having lead spacing of 2.54mm
- Maximum wavelength is 940nm

USES:

IR LED is used in various daily used electronic appliances for example as the remote of the television, infrared cameras and transmission systems. We can make various projects, sensor using the IR LED like obstacle detector, visitor-counter and line-followers.

2.5 PHOTO DIODE:

A photo-diode is a reverse-biased silicon or germanium p-n junction in which reverse current increases when the junction is exposed to light. The reverse current in a photo-diode is directly proportional to the intensity of light falling on its p-n junction. This means that greater the intensity of light falling on the p-n junction of photo-diode, the greater will be the reverse current.



Fig : Photo diode

CHARACTERISTICS OF PHOTO-DIODE:

There are two important characteristics of photodiode

- (i) Reverse current-illumination curve
- (ii) Reverse voltage-Reverse current curve.

APPLICATIONS OF PHOTO-DIODES:

1. A photo diode is use in an alarm system
2. A photo diode may be used to count items on a convey or belt.

2.6 LIGHT-EMITTING DIODE (LED):

Light-emitting diodes are not made from silicon or germanium but are made by using elements like gallium, phosphorus and arsenic. By varying the quantities of these elements, it is possible to produce light of different wavelengths with colours that include red, green, yellow and blue. For example, when a LED is manufactured using gallium arsenide, it will produce a red light. If the LED is made with gallium phosphide, it will produce a green light.



Fig : LED

ADVANTAGES OF LED:

The light-emitting diode (LED) is a solid-state light source. LEDs have replaced incandescent lamps in many applications because they have the following advantages:

- (i) Low voltage.
- (ii) Longer life (more than 20 years).
- (iii) Fast on-off switching.

APPLICATIONS OF LEDS:

The LED is a low-power device. The power rating of a LED is of the order of mill watt. This means that it is useful as an indicator but not good for illumination. Probably the two most common applications for visible LEDs are:

- As a Power indicator.
- Seven-segment display

2.7 PRESET OR VARIABLE RESISTOR:

A pre-set is a three legged electronic component which can be made to offer varying resistance in a circuit. The resistance is varied by adjusting the rotary control over it. The adjustment can be done by using a small screw driver or a similar tool. The resistance does not vary linearly but rather varies in exponential or logarithmic manners. Such variable resistors are commonly used for adjusting sensitivity along with a sensor.

The variable resistance is obtained across the single terminal at front and one of the two other terminals. The two legs at back offer fixed resistance which is divided by the front leg. So whenever only the back terminals are used, a pre-set acts as a fixed resistor. Pre-sets are specified by the fixed value resistance.



Fig : Variable resistor potentiometer trimmer.

2.8 PIEZO BUZZER:

A buzzer is a small yet efficient component to add sound features to our project. It is very small and compact 2-pin structure hence can be easily used on PCB board which makes this a widely used component in most electronic applications. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. The one shown here is a simple buzzer which when powered will make a continuous Beeeeeepppp.....sound. This buzzer kindly used by simply powering it using a DC power supply ranging from 4V to 9V. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

BUZZER FEATURE AND SPECIFICATION:

- Rated voltage : 6V DC
- Operating voltage: 4-8V DC
- Rated current: <30mA
- Sound type: continuous beep
- Resonant frequency: ~2300Hz
- Small and neat sealed package
- PCB friendly



Fig : Buzzer

APPLICATIONS OF BUZZER:

- Alarming circuits, where the user has to be alarmed about something.
- Communication equipment's.
- Automobile electronics.
- Portable equipment's, due to its compact size.

2.9 BATTERY/ SUPPLY (DC):

The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors and various types of circuits. The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulphide, and in rechargeable form in nickel-cadmium, nickel metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content. Most nine-volt alkaline batteries are constructed of six individual 1.5 V LR61 cells enclosed in a wrapper. Carbon-zinc types are made with six flat cells in a stack, enclosed in a moisture resistant wrapper to prevent drying.



Fig : 9V Battery

Primary lithium types are made with three cells in series. The smaller circular (male) terminal is positive, and the larger hexagonal or octagonal (female) terminal is the negative contacts.

2.10 LM358 IC:

The LM358 IC is a great, low power and easy to use dual channel op-amp f c. It is designed and introduced by national semiconductor. It consists of two internally frequency compensated, high gain, and independent op-amps. This IC is designed for specially to operate from a single power supply over a wide range of voltages. The LM35g IC is available in a chip sized package and applications of this op amp include conventional op-amp circuits, DC gain blocks and transducer amplifiers. LM358 IC is a good, standard operational amplifier and it is suitable for our needs. It can handle 3-32v DC supply & source up to 20mA per channel.



Fig : LM358

FEATURES OF LM358 IC:

The features of the LM358 IC are:

- The large voltage gain is 100 dB
- Wide bandwidth is 1MHz.
- Range of wide power supplies includes single and dual power supplies.
- Range of Single power supply is from 3V to 32V.
- Range of dual power supplies is from + or -1.5V to + or -16V.
- The supply current drain is very low, i.e., 500 pA.

PIN CONFIGURATION OF LM358 IC:

The pin diagram of LM358 IC comprises of 8 pins, where

- Pin-1 and pin-7 are o/p of the comparator.
- Pin-2 and pin-6 are inverting i/p supply.
- Pin-3 and pin-5 are non-inverting i/p supply.
- Pin-4 is GND terminal Pin-8 is VCC+.

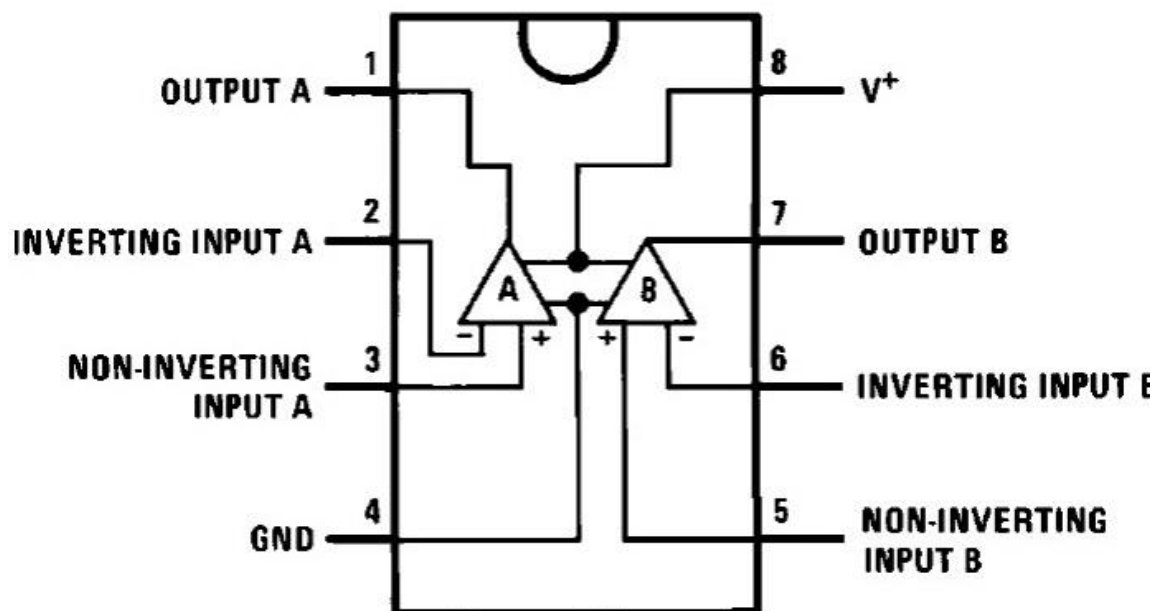


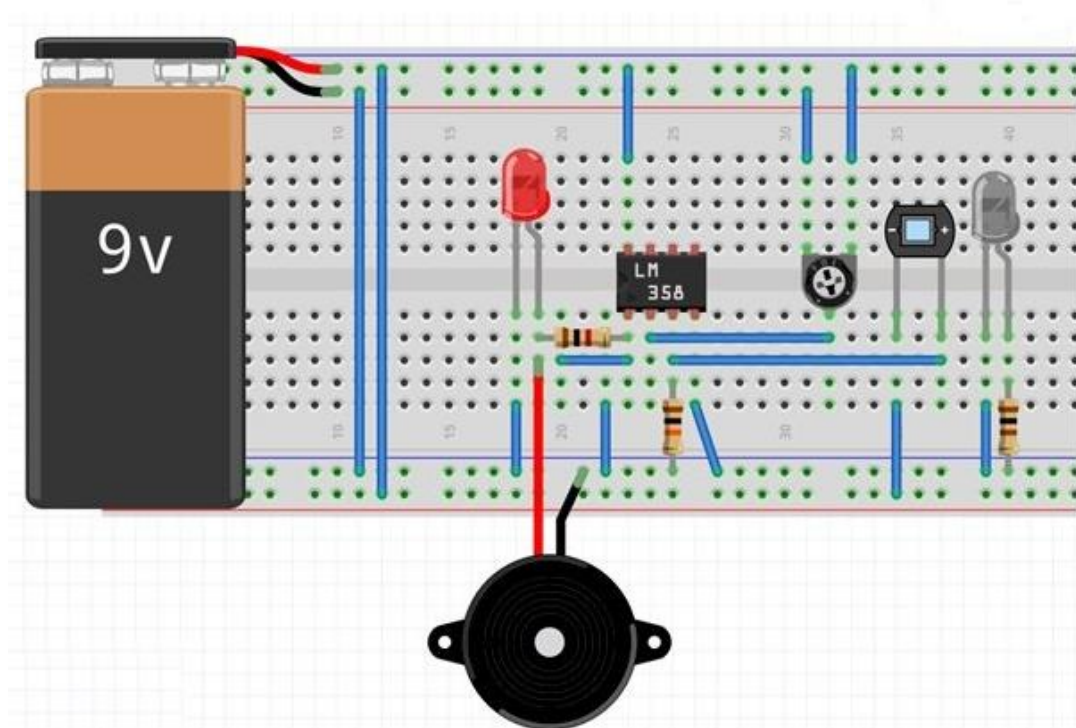
Fig : LM358 IC

APPLICATIONS OF LM358 IC:

- LM358 IC is used in Dark Sensor Circuit.
- LM358 IC is used in Shock Alarm Circuit.

3. DEVELOPMENT OF THE CIRCUIT

3.1 BREADBOARD DIAGRAM



3.2WORKING PRINCIPLE

IR Sensor working principle:

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure below.

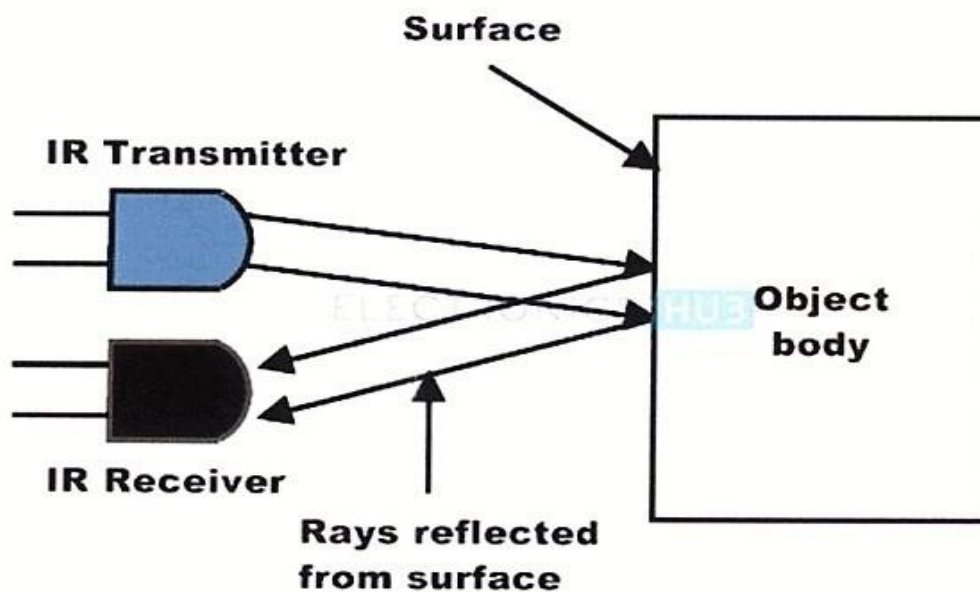


Fig : IR sensor

An IR sensor consists of an IR LED and IR Photodiode. Together they are called as Photo - Coupler or Opto-Coupler.

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

Although infrared detectors can be designed to perform different functions, all infrared detectors are made of pyro electric materials, whether natural or artificial, the pyro electric material produces an electrical voltage whenever it is heated or cooled. Most infrared detectors are coated with either parabolic mirrors or Fresnel lenses to retrieve the infrared waves from an entire room or area, as the infrared waves reach the sensor from different areas, they cause

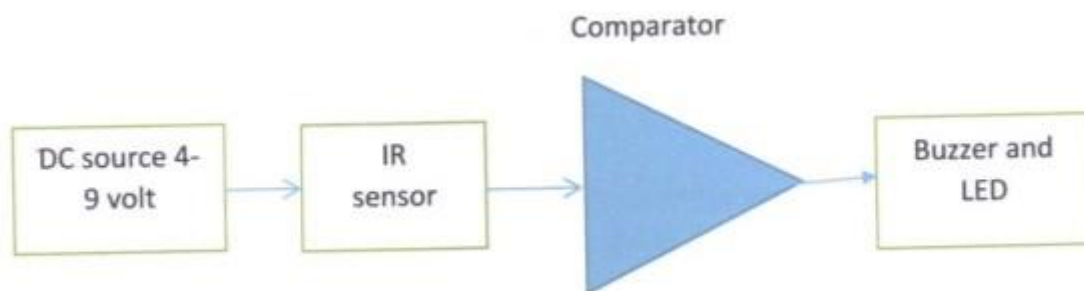
the sensor to generate a voltage in different waves that can be used to trigger an alarm or activate some other type of system.

Infrared sensor uses:

Infrared detectors are used in a wide variety of applications, they can be used in any situation that requires thermal energy detection, they are most used in the conjunction with an infrared emitter to transfer the infrared light' infrared detectors are used as motion detectors to open the doors, track the objects, or activate specific systems based on the thermal energy which is irradiated from the people' the animals and moving objects.

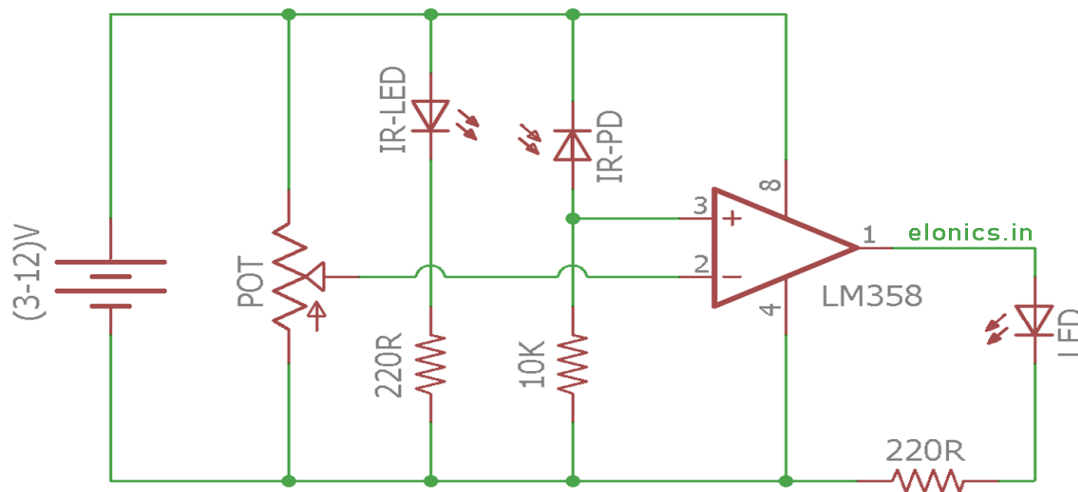
Infrared detectors are used in night-vision applications, laser range finding and heat seeking missiles, Television remotes emit infrared light to change the channels and the television itself has a built-in infrared sensor to receive the remote.

BLOCK DIAGRAM OF TOUCH LESS DOORBELL



3.3 Obstacle Sensing Circuit Or IR Sensor Circuit:

A typical IR sensing circuit is shown below.



IR PROXIMITY SENSOR SCHEMATIC

It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier and an LED. IR LED emits infrared light. The Photodiode detects the infrared light. An IC Op-Amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement.

When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls down from a huge value. One of the inputs of the op-amp is at threshold value set by the potentiometer. The other input to the op amp is from the photodiode's series resistor. When the incident radiation is more on the photodiode, the voltage drop across the series resistor will be high. In the IC, both the threshold voltage and the voltage across the series resistor are compared. If the voltage across the resistor series to photodiode is greater than that of the threshold voltage, the output of the IC Op-Amp is high. As the output of the IC is connected to

an LED, it lightens up. The threshold voltage can be adjusted by adjusting the potentiometer depending on the environmental conditions.

The sensing component in this circuit is IR photo-diode. More the amount of Infrared light falling on the IR photodiode more is the current flowing through it. (Energy from IR waves is absorbed by electrons at p-n junction of IR photodiode, which causes current to flow).

The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver. Hence there is a line of sight communication between the infrared transmitter and the receiver.

If an object falls in this line, it obstructs the radiation from reaching the receiver other by reflecting the radiation or absorbing the radiation.

This current when flows through the 10k resistor, causes potential difference (voltage) to develop. The magnitude of this voltage is given by Ohm's law, $V=IR$. As the value of resistor is constant, the voltage across the resistor is directly proportional to the magnitude of current flowing, which in turn is directly proportional to the amount of Infra-Red waves incident on the IR photodiode.

So, when any object is brought nearer to the IR LED, Photo-Diode pair, the amount of IR rays from IR LED which reflects and falls on the IR photodiode increases and therefore voltage at the resistor increases (from the deduction in previous Para).

We compare this voltage change (nearer the object, more is the voltage at 10K resistor / IR photodiode) with a fixed reference voltage (Created using a potentiometer).

Here, LM358 IC (A comparator/OpAmp) is used for comparing the sensor and reference voltages. The positive terminal of photodiode (This is the point where the voltage changes proportion to object distance) is connected to non-inverting input of OpAmp and the reference voltage is connected to inverting input of OpAmp.

The OpAmp functions in a way that whenever the voltage at non-inverting input is more than the voltage at inverting input, the output turns ON.

When no object is near the IR proximity sensor, we need LED to be turned off. So we adjust the potentiometer so as to make the voltage at inverting input more than non-inverting.

When any object approaches the IR proximity sensor, the voltage at photodiode increases and at some point the voltage at non-inverting input becomes more than inverting input, which causes OpAmp to turn on the LED.

In the same manner, when the object moves farther from the IR proximity sensor, the voltage at non-inverting input reduces and at some point becomes less than inverting input, which causes OpAmp to turn off the LED.

4. ADVANTAGE AND LIMITATIONS OF THE SYSTEM

4.1 ADVANTAGES OF TOUCH LESS DOOR BELL:

- Save time for searching doorbell switch.
- Low power requirements and hence save electricity.
- Low circuitry cost.
- Save manpower.
- No corrosion or oxidation can effect of the infrared sensors.
- It deliveries has repeatability.
- Portable.
- Easy of application (patient can applied at home).
- It does not penetrate walls which improve the security of data transmitted.

4.2 LIMITATIONS OF TOUCH LESS DOORBELL:

- If any component is damaged then it is does not work.
- Short range: performance drops off with longer distances.
- Light, weather sensitive: direct sunlight, rain, fog, dust, pollution can affect transmission.
- Signal Interference: The signal can be blocked by any foreign material that is actually in the front of the transmitter.
- The ray sent by the IR transmitter to the object must be reflected and received by the photo diode.
- Speed of Transmission: speed at which the data is transmitted by infrared light is slower than the wired transmission.
- Very limited bandwidth

5.COST ESTIMATION & CONCLUSION

5.1COST ESTIMATION

ITEMS	QUANTITY	PRICE
LED	1	Rs. 5/-
RESISTORS (10k,220ohm,100ohm)	3	Rs. 25/-
PCB	1	Rs. 20/-
IR LED	1	Rs. 10/-
PHOTO DIODE	1	Rs. 10/-
PRESET(10k)	1	Rs. 5/-
BUZZER	1	Rs. 20/-
9V BATTERY	1	Rs. 20/-
LM358 IC	1	Rs. 20/-
ON/OFF SWITCH	1	Rs.10/-
TOTAL	12	Rs. 145/-

5.2 CONCLUSION

The automatic doorbell circuit, which we assembled, generates Beeping sound at working and as we know that the human hearing frequency is 20Hz to 20KHz. Thus, there would be no problem related to this frequency to humans. The buzzer produces the sound in the frequency range of 20Hz to 20 KHz which is hear-able to any human when an object comes closer to the sensors. This project is cost Rs.145/- as seen from the appendix which is a very low and can be affordable by any average consumer.

6.FUTURE SCOPE & APPLICATION

6.1FUTURE SCOPE

In future invention we can modify doorbell as with sensors and camera ;when person come near to doorbell area, then sensor will detect the person and ringer will ringing sound and camera will captures this image at displayed that image in home.

6.2APPLICATION

Some general applications of the touch less doorbell system are:

- Fire engines.
- In telephones.
- Railroad crossings.
- School bells.
- Alarms in industrial plant's etc.,
- The circuit can be used as a door bell by connecting the supply to a switch.
- With some modifications it can be used to produce different sounds.

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