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# Design and Implementation of an Automatic Water Level Indicator and Controller

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**ABSTRACT:** Although water covers the majority of the earth's surface, less than 5% of it is usable. Thus, preserving water has become a significant concern, necessitating the use of certain water management measures. Using an ultrasonic sensor that measures the volume of water in the tank and provides the percentage of water present, we examine the management of water level. An Arduino, motor pump, and LED are all part of this setup. Every component is interfaced with the Arduino and operates automatically based on code that has been uploaded. The overhead tank was divided by the system using average percentages, most likely 10%, 50%, and 100%. 10% is the tank's condition when there is very little water in it, and 100% is the tank's maximum condition. When there is less water in the tank, the system must monitor and maintain it. When the water level drops below 10%, the leds automatically switch off, making sense, and the relay-based motor starts and stops until the tank is full. Therefore, nobody is needed to keep an eye on the tank or the motor's switching. The primary technique we used is echo, which is simply understood by using the example of a silent cave. When you make a sound, you will hear the same thing at a high intensity. For instance, the ultrasonic sensor has two tiny holes in it. In which one opening sends the high frequency sound pulse called as ultrasonic waves like a small speaker (sender) and other opening receives them like a small microphone (receiver).

**KEYWORDS:** Energy, Solar, Arduino, Flow rate, Controllers, Sensors

## I. INTRODUCTION

Water is the first step in the daily regimen. It is among the necessities for survival. For everyday use, people rely on overhead tanks. The opaque substance used to make the above tank inhibits the formation of algae, and the lid keeps out dust and mosquitoes. Therefore, it is unknown how much water is in the tank. We frequently turn on the engine and forget to turn it off, which results in the unintentional waste of the majority of the water and energy. Water scarcity is the result of this. Therefore, a substitute that can turn the engine on and off automatically when the water level reaches the desired level is required. An ultrasonic sensor measures the water level without making contact, and an Arduino uses digital logic and a relay to regulate the motor.

Applications such as flood monitoring, river level monitoring, wetland studies, tidal studies, groundwater monitoring, and surface water monitoring frequently use water level monitoring. Life cannot exist without clean water, and human health and well-being are greatly influenced by the quality of the water. This project aims to save human labor by automatically controlling the water level.

Akshay Sharma[1] Published a review on IoT based water level sensing and controlling at IJERT. He mainly discussed about to reduce human intervention to reduce wastage of water in household and in industry. The paper also compared wired and wireless technology to measure and control the water level.

The research paper by Asaad Ahmed Mohammedahmed Eltaieb , Zhang Jian Min[2] involves designing and development of automatic water level control system had exposed to the better way of software and hardware architecture that blends together for the interfacing purposes. The system employs the use of advance sensing technology to detect the water level. It uses Arduino and uses relay to control motor. Different wires are attached at different Junctions of the Beaker. When we pour water in the beaker. The water comes in contact with the wire and tells the level of water in the tank. Accordingly, they have displayed the level of water on LCD display. And uses relay to turn ON and OFF the motor.

This research paper by Ria Sood, Manjit Kaur, Hemant Lenka[3] emphases on the need of water level controllers in irrigation in agriculture. It says that every crop requires require different amount of water and this can be done by using automatic water level controller which will also help in reducing wastage of water. Here they use a technique to measure flow rate of water in irrigation pipelines.

### Problem Statement

- Use Arduino to design and build a water level indication and control system.
- It uses an ultrasonic sensor to measure the water level and an Arduino and relay to regulate the water pump.

### 1.2 Objective

- It prevents water waste from tank overflow.
- It conserves electricity.
- It reduces the amount of human labor required to manually turn the water pump on and off.

### 1.3 SCOPE

- The future of automatic water level controllers is bright, particularly for overhead tanks.
- It has a good range of uses in homes as well since it reduces water and electricity waste, which saves money.

## II. SYSTEM MODELLING

### 2.1 Block diagram of the system

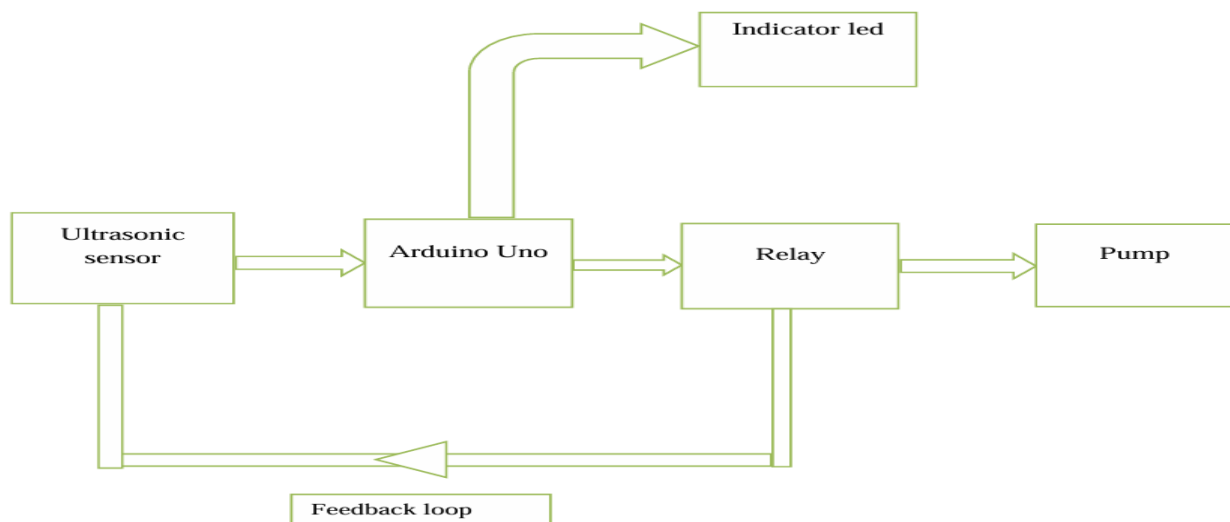


Figure 2.1 Block diagram of Automatic Water level controller system



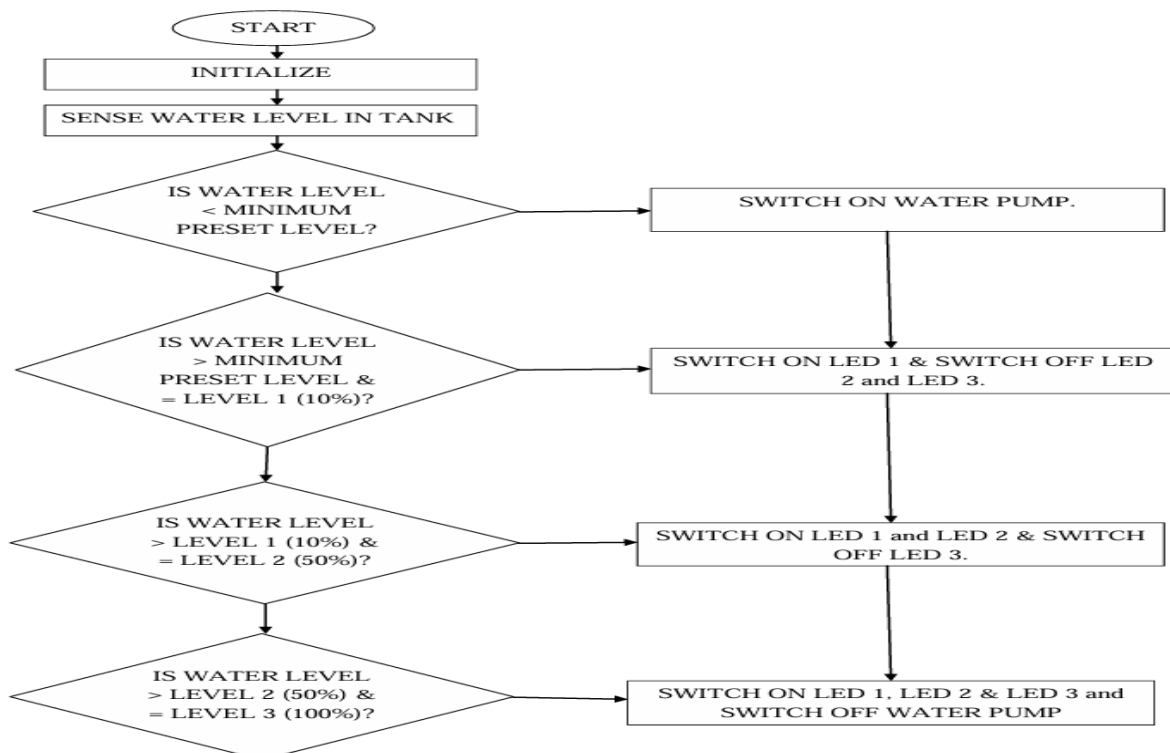
### 2.1.1 Block Diagram Description:

The Automatic Water Level Indication and Controller system is depicted in the block diagram in figure 2.1. The system's brain is the central Arduino Uno unit. The entire system is controlled by an Arduino Uno. Every two seconds, an ultrasonic sensor detects the water level and sends a signal to the Arduino board. By measuring the time it takes to receive the broadcast signal back, Arduino calculates the distance to the empty tank. Relay receives a signal and powers the engine when the tank drops below 10%. Three LEDs display the tank's water level based on the distance determined by an ultrasonic sensor. Power supplies are utilized to deliver coil voltage for relays and a steady 5V DC supply for ultrasonic sensors.

### 2.2 Functions of each block:

- **Ultrasonic Sensor:** This device measures the distance to an empty tank in order to determine the water level. From Trigger, it sends ultrasonic waves, which it then returns to the Echo. calculates the distance by the time it takes to receive a signal that has been relayed back.
- **Power Supply:** In this case, a 5V supply powers the relay and the ultrasonic sensor. The Arduino Uno board receives its power from a 9V adaptor.
- **The Arduino Uno** is a device that operates on input from ultrasonic sensors and provides operational digital signals to relays and indication LEDs.
- **LED indicators:** LEDs are used to show various water levels, including 10%, 50%, and 100%. One by one, the LEDs light on when the Arduino outputs logic 1, and they stay on until the logic is changed to 0.
- **Relay:** Relays are electrically powered switches that, like all switches, can be turned ON or OFF to allow current to flow through. It enables us to manage high voltage loads, such as a 220V AC motor pump, and may be operated at low voltages, such as the 5V DC supplied by the Arduino Uno.
- **Pump:** Water is lifted from the sump tank to the above tank using a pump. Typically, it runs on 220V AC and is relay-controlled.

### 2.3 Flowchart:



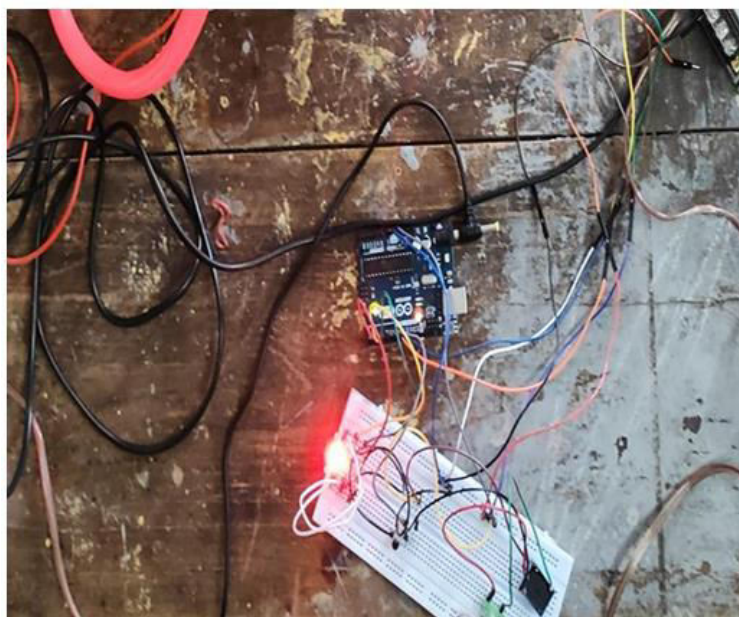
### III. CONDUCTING THE EXPERIMENT

If the circuit is constructed as shown above, if initially the water in the tank is below minimum threshold, and the system is turned ON, the pump will start pumping water into the tank, and no LED will come ON, but immediately water reaches the minimum threshold, the red LED will come ON, indicating that the tank is one third full. As water keeps pumping, when the tank is two third full the yellow LED will come ON, and when the tank is full, the green LED will come ON while the pump switches OFF automatically. If water starts receding from the tank, the LEDs will start going OFF gradually to indicate the level of water in the tank as it recedes. Finally, when the water has reached the minimum threshold, the pump will come ON again.



**Photograph 5.3 Case 2 (system is at mid-state)**

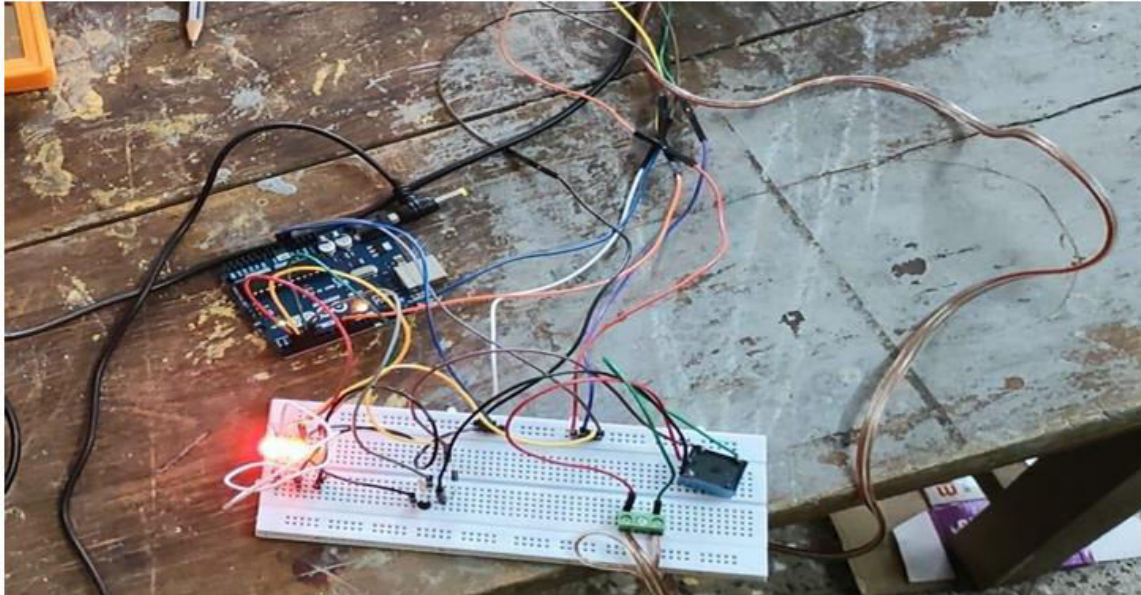
**3.1 Case 1: System is at initial state and water level in tank is at 10%.**



**Photograph 3.2 Case 1 (System is at initial state)**

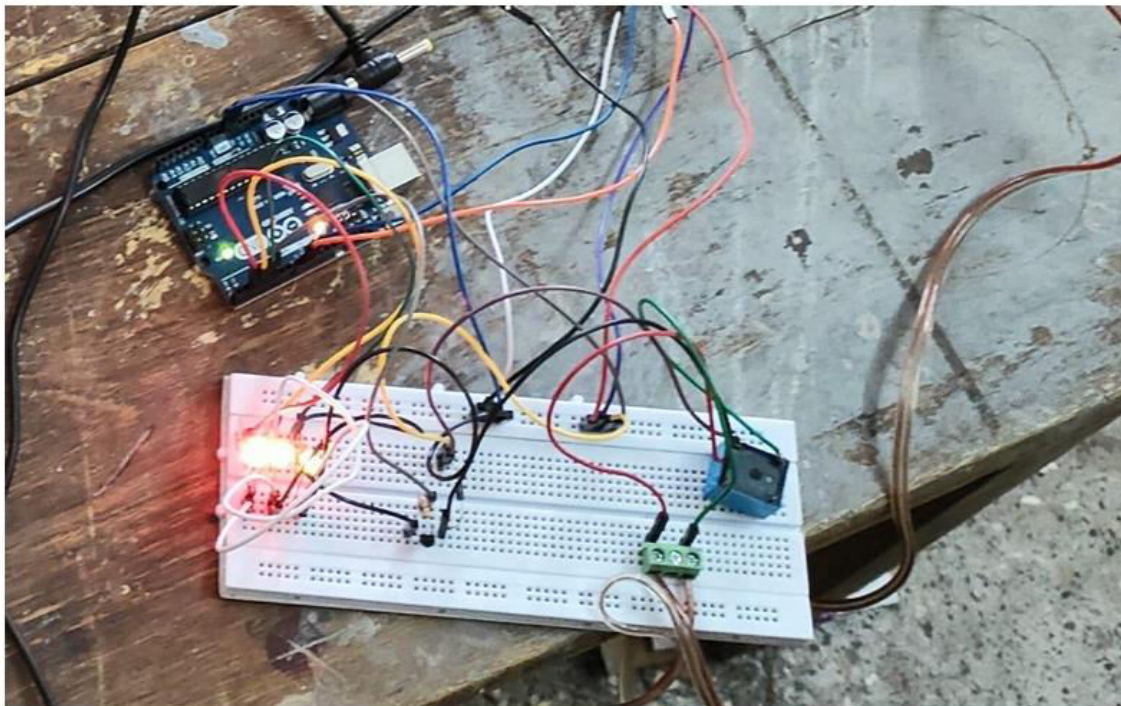


3.2 Case 2: It is a mid state of the system. Two LED's are glowing which shows water level in the tank is 50%



Photograph 3.3 Case 2 (system is at mid-state)

3.3 Case 3: It is a final state of the system. All three LED's are glowing and pump will OFF. Water level in the tank is 100%



Photograph 5.3 Case 2 (system is at mid-state)

## IV. SUMMARY AND CONCLUSION:

## 4.1 Advantages:

## 1. Power Saver:

Living in an age where we need to be more conscious of the energy that we use, a water level controller is ideal at saving power. Normally, regulating water levels can consume electricity and waste water. However, with automatic controllers, the electricity usage is limited as well as less water needed to regulate a supply.

## 2. Money Saver:

A water level controller helps save money by limiting the waste of water and electricity. These devices accurately regulate how much energy is used to protect against any unnecessary water/electricity usage. Over time, the money saved is quite substantial.

## 3. Automatic:

Another notable advantage with these devices is that they regulate on their own. Eliminating manual operations with a timer switch, the frustrations of manual monitoring water tanks is minimized. Water levels are maintained at the appropriate levels thanks to the automatic operations of these devices.

## 4. Water Maximization:

On average, water pumps are used more during mid-day. A water level controller can maximize the water usage provided during mid-day while automatically lessening the water usage at night. This results to an appropriate level of water always being maintained, while providing you with the maximum use of your water at the appropriate times.

## 4.2 Disadvantages:

- 1) Can't turn OFF the system if sump tank is empty which causes pump failure.
- 2) It is unable to detect leakage of pipe line which causes wastage of water.

## 4.3 Applications &amp; Uses:

The uses of a water level indicator include the following applications:

- 1) Can be used in water tanks to control water levels
- 2) Automatically turn ON/OFF pumps
- 3) Can be used in factories, commercial complexes, apartments, homes etc.
- 4) Fuel tank level gauging
- 5) Oil tank level control
- 6) Pool water level control
- 7) Cooling tower water level control
- 8) Sewage pump level control
- 9) Remote monitoring liquid
- 10) Pump controller
- 11) Irrigation control

## V. FUTURE SCOPE

A water level controller helps save money by limiting the waste of water and electricity. These devices accurately regulate how much energy is used to protect against any unnecessary water/electricity usage. Over time, the money saved is quite substantial. 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.

## V. CONCLUSION

Automation of the various components around us has been widely increased to reduce human intervention and save time. The water tank overflows as the height of water in the tank cannot be randomly guessed. This leads to extra energy consumption, which is a high concern in the present. People also need to wait and stop doing their other activities until the tank is full. Hence, here is an idea which senses and indicates the water level so that the pump can be switched off on appropriate time and save water, electricity and time as well. Therefore “Automatic Water Level Indicator and Controller Using Arduino” project can definitely be useful on a large scale basis due to minimum requirement of man power and also the installation process being easier making more compatible for everyone to use.

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