

ARDUINO BASED LIQUID LEVEL SENSOR

❖ Introduction:

Monitoring the liquid level in a container is a common requirement in various industrial and DIY projects. Whether you need to keep track of water levels in a reservoir, fuel levels in a tank, or any other liquid-based application, having an accurate and cost-effective solution is crucial. In this guide, we will explore a unique approach to create a homemade liquid level sensor using simple materials and couple it with an Arduino microcontroller for precise level measurements. Additionally, we'll learn how to visualize the liquid level graphically on a PC monitor, thanks to the versatile "SerialComInstruments" software.

The DIY sensor we are about to construct is not only cost-effective but also quite ingenious. The primary component needed is a ribbon cable salvaged from an old IDE disk or floppy drive. By using this ribbon cable, we can create a sensor that is not only reliable but also adaptable to various container depths. With a bit of creativity and some simple electronics, we can craft a sensor that accurately measures liquid levels based on changes in capacitance.

To start, you'll need to extract four wires from the ribbon cable and cut them to a length that matches the depth of the container you wish to monitor. Next, on one end of these wires, you'll remove the insulation for a length of about 1 centimeter. On the other end, you'll need to waterproof them in some way to ensure their durability and functionality when submerged in the liquid.

The concept behind this sensor is that when it's immersed in a liquid, the capacitance of the sensor changes proportionally with the liquid level. This change in capacitance can be detected and measured using an Arduino microcontroller. To achieve this, we'll utilize the "Capacitor" library, which allows us to measure capacitance without the need for external hardware. With just one digital pin and one analog pin on the Arduino, we can accurately capture the changes in capacitance as the liquid level varies in the container.

Now, as exciting as it is to measure the liquid level with precision, we can take this project a step further by visualizing the data on a PC monitor. For this purpose, we will employ the versatile and free software called "SerialComInstruments." This software enables you to create a set of virtual instruments for bidirectional communication with microcontrollers like the Arduino. It offers a variety of instruments that can be placed anywhere on the screen, and its data protocol is user-friendly, making it accessible even to hobbyists. The software's simplicity, combined with a few lines of microcontroller code, allows you to quickly develop a working project.

In this guide, we'll walk you through the entire process of constructing the DIY liquid level sensor, interfacing it with an Arduino, and setting up the visualization on your PC monitor using "SerialComInstruments." The sensor's precision and linearity make it an ideal choice for a wide range of applications, and you can further enhance its accuracy by using two metal strips placed in parallel and insulated with plastic wrap.

By the end of this project, you'll have a reliable and cost-effective solution for monitoring liquid levels, with the added benefit of graphical visualization for data interpretation and analysis. Let's dive into the details and create a practical, high-precision liquid level sensor.

❖ Methodology:

1. Sensor Construction:

- Gather a ribbon cable from an old IDE disk or floppy drive.
- Separate and cut four wires to the depth of the liquid container.
- Remove insulation from one end, leaving about 1 cm exposed.
- Waterproof the other end of the wires.
- Create two parallel metal strips, laminated with plastic wrap, to increase accuracy.
- Ensure the metal strips are isolated from the liquid.

2. Arduino Setup:

- Program the Arduino microcontroller using the "Capacitor" library.
- Connect the sensor to one digital pin and one analog pin on the Arduino.

3. Software Installation:

- Download and install "SerialComInstruments 4.1" software from the author's page.

4. Configuration and Interface Design:

- Open "SerialComInstruments" software.
- Configure the software for bidirectional communication with the Arduino.
- Design a graphical interface to monitor the liquid level using virtual instruments.

5. Data Protocol:

- Establish a simple data protocol for communication between the Arduino and the software.

6. Calibration:

- Calibrate the system to ensure accurate level measurements. This may involve setting reference points for different liquid levels.

7. Monitoring and Display:

- Implement code on the Arduino to continuously measure the capacitance of the sensor.
- Send this data to the PC using the established data protocol.
- Display the liquid level information graphically on the PC monitor using the software.

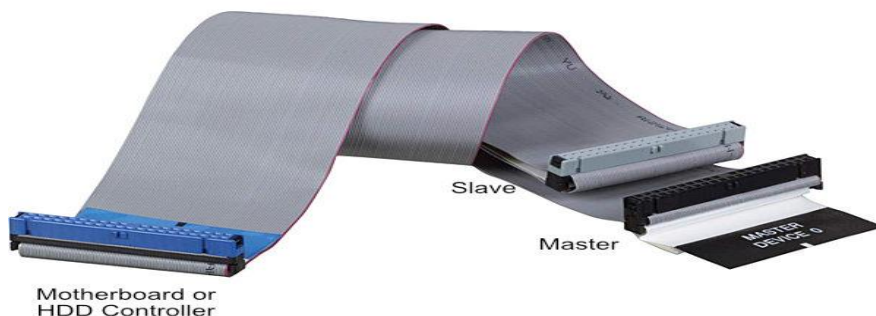
8. Visualization and Analysis:

- Monitor the liquid level changes and observe the graphical representation in real-time.
- Analyze the data and make any necessary adjustments to improve accuracy and precision.

Materials and Tools:

- IDE or floppy drive ribbon cable

A ribbon cable connects a floppy disk drive to a computer's motherboard, transmitting data and power to read/write data on disks.



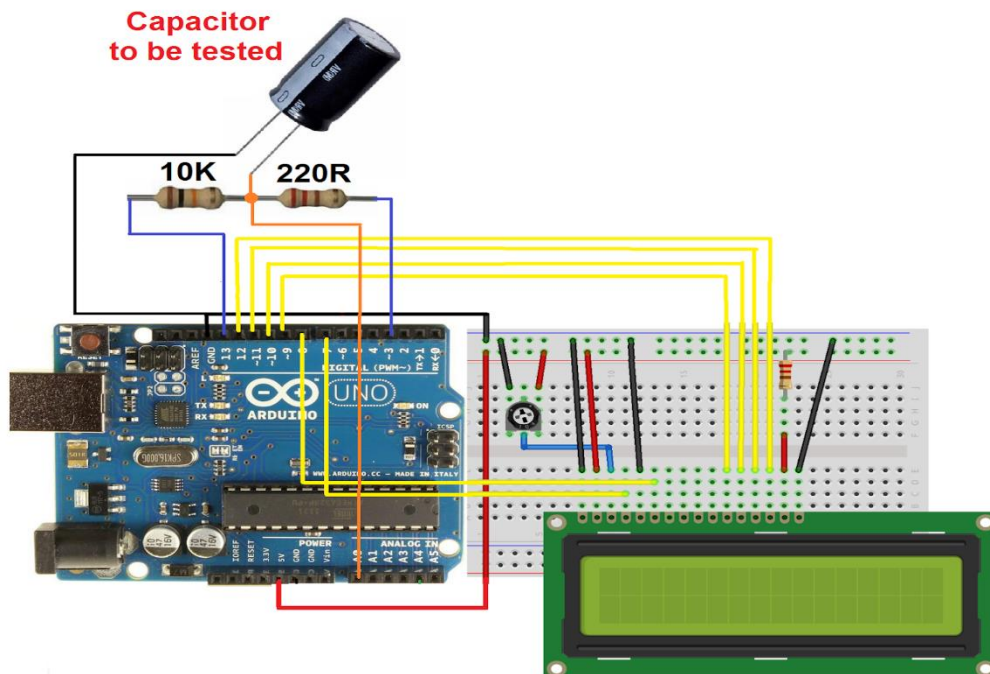
- Arduino microcontroller

Arduino is an open-source microcontroller platform for building electronic projects, offering a versatile hardware and software ecosystem for makers and hobbyists.



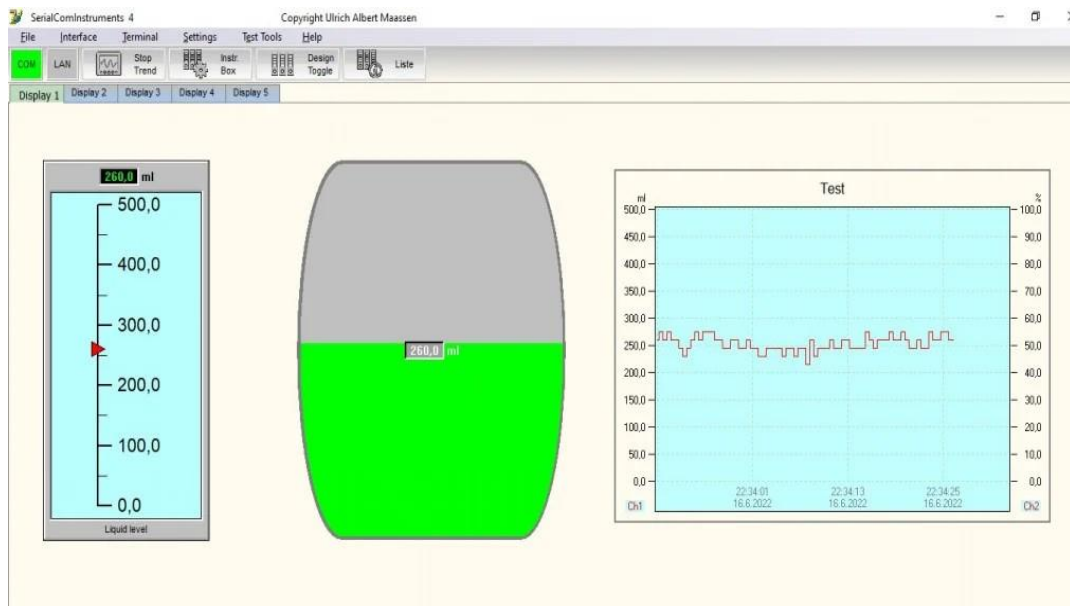
- Capacitor library for Arduino

A capacitor library for Arduino provides code and functions to manage capacitors, enabling precise timing, filtering, and energy storage in electronic projects.



- SerialComInstruments software

Serial communication instrument software facilitates data exchange between a computer and measuring instruments, such as oscilloscopes, allowing data analysis and control.



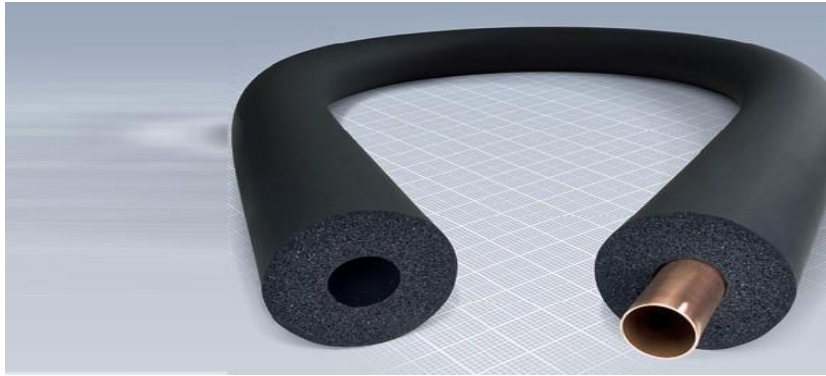
- Water container

A water container is a vessel designed to hold and store water for various purposes, such as drinking, cooking, or irrigation.



- Insulation and sealing materials

Insulation and sealing materials prevent heat transfer and air leakage, improving energy efficiency and maintaining temperature control in buildings and equipment.



- Two metal strips

"Two metal strips" typically refers to two parallel metal pieces used for various purposes, such as electrical connections, construction, or fastening materials.



- Plastic wrap

Plastic wrap, often made of polyethylene, is a thin, transparent material used for sealing and preserving food or protecting items.



❖ Problem Statement for Real-World Application:

In various industrial and domestic scenarios, there is a need for accurately monitoring the level of liquids in containers. Existing solutions often come with cost and complexity constraints. To address these challenges, we propose a cost-effective and reliable homemade liquid level sensor using a simple DIY method. The sensor is constructed from readily available materials such as an old IDE disk or floppy drive ribbon cable, and it is interfaced with an Arduino microcontroller. The sensor's capacitance changes proportionally as it is immersed in the liquid, allowing precise level measurement.

The challenge is to develop an effective, low-cost, and easily replicable liquid level monitoring system for a range of applications, including but not limited to:

1. Industrial tanks and reservoirs: Accurate monitoring of liquid levels in storage tanks, ensuring efficient resource management and preventing overflows or shortages.
2. Agricultural irrigation: Efficiently managing water resources for irrigation, preventing water wastage and ensuring crops receive the right amount of moisture.
3. Home automation: Monitoring water levels in home water tanks, sump pumps, or swimming pools to prevent flooding or running out of water.
4. Environmental monitoring: Tracking water levels in natural bodies of water, such as rivers, lakes, and groundwater, for research and environmental conservation purposes.
5. Chemical and pharmaceutical processes: Ensuring precise control of liquid levels in various processes, maintaining product quality and safety.
6. Laboratory applications: Accurate measurement of liquid levels in research and experimentation setups.
7. Water treatment plants: Monitoring the levels of chemicals or liquids used in water treatment processes to maintain water quality.

The proposed DIY sensor and Arduino-based system provide a low-cost, versatile solution for liquid level monitoring. The project aims to address the need for an accessible and accurate system that can be easily replicated by individuals and organizations to enhance liquid level monitoring and management in diverse real-world applications. This project can contribute to resource efficiency, cost savings, and environmental sustainability.

❖ Conclusion:

this DIY liquid level meter project demonstrates an innovative and cost-effective approach to liquid level monitoring. By leveraging homemade sensors and Arduino microcontrollers, enthusiasts and hobbyists can create highly accurate and customizable solutions for various applications. The project not only emphasizes the technical aspects of sensor construction and data acquisition but also highlights the importance of open-source software tools like SerialComInstruments, enabling users to visualize and analyze the collected data effectively. Overall, this project showcases the power of DIY electronics and software integration, empowering individuals to create practical solutions tailored to their specific needs.

❖ References:

<https://maker.pro/arduino/projects/arduino-liquid-level-meter-with-simple-homemade-sensor>

<https://youtu.be/M4eMRBKIfjE?si=2HqeLlpNQLvC78w2>