Digital Electronic Circuits Lab

A MINI PROJECT REPORT

ON

THERMISTOR TEMPARATURE SENSING ALARM

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CERTIFICATE

This is to certify that **Sandeep (4NM17EC133), Sanjana (4NM17EC134) and Sanjana G. Rao (4NM17EC136),** bonafide students of N.M.A.M. Institute of Technology, Nitte have submitted the report for the project entitled "**THERMISTOR TEMPARATURE SENSING ALARM"** in partial fulfillment of the requirements for the Digital Electronic Circuits Laboratory during the year 2018-2019.

Name of the Reviewer **Signature with date**

Project Evaluation

Name of the Examiners **Signature with date**

1. _____ _____
2. _____ _____

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CHAPTER 1

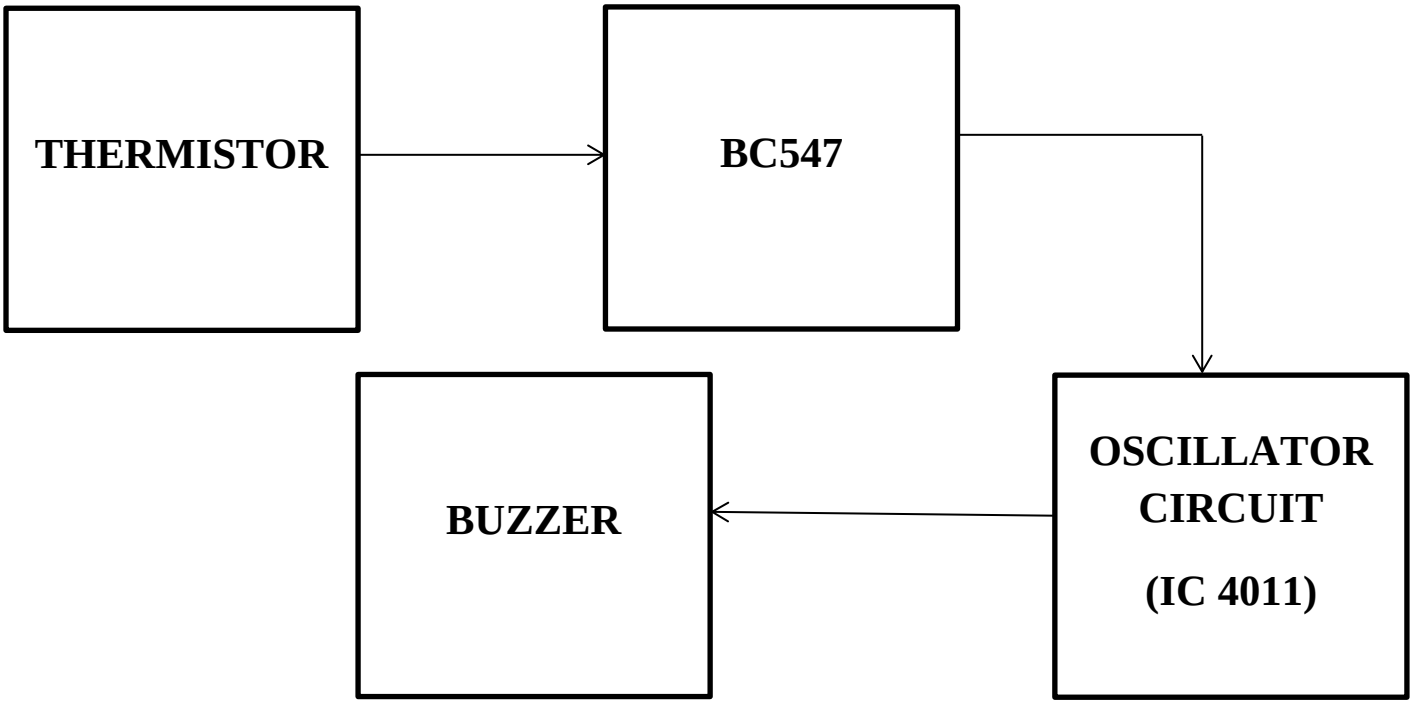
INTRODUCTION

Thermistor temperature sensing alarm circuit is a temperature sensing as well as alarm circuit. The circuit raises an alarm by turning on the alarm whenever the temperature crosses a certain limit. Temperature monitoring is a very important and frequently used application in industries and in many other places where the temperature should be kept below a maximum allowable level. This circuit comes to our rescue when a situation of that sort arises.

The circuit is with fewer resources and is cost efficient without compromising on the performance. Although it is not an industry level calibrated circuit, it is quite sufficient where it is not a mission critical application.

CHAPTER 2

BLOCK DIAGRAM



WORKING

Voltage is constantly flowing through the buzzer and the thermistor. When the thermistor gets hot, as it would during a fire, the resistance drops allowing the positive voltage to pass through the thermistor and the 1k resistor. The 1k resistor regulates the voltage to the transistor to ensure proper function. Once the positive voltage flows through the transistor, it "switches" on allowing the buzzer to create an audio frequency.

The circuit makes use of two BC547 NPN transistors to switch the alarm when the temperature above desired value is detected. The IC 4011 which is used in the circuit is a quad NAND gate integrated circuit. It has four NAND gates assembled in the single IC itself. This reduces the space and complexity of the circuit.

The combinational circuit which is built using the NAND gates is an oscillator circuit. Any combinational circuit has an inherent time delay between the input and the output. This time

delay is usually considered as undesirable but in this case, the delay is used to make it work like an oscillator. The circuit turns on and off repeatedly with a time delay operating as a square wave oscillator. The output of the oscillator is given to a buzzer. The capacitors used in the circuit acts as filters to remove unwanted components of the signals hence ensuring stability and proper operation.

CHAPTER 3

CIRCUIT DESIGN

3.1 Circuit Description

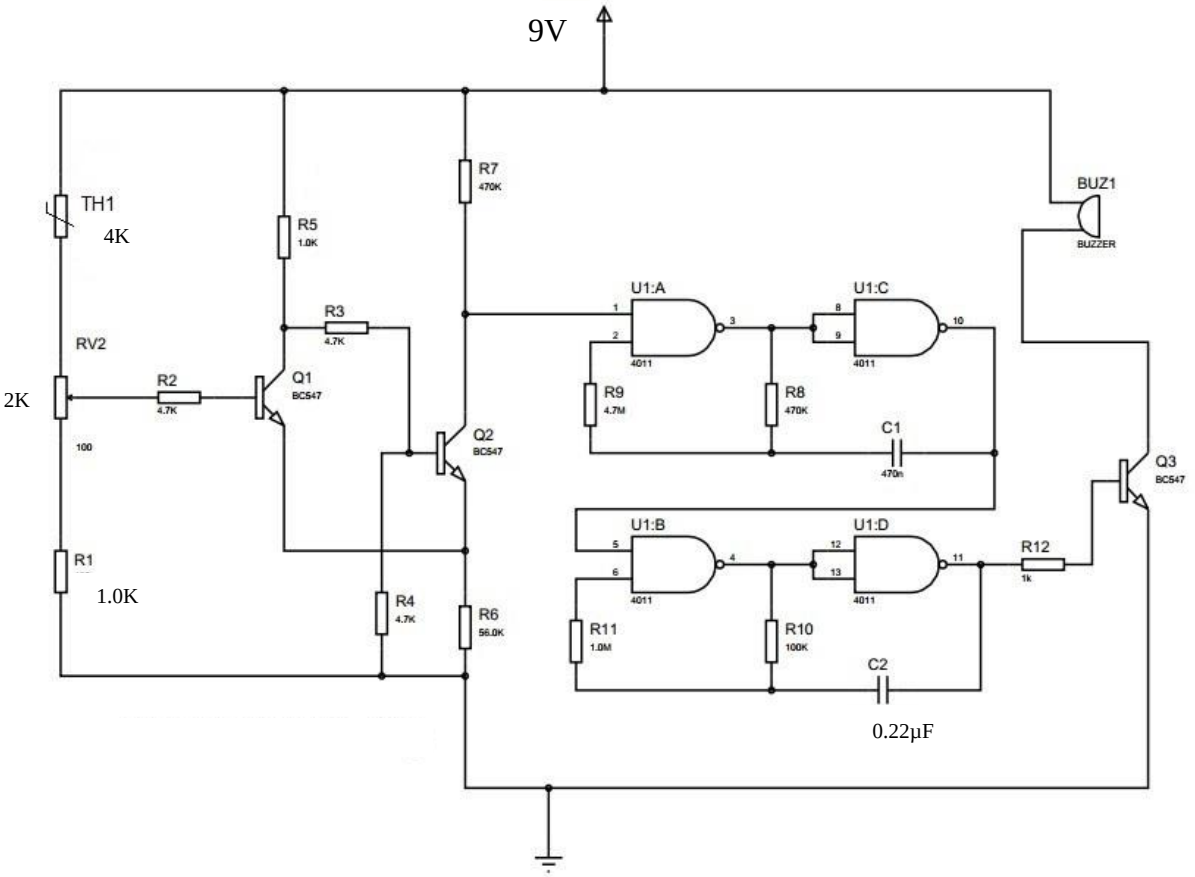


Figure 3.1: Thermistor temperature sensing alarm circuit diagram

Table 3.1: Truth table of IC 4011

Input 1	Input 2	Output
0	0	1
0	1	1
1	0	1
1	1	0

3.2 Component Description

- **4K Thermistor:**

Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature.

Figure 3.2: 4K NTC Thermistor

- **BC547 Transistor**:

Here Transistor BC547 is used as a Heat Sensor. As the temperature of PN junction increase, transistor starts conducting to some extent. This 'temperature' property of transistor is used here to use it as a heat sensor.

- **Resistors**:

Resistors is an electrical component that controls the flow of current to other components. The resistor's ability to reduce current is called resistance and is measured in terms of ohms (Ω).

- **2K Preset**:

A voltage output can be obtained at a predetermined temperature set point for example; 5v output at 60^{o}C and by varying the preset a particular output voltage level can be obtained over a wider temperature range.

Figure 3.3: 2K Carbon Preset

- **Buzzer**:

Audio frequency producing device. A buzzer is between +9V battery and collector terminal of the transistor. When the temperature exceeds a certain level, we can hear the alarm sound.

- **Capacitors**:

Capacitors act as filters to remove unwanted components of the signals and hence ensuring stability and proper operation.

- **9V battery**:

A battery acts as current source.

- **IC 4011**:

The 4011 is a member of the 4000 Series CMOS range, and contains four independent NAND gates, each with two inputs.

Figure 3.4: IC 4011

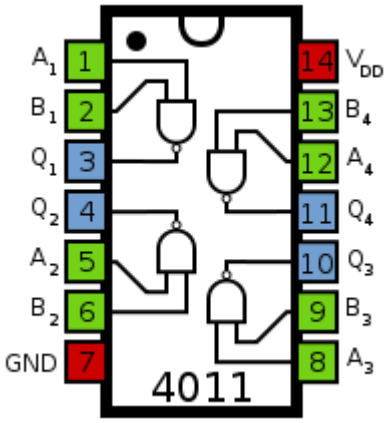


Figure 3.5: Pin Diagram

- **Printed Circuit Board (PCB)**:

A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

- **Soldering Lead**:

Solder is a fusible metal alloy used to create a permanent bond between metal work pieces.

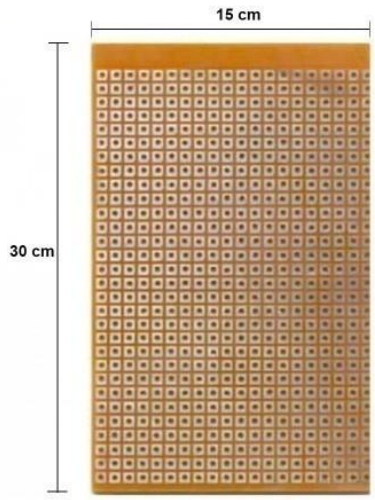


Figure 3.6: General Purpose PCB

CHAPTER 4

WORKING PRINCIPLE

The element in the circuit that senses the temperature of the environment is a thermistor. The name itself has its meaning, that is, thermal-resistor. It means that the resistance of the thermistor varies with change in temperature and the relationship between the resistance of the thermistor and temperature is inversely related. If the temperature in the atmosphere increases, the resistance offered by the thermistor decreases and if the temperature outside decreases, the resistance of the thermistor increases. This property of the thermistor helps us to make use of it to sense the temperature of the surroundings.

The thermistor method uses heat detection to activate. The alarm activates once the thermistor detects a high temperature. Thermistor temperature detection doesn't require smoke to activate and has fewer false alarms. The thermistor uses the ambient temperature of a building and will only activate when that temperature increases exponentially.

CHAPTER 5

RESULT

Voltage is constantly flowing through the buzzer and the thermistor. When the thermistor gets hot, as it would during a fire, the resistance drops allowing the positive voltage to pass through the thermistor, transistor and the 1k resistor. The 1k resistor regulates the voltage to the transistor to ensure proper function. The transistor connects the ground to the buzzer and is required to complete the circuit. Once the positive voltage flows through the transistor, it "switches" on allowing the buzzer to sound.

'Thermistor Temperature Sensing Alarm' - circuit was designed and tested. The desired output was observed for the given input.

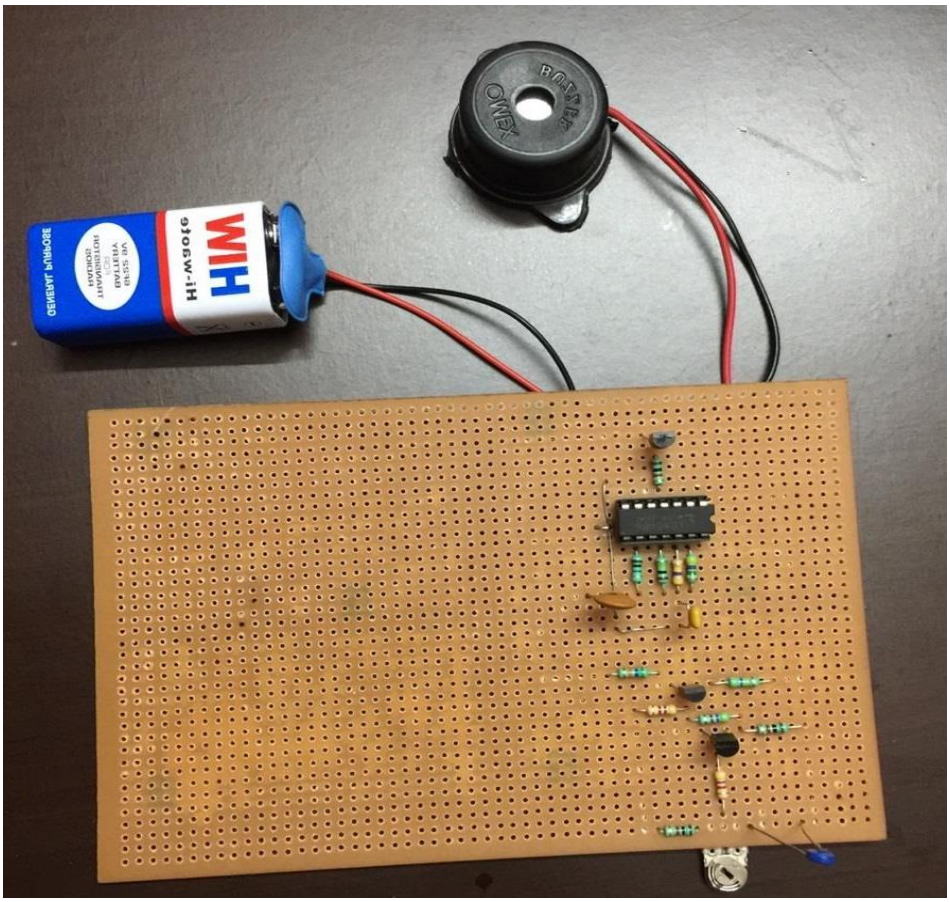


Figure 5.1: Connections of the circuit on Printed Circuit Board

CHAPTER 6

CONCLUSION

Thermistors as temperature detectors are versatile in the fire alarm example because of the many placement options available. Thermistor fire detectors can be placed in areas with high steam, such as in dairy factories, in incineration and oven rooms where smoke usually gathers, rooms with high temperatures like welding workshops and industrial workplaces with a lot of dust and smoke.

With strategic placing, the thermistor method would not cause unnecessary alarms, while still being reliable in the industrial workplace to ensure all employees reach safety when a threat of fire occurs. Thermistors can activate at specific temperatures. The fine tuning allows for even greater versatility in their placement.

The designed circuit can also be modified using DC motor connected to a fan in place of a buzzer which turns on automatically depending on the variation in temperature to cool the system.