B.Tech Semester-4

Special Assignment - Analog Electronics

PROJECT REPORT

A3 batch

22bec053 Ishaan Patel

22bec058 Jatin Shrimali

Submitted To :- Jayesh Patel Sir

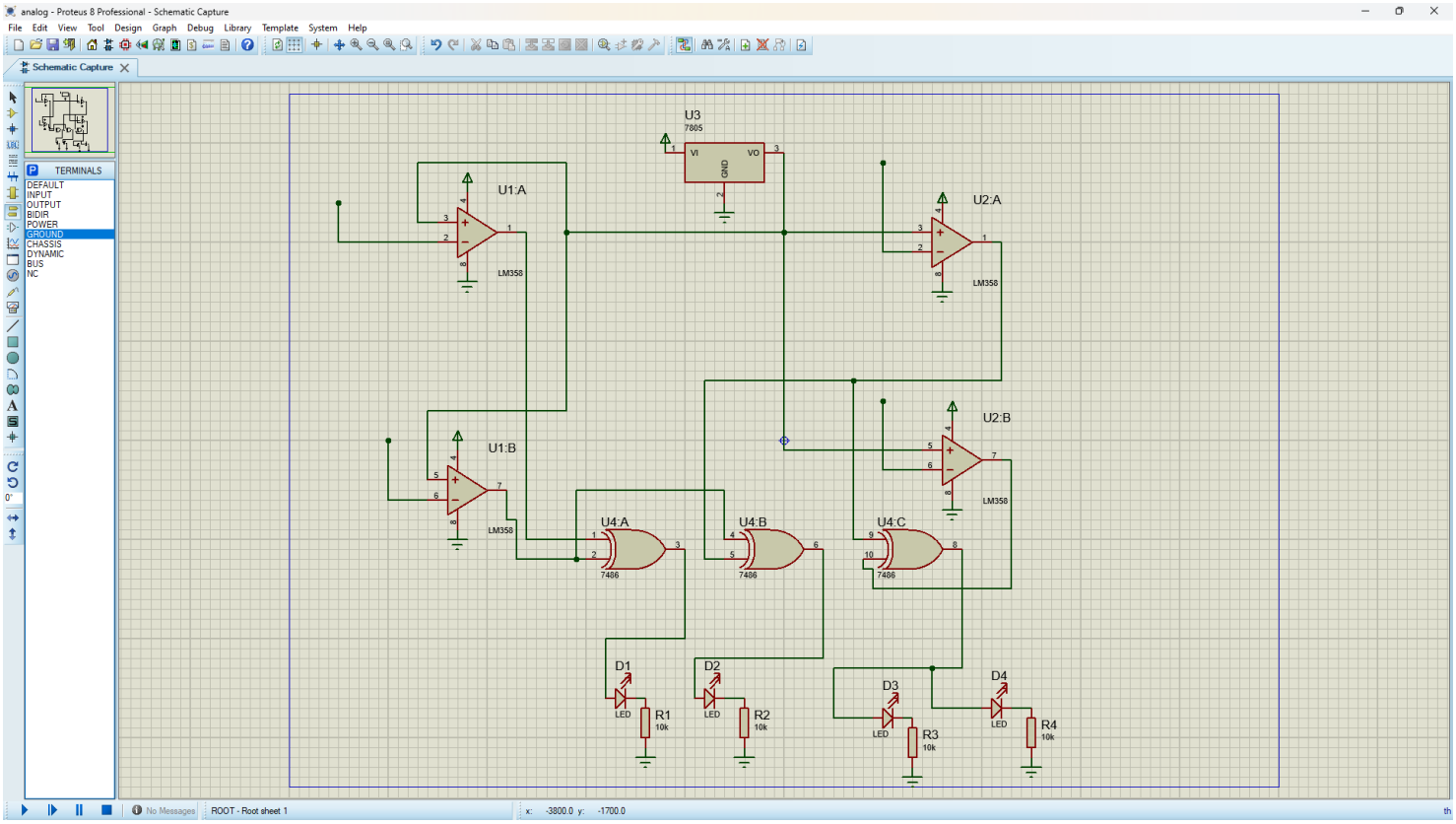
Water Level Indicator

24th April 2024

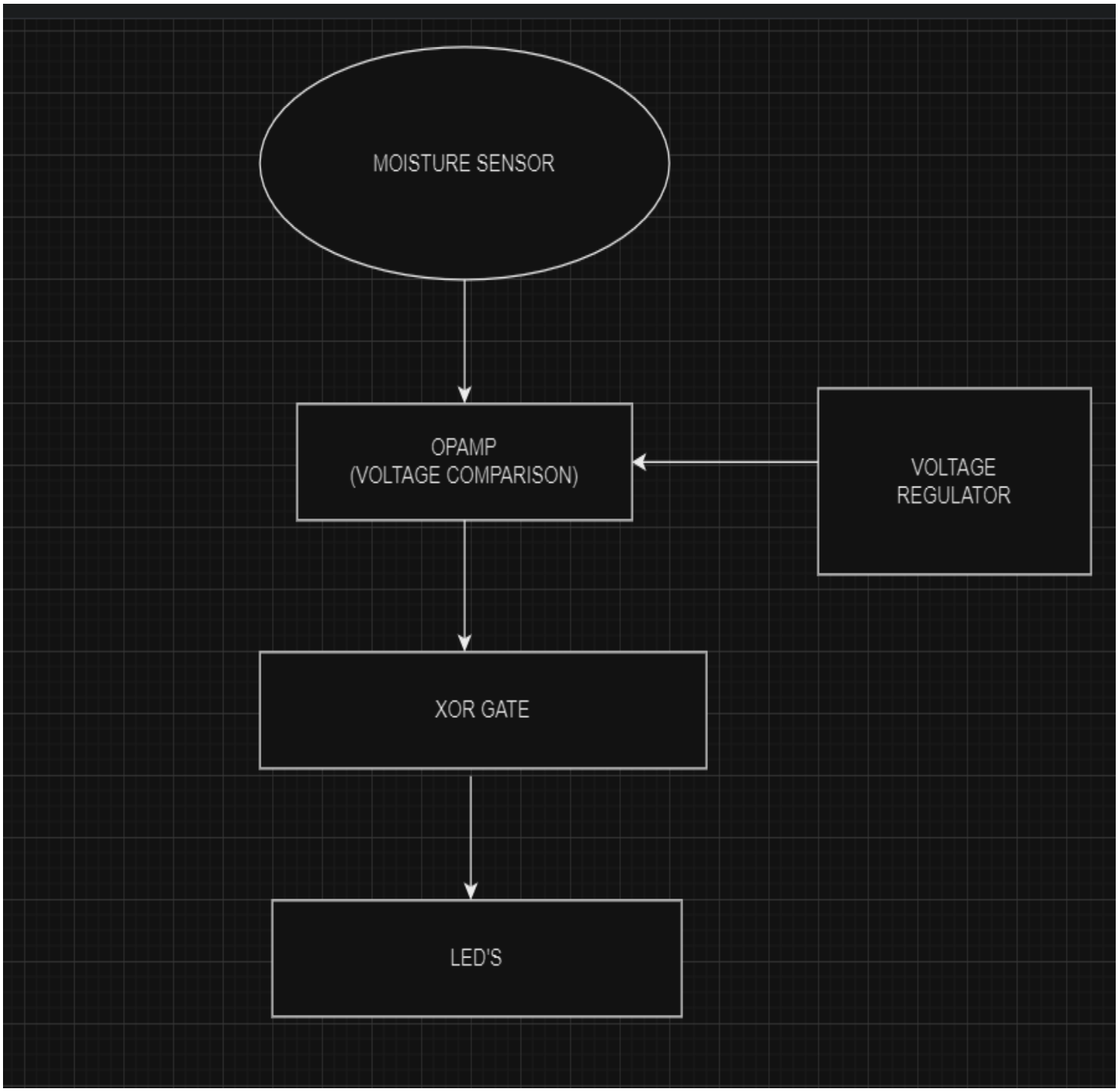
Introduction

In this project we have used operational amplifiers (op-amps) to create a complex 4-level water indicator. Moisture sensors are positioned at various levels in a smart manner in this novel system. Each sensor deactivates the previously illuminated light-emitting diode (LED) and activates a corresponding LED as water progressively rises. The accuracy of monitoring is improved by this sequential lighting method, which guarantees accurate water level detection. Smooth LED activation and deactivation is made possible by the op-amp architecture, which also provides accurate threshold detection and effective signal amplification. This water indicator offers a dependable way to monitor water levels in a variety of settings, from home water tanks to industrial reservoirs, in addition to providing visual feedback. It provides a practical solution at a reasonable cost and is an indispensable tool for water management applications due to its simplicity, efficacy, and scalability.

Circuit



BLOCK DIAGRAM



Components Used in the Project

The water level indicator is designed mainly using LM358 Op-amp,Moisture sensor, Voltage Regulator and XOR gate.

LM358(OP-AMP)

The LM358 is a widely used dual operational amplifier (op-amp) integrated circuit (IC) manufactured by various semiconductor companies. Here are some key points about the LM358 op-amp:

1)Dual Operational Amplifier: The LM358 contains two independent, high-gain, frequency-compensated operational amplifiers in a single package. This dual configuration makes it suitable for applications requiring multiple op-amps, saving space and reducing costs.

2) Low Power Consumption: It is designed for low power consumption, making it suitable for battery-powered applications or circuits where power efficiency is crucial.

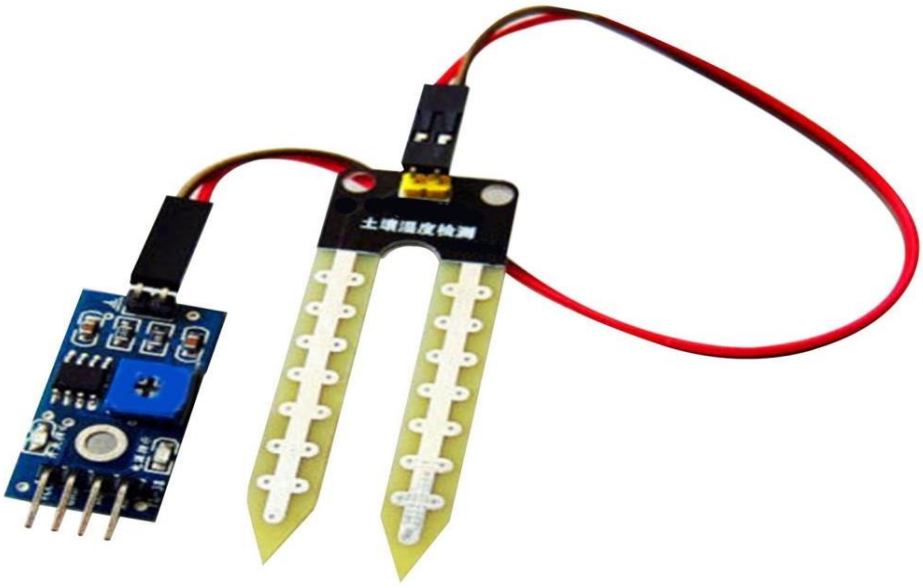
3) Wide Supply Voltage Range: The LM358 can operate from a wide range of supply voltages, typically from a single positive supply voltage (e.g., 3V to 32V) or dual supply voltages (e.g., ±1.5V to ±16V).

Moisture Sensor(HW080)

The HW-080 moisture sensor operates based on the electrical conductivity concept. The sensor detects the resistance between two embedded electrodes, and the resistance changes based on the soil's moisture content. The resistivity is highest in dry soil and diminishes with increasing moisture content.

Construction: The sensor is normally composed of two electrodes that are implanted in a protective housing and are typically made of materials that are resistant to corrosion, such as gold or stainless steel. To enable direct touch with the earth, uncovered sections of the housing are common.

Operating Voltage: The HW-080 moisture sensor is compatible with the majority of microcontroller systems and digital circuits since it normally operates at low voltages, ranging from 3.3V to 5V.



Voltage Regulator(7805)

1)The 7805 is a member of the 78xx series of fixed linear voltage regulators. It is designed to provide a regulated output voltage of +5 volts (+5V) from an unregulated input voltage.

2)It is a three-terminal device with an input (Vin), ground (GND), and output (Vout) pin. When connected in a circuit, it regulates the output voltage to a steady +5V regardless of variations in the input voltage or load current within its specified limits.

3)The 7805 is widely used in electronic circuits, especially in microcontroller-based projects, to provide a stable power supply voltage.

XOR Gate (7486)

1)The 7486 IC is a quad 2-input XOR gate IC, meaning it contains four individual XOR gates in a single package.

2)Each XOR gate within the 7486 IC has two inputs (A and B) and one output (Y).

3)The inputs (A and B) of each XOR gate can accept digital signals (either HIGH or LOW), and the output (Y) provides the result of the XOR operation on the inputs.

4)The 7486 IC is commonly used in digital electronics for various applications such as arithmetic operations, data encryption, parity generation and checking, and signal processing..

WORKING

1)We utilize op-amps as voltage comparators to monitor the voltage levels from the moisture sensor and the voltage regulator.

2)The op-amp is configured with its non-inverting input (pin 3) connected to the output of the voltage regulator and its inverting input (pin 2) connected to the output of the moisture sensor.

3)Pin 4 (the ground pin) of the op-amp is connected to ground to provide reference potential.

4)As a result, the voltage at the inverting input (pin 2) of the op-amp is higher than that at the non-inverting input (pin 3), causing the op-amp's output to be low (0V).

5) When the moisture sensor detects water, its voltage decreases due to the conductivity of water, causing the voltage at pin 2 to drop.

6)If the voltage at pin 2 becomes lower than that at pin 3, the op-amp's output switches to a high state (+Vcc). This high output voltage from the op-amp activates the LED connected to its output pin, indicating the presence of water at the corresponding level.

7)To achieve the desired functionality where the illumination of LEDs alternates between successive levels of water detected by the sensors, we employ XOR gates in our circuit design.

8)When water reaches the second sensor, for instance, we take the XOR of the outputs from the first and second op-amps.

9)If the output of the first op-amp is high (indicating water detection at the first sensor) and the output of the second op-amp is low (indicating no water detection at the second sensor), the XOR gate outputs a high signal.

10)This high signal activates the LED associated with the second sensor, while simultaneously deactivating the LED associated with the first sensor, as desired.

11)Similarly, this XOR logic is applied for subsequent sensors, ensuring the sequential activation and deactivation of LEDs as water levels rise.

Bill Of Material

Sr. No.	Item	Quantity	Price
1	LM 358	2	2*20=40
2	Voltage Regulator(7805)	1	20
3	XOR gate(7486)	1	50
4	LED	4	4*4=16
5	Moisture Sensor	4	4*38=152
6	Miscellaneous(Jumper wire, IC Socket etc.)	2	100
		TOTAL	378

Conclusions

Our water level indicator project uses XOR gates and operational amplifiers (op-amps) to demonstrate a simple, effective method of monitoring water levels. We have created an accurate way to detect and display water levels by carefully combining voltage regulators with moisture sensors. Users can easily monitor water levels thanks to the sequential activation and deactivation of LEDs, which provide clear visual feedback as water rises or decreases. The incorporation of XOR gates enables smooth transitions between LED states, guaranteeing accurate and effective regulation of LED brightness. This project shows how digital logic and analog components can be used effectively to produce a workable solution for water level monitoring in a variety of applications, such as industrial reservoirs and agricultural irrigation systems.