RAIN SENSOR ALARM

(Submitted as a part of PCB workshop by First Year students of B.Tech Information Technology)

Submitted By:

Vishnu Dasan - 16010422232

Prachi Gandhi - 16010422233

Chandana Galgali - 16010422234

Mahek Thakkar - 16010422235

Yash Jadhav - 16010422236

Under the Guidance of:

Dr. Neethu Anna Sabu

Project Guide

Examiner

Workshop Superintendent

Principal

Date:

CERTIFICATE

This is to certify that the project-based laboratory report entitled "RAIN SENSOR ALARM" submitted by Vishnu Dasan (16010422232), Prachi Gandhi (16010422233), Chandana Galgali (16010422234), Mahek Thakkar (16010422235) and Yash Jadhav (16010422236) studying in first year pursuing B.Tech Information Technology have satisfactorily completed the project in Semester-II during the academic year 2022-23.

ACKNOWLEDGEMENT

We would like to convey our heartfelt appreciation and gratitude to our Professors Mr. Raghunath Patil & Dr. Neethu Anna Sabu for providing us the chance to work on this project of "Rain Sensor Alarm". The completion of this project could not have been possible without the guidance, supervision, assistance and support of our professors.

We would also like to extend our gratitude to the Principal Mam, Dr. Shubha Pandit for providing us with all the facilities that were required.

INDEX

PROBLEM DEFINITION

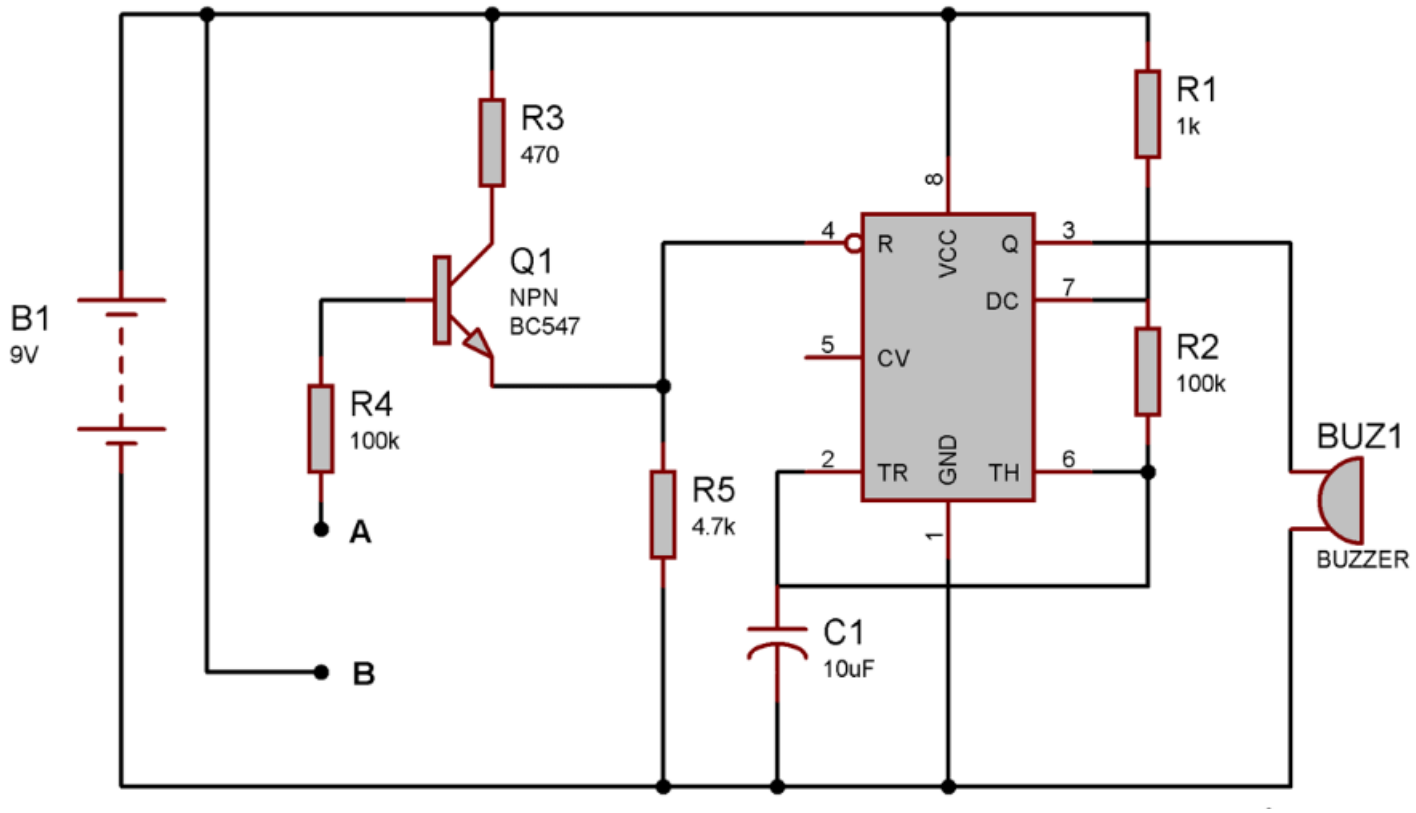
Rainwater can cause significant damage to property, especially in outdoor areas such as gardens, homes and farms. Water damage can result in high repair costs and inconvenience for property owners. Therefore, there is a need for a rain sensor alarm system that can detect the presence of rain and alert the user to take preventive measures.The existing solutions for rain sensor alarm systems are often expensive, complicated, and require professional installation. Moreover, they may not be suitable for all applications, such as small gardens or outdoor areas where a simple and cost-effective solution is needed. Therefore, there is a need for a rain sensor alarm system that is simple, easy to use, and cost-effective.

INTRODUCTION

Rain sensor alarm systems are an essential component of various outdoor applications, such as gardens, homes, industries and farms. These systems alert users of the presence of rain and help them take the necessary preventive measures to protect their property from water damage. The rain sensor alarm system detects the presence of water and triggers an alarm to alert the user.

In this project, we will design and implement a rain sensor alarm that can detect rain and alert the user through an audible buzzer. The PCB will utilize a rain sensor module, which is a simple, easy-to-use and cost-effective device. The PCB can be powered using a 9V battery or an external DC power supply. The compact size and versatility of the rain sensor alarm PCB make it a useful addition to any outdoor application where water damage is a concern.

CIRCUIT DIAGRAM



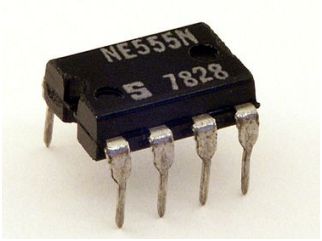
WORKING ACTION

It is a very simple rain alarm circuit which is designed using mainly a transistor, water sensor and a 555 timer IC. Whenever there is rain, rain drops fall on the rain sensor, and as you can see in the diagram of the rain sensor, water on the rain sensor would short the Point A and B. As soon as Point A and B become short, a positive voltage would get applied on the base of Transistor Q1, through the resistance R4. Because of the voltage at the base, the transistor becomes ON (initially it was in OFF state), and current starts flowing from the collector to the emitter.

Now reset pin 4 of the 555 Timer, gets a positive voltage and the 555 timer IC becomes ON and the Buzzer starts beeping. Here we should note that initially there was no positive voltage at reset pin 4 of 555 IC, as it was connected to the ground through resistance R5 (4.7k) and 555 IC only works when the reset pin gets positive voltage.

Here we can see that 555 Timer IC has been configured in Astable mode so that the Buzzer generates an oscillating sound (means periodically on and off). This oscillation frequency can be controlled by changing the value of resistor R2 and/or capacitor C1. Resistors R3 and R4 have been used to control the transistor's collector and base current respectively.

REQUIREMENTS

	Material/Component	Details	Quantity	Price (in Rs.)
1.	IC	555 Timer IC 	1	8.5
2.	NPN Transistor	BC547 NPN Transistor 	1	8
3.	Resistors	470 Ω 	1	0.4

		$1k\ \Omega$ 	1	0.4
		$4.7k\ \Omega$ 	1	0.4
		$100k\ \Omega$ 	2	0.4*2 =0.8
4.	Buzzer		1	25

5.	Capacitor	10 µ*f* 	1	3.5
6.	Rain Sensor		1	43
7.	Battery	9*V* 	1	20

PROJECT BUDGET

Total Cost of the Components (approx.) = Rs 110

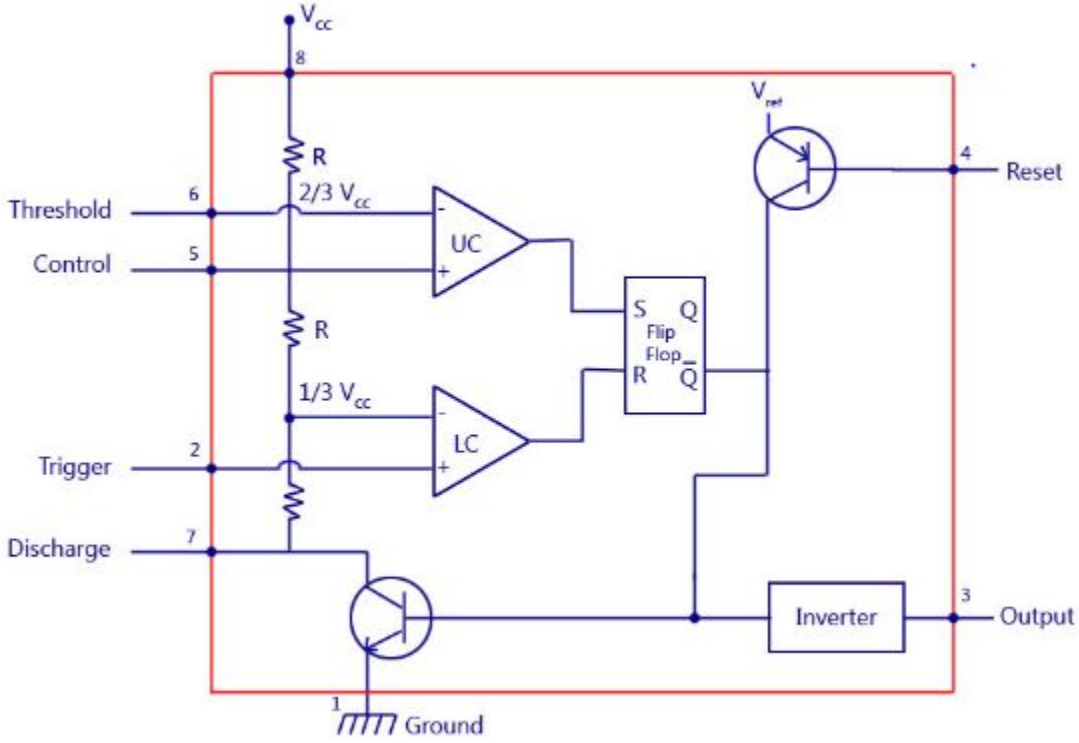
*Dimensions of PCB circuit = (95 * 80) mm*

Total cost of fabrication = Rs 80

Cost of other materials (plastic container, conducting wires, etc.) = Rs 10

TOTAL PROJECT BUDGET = Rs 200

555 Timer IC

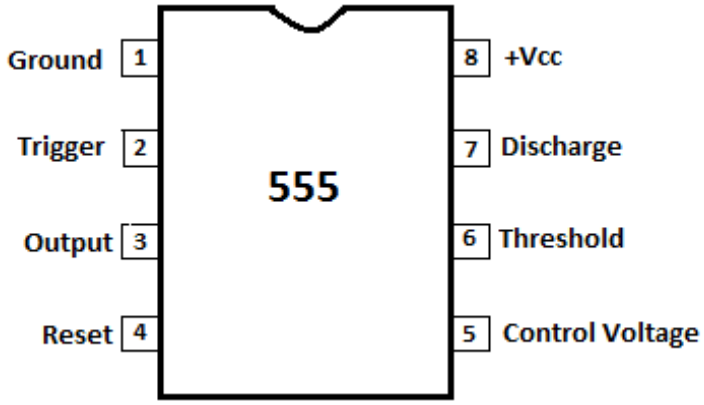


The 555 timer IC is an integral part of electronics projects. Be it a simple project involving a single 8-bit microcontroller and some peripherals or a complex one involving a system on chips (SoCs), a 555 timer is involved. These provide time delays, as an oscillator and as a flip-flop element among other applications.

Introduced in 1971 by the American company Signetics, the 555 is still in widespread use due to its low price, ease of use, and stability. It is made by many companies in the original bipolar and low-power CMOS types. According to an estimate, a billion units were manufactured back in the year 2003 alone.

Depending on the manufacturer, the standard 555 timer package includes 25 transistors, 2 diodes, and 15 resistors on a silicon chip installed in an 8-pin mini dual-in-line package (DIP-8). Variants consist of combining multiple chips on one board. However, 555 is still the most popular.

555 Timer IC Pin Diagram:



PIN	NAME	PURPOSE
1	GND	Ground reference voltage, low level (0 V)
2	TRIG	The OUT pin goes high and a timing interval starts when this input falls below 1/2 of CTRL voltage (which is typically 1/3 Vcc, CTRL being 2/3 Vcc by default if CTRL is left open). In other words, OUT is high as long as the trigger is low. The output of the timer totally depends

		upon the amplitude of the external trigger voltage applied to this pin.
3	OUT	This output is driven to approximately 1.7 V below +Vcc, or to GND.
4	RESET	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts. Overrides TRIG which overrides threshold
5	CTRL	Provides "control" access to the internal voltage divider (by default, 2/3 Vcc).
6	THR	The timing (OUT high) interval ends when the voltage at the threshold is greater than that at CTRL (2/3 Vcc if CTRL is open).
7	DIS	Open collector output which may discharge a capacitor between intervals. In phase with output.
8	Vcc	Positive supply voltage, which is usually between 3 and 15 V depending on the variation.

555 Timer Specification:

The 555 timer is used in almost every electronic circuit today. A 555 timer works as a flip-flop or as a multi-vibrator, it has a particular set of configurations. Some of the major features of the 555 timers are:

- It operates from a wide range of power ranging from +5 Volts to +18 Volts supply voltage.
- Sinking or sourcing 200 mA of load current.
- The external components should be selected properly so that the timing intervals can be made into several minutes along with the frequencies exceeding several hundred kilohertz.
- The output pin of a 555 timer can drive a transistor-transistor logic (TTL) due to its high current output.
- It has a temperature stability of 50 parts per million (ppm) per degree Celsius change in temperature which is equivalent to 0.005 %/ °C.
- The duty cycle of the timer is adjustable.
- Also, the maximum power dissipation per package is 600 mW, and its trigger pulse and reset inputs have logic compatibility.

555 Timer Working:

The 555 timer IC generally operates in 3 modes:

- Astable Mode
- Monostable Mode
- Bi-stable Mode

Astable Mode:

This means there will be no stable level of output. So the output will be swinging between high and low. This character of unstable output is used as a clock or square wave output for many applications.

Monostable Mode:

This configuration consists of one stable and one unstable state. The stable state can be chosen as either high or low by the user. If the stable output is set at high (1), the output of the timer is high (1). At the application of an interrupt, the timer output turns low (0). Since the low state is unstable it goes to high (1) automatically after the interrupt passes. Similar is the case for a low stable monostable mode.

Bi-stable Mode:

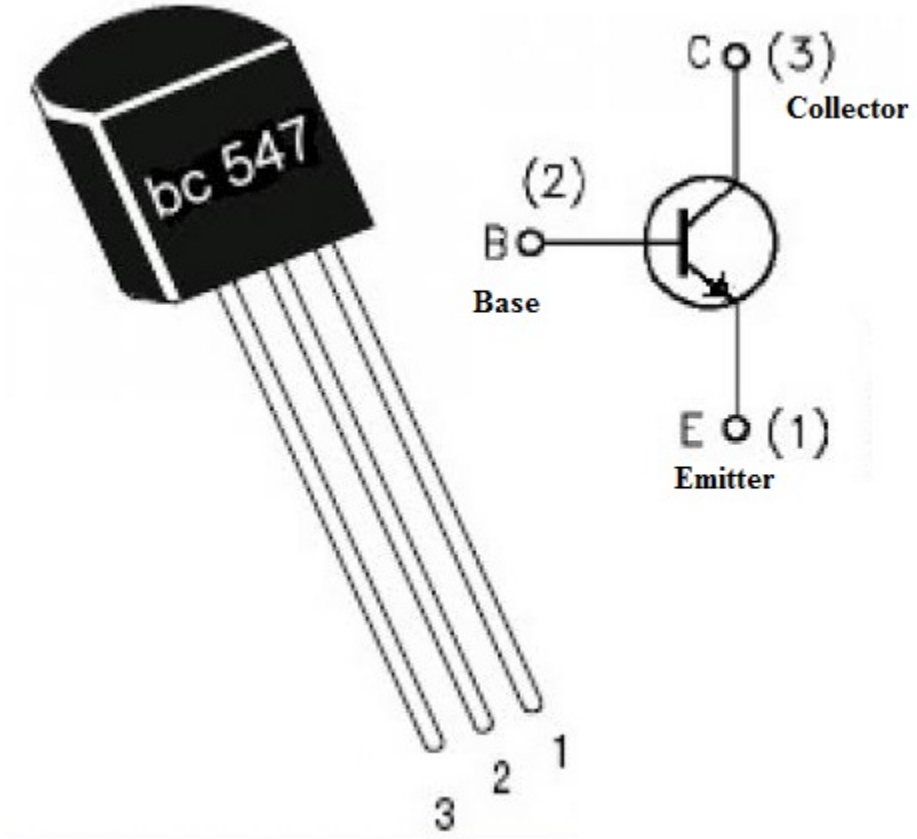
In bistable mode, both the output states are stable. At each interrupt, the output changes from low (0) to high (1) and vice versa, and stays there. For example, if we have a high (1) output, it will go low(0) once it receives an interrupt and stays low (0) till the next interrupt changes the status.

BC547 NPN TRANSISTOR

A semiconductor device like a transistor is one kind of switch which controls electrically. It consists of three terminals like an i/p, o/p & a control line. These are named as the emitter (E), collector(C) and base (B). A transistor works like a switch as well as an amplifier to convert the waves from audio to electronic. Transistors are smaller in size, long life and can operate with low voltage supplies. The first transistor was designed with Ge (germanium). In modern electronics, it is the basic building block and used in various electrical and electronic systems. The BC547 transistor is an NPN transistor. A transistor is nothing but the transfer of resistance which is used for amplifying the current. A small current of the base terminal of this transistor will control the large current of the emitter and base terminals. The main function of this transistor is to amplify as well as switching purposes. The maximum gain current of this transistor is 800A. The similar transistors are like BC548 & BC549. This transistor works in a fixed DC voltage in the preferred region of its characteristics which is called the biasing. Further, the series of this transistor can be divided into three groups based on the current gain like BC547A, BC547B & BC547C.

BC547 Transistor Pin Configuration:

The BC547 transistor includes three pins which include the following.



- Pin1 (Collector): This pin is denoted with symbol ‘C’ and the flow of current will be through the collector terminal.
- Pin2 (Base): This pin controls the transistor biasing.
- Pin3 (Emitter): The current supplies out through the emitter terminal.

A Transistor works as an amplifier while functions in the active region to amplify voltage, current, and power at various configurations. The amplifier circuit uses three configurations:

- Common emitter (CE) amplifier
- Common collector (CC) amplifier
- Common base (CB) amplifier

Working States of Transistor:

The working states of BC547 transistors include the following.

- Forward Bias.
- Reverse Bias.

In a forward bias mode, the two terminals like emitter & collector are connected to allow the flow of current through it. Whereas in a reverse bias mode, it doesn't allow the flow of current through it because it works as an open switch.

Features:

The features of the BC547 transistor include the following.

- The gain of DC current (hFE) = 800 A
- Continuous Ic (collector current) = 100mA
- VBE (emitter-base voltage) = 6V

- IB (base current) = 5mA
- The polarity of the transistor is NPN
- The transition frequency is 300MHz
- It is obtainable in semiconductor package like-92
- Power dissipation is 625mW

Precautions of this Transistor:

The precautions of this transistor include the following.

- To run the transistor for a long time in a circuit, it is very important that it doesn't increase the load more than 100mA.
- The voltage should not exceed 45V DC across the transistor.
- The base resistor should be used for providing the necessary current intended for saturation.
- Maintain the temperature from the above +150oC to -65 oC.
- Always verify the three terminals of the transistor while connecting in-circuit otherwise the performance can be reduced and the circuit can be damaged.

Applications:

Applications of BC547 transistors include the following.

- This BC547 transistor is used general-purpose, widely used and it is used as an alternative as well as a substitute to different kinds of transistors. Thus, it can use in different electronic circuits
- The utmost transition frequency of BC547 is 300MHz so that it will perform well within RF circuits.
- Amplification of current
- Audio Amplifiers
- Switching Loads < 100mA
- Transistor Darlington Pairs
- Drivers like an LED driver, Relay Driver, etc.
- Amplifiers like Audio, signal, etc..
- Darlington pair
- Quick switching
- PWM (Pulse Width Modulation)

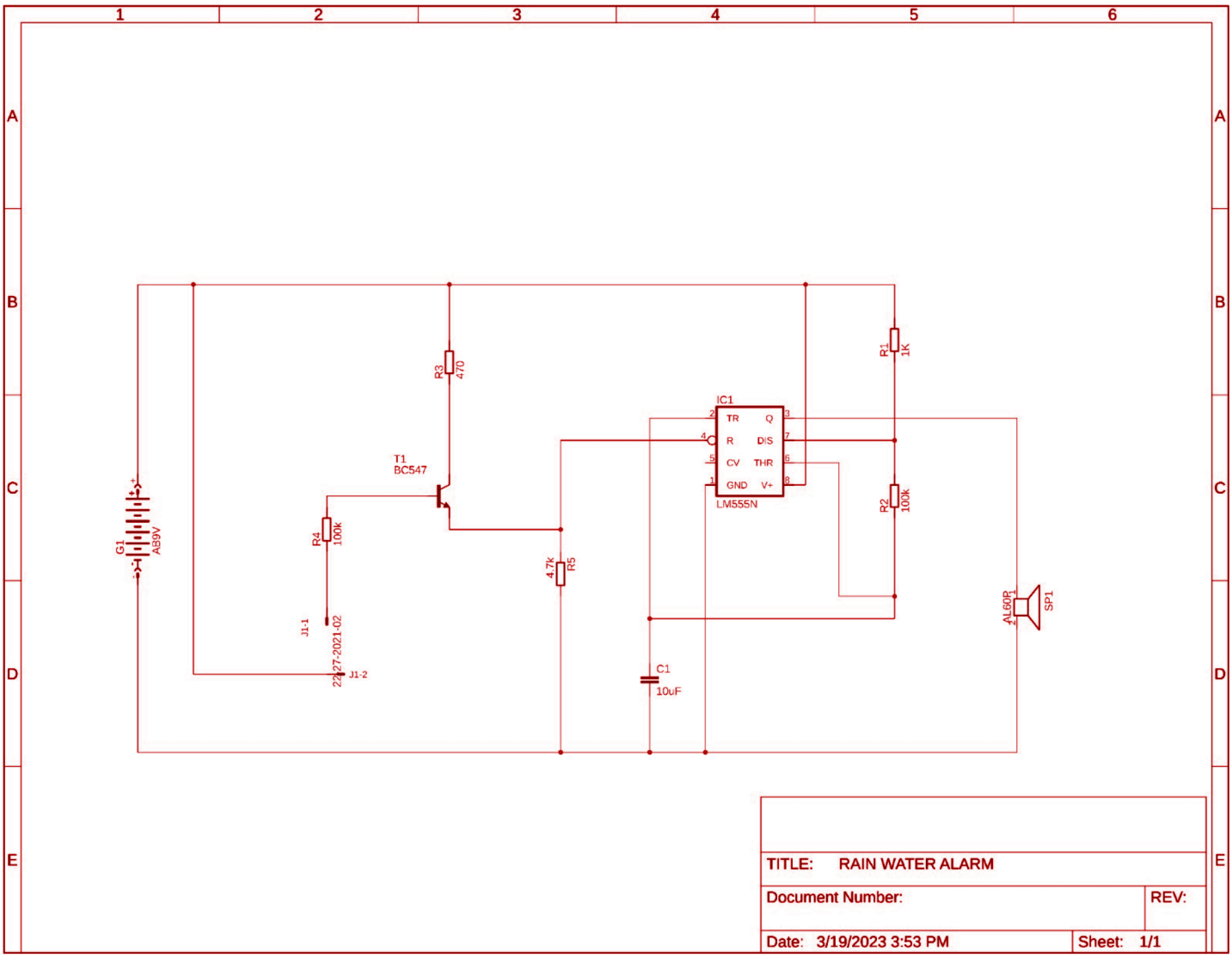
These transistors are used to build various electrical and electronic circuits which include the following.

- Alarm circuits
- LED flasher circuit
- Water level indicator

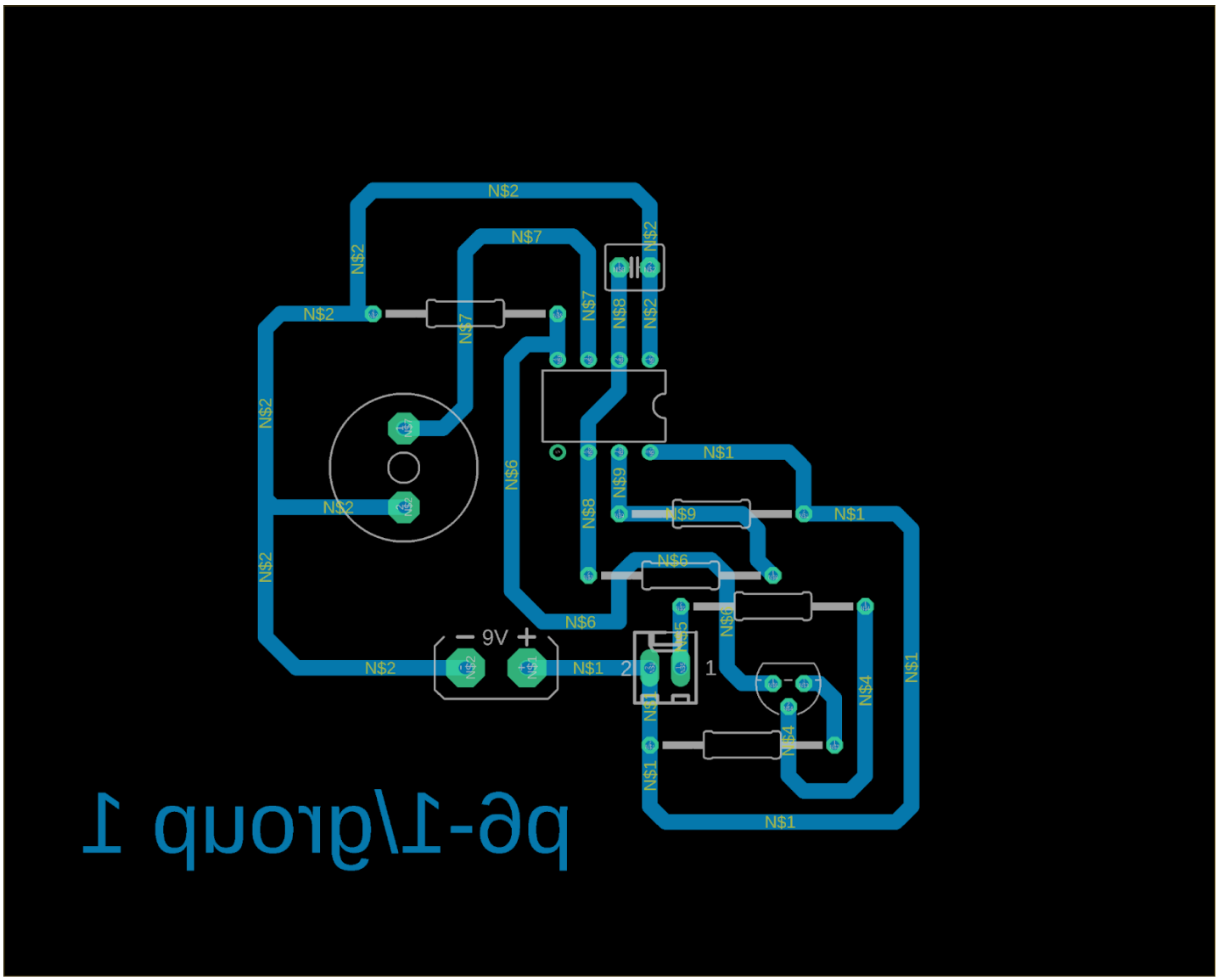
- Sensor-based circuits
- Audio Preamp circuits
- RF Circuits
- Touch-sensitive switch circuit
- Heat sensor circuit
- Moisture sensitive alarm
- Latch circuit
- Street light circuit
- Relay driver based on one channel
- Indication of volume level

PCB SCHEMATIC & LAYOUT

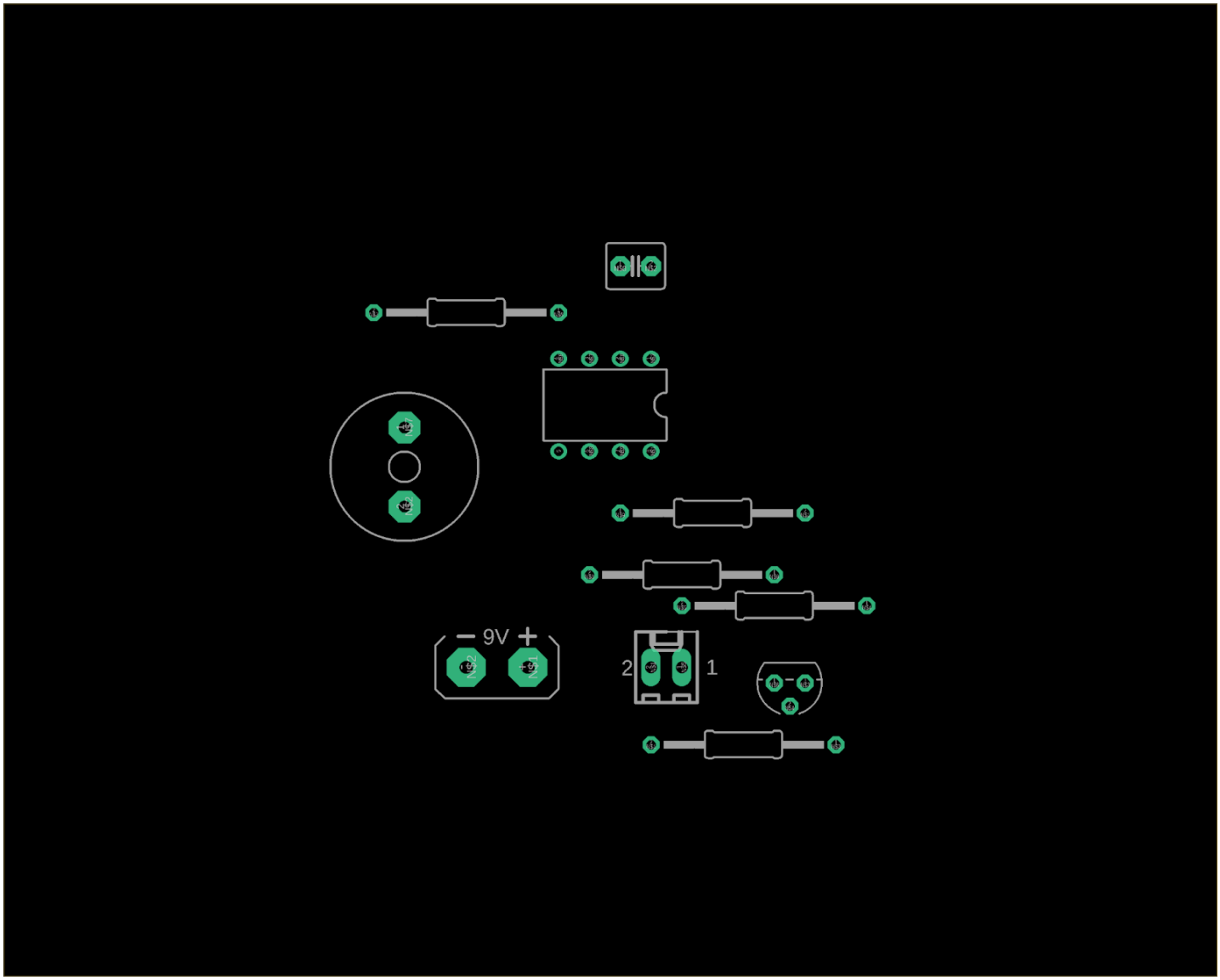
SCHEMATIC:



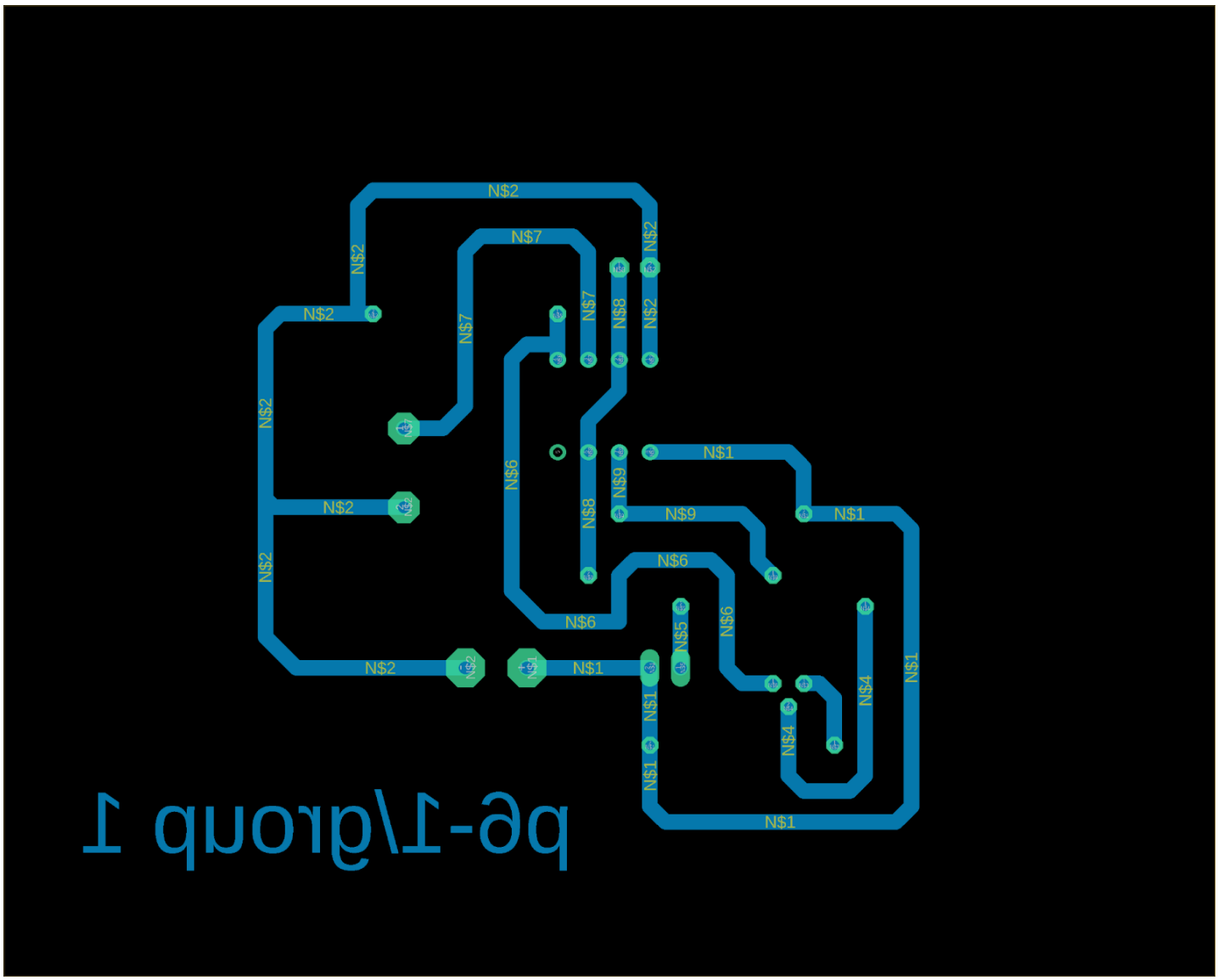
LAYOUT:



TOP VIEW:



BOTTOM VIEW:



APPLICATIONS

1. In the agricultural field rain is a basic need but if intense rainfall occurs it may damage the crops by affecting their root growth. When the rain detector detects rain it triggers the alarm. Rain detector alarm is an efficient way to stop irrigation whenever rain occurs.
2. In automobiles, when the rain detector detects the rain it will immediately activate the wipers and inform the driver.
3. In communications, it will boost the power of the antenna and increase the signal strength to send or receive the signals.
4. In a normal household, with the help of a rain water detector we can automatically save the rain water. This can be done only when home automation is done and there is proper equipment to save the rain water. In this, rain water detector will detect the rain and switch ON the equipment which will automatically save rain water for different purposes. It is also used in home automation by users to close the windows.
5. Since it can rain at any time without any warning, clothes in a clothes' line outside the house that are almost dry may get wet if we do not realize on time that it is raining.
6. This can also be used if there is a chemical rain also. This is very common in industrial areas.

REFERENCES

1. https://www.electronicshub.org/rain-alarm-project/
2. https://circuitdigest.com/electronic-circuits/rain-alarm-project
3. https://www.circuits-diy.com/how-to-make-rain-alarm-circuit-electronics-projects/
4. https://www.electronicsforu.com/technology-trends/learn-electronics/555-timer-working-specifications
5. https://www.elprocus.com/bc547-transistor-working-and-its-applications/

FEEDBACK

It was a challenging yet rewarding experience, working in the PCB workshop. There were lots of key learnings and takeaways from the sessions conducted in the semester. We understood how a PCB is fabricated and all the processes required for the same. We learnt to coordinate and work together as a team. We were able to develop a "RAIN SENSOR ALARM" from scratch under the guidance of Dr. Neethu Anna Sabu Mam whose immaculate knowledge and experience helped us to carry out the process smoothly. The project could thus be completed successfully. We got a chance to learn and implement many new skills while working on this project.

THANK YOU!