Water and Oil Level Sensing

OBJECTIVE

- Underfill Prevention
- System Alerts and Maintenance
- Continuous Water Level Measurement

FEATURES

- Non-Contact with Liquid

APPROACHES

1. **Capacitive Sensors:-** These sensors detect changes in capacitance caused by the liquid level inside the container. They are usually mounted outside and can measure levels through non-metallic containers.

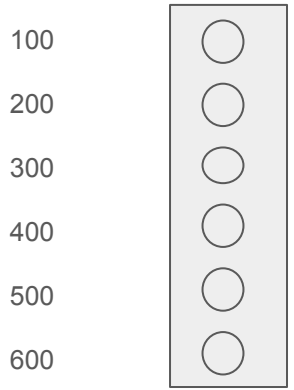
   Advantages:- Non-Contact
   Easy to Fit
   Durable

   Disadvantages:- Costly
   Less Accurate
   Thickness of Container Matter

Concept and Working using Capacitive Sensor

- Multiple sensors (4-5) are arranged in sequence on a strip, which is then attached to the container.

- By monitoring the activation of each sensor, we can accurately determine the water level within the container.



2. **Ultrasonic Sensors:-** An ultrasonic sensor placed at the top of the container emits sound waves, which reflect off the liquid's surface and return to the sensor. By calculating the time taken for the sound to bounce back, you can determine the distance from the sensor to the liquid.

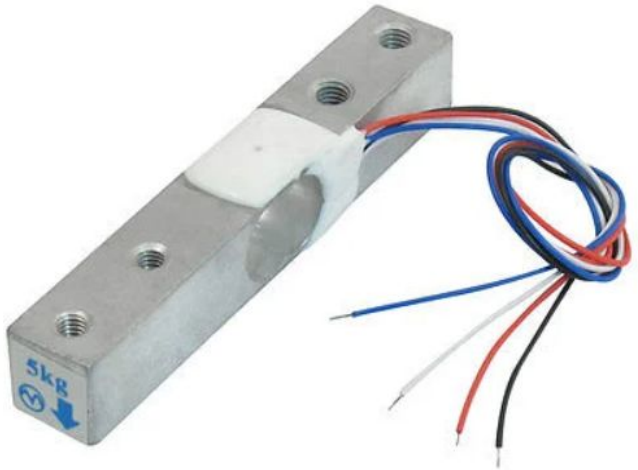
Advantages:- Non-Contact
Cost Effective
Accurate

Disadvantages:- Placing the sensor.

3. **Load Cells:-** It measures the container's weight change as liquid is added or removed. By knowing the density of the liquid, you can calculate the volume at various levels

Advantages:- Non-Contact
Easy to Fit

Disadvantages:- 1. Calibration Needed for Each Liquids
2. Placement



4. **Pressure Sensors:-** It measure the hydrostatic pressure at the bottom of a tank. Since water pressure increases with depth, the sensor can calculate the water level based on pressure readings.

Advantages:- Non-Contact
Easy to Fit
Accurate

Disadvantages:- Calibration Needed
Not Accurate

5. **Setting Up Continuous-Level Capacitive Sensing:-**

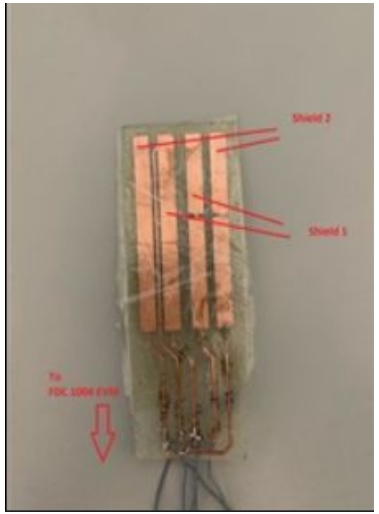
- Two parallel conductive plates or a cylindrical probe that placed vertically with container.

- Conductive Plates or probes to a capacitance measurement circuit like RC (resistor-capacitor) circuit, oscillator, or microcontroller with a capacitive measurement interface.

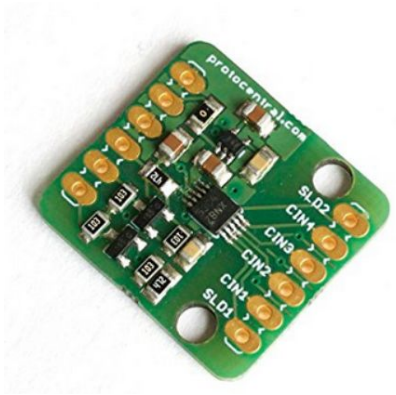
- As water level changes, the capacitance changes, altering the charging time of the capacitor. Measure the time it takes for the voltage to reach a threshold(half of the voltage).

- Using this timing as a proxy for capacitance and thus for water level.

Concept and Working

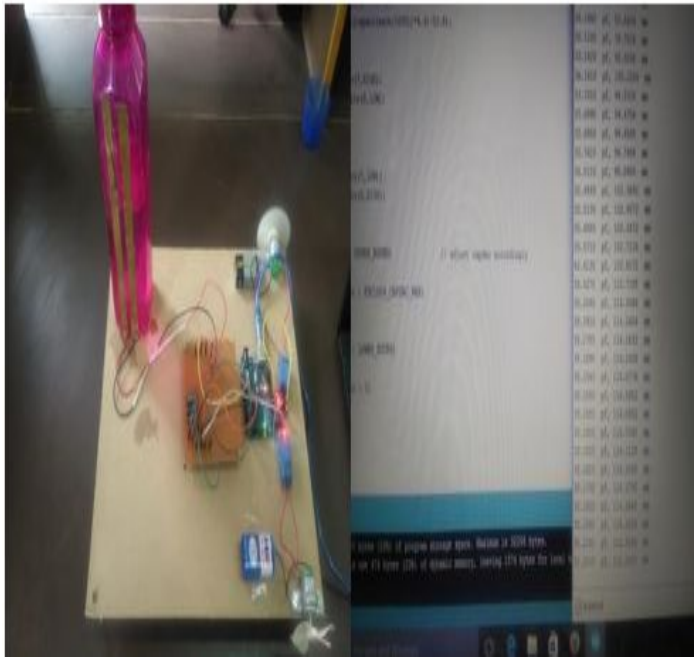


Copper Strips



FDC1004

Microcontroller

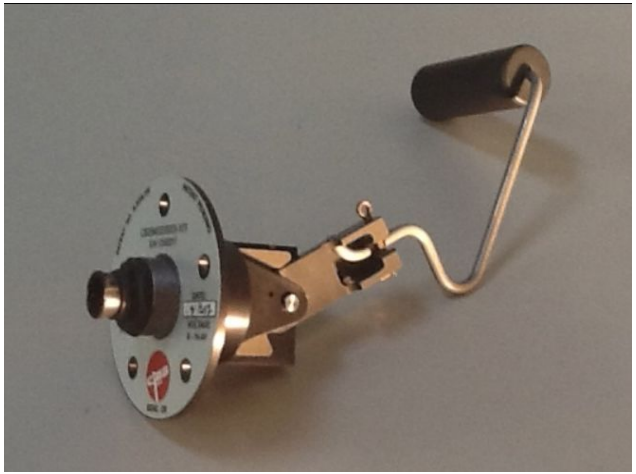


6. **Magnetostrictive Sensors:-**

a. A float with a built-in magnet moves up and down with the liquid level along a waveguide, which is housed in the sensor probe.

b. Movement of the float as water level changes will create magnetic field which sensed by the sensor.

Advantages:- Precise Measurement



7. **State Dependent Frequency Monitor**

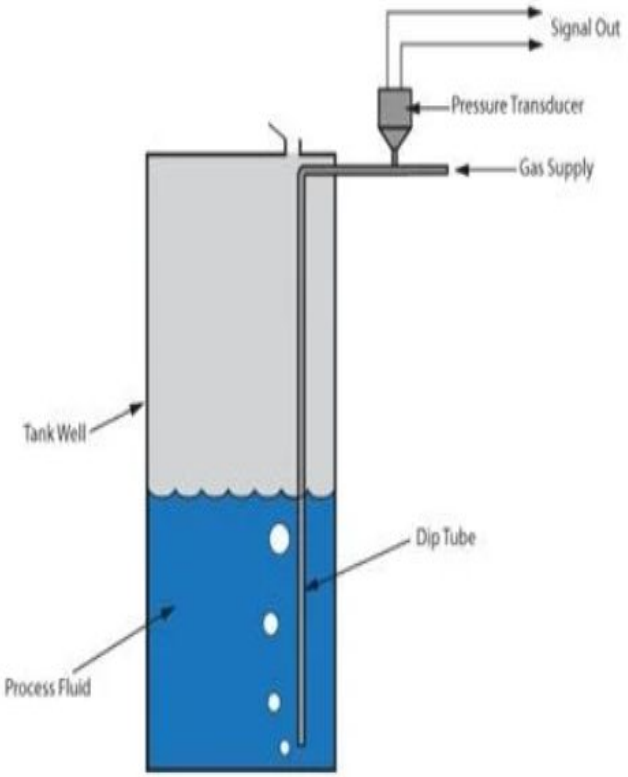
a. A microprocessor controlled frequency state change detection method uses a low amplitude signal generated on multiple sensor probes of differing lengths.

b. The state change of the frequency on each probe is monitored by a microprocessor which can perform multiple water level control functions.

8. **Bubbler System**

a. An air bubbler level sensor uses a tube with an opening below the surface of the liquid level. A fixed flow of air is passed through the tube.

b. Pressure in the tube is proportional to the depth of the liquid over the outlet of the tube



9. Using One Capacitive Sensor and Flow Sensor

a. Mounting of a Capacitive Sensor at top of the container.

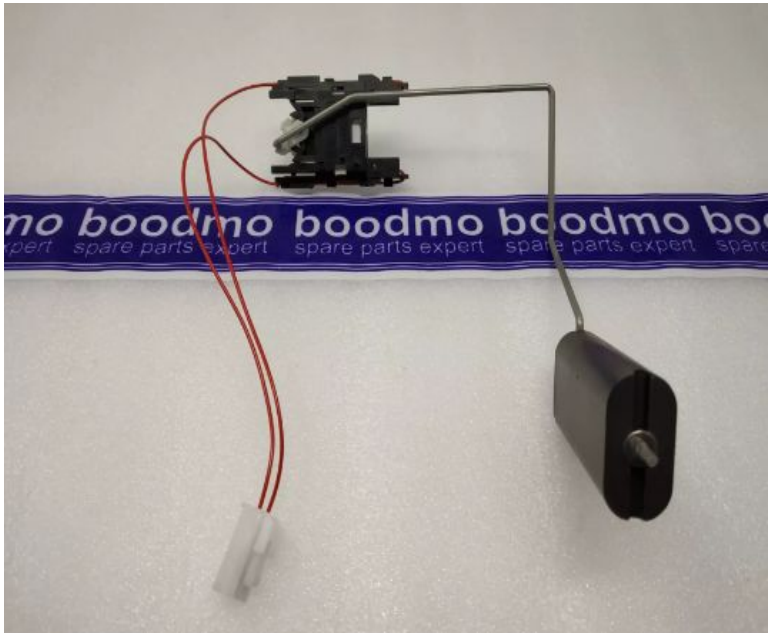
b. Flow Sensor will be mounted on the Pipe.

Automotive Level Sensors

Ultrasonic Level Meter

Radar Level Meter

Link :- https://youtu.be/06hePJyihNU?si=Y0RtXGXni4FnE6zC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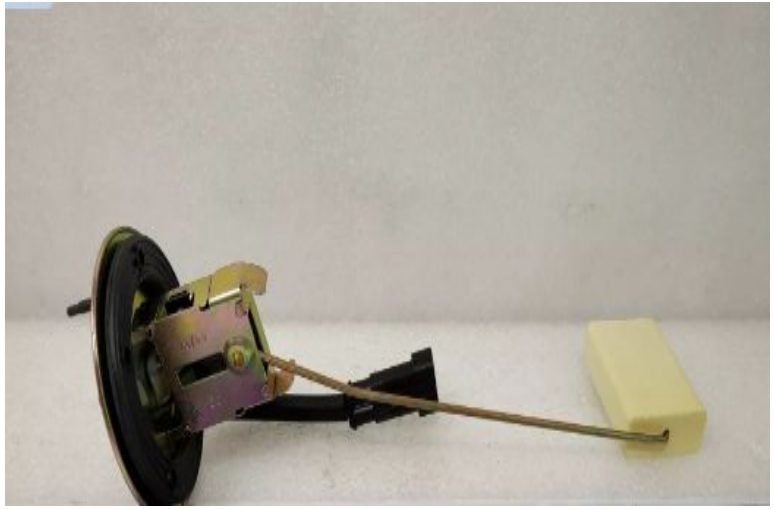
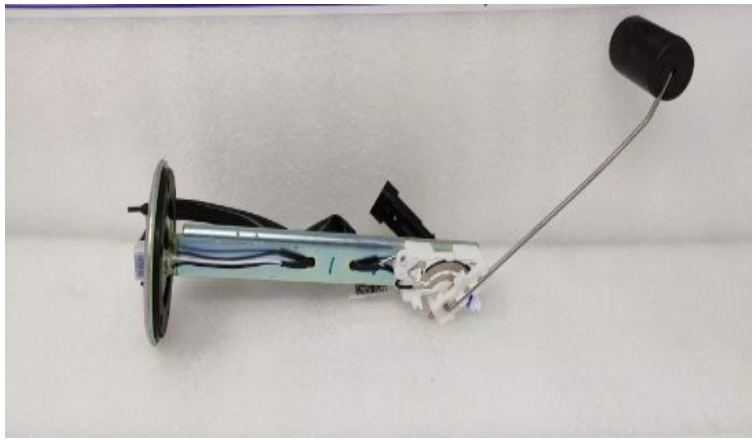
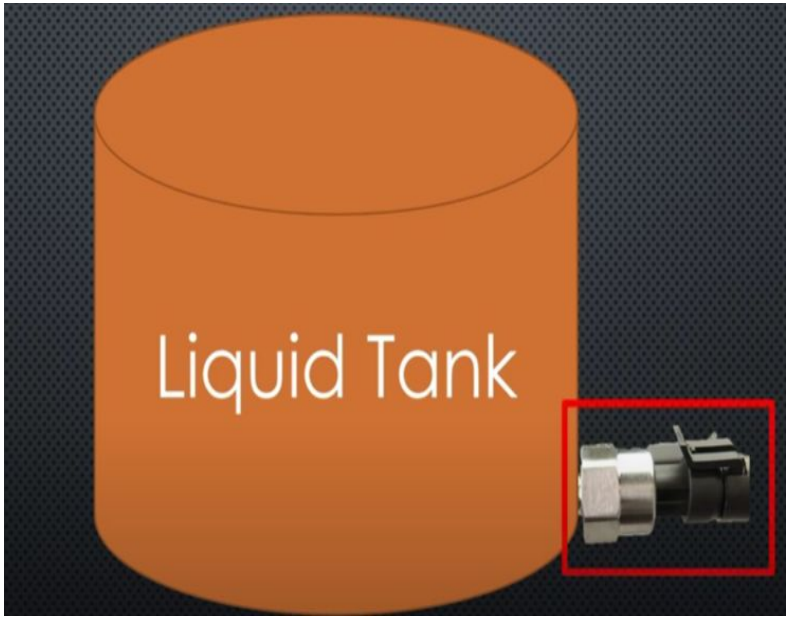
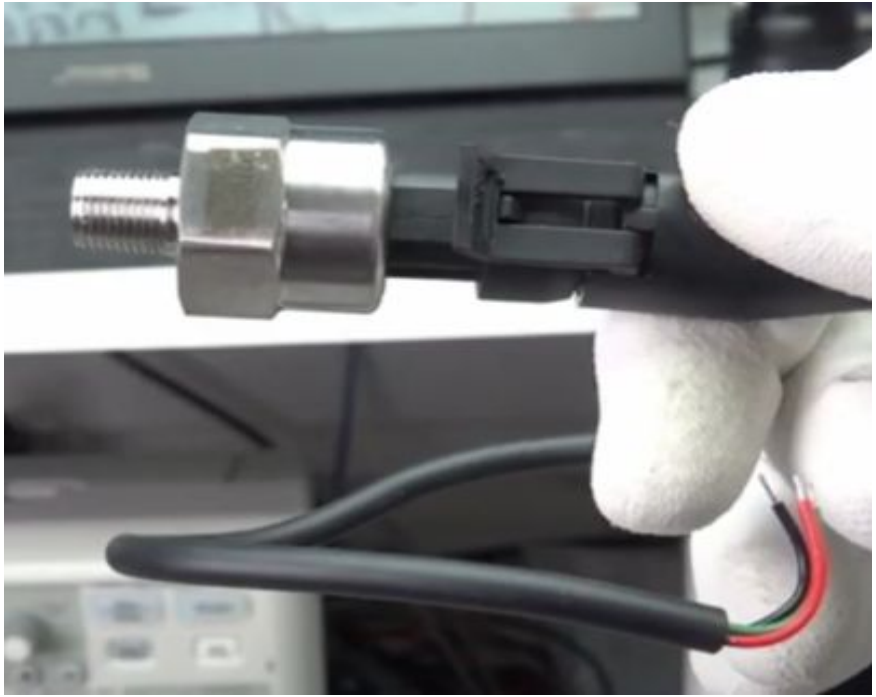





Liquid Tank

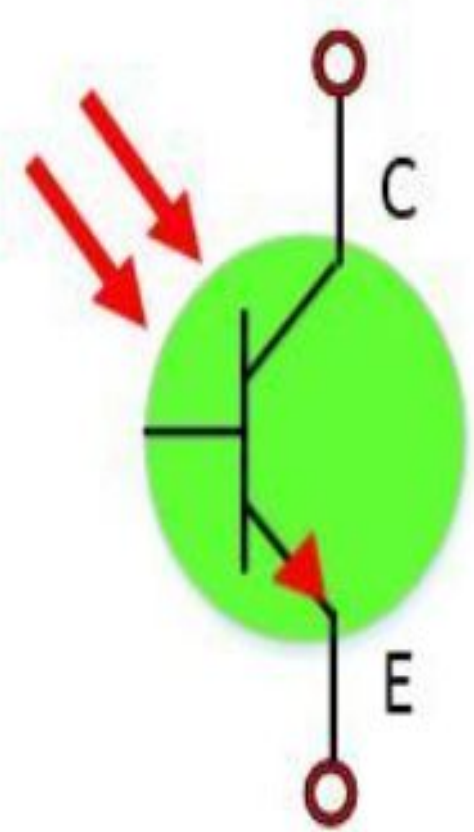


Working

- Inside the guide rod, there is a series of small, sealed reed switches connected to a resistor ladder.
- The float contains a magnet that interacts with these reed switches as it moves along the rod.
- When the float moves up, its magnetic field closes specific reed switches in the array.

Water Level Using Phototransistors

- The phototransistor is a three-layer semiconductor device which has a light-sensitive base region.
- The base senses the light and converts it into the current which flows between the collector and the emitter region.
- The presence or absence of water alters the intensity of light reaching the phototransistor, causing a measurable change in its output current.
- The difference in light intensity, caused by the presence or absence of water, leads to a variation in the ADC value. This change in ADC value can be utilized as a parameter to measure the water level.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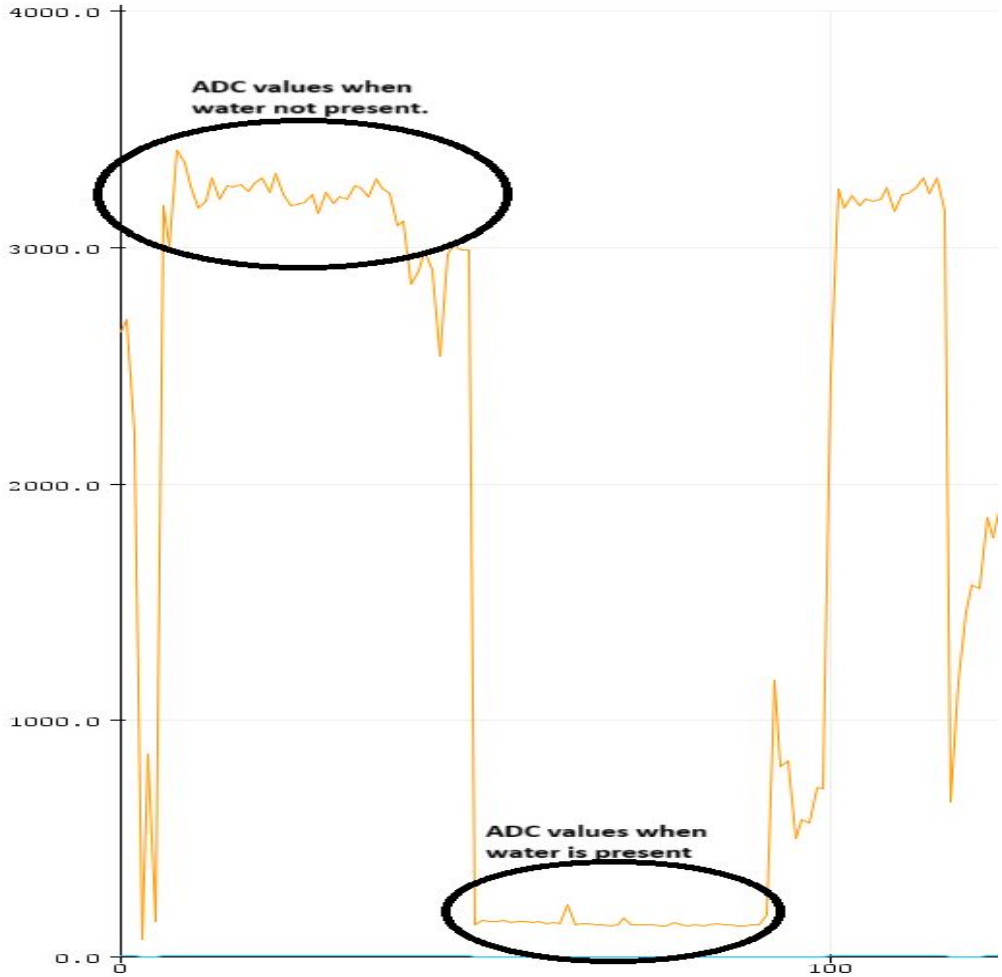
E


4000.0
3000.0
2000.0
1000.0
0.0
0
100
ADC values when
water not present.
ADC values when
water is present

COMPONENTS TO BE USED IN PROTOTYPING

1. **Phototransistor:-** It detect the presence or absence of water by measuring changes in light intensity. When water blocks light reaching the phototransistor, it outputs a digital LOW signal, indicating water presence; otherwise, it outputs a HIGH signal.

A.TEPT4400 Phototransistor :-

a. High Light Sensitivity
b. Low Cost
c. Viewing Angle:- 60 degree:-The phototransistor can detect light most effectively within a cone-shaped region extending 30° on either side of its central axis.
d. The 60° viewing angle defines the "vision cone" of the TEPT4400 for optimal light detection.

B. **3DU5C 3DU5 silicon phototransistor metal Packaging**
    a. The viewing angle of phototransistors typically ranges from 20° to 30°.
    b. Metal Packaging to focus on a single point.

C. **ROHM RPR-0521RS**
    a. SMD Component
    b. Viewing angle 30 to 40 degree.

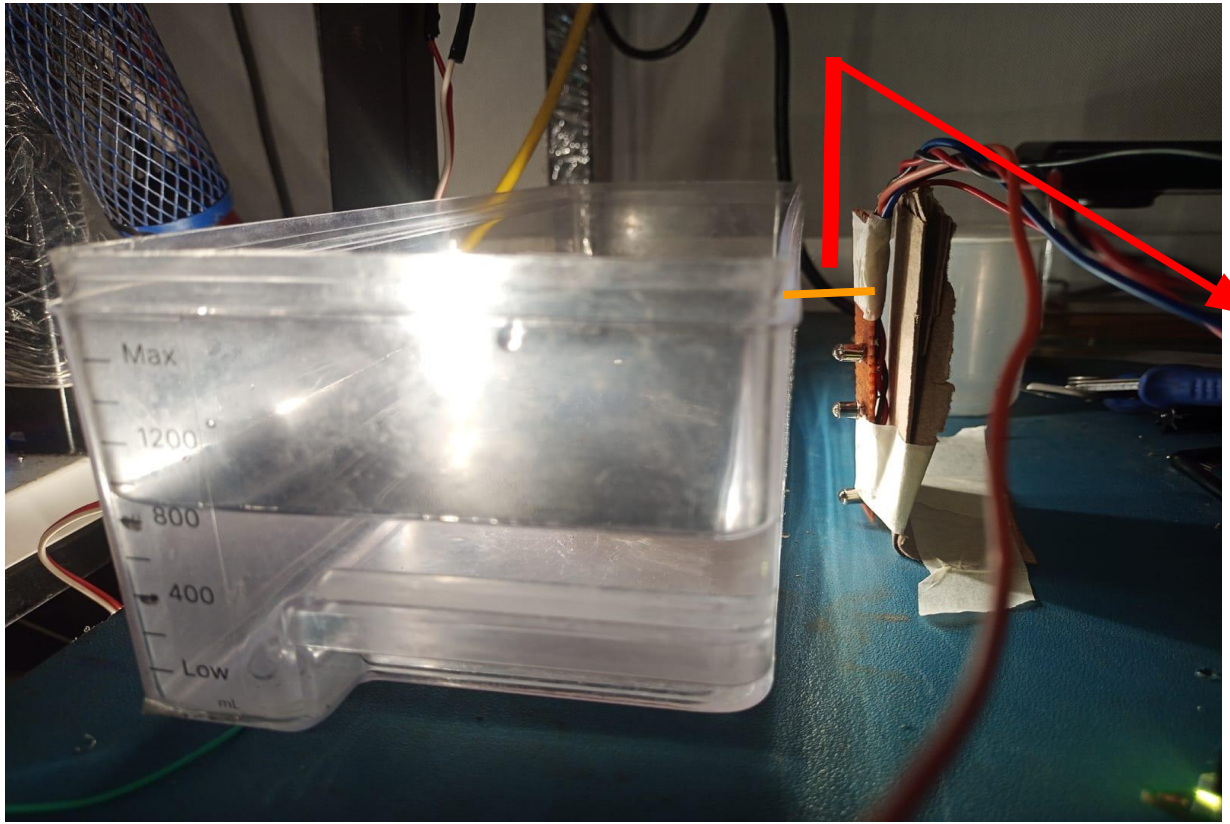
2. Strip Lights:- The strip lights serve as the light source for the phototransistors, enabling water level detection.

a. Choose white or red LEDs for maximum light penetration through water.
b. Avoid blue LEDs unless water clarity is high, as they may scatter more.
c. Strip Lights should be waterproof.
d. Options to Select From:- 2835 LED Strip (Single Color),WS2812B

3. **Microcontrollers:**- Any microcontroller for collecting data from phototransistors and displaying.

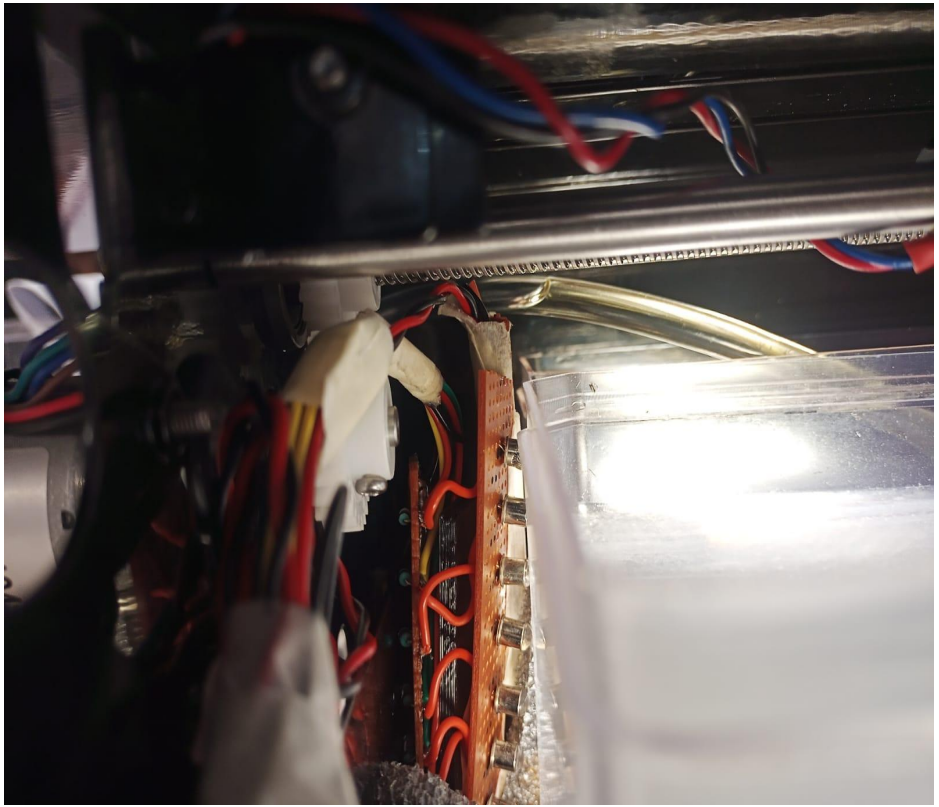
4. **LCD**:- For displaying the result.

Distance between Sensor and Container



Distance:- Upto 10mm maximum for precise values.

PROTOTYPING



SENSOR AND LIGHT PLACEMENTS

FOR WATER LEVEL

a. Place the phototransistors vertically along the **back side** of the container at intervals corresponding to the desired water level detection points.

b. Lights should be placed approx 10 cm away from the sensor on the other side of container.

c. Strip lights can be placed either horizontally or vertically.

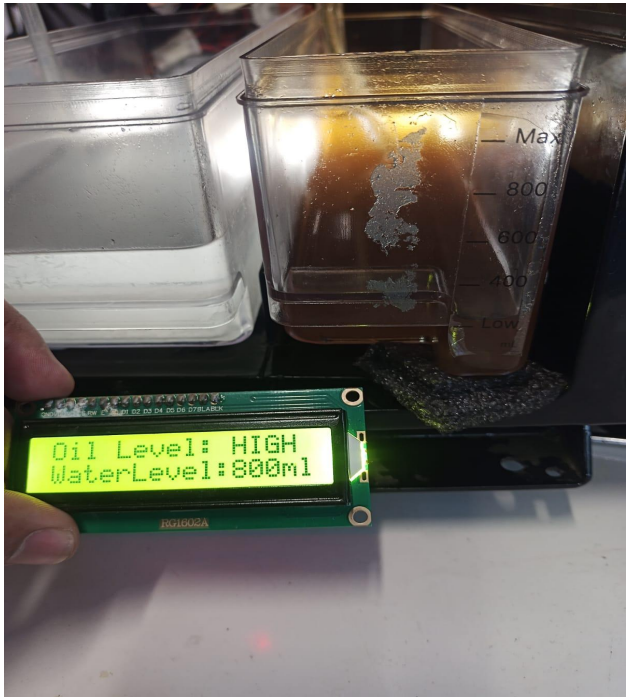
FOR OIL LEVEL

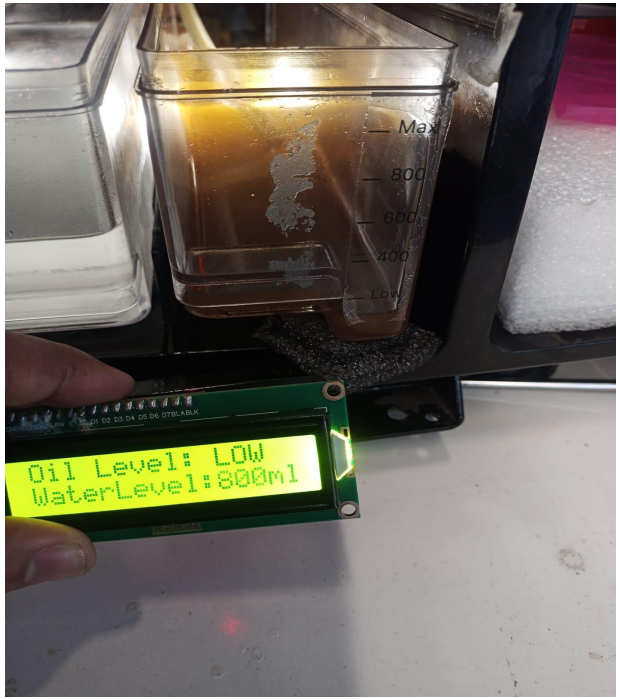
a. Place the phototransistor at the **exact level you want to measure** on the back side of the container.

b. The light should be placed at the exact same level, approximately 5 cm away on the opposite side of the container.

c. Lights should be placed **horizontally at same level you want to measure**.

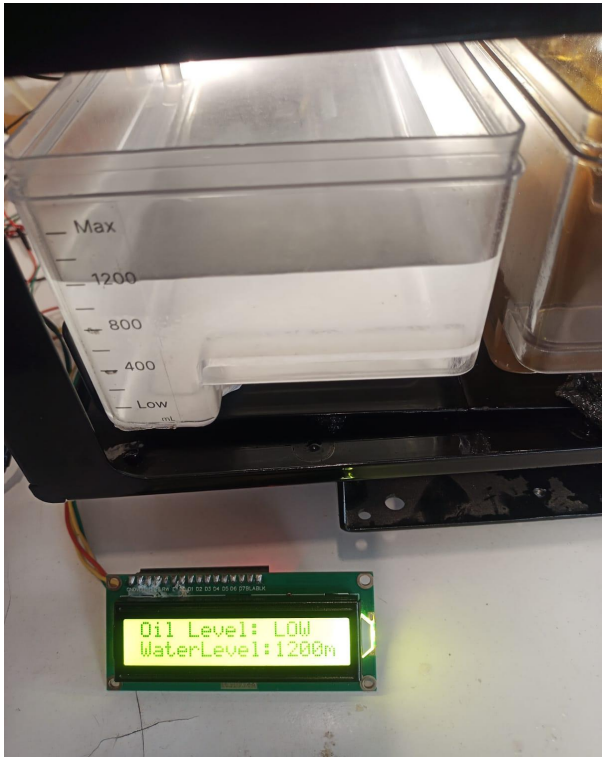
RESULTS





OIL LEVEL CHANGES AS IT CHANGING IN CONTAINER.

FULL WORKING VIDEO



WATER LEVEL IS CHANGING AS WATER LEVEL IS CHANGING IN CONTAINER

FULL WORKING VIDEO