Design and Implementation of Smart Water Level Indicator and Valve Controller

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Abstract **—Accurate and reliable water level monitoring and control are crucial for efficient water management. This research paper presents the design and implementation of a smart water level indicator that utilizes the BC547 transistor-based inductive level measurement technique for discrete level measurement. The system includes an ATmega328p microcontroller that processes the data and controls the different inputs and output lines, such as LEDs and an online interface for remote monitoring and control of water levels. The system uses the inductive properties of water to detect water levels at four different levels. The online interface displays real-time water levels and allows the user to control the solenoid valve to manage water levels. The smart water level indicator provides an efficient and user-friendly solution to water level management, helping to minimize water wastage and promote sustainable water usage. The results of testing demonstrate the accuracy and reliability of the system in monitoring and controlling water levels.**

Index Terms**—Water level sensor, ATmega328p, ESP8266, Solenoid Valve.**

I. INTRODUCTION

In a broad range of situations, including industrial and domestic applications, such as fuel storage, flood warning, and water level control in homes, accurate, moderately priced, and dependable equipment for detecting liquid levels is crucial. Conventional liquid level sensors use electromechanical methods, which raise safety issues in areas where explosives are present. Point level measurement sensors and continuous level sensors are the two primary types of level measurement control sensors utilised in industries. Continuous level sensors monitor fluid level across a wide range as opposed to at a single spot, unlike point level measurement sensors. Different level measurement devices have been developed, including mechanical, capacitive, inductive, ultrasonic, acoustic, or optical methods. While mechanical and ultrasonic methods are primarily used for measuring the level of solid materials in the form of dust, capacitive and optical methods are better suited for detecting fluid levels.

The main focus on designing and implementing a smart water level indicator using the discrete water level indication technique with an NPN bipolar transistor-based sensor, specifically the BC547 transistor. This technology works on the conductive properties of water, making it an affordable and reliable option for liquid level measurement. Our system includes an ATmega328p microcontroller connected to the BC547 transistor for processing data, with different inputs and output lines such as an LCD display and a buzzer for providing real-time information to the user.

We also incorporate an ESP8266 Wi-Fi module that provides a connection to a website interface, allowing the user to interact with the system remotely. The website interface displays real-time water levels and allows the user to control the solenoid valve to manage water levels.

The significance of the smart water level indicator in industrial processes cannot be overstated. It is a crucial component that plays a vital role. Water scarcity is a significant problem that affects many areas worldwide, and improper management and control of water resources often contribute to the lack of access to clean

water. Our project aims to provide an efficient and user-friendly solution to water level management, which helps to minimize water wastage and promote sustainable water usage.

II. LITERATURE REVIEW

[1] This paper focuses on limiting the amount of water supplied to each household. When this system is installed in a house, it continuously monitors the total water usage of that house. Once the amount of water used reaches a threshold value, the flow of water entering the house is reduced by a fraction of the original, the system sends a message to the consumer via email once the water limit reaches 80% and 100%. Also, it periodically updates the user about the volume of water spent, along with information about the exact points in the house where consumption is maximum.

[2] This Project mainly focuses on minimizing water and electricity wastage by building an efficient automated water pump. Some sophisticated automation materials have been established in order to set some works automatically such as Arduino microprocessor, which enables to control the electrical circuits logically. The ultrasonic sensors used, will automatically turn on the machine in the water tank and it will be turned off automatically after the water tank is fully filled by the water. As there are many ways to create a water level controller so in case

[3] The system consists of similar components but instead of an LCD display it has a buzzer alarming system. Such that when the tank is about to get empty the buzzer makes sound indicating tank the water pump will be started. It helps to prevent dry running of motor which causes financial loss and waste of time.In

[4] there is an overview of the Efficient Automatic Water Control Level Management it is also implemented by Arduino and ultrasonic sensor. Although it is a bit expensive system as it involves a Wi-Fi module. Resulting the things can be controlled through a mobile application making it more accessible from anyplace. This system also has a help in saving time. It also uses relay module to break or join contact with given circuit based on the input given.

[5] This paper is used to make the automatic water level monitoring. the main aim of this project is to sense the level of the water in bucket and the tap turns on and off according to the condition and display it on the screen.

[6] This paper has developed a system which firstly check the level of the water in bucket with the help of water level indicator. this system consists of ultrasonic sensor and Arduino Uno.

[7] This paper introduced a system in which the automatic water level monitoring takes place with the help of sensor. With the use of sensor, we realize the different level of water in bucket and stop the overflow of water.

[8] This paper deals with the process of development of a system for automation of fossil fuel pump for filling a container. Basically, the author is working on petrol level indicator which has an automated audio alert system. With the help of magnetic sensors, the author has come up with a unique application. Water level controllers are not appropriate in this project due to the direct contact of liquid with the electrodes. The concept is very much similar to water level indicator project but defined in different fashion.

[9] This paper works with the concept of measurement of water level. The author has used ultrasonic measurements for measuring the level of water and AVR Microcontroller to control the flow of water. Ultrasonic sensors use the concept of ECHO.

III. OBJECTIVE OF WORK

The primary objectives of this project are to design and develop a reliable and costeffective water level indicator with online interfacing capabilities. Additionally, the project aims to incorporate a valve controller for efficient water level management in household applications.

- Safety & Hazard Mitigation: To prevent catastrophic failures like tank overflows, dry-running pumps, or high-pressure ruptures through automated shut-off mechanisms.
- Operational Automation: To execute continuous, autonomous fluid management—such as activating motors, valves, and pumping units based on real-time sensor data without requiring manual intervention.

- Resource & Energy Efficiency: To minimize power waste by optimizing pump duty cycles and efficiently managing system resources.
- Precision Monitoring: To provide continuous, accurate level tracking across multiple phases (e.g., empty, low, medium, high, and critical levels).

IV. PROPOSED SYSTEM

The "Advanced Programmable Multiple Function Fluid Level Operating System" is an automated industrial or domestic system that replaces manual labor and rudimentary mechanical float valves. It relies on a Programmable Logic Controller (PLC) or microcontroller to intelligently monitor, manage, and distribute fluids across single or multiple interconnected tanks based on predefined parameters.

V. METHODOLOGY

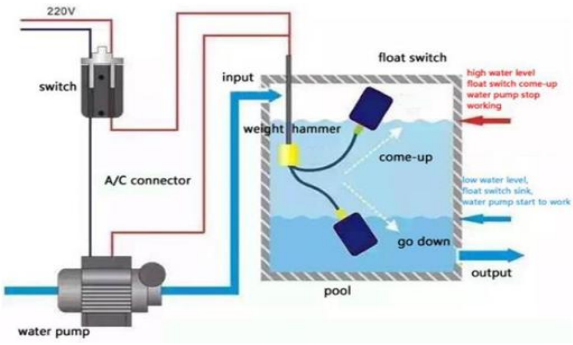


Fig 1: Block Digram

1. Arduino-Uno – It is a micro controller having a USB interface, 14 digital input/output pins of which 6 are analog input and 6 can be used as PWM output, and which has Tx and Rx pins to support serial communication is called as Arduino Uno. It is the brain of the system.

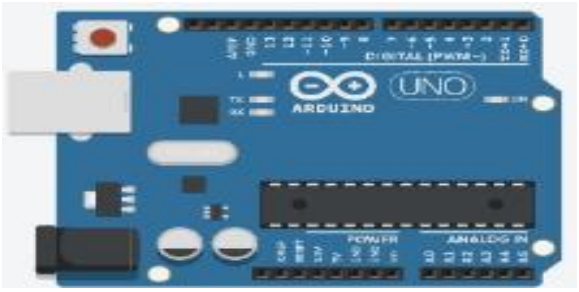


Fig. 2 Arduino-Uno

UNO Board by Arduino Figure 4 depicts Arduino UN O is an open-source microcontroller board designed b y Adruino.cc and based on the ATmega328p microco ntroller. The board features 6 analogue pins and 14 di gital pins that may be programmed using Arduino ID E and a USB Type B connector. It can be powered by a mains voltage battery.

2. Ultrasonic Distance Sensor: It is an electronic device used to measure the distance between two objects or surfaces with help of ultrasonic sound waves. It consists of a transmitter to emit ultrasonic sound waves and a receiver that receives the sound waves which bounces back after hitting the particular object.

Fig. 3 Ultrasonic Sensor

3. LCD: It is a 16 x2 liquid crystal display. It can display 2 lines and 16 characters per line. It is an alphanumeric display that is it can display numbers as well as alphabets. Can work on both 8-bit and 4-bit mode. It is used to display the water level.

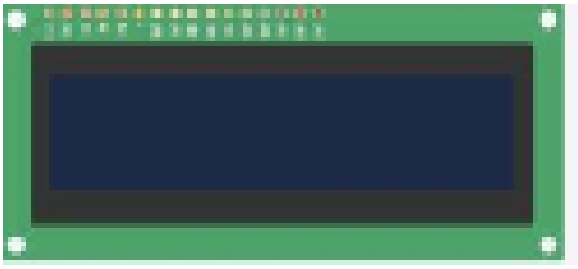
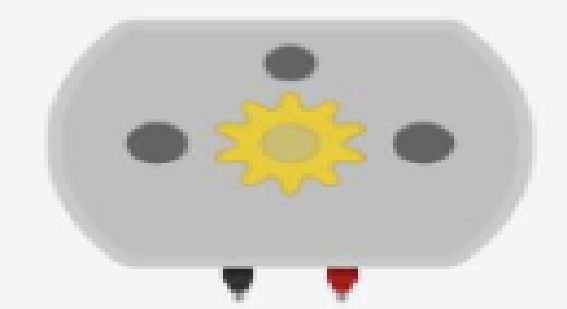


Fig. 4 LED

4. DC Motor: An electric motor operated by direct current rather than alternating current is known as a DC motor. It helps in the conversion of DC electrical energy into mechanical energy. It helps in the pumping of water in our project



The automatic water level controller minimizes the need for any manual switching and human interference. The machine helps to detect level of water or any liquid. For this ultrasonic sensor is used. It detects the distance between the top of tank to level of liquid and with help of programmed Arduino Uno it displays the information on the LCD display. And as the water level goes below a certain level it turns the valve on and starts the water flow with help of motor. Similarly, as water level reaches the top of the storage tank which is being detected by sonar sensor, then with help of programmed Arduino the valve automatically turns off which shuts the motor and thereby closes the water flow. As the valve is servo motor thus similarly like sonar sensor it is also controlled by Arduino

5. Micro Servo: A servo motor may be a thought of as a positioner or a motor that permits for a particular control in terms of the position, acceleration, and velocity. Basically, it has certain capabilities that a normal motor doesn't have. Consequently, it makes use of a normal motor and pairs it with a sensor for position feedback. It helps to control the valve by turning water flow on or off as required

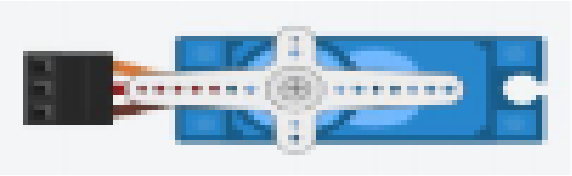


Fig. 6 Micro Servo

VI. RESULTS

As soon as water starts flowing in the container, the LCD screen starts displaying amount of water collected. Once water level reaches the brim of the container, water flow automatically stops. When the container is empty, the water flow starts automatically. At all times, percentage amount of water in the container is displayed on the LCD screen

VII. CONCLUSION

With the help of this project, we aim to save electricity as well as water. It is very important to save the natural resources. When the water in bucket /tank is reaches at a particular level we don't realize that the tank is overflowing. This leads to more water as well as energy consumption. People too get engaged in that and stop doing other work until the tank is full which can cause a lot of unnecessary time consumption. So, to overcome this situation this project can sense and indicate the water level in the tank when it reaches at a particular level and then the pump/tap turns on/off which will save water and electricity. Therefore, the water level monitoring and controller using Arduino project can prove very helpful in minimizing the use of man power. Its application is not only limited to house hold but can also be used in the industrial and agricultural sector.

The automatic water level controller has a great future scope. By adding a Wi-Fi module through which it can be controlled through mobile application by doing so it can be used in big building, offices, malls. It also has a bright future in Agricultural sector

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