K. J. Somaiya College of Engineering, Vidyavihar, Mumbai 400077.

(A Constituent College of Somaiya Vidyavihar University.)

WATER LEVEL INDICATOR

Submitted as a part of PCB Workshop by First Year Students of B. Tech Artificial Intelligence and Data Science

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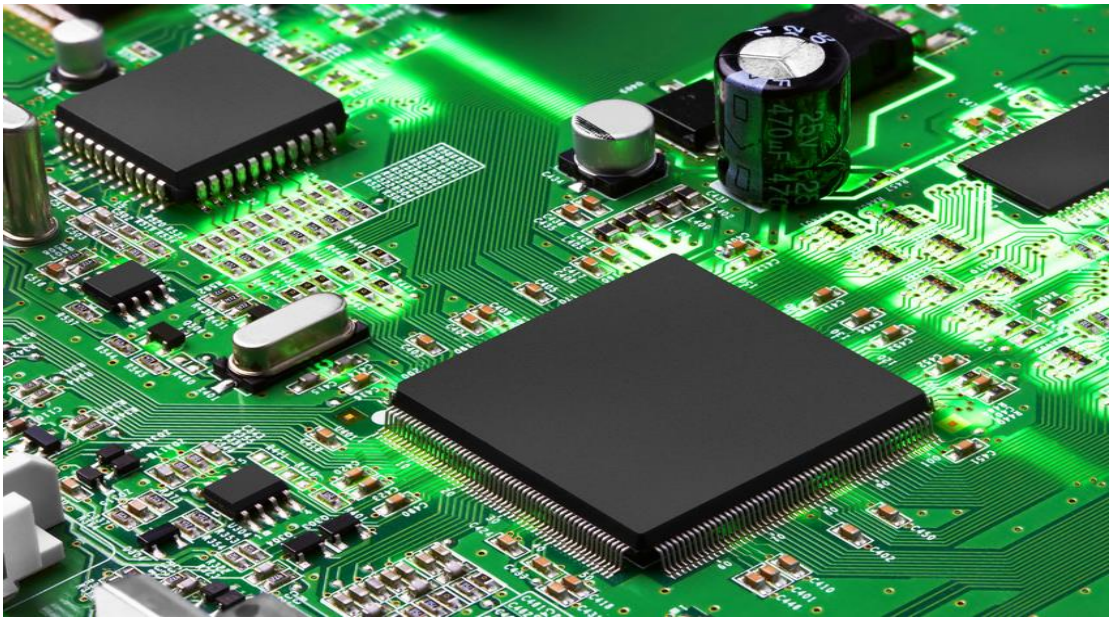
INTRODUCTION



What is a PCB?

A Printed Circuit Board (PCB) is a basic component of almost every electronic device nowadays. Whether it's a simple single-layer board found in domestic appliances such as garage openers, or an advanced multi-layer board found in smartwatches and high-end servers, PCBs serve as the basic structure that houses and links different electronic components.

These components like semiconductors, capacitors, resistors, diodes, and connectors are mounted on the PCB so that they can "talk" to each other and work together.

Most of the world's PCBs are rigid and constitute approximately 90% of the market. The rigid boards offer mechanical strength and consistent

performance. However, a portion of approximately 10% of PCBs are flexible — they can be folded and bent for use in compact or mobile applications, and they can withstand thousands of bends without being harmed. Rigid-flex PCBs also exist, where partial sections of the board are flexible and some are rigid, benefiting from both designs.

Another cutting-edge advancement in PCB technology is printed electronics. They are very thin and inexpensive circuits commonly found in wearables and disposable electronics. This technology presents new creative possibilities for electronic product design.

Development and Types of PCBs:

Conventional PCBs can be as straightforward as a single-layer structure or as complicated as over 50 layers. Copper tracks are employed in these boards to connect the different components and conduct signals efficiently.

PCB use started in the early 20th century, but the explosion of technological advancement has accelerated their development incredibly. With increasing demands for compact, high-speed, and efficient electronics, PCB fabrication has become increasingly sophisticated.

A major player in the PCB industry is Printed Circuits LLC, which was established in 1977. The company initially manufactured all types of PCBs before concentrating on the production of advanced rigid-

flex and flexible PCBs. Now, they provide PCBs to a broad spectrum of industries such as defense, healthcare, telecommunication, aerospace, and consumer electronics.

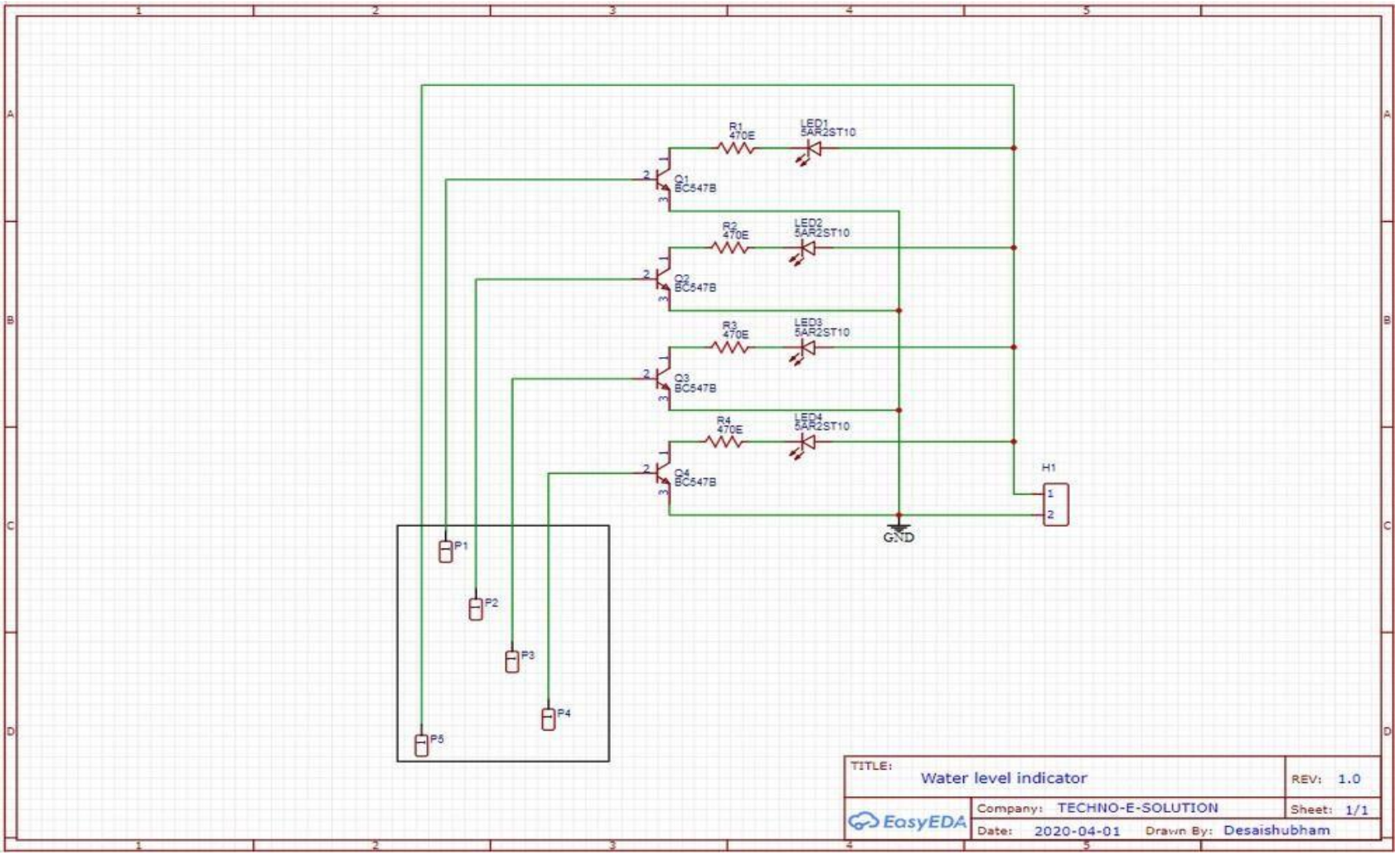
Why Are PCBs Used?

They have numerous benefits when compared to traditional wired circuits. PCBs are compact, light in weight, trustworthy, and maintainable. Producing them is cost-effective too, and they become the favorite when large-scale production is undertaken.
PCBs have characteristics which suit them best to be implemented across numerous industries.

PROJECT OVERVIEW

A water level indicator is a system that relays information about how high or low the level of water is in a particular water body. A water level indicator consists of circuit made of 4 LEDs to denote 4 different levels of water. The circuit is designed to indicate 4 levels of water in a tank or in any reservoir, when there is no or very less water in the tank no led is on which indicates the low level of water and when there is overflow or very high level of water the RED LED gets activated denoting very high or overflow of water. This device is very helpful and has a use in wide range use of industry-based application such as monitoring a sump pit (to control pump activation), rainfall detection, and leakage detection.

CIRCUIT DIAGRAM



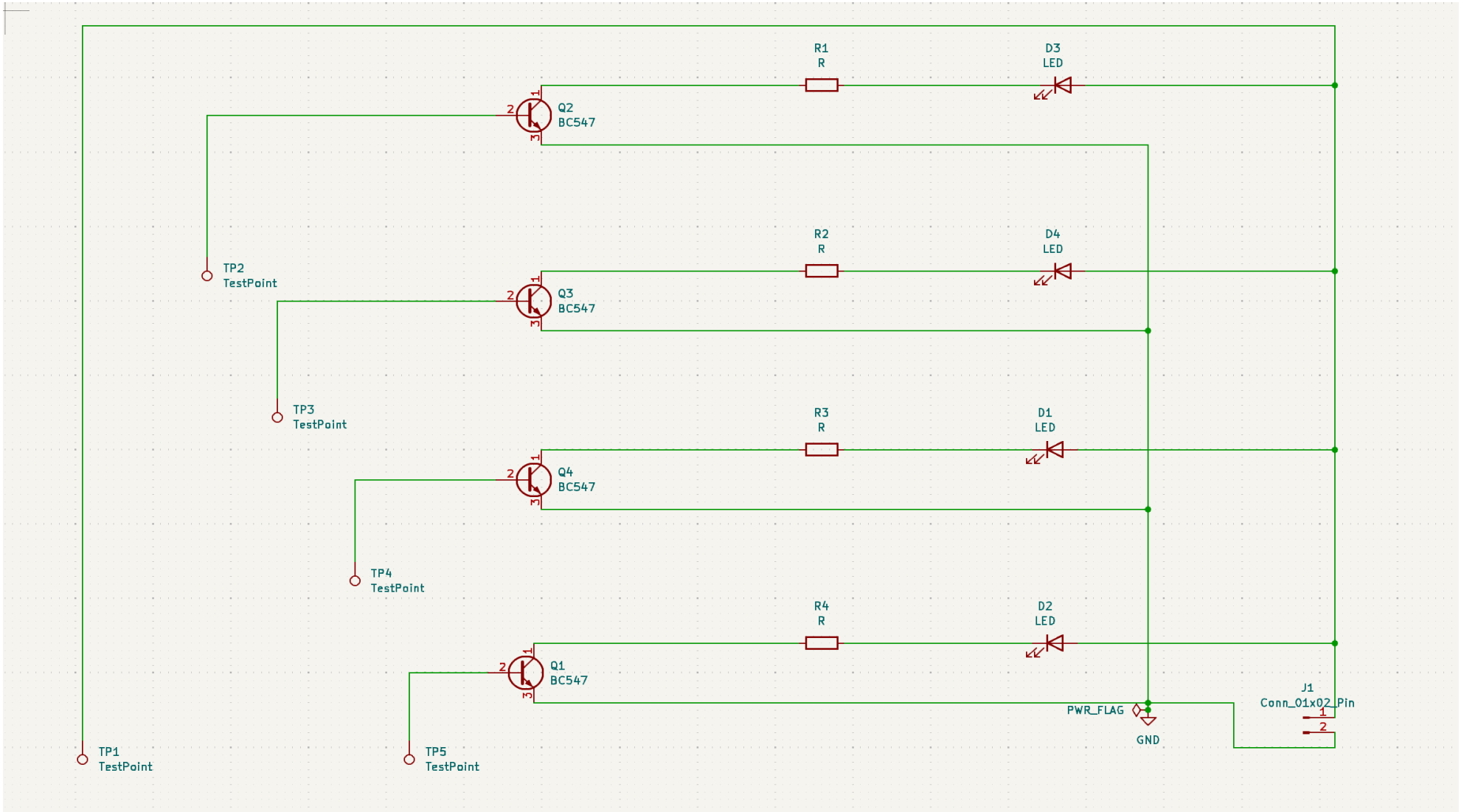
WORKING EXPLANATION

- The working of the circuit is very simple
- The 4 mounted pads are which are connected to the LEDs through transistors are placed inside the tank and the 5th mounted pad is directly connected to the output source.
- When the water level hits one of the particular mount pad the along with the mount pad connecting the battery the circuit gets complete and the led starts glowing.
- As we increase the water level gradually the different mount pads come in contact with the water and thus different LED glows.
- The circuit uses 4 BC547 transistors (J1, J2, J3, J4) which is a NPN

transistor. The base of the transistor is connected to the mount pad and the collector is connected to the resistor which is connected directly to the DIODES. And the emitter is connected to the GROUND.

- The circuit uses 5 470E resistors (R1, R2, R3, R4) connected directly to the LEDs (LED1, LED2, LED3, LED4).

SCHEMATIC DIAGRAM



COMPONENT LIST

COMPONENT NAME	TYPE	RATING
BC547	Transistor	Max Current gain 800mA
Multicolor LED	LED	5mm
Battery	Battery	9V
R1, R2, R3, R4	Resistors	470 ohms
Battery Cap	-	-
Insulated Copper Wire	Wire	Length-1mtr
PCB Board	-	-

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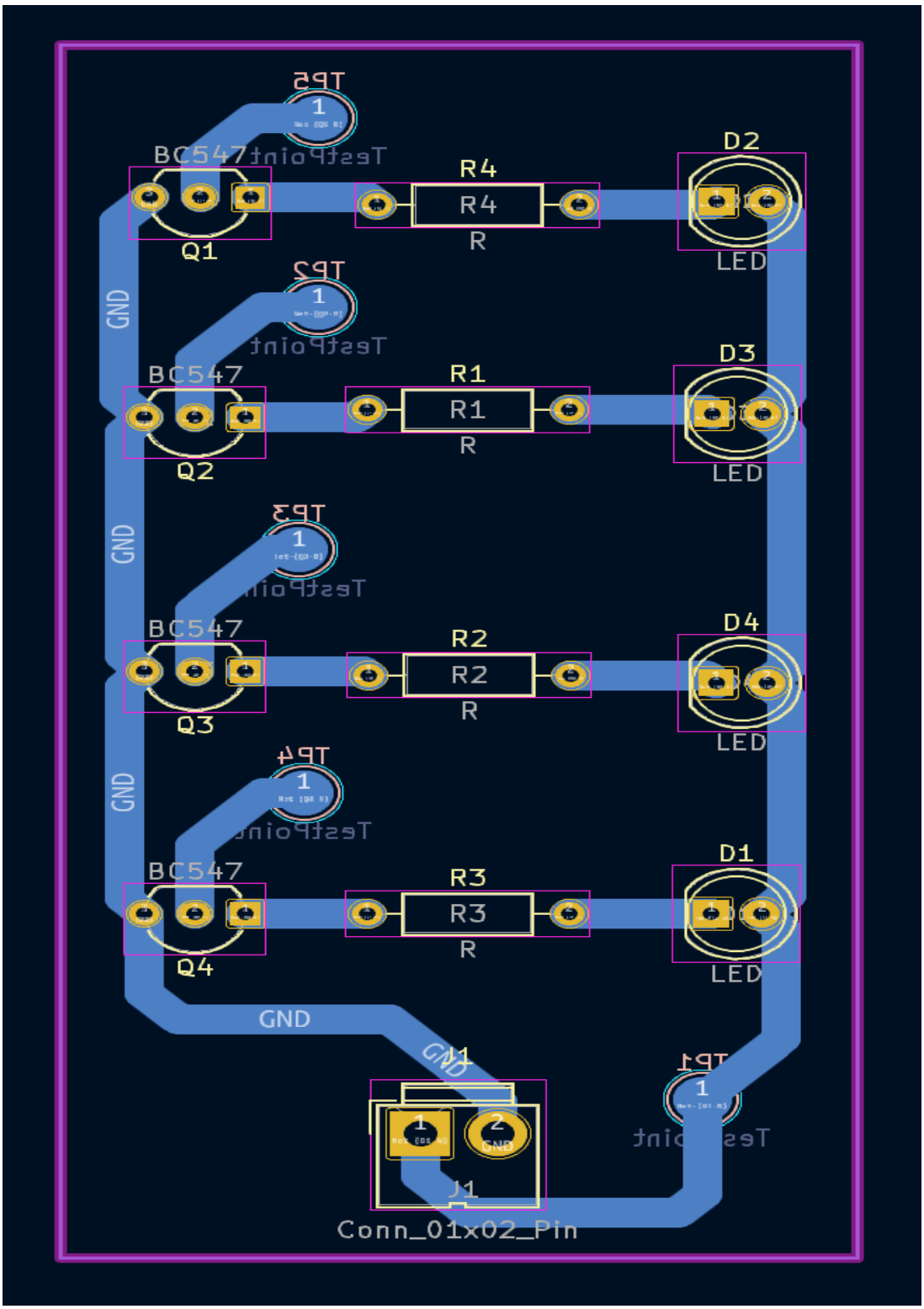
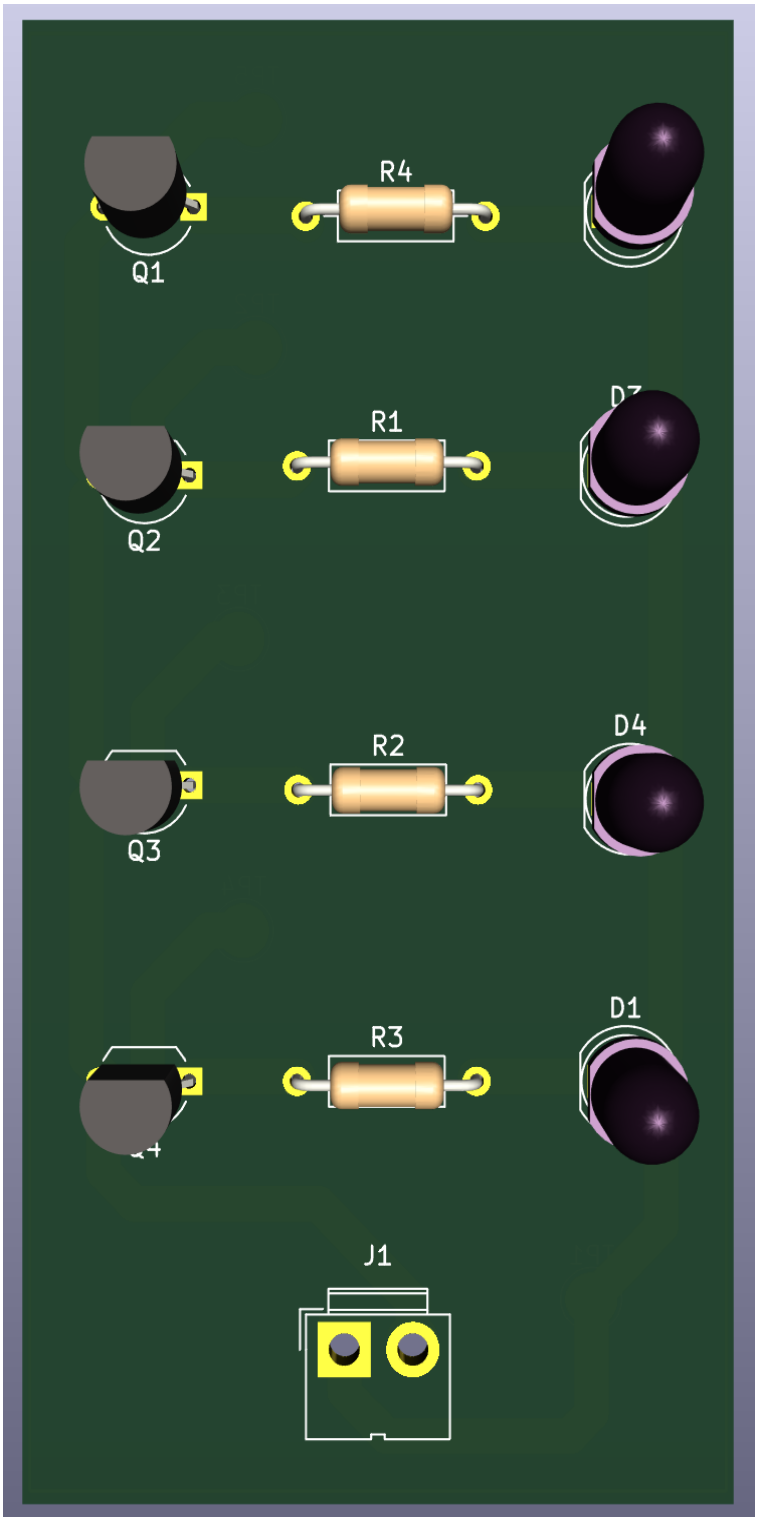
PCB LAYOUT



3D VIEW OF PCB



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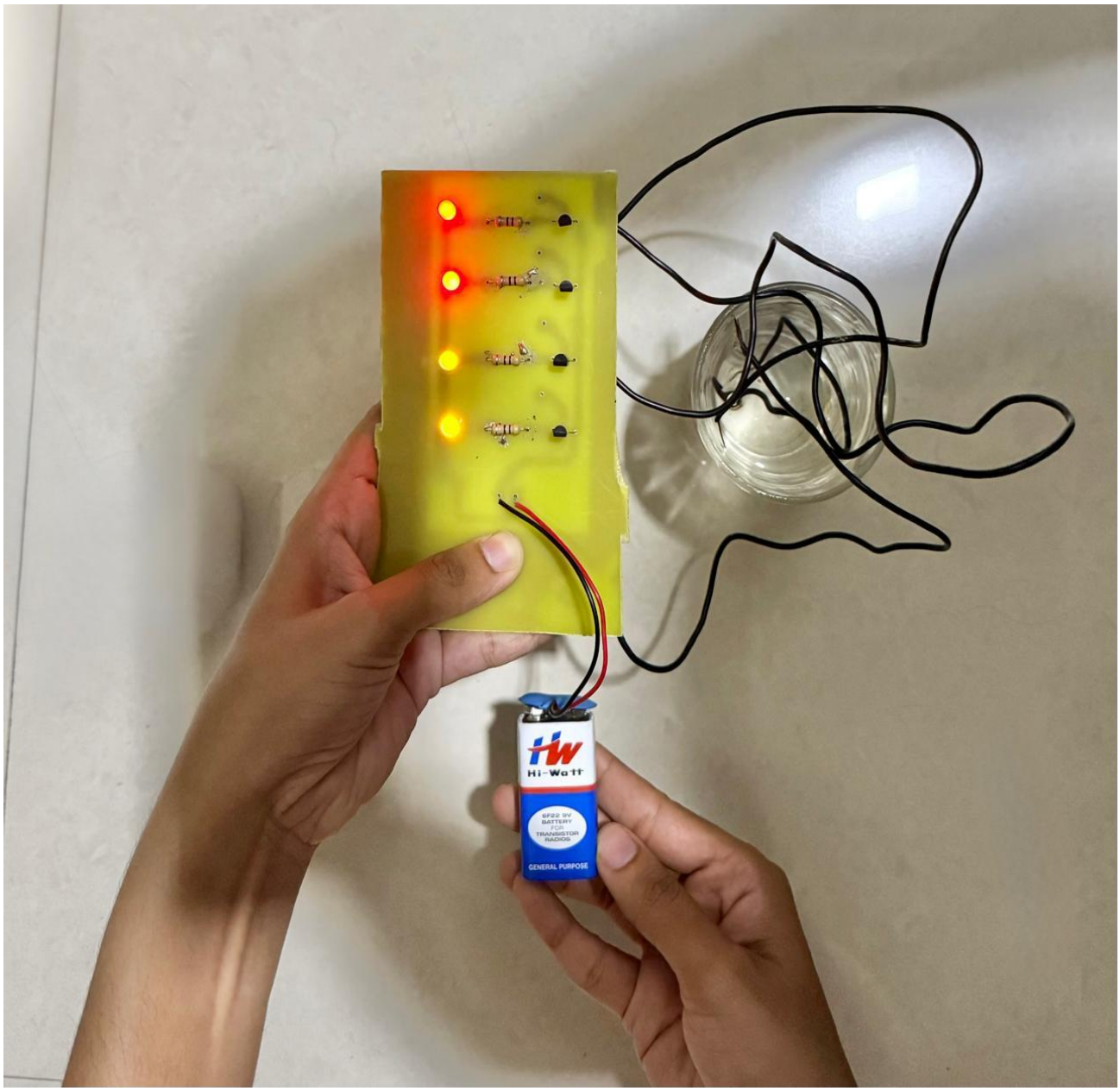
PCB MODEL



MAIN COMPONENTS OF THE CIRCUIT

- **BC547 Transistor**

The BC547 is a general-purpose NPN bipolar junction transistor (BJT) widely used in low current, medium voltage, and low power switching and amplification applications. It has three terminals: the collector, base, and emitter. When a small current flows into the base terminal, it allows a larger current to flow from the collector to the emitter. The BC547 typically handles collector currents up to 100 mA and voltages up to 45V, making it suitable for various electronic projects and circuits, especially in switching and signal amplification.

In practical applications, the BC547 is often used in signal processing, sensor circuits, and microcontroller interfacing due to its sensitivity and fast response. Its compact TO-92 package allows it to be easily mounted on breadboards and PCBs. Additionally, its affordable cost and availability make it a go-to choice for beginners and professionals alike in electronics prototyping.

- **470 Ohm Resistor**

A 470-ohm resistor is a passive electronic component that limits the flow of electric current in a circuit. It follows Ohm's Law, where resistance (measured in ohms, symbol: Ω) controls the current according to the formula V = IR. This specific resistance value is commonly used in circuits involving LEDs to prevent excessive current, which could damage sensitive components. The resistor helps ensure a safe and stable operation by dropping voltage or regulating current flow.

Physically, resistors are small cylindrical components marked with coloured bands that indicate their

resistance value and tolerance. The 470-ohm resistor is often color-coded with yellow, violet, and brown bands. It's widely used in electronic circuits for current limiting, voltage division, and pull-up/down applications. Its reliability, low cost, and simplicity make it an essential part of any electronics toolkit.

- **LED (Light Emitting Diode)**

An LED, or Light Emitting Diode, is a semiconductor device that emits light when an electric current passes through it. It operates based on electroluminescence, where electrons recombine with holes in the material, releasing energy in the form of visible light. LEDs are polarity-sensitive components with two terminals: the anode (positive) and cathode (negative). They are energy-efficient, long-lasting, and available in various colours, shapes, and sizes, making them suitable for everything from indicator lights to displays and illumination.

In electronic circuits, LEDs are often used as indicators to show power status or signal activity. They require a current-limiting resistor (such as a 470-ohm resistor) to avoid being damaged by excessive current. LEDs are essential in modern electronics due to their low power consumption, durability, and versatility. They're used in applications ranging from small electronic gadgets to large display panels and lighting systems.

APPLICATIONS

1. Domestic Applications

- **Water Tank Monitoring:** Helps homeowners keep track of water levels in overhead and underground tanks.
- **Water Conservation:** Prevents wastage by alerting users when tanks are full or nearing empty.
- **Pump Automation:** Can be integrated with pumps to turn them on or off based on water levels.

2. Industrial Applications

- **Boilers and Cooling Towers:** Ensures water levels in industrial boilers and cooling towers remain optimal to prevent damage.
- **Chemical and Pharmaceutical Plants:** Monitors liquid levels in storage tanks for process efficiency.
- **Manufacturing Units:** Used to control water levels in processes requiring precise liquid handling.

3. Agricultural Applications

- **Irrigation Management:** Helps farmers maintain proper water levels in storage tanks for irrigation.
- **Well and Borewell Monitoring:** Ensures a stable water supply by indicating depletion levels.
- **Automated Watering Systems:** Triggers water flow for crop irrigation when levels drop below the required threshold.

4. Commercial and Institutional Use

- **Hotels and Apartments:** Ensures uninterrupted water supply by monitoring storage tanks.
- **Hospitals and Schools:** Helps in maintaining an adequate water supply for sanitation and other utilities.

- **Shopping malls and Office Buildings:** Prevents overflow and ensures efficient water distribution.

5. Water Supply and Distribution Systems

- **Municipal Water Supply Monitoring:** Tracks reservoir and overhead tank levels to regulate supply.
- **Smart Water Management Systems:** Can be integrated with IoT devices for real-time water level data and analytics.
- **Water Treatment Plants:** Monitors water levels in filtration and purification tanks.

6. Marine and Navigation Applications

- **Ships and Submarines:** Used to monitor ballast tanks and storage water levels.
- **Dams and Reservoirs:** Helps in flood management by tracking rising water levels.
- **Underground Water Storage:** Tracks groundwater levels for sustainable use.

7. Environmental and Disaster Management

- **Flood Detection and Prevention:** Monitor's River or dam water levels to predict and manage floods.
- **Rainwater Harvesting Systems:** Ensures optimal water storage in rainwater collection tanks.
- **Sewage and Drainage Systems:** Helps prevent overflow in wastewater treatment plants.

8. Smart Homes and IoT Integration

- **Remote Monitoring:** IoT-enabled water level indicators provide real-time alerts via mobile apps.
- **Automation with AI Assistants:** Can be integrated with smart home systems to manage water usage efficiently.
- **Leak Detection Systems:** Helps in detecting leaks by monitoring unexpected water level changes.

REFERENCE

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