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Title :

Water level indicator using BJT.

Objective:

The objective of a water level indicator using a BJT is to provide a reliable cost-effective solution for monitoring water levels.

Introduction :

A water level indicator is a system that relays information back to a control panel to indicate the high or low water level. The purpose of a water level indicator is to gauge and manage water levels in a water tank. Water level indicators can be used in Hotels, Pools, Factories, fire protection systems in buildings and more. Without water level indicators in a water tank, one would have to manually check whether enough water is in the tank or not. Water level indicators allow to remotely monitor water levels.

Our water level indicator using BJT is a very useful project to notify the user about the amount of the water in the water tank. This project helps us to learn about the real life applications of BJT.

Motivation:

The traditional method of manually checking water levels can be cumbersome. Moreover, the method comes with the risk of human error, which can lead to disaster in scenarios where maintenance of a certain water level is crucial. By harnessing the advantages of low power BJTs, the indicator offers a reliable, low cost and energy efficient way to measure and maintain water levels with precision.

Relevant Theory:

The abbreviation BJT, from bipolar junction transistor, is often applied to three-terminal device. The term bipolar reflects the fact that holes and electrons participate in the injection process into the oppositely polarized material. Bipolar junction transistor (BJT) is the type of transistor and three-

terminal semiconductor device, which has two p-n junctions. They are mainly used as amplifiers or current controlled devices in electronic circuits. Both the electrons and holes will act as the charge carriers in the bipolar junction transistor. The three terminals are namely, base, emitter and collector. For the biasing the terminals have been indicated by the capital letters E for emitter , C for collector , and B for base .In BJT, a small amount of current will flow between base and emitter terminals and a larger current will flow between collector and emitter terminals. The transistor is a three-layer semiconductor device consisting of either two n - and one p - type layers of material or two p - and one n -type layers of material. The former is called an npn transistor , and the latter is called a pnp transistor.

Water is a conducting material due to the ions that are present in it. So it can complete a circuit if the two terminals are submerged in it.

Apparatus :

List of equipment that were needed for this project:

Name	Quantity
Bipolar junction transistor (BJT)	3
220 ohm resistance	3
LED	3
Bread board and wires	1 set
9V battery	1

Circuit Diagram:

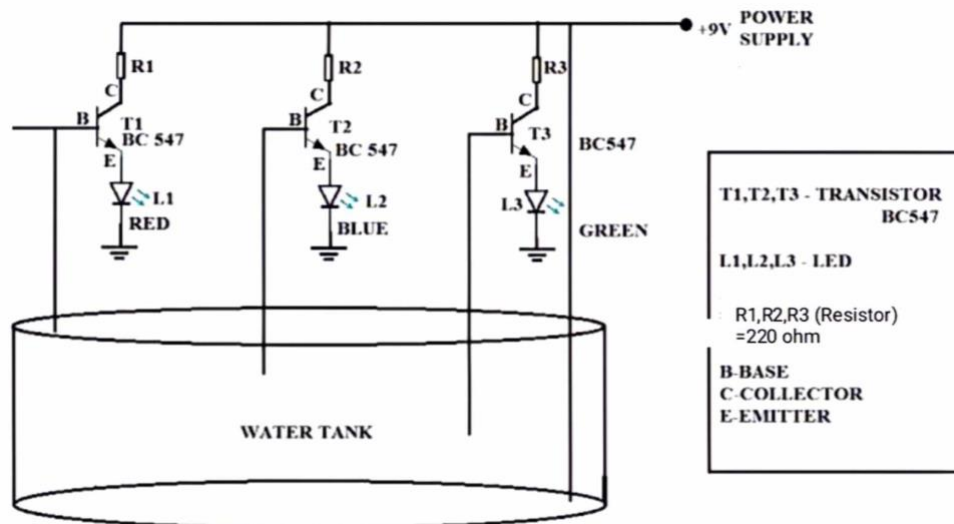


Fig 1: Water level indicator Circuit.

Circuit Explanation :

- Connect three BJT's collector terminal to three different LED's negative side(shorter pin) and LED's positive side (longer pin) to the positive side of the breadboard.
- Connect each of the three resistance with each BJT's base.
- Connect 3 wires from the emitter of the transistor to the negative rail of the bread board.
- Connect 3 wires from the resistance and 1 wire in the positive side of the breadboard.
- Finally connect the 9v battery (negative side to the negative end of the breadboard and positive side to the positive end of the bread board)

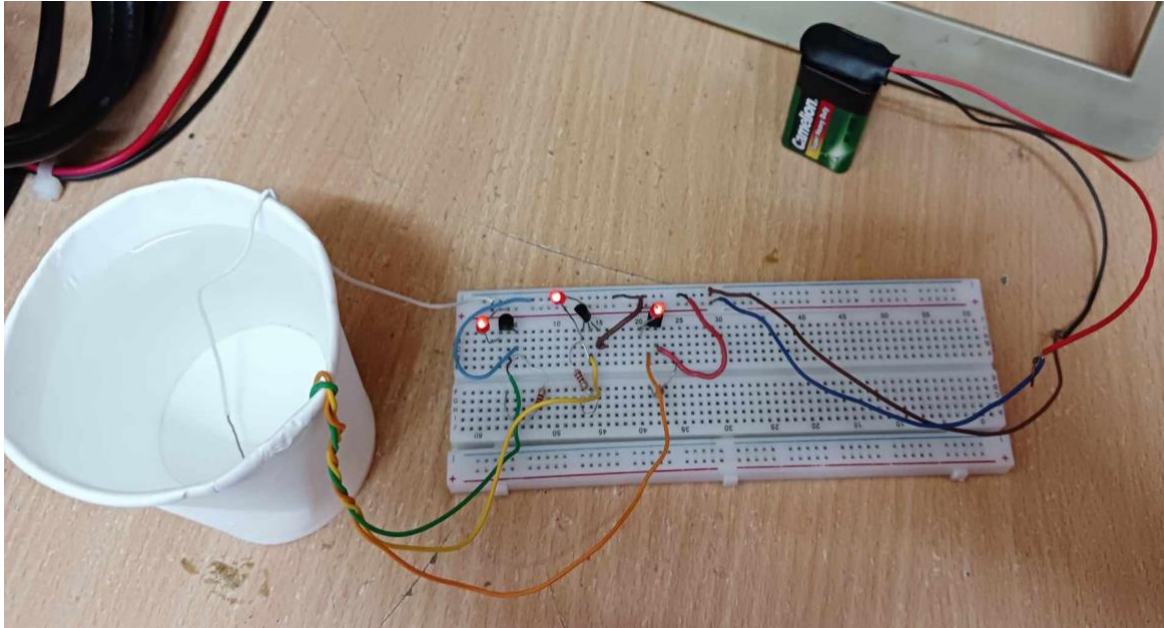


fig 2: Water level Indicator using BJT

Working Policy:

BJT working as a switch, the base terminal is put into the water vessel, when water touches the base terminal, the circuit completes and the current starts flowing and LED connected to the collector terminal glows and indicate that the water level is raised. The circuit consists of a 9v battery, BJT transistors, resistors, and three wires to indicate the water level of tank. A wire connected to the base of BJT transistor and another is connected to the ground.

When water touches the wire, it completes the circuit and allowing current to flow through the base-emitter junction of the BJT transistor. This current flow turns on the transistor, allowing current to flow from the collector to the emitter.

The collector-emitter circuit can be used to drive an LED to indicating the water level. The three wires indicates the three multiple levels of tank.

Discussion:

BJT controls the output current (collector-emitter loop) based on the input current (base-emitter loop). When the base emitter current starts flowing through a greater portion of it passes through the base-collector junction and further flows through the collector terminal.

The occurrence described only happens when the collector-base terminal is generally put into reverse bias and the emitter–base terminal is kept at forward bias. If the base-emitter terminal is left open circuited the collector terminal does not have enough current flowing through it to power anything connected to it(it still has a very small, trivial current flows due to minority carriers).

Current at a fundamental level is the flow of electrons. When the base terminal wire touches the water that already has the positive terminal of the battery wire submerged, the loop is completed. Water has mineral ions that can freely move and carry electrons from one wire to another, completing the loop in process. And as the base-emitter current starts flowing, so does the base-collector current. As a result the LED lights up giving us the indication where the water level is currently at, since the wiring measurement was known to us beforehand.

Result Analysis:

The water level indicator lights the LED when the water reaches the LED's assigned level, giving a precise water level reading.

Conclusion:

The water level indicator using the BJT project offers a reliable solution for monitoring water levels. This system can accurately detect and indicate water levels. As BJT transistors have low power consumption, it offers an energy efficient solution for continuous monitoring. Its simplicity is suitable for wide range of applications from small-scale residential tanks to large industrial reservoirs.

However, this project provides a practical and efficient way to ensure ideal water management. It can give rid from the difficulties of overflow or shortage issues.

Reference :

- Electronic Devices and Circuit Theory (11th Edition) by R. Boylestad and L. Nashelsky
- <https://www.electronicshub.org/water-level-alarm-using-555-timer/>
- <https://byjus.com/jee/transistor/>