

# Automation, Control and Instrumentation: Water Level Controller

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**Abstract**—The drinking water crisis in India is reaching alarming proportions. It might very soon attain the nature of global crisis. Hence, it is of utmost importance to preserve water. In many houses there is unnecessary wastage of water due to overflow in Overhead Tanks. Automatic Water Level Controller can provide a solution to this problem. The operation of water level controller works upon the fact that water acts as obstacle for ultrasonic sensor so water can be used to open or close a circuit. As the water level rises or falls, different circuits in the controller send different signals. These signals are used to switch ON or switch OFF the motor pump as per our requirements. To measure the level of water we program our ARDUINO to calculate the distance of water from ultrasonic sensor and to control the level of water we specify two levels minimum and maximum levels of ARDUINO and program it to turn OFF the pump when tank is filled till the maximum specified level and switch ON the pump when the level of water tank is below a specified level. This paper has achieved the main objective non-contact water level monitoring system implemented using ARDUINO where water level in tank is monitored and according to that the pump in the ground switched ON and OFF automatically.

## 1. INTRODUCTION

In everyday life, there must be some physical elements that need to be controlled in order for them to perform their expected behaviors. A control system therefore can be defined as a device, or set of devices, that manages commands, directs or regulates the behavior of other device or system. Consequently, automatic controlling involves designing a control system to function with minimal or no human interference. Intelligent systems are being used in a wide range of fields including from medical sciences to financial sciences, education, law, and so on.

The monitoring of the water level in a reservoir is important in the applications related to agriculture, flood prevention, and industry, etc. Almost all aspects of human life have undergone rapid development. This development is supported by the advance of electronics and information technology. The job can be performed on schedule precisely and efficiently by adopting this advance technology. An achievement in computer technology is used not only in business and industry but has also covers almost all fields, including control system where a computer system can be used to control the hardware

in a flexible way. Therefore, computer based control system has become more common in recent development of control system. Computer-based control system also can be implemented for optimizing water flow management to minimize flood caused by water overflow. Management can be performed based on elevation of water level on the river as an input data and control the sluices along the river stream based on that data.

Automatic water level controller is a series of functions to control the Automatic Water Pump Controller Circuit in a reservoir or water storage. The water level sensor is made with a metal plate mounted on the reservoir or water tank, with a sensor in the short to create the top level and a detection sensor for detecting long again made for the lower level and ground lines connected to the bottom of reservoirs or reservoir.

The paper is automatic water level controller through the use of different technologies in its design, development, and implementation. In this project we will use ARDUINO UNO to automate the process of water pumping in over-head tank storage system and has the ability to detect the level of water in a tank, switch on/off the pump accordingly.

In this Arduino based automatic water level indicator and controller project we are going to measure the water level by using ultrasonic sensors. Basic principal of **ultrasonic distance measurement** is based on ECHO. When sound waves are transmitted in environment then they return back to the origin as ECHO after striking on any obstacle. So we have to only calculate its travelling time of both sounds means outgoing time and returning time to origin after striking on any obstacle. And after some calculation we can get a result that is the distance. This concept is used in our water controller project where the water motor pump is automatically turned on when water level in the tank becomes low.

This paper shows non-contact water level monitoring system implemented using ARDUINO .Water depth of the tank is measured by Ultrasonic sensor. Hence the water level present in the tank is known. Depending on the sensor reading

ARDUINO program sends the data to ARDUINO and through ARDUINO board the pump is switched ON if the water level in the upper tank is low and pump is switched OFF if the water level is completely filled in the upper tank. The input to ARDUINO board is from ultrasonic sensor. Arduino read the height and reports the water depth of the tank and the same is displayed in serial monitor. Advantage of this over other existing automatic system is it provides non-contact water level measurement using ultrasonic sensor, but existing automatic system using stainless steel sensor which is a contact type water level sensor and also these sensors quickly corroded by some chemicals.

## 2. SYSTEM DESCRIPTION

The proposed system consists of following components.

A. Ultrasonic Sensor Module

B. ARDUINO

### A. Ultrasonic Sensor Module

The ultrasonic sensor module works on the natural phenomenon of ECHO of sound. A pulse is sent for about **10us** to trigger the module. After which the module automatically sends 8 cycles of 40 KHz ultrasound signal and checks its echo. The signal after striking with an obstacle returns back and is captured by the receiver. Thus the distance of the obstacle from the sensor is simply calculated by the formula given as

$$\text{Distance} = (\text{time} \times \text{speed}) / 2$$

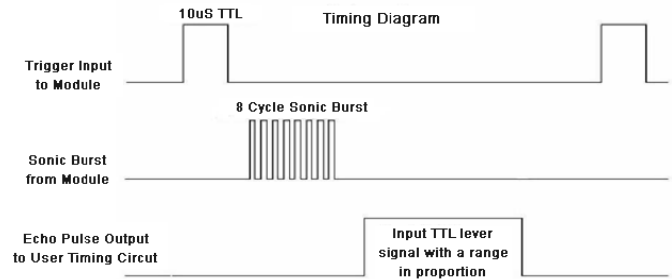
Here we have divided the product of speed and time by 2 because the time is the total time it took to reach the obstacle and return back. Thus the time to reach obstacle is just half the total time taken.

We have used The HC-SR04 Ultrasonic Module. It has 4 pins-

1. Ground
2. VCC
3. Trig and
4. Echo

The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the ARDUINO Board respectively and the trig and echo pins to any Digital I/O pin on the ARDUINO Board

In order to generate the ultrasound you need to set the Trig on a High State for 10  $\mu$ s. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave travelled



## B. ARDUINO

ARDUINO is an open-source platform used for building electronics projects. ARDUINO consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on our computer, used to write and upload computer code to the physical board.

The ARDUINO platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the ARDUINO does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – We can simply use a USB cable. Additionally, the ARDUINO IDE uses a simplified version of C++, making it easier to learn to program. Finally, ARDUINO provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

There are many types of ARDUINO some of which are given below:

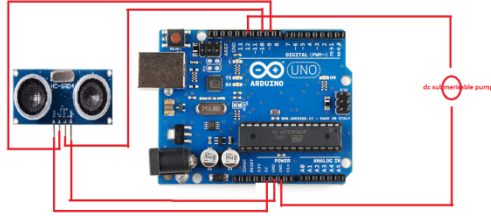
1. Arduino RS232 (male pins)
2. Arduino Diecimila
3. Arduino Duemilanov (rev 2009b)
4. Arduino Uno R2
5. Arduino Uno SMD R3
6. Arduino Nano (DIP-30 footprint)

We have used ARDUINO UNO SMD R3 in this project

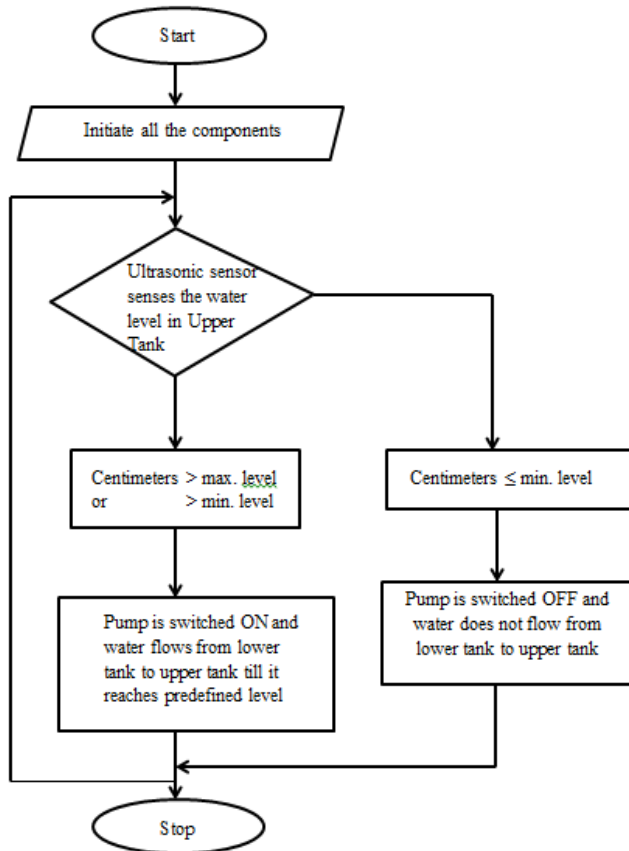
## 3. CIRCUIT DIAGRAM FOR AUTOMATIC WATER LEVEL CONTROLLER

Circuit diagram for water level controller is shown in figure:-

- Vcc and ground of HC-SRC4 are connected to the 5V and GND pins of power pins.
- Trigger and echo pins are connected to digital pins 9 and 10 of Arduino.
- DC submersible pump is connected between ground and digital pin 12



#### 4. FLOW DIAGRAM OF AUTOMATIC WATER LEVEL CONTROLLER



#### 5. RESULT AND DISCUSSION

##### A. When the water level in upper tank is low pump is switched ON.

Defined maximum water level and minimum level in upper tank is 20 cm and 5 cm respectively. If water level measured by ultrasonic sensor is 30cm implies that water level in upper tank is low and the pump is switched ON.

##### B. Till water reaches the predetermined level i.e. till the upper tank fills completely pump will be in ON condition.

If water level measured by ultrasonic sensor is 15cm implies that upper tank is not completely filled. Hence pump remains in ON condition.

##### C. When water reaches predetermined level(i.e.=20 cm) the pump gets switched OFF

If water level measured by ultrasonic sensor is 4cm implies that water has reached the min level i.e. 5 cm or above it hence the upper tank is completely filled and pump gets switched OFF automatically.

#### 6. CONCLUSION

This paper has achieved the main objectives. Non-Contact Water Level Monitoring System implemented Using Arduino where water level in the upper tank is monitored and according to that the pump in the lower tank or pump in the ground is switched ON and OFF automatically. This paper overcomes the disadvantage of existing automatic method which uses SS sensor where sensor senses the water level when comes in contact with that because of this sensor may corrode with some chemicals present in it.

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