

**A Minor Project Report**

**On**

**METAL DETECTOR**

**SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE**

**AWARD OF DEGREE OF**

**BACHELOR OF TECHNOLOGY**

**in**

**ELECTRICAL ENGINEERING**



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**JANUARY-JUNE 2023**

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I hereby certify that the work which is being presented in the project entitled "METAL DETECTOR " by Shiwang, Baldev Kainth, Harninder Singh, Kamalpreet Singh, RohitKumar, Hardeep Singh in partial fulfillment of requirements for the award of degree of Bachelor of Technology (Electrical Engineering) submitted to the department of Electrical Engineering at Sant Baba Bhag Singh University, Jalandhar, is an authentic record of our own work carried out during the period from January 2023 to June2023.The matter presented in this project has not been submitted to any other University/Institute for the award of Bachelor of Technology (Electrical Engineering) degree.

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## CHAPTER 1

### Introduction

The first industrial metal detector was developed in the year 1960 and was used for mineral prospecting and other industrial applications. A metal detector is an electronic device that includes an oscillator which produces AC that passes through a coil producing an alternating magnetic field. If a part of the metal is near to the coil, eddy current will be induced in the metal and this produces a magnetic field of its own. If another coil is used to measure the magnetic field, the change in the magnetic field, the change in the magnetic field due to the metallic object can be detected.

The metal detectors are used to detect the weapons like guns, knives in the airports, and also used in the construction industry to detect steel reinforcing bars in wires, concrete, pipes buried in floors and walls [1].

## CHAPTER 2

### Circuit Diagram and Description of Components Used

#### 2.1 Circuit Diagram

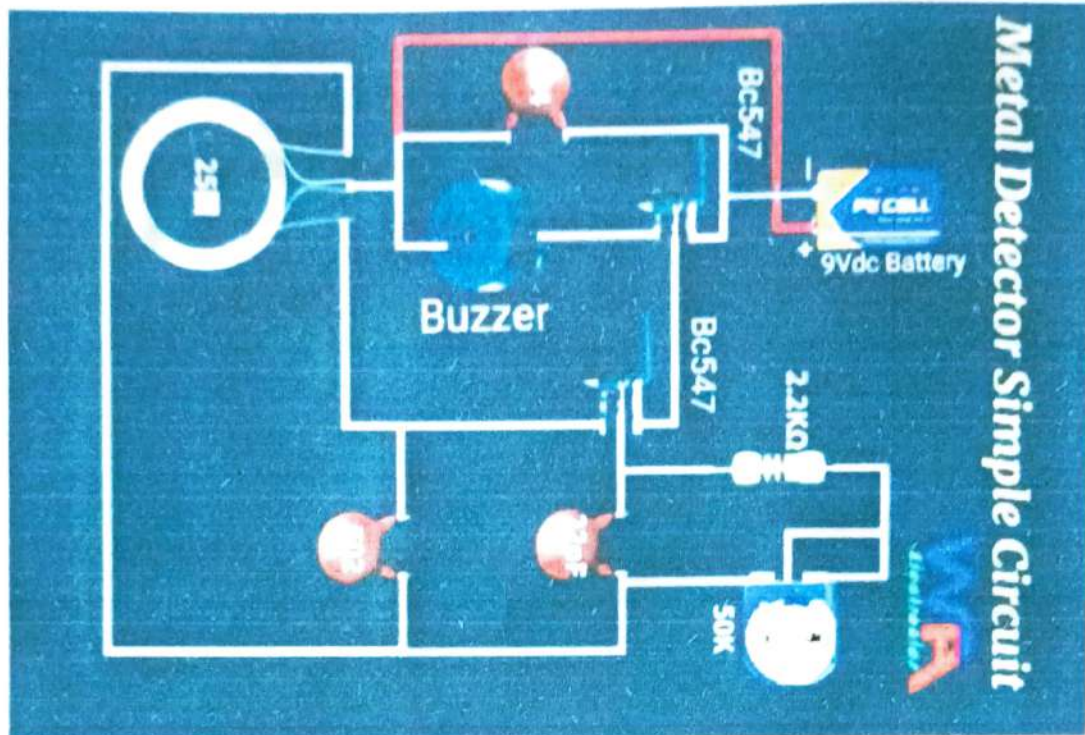


Figure 2.1- Circuit Diagram of Metal Detector

#### 2.2 Component Used

- Copper Coil
- BC 547npn Transistor
- Capacitor (22pf ceramic disc)
- Resistor (2.2K ohm)
- Buzzer
- Battery (9V)

#### 2.3 Description of Components

##### 2.3.1 Resistor

The Resistor is a passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

2) **Non-linear resistors:** The resistor values change according to the temperature and voltage applied and is not dependent on ohms law. Following are the different types of non-linear resistors [2]:

- Thermistors
- Varistors
- Photo resistors

Figure 2.3 shows how to determine the resistance and tolerance for resistors. It can also be used to specify the color of the bands when the values are known.

## How to Read Resistor Color Codes

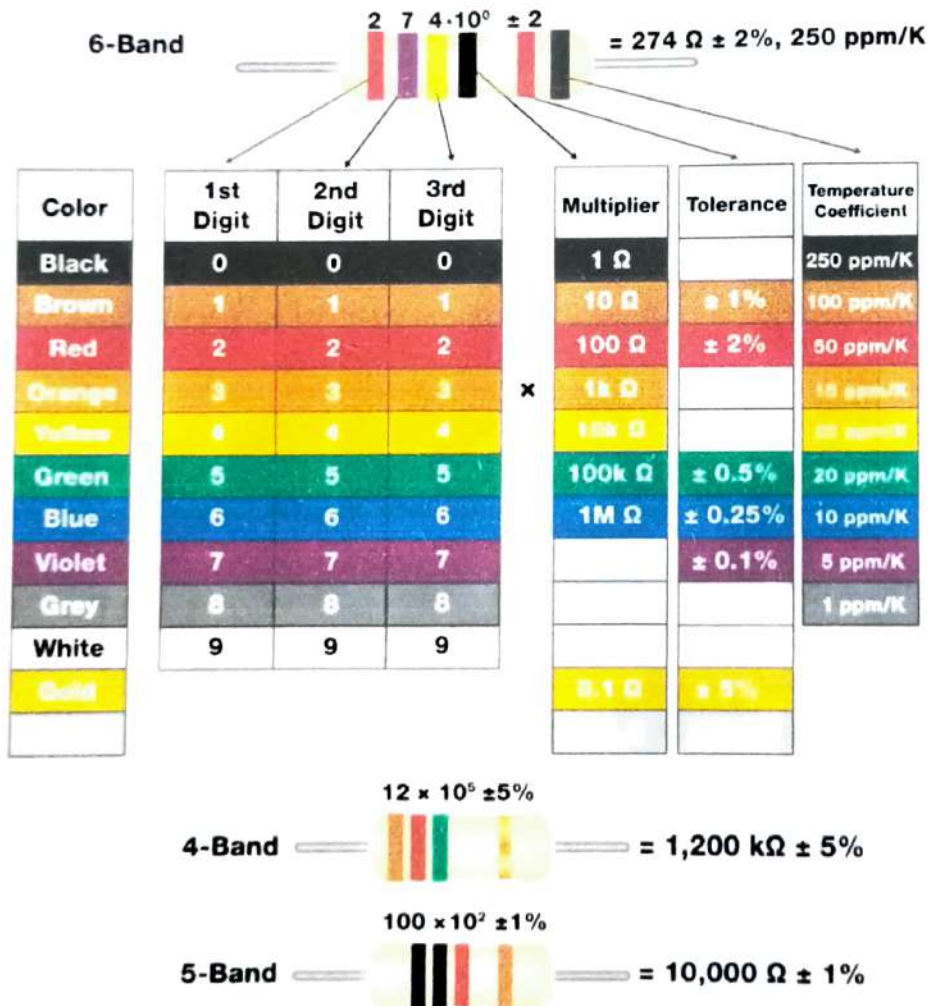


Figure 2.3- Resistor color codes.

### Working of Metal Detector

#### 3.1 Working of Metal Detector

The working of metal detector is based on the principle of electromagnetic induction. In the circuit we used battery, two npn transistor, capacitor, variable resistance & coil. The first npn transistor emitter is connect to the negative terminal of the battery and capacitor, the collector is connect to the negative terminal of buzzer & positive terminal of buzzer is connect to the emitter without base connect with positive terminal of battery the circuit is incomplete. We used another BC547 npn transistor .The emitter terminal of 2<sup>nd</sup> transistor is connect to the base terminal of 1<sup>st</sup> transistor. The base of 2<sup>nd</sup> transistor is connect to a variable resistance. The variable resistance works same as a potentiometer to control the range. The main function of all the capacitor present in the circuit is to filter the voltage ripples. The 2<sup>nd</sup> npn transistor base is connect with the variable resistance & coil first end. The collector is connect with the last turn of coil .The supply is given to the coil through central tap. When any object is detected the eddy current induce in the coil the eddy current induce their own magnetic field , which generate opposite cuurent in the coil, which induce a signal indicating the presence of metal. The circuit is complete and the buzzer gives sound when any metal detected.

# Advantages Disadvantages and Applications of Metal Detector

### 4.1.1 Advantages of Metal Detector

Metal Detectors are metal sensitive, hence, they immediately detect whenever a metal substance whether ferrous, non-ferrous or stainless steel comes in their proximity. Here are their advantages:

- Low cost
- Circuit is simple
- Easy to use
- Can be operated for long time without requiring much maintenance.

### 4.1.2 Disadvantage of Metal Detector

- Detection range is low
- Can detect iron only

### 4.1.3 Applications of Metal Detector

- This simple Metal Detector can be used to detect iron only.
- Since it is a simple project, we can use this in our home to scan for nails, metal scraps etc. which are not easily spotable by naked eye.





SANT BABA BHAG SINGH UNIVERSITY, JALANDHAR

**A MINOR PROJECT**  
**REPORT ON**  
**MOTION DETECTION USING PIR SENSOR**  
**IN PARTIAL FULFILLMENT FOR AWARD OF THE DEGREE OF**  
**BACHELOR OF TECHNOLOGY**  
**in**  
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## CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the project entitled "MOTION DETECTION USING PIR SENSOR " by Maninder Singh, Sukhwinder Singh, Parasdeep Singh, Arashdeep Singh, Rohit, Vishal Thakur in partial fulfilment of requirements for the award of degree of Bachelor of Technology (Electrical Engineering) submitted to the department of Electrical Engineering at Sant Baba Bhag Singh University, Jalandhar, is an authentic record of our own work carried out during the period from January 2023 to June 2023 under the supervision of Dr. Amandeep Singh (Professor, EE, UIET, SBBSU) . The matter presented in this project has not been submitted to any other University/ Institute for the award of Bachelor of Technology (Electrical Engineering) degree.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

Motion detection using a PIR sensor circuit can be used for providing security to home, shopping malls etc, as the PIR sensor used in this system detects the motion of human around this circuit. With the help of buzzer, we can identify the motion of human which was detected by the sensor. This system can be used at any place where security is needed. Security is needed by everyone in the society now-a-days to protect their property or confidential information from others which is sensor sense a human motion and then transmit the signal wirelessly.

However, this project will relate to auto power ON light and fan system. When the sensor senses a human motion in the sensor's detection area, sensor will be triggered and then the room's light will automatically switch ON. It is useful for us when we cannot find the switch in the dark condition.

For the fan's function, it is depends on the room temperature, when the temperature is higher, fan will run when the PIR had detect motion in the detection area. When the room temperature is low, fan will not run. Degree of temperature is measure by the temperature sensor and temperature will show on a LCD display (2x16). Light and fan will automatically OFF when the user was going out from the room. As long as PIR sensor does not detect motion in the detection area, light and fans are not function and the fan is depends on the room temperature. Once the sensor is triggered, system will have around 2 minutes to run the function. After 2 minutes and sensor does not detect any motion, light and fans will be switched OFF automatically.

## CHAPTER 2

# COMPONENTS USED, CIRCUIT DIAGRAM AND WORKING

### 2.1 Description of components used

- Passive Infrared (PIR) sensor (HC-SR501)
- Relay (5V)
- Transistor (BC547)
- Diode (1N4007)
- Resistor (1K)
- Battery (9V)

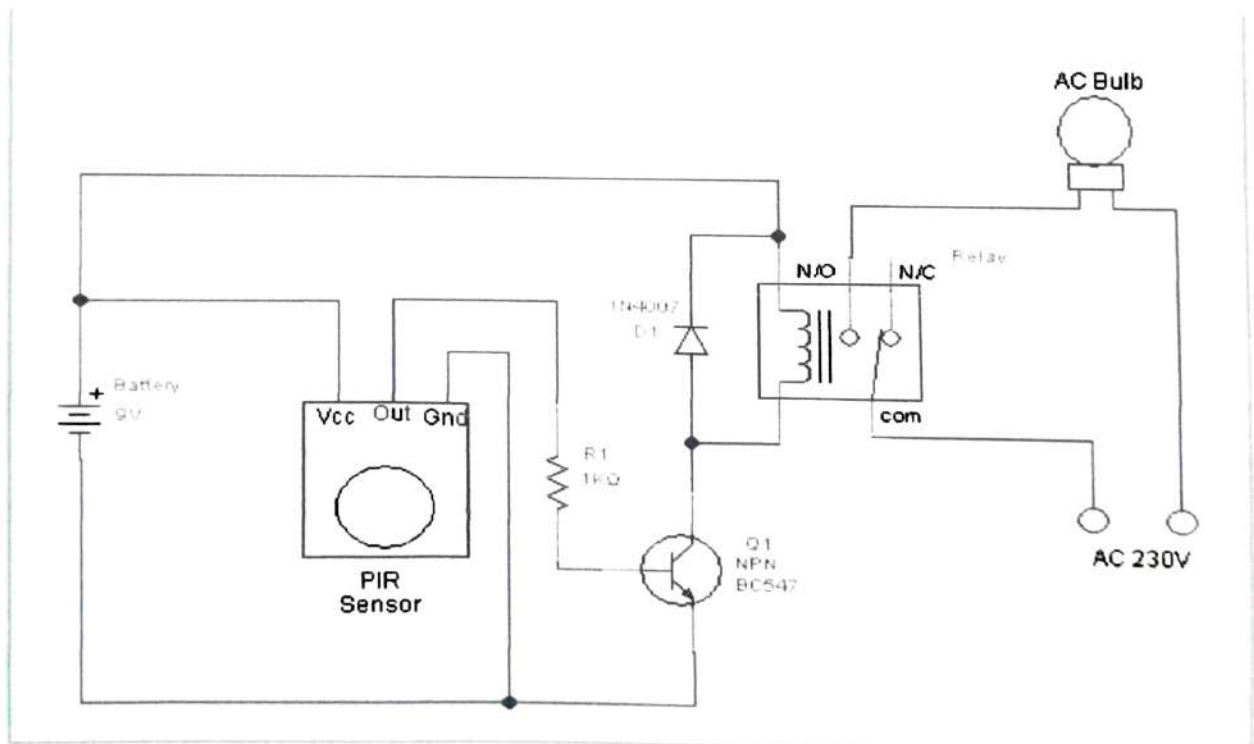


Figure 2.1- Circuit Diagram of PIR Motion Detection Circuit

PIR sensor, and its typical pin configuration which is quite simple to understand the pin-outs. The pin configuration of PIR sensor is shown in Figure 2.5.

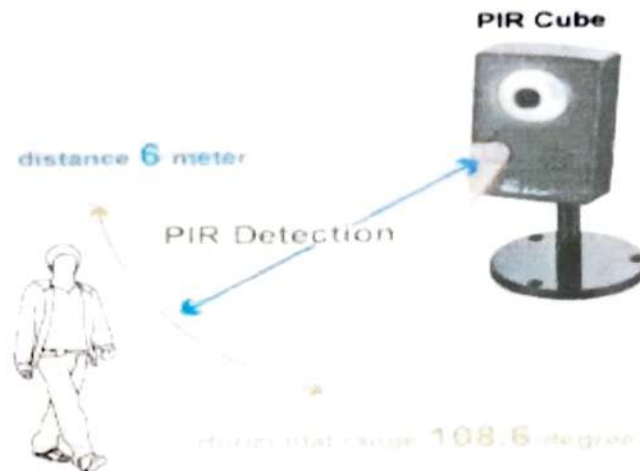


Figure 2.3- Passive Infrared Sensor.



Figure 2.4 PIR Sensor.

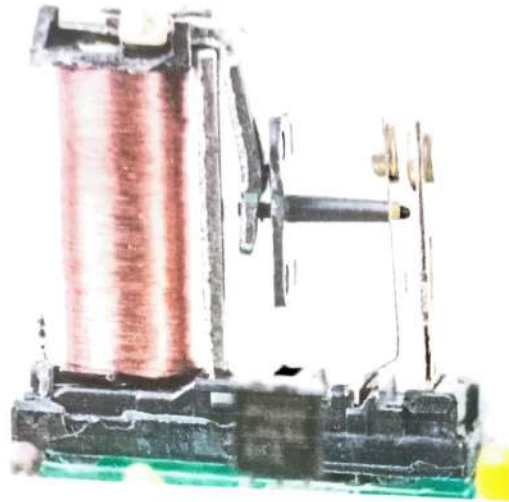


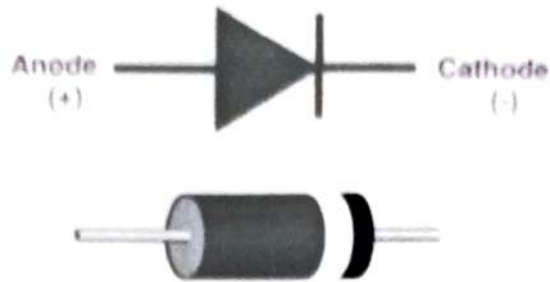
Figure 2.6- Structure of a Relay.

#### ❖ Use of Relay

- **Control Systems:** Relays are used to control the operation of motors, lights, solenoids, valves, and other devices in industrial automation, building automation, and other control systems.
- **Power Distribution:** Relays are employed in power distribution systems to switch and control the flow of electrical power between different circuits, transformers, or sources.
- **Protection and Safety:** Relays are used for protection purposes, such as overcurrent protection, voltage regulation, and circuit breakers. They can detect abnormal conditions and interrupt the circuit to prevent damage to equipment or ensure safety.
- **Signal Amplification:** In electronic circuits, relays can be used to amplify or isolate signals, enabling compatibility between systems with different voltage levels or impedance.
- **Timing and Sequencing:** Relays can be used to control the timing and sequencing of operations in various applications, such as in control panels, motor starters, and timing circuits.
- **Automotive Applications:** Relays are extensively used in automotive systems for controlling lights, wipers, power windows, ignition systems, and other functions.

#### ❖ Types of Relays

- Electromagnetic Relays.

**Figure5.1 Diode**

### 2.1.5. Resistor 1K $\Omega$

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits. The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit. It is made of copper wires which are coiled around a ceramic rod and the outer part of the resistor is coated with an insulating paint.

**Figure5.2 Resistor**

#### ❖ Resistor Color Code





## **CHAPTER 5**

### **APPLICATIONS**

#### **5.1 APPLICATIONS:**

- Common staircases.
- For parking lights.
- For garden lights.
- For changing rooms in shop.
- For corridors.
- Security alarms and many more.

#### **5.2. CONCLUSION**

In this project, we have successfully implemented a PIR sensor circuit using a BC547 transistor and a 5V relay to control other devices based on motion detection. This circuit can be used for a variety of applications such as automatic lights, security systems, etc.