

AUTOMATIC WATER LEVEL INDICATOR AND CONTROLLER USING ARDUINO

Ms. Pooja K¹, Ms. Kusumavathi ², Ms. Pavithra³, Ms. Nishmitha⁴, Prof. Aishwarya D Shetty⁵

¹⁻⁴Students, Dept. of Information Science and Engineering, Yenepoya Institute of Technology, Moodbidri, Karnataka, India

⁵Assistant Professor, Dept. of Information Science and Engineering, Yenepoya Institute of Technology, Moodbidri, Karnataka, India

Abstract - Most of the people in residential areas face the problem of running out of water and overflow of water in water tanks due to excess supply of water. It becomes difficult for users to judge the level of water in water tanks. When the pump is turned ON, users will not realize that the water tank is filled, which may result in overflow. Water level indicator and controller system is used to sort out the issues associated with water tank. It is also possible to check the level of the water using sensor so that whenever the water goes below, pump gets turned ON automatically. Also when there is overflow of water in water tank it uses sensor to detect the water level so that if the water level goes above, the pump gets turned off automatically. This system prevents wastage of water.

Key Words: Arduino UNO, Ultrasonic sensor, 7-Segment Display, Relay, Connecting Wires, etc.

1. INTRODUCTION

Water is a universal solvent which plays an important role in everyday life. The total amount of water available on earth has been estimated at 1.4 billion cubic kilometers, enough to cover the planet with a layer of about 3km. About 95% of the Earth's water is unfit for human consumption. About 4% is locked in the polar ice caps, and the rest 1% constitutes all fresh water found in rivers, streams and lakes which is suitable for our consumption. A study estimated that a person in India consumes an average of 135 liters per day. This consumption would rise by 40% by the year 2025. This signifies the need to preserve our fresh water resources. Many houses make use of supplementary water tank to store water that is collected from rain water or water pumped from well or underground. At present, water meters are used to calculate the amount of water used at homes. This doesn't provide an efficient method of monitoring the water usage. The water is wasted at each and every outlet knowingly or unknowingly which adds up to huge amount in the end. Efficient management of the water used at homes is very much necessary as, about 50% of water

supplied to the cities gets wasted through its improper usage. Water management is only possible, if the user is aware of the quantity of water he uses and the quantity available to him.

Water is essential in every hour of our lives. Hardly anyone keeps in track of the level of water in the overhead tanks. Consequently, automatic controlling involves designing a control system to function with minimal or no human interference. The idea can be implicitly used to ascertain and control the level of water in overhead tanks and prevent the wastage. In this Arduino based automatic water level indicator and controller project, the water level is being measured by using ultrasonic sensors. The objective of the project is to measure the level of water in the tank and notify the user about the water level. In "Automatic0.07

Water Level Indicator and Controller using Arduino" project, the water is being measured by using ultrasonic sensors. Initially, the tank is considered to be empty. The motor pump is automatically turned ON when the water level becomes low and turned OFF when the tank is full.

1.1 OBJECTIVES

There are some objectives need to be achieved in order to accomplish this project. These objectives will act as a guide and will restrict the system to be implemented for certain situations:

1. To develop water level control system to control the water level in the tank.
2. To check the level of water in the tank. Depending on the water level, the motor switches ON when the water level goes below a predetermined level or the motor switches OFF when the tank is full.
3. To display the water level and other important data on a 7-Segment Display.
4. To monitor the level of water in the tank. If the level inside the tank is low, the motor

turns ON. Similarly if the tank is full, the motor turns OFF.

2. LITERATURE SURVEY

- [1] This paper has an implemented Automatic water level control system consisted of arduino to automate the process of water pumping in a tank and has the ability to detect the level of water in a tank and switches ON or OFF the pump accordingly and displays the status on the LCD screen. The system also monitors the level of water in the sump tank (source tank). If the level inside the sump tank is low, the pump will not be switched ON and this protects the motor from dry running. A beep sound is generated when the level in the sump tank is low or if there is any fault with the sensors.
- [2] This paper have developed a system which initially tests the availability of water in the tank with the help of a level detector and then adjusts the state of the water pump according to the information collected through the level detector. This design makes use of seven segment display and a motor pump. The proposed system consists of water level sensor and a digital logic processor circuit. The proposed system eliminates manually controlling of water requirements in home and agricultural fields.
- [3] This paper introduced a system which proposes a simple water level monitoring system with different levels indicated. It also signifies when the water level is below and above than the requirement. This method helped us to understand the use of Bluetooth modules and how it can be made as a portable device.
- [4] This paper introduced a system which measures water level by using ultrasonic sensors. The system makes use of water level indicator, water level sensor, water pump controlling system and microcontroller. Ultrasonic sensor gets water level reading and it will send a signal to microcontroller and starts to echo the pulses.
- [5] The system used microcontroller to automate the process of water pumping in an over-head tank storage system and has the ability to detect the level of water in a tank, switch on/off the pump accordingly and display the status on an LCD

screen. This research has successfully provided an improvement on the existing water level controllers by its use of calibrated circuit to indicate the water level and use of DC instead of AC power thereby eliminating risk of electrocution.

- [6] This paper proposed Automatic water level controller with Short Messaging Service (SMS) Notification. SMS Notification was added to automatic controller system so that water can be managed by user during load shedding. Two systems work synergistically; automatic level controller system and SMS system. The program was developed in Aurdino program developing environment and uploaded to the Microcontroller. Water level in the system is controlled automatically. The controller operates on battery power. Whenever the system encounters empty level and the status of load shedding, the SMS notification is sent to the user.

3. SOFTWARE REQUIREMENT AND SPECIFICATION

A System Requirements Specification (SRS) (also known as a Software Requirements Specification) is a document or set of documentation that describes the features and behaviour of a system or software application. It includes a variety of elements that attempts to define the intended functionality required.

3.1 FUNCTIONAL REQUIREMENTS

A functional requirements defines a function of a system or its component. Where a function is described as a specification of behaviour between inputs and outputs.

3.2 NON-FUNCTIONAL REQUIREMENTS

Software requirement can be non-functional and also be a performance requirements. Non-functional requirements are the characteristics or attributes of the system that can judge its operation.

3.3 HARDWARE REQUIREMENTS

Hardware requirement analysis is to define and analyse a complete set of functional, operational, performance, interface, quality factors, design, criticality and test requirements. Water Level uses the Arduino board along with the ultrasonic sensors.

3.3.1 ARDUINO

Arduino UNO has the micro-controller ATmega328 embedded in it. It has 14 digital I/O pins out of which 6 provide PWR output. It is an open-source and provides

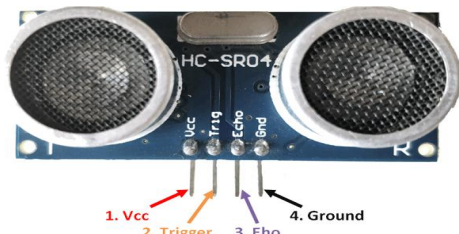
prototype platform. It also has a 16MHz crystal oscillator attached to it. In addition to the above features, it also has an USB connection, a power jack, an ICSP, header and reset button. It has everything to support a micro-controller. It can simply be connected to a computer using an USB cable or power it with an AC or a DC adapter or a battery.



Fig. -1: Arduino UNO circuit board

3.3.2 ULTRASONIC SENSOR

It is basically a distance sensor and is used for detecting the distance. It has two ultrasonic transmitters namely the receiver and the control circuit. The transmitter emits a high frequency ultrasonic sound wave which bounces off from any solid object and receiver receives it as an echo. The echo is then processed by the control circuit to calculate the time and the difference between the transmitter and receiver signal. This time can subsequently be used to measure the distance between the sensor and the reflecting object. It has an ultrasonic frequency of 40 KHz and accuracy



is nearest to 0.3 cm.

Fig. -2: Pin Configurations of Ultrasonic Sensor

3.3.3 SEVEN SEGMENT DISPLAY

A seven segment display is the most basic electronic display device that can display digits from 0-9. They find wide application in devices that display numeric information like digital clocks, radio, microwave ovens, electronic meters etc.

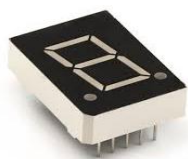


Fig. -3: Seven Segment Display

The most common configuration has an array of eight segments arranged in a special pattern to display these digits.

3.3.4 CONNECTING WIRES

In any electronic circuitry wires are the conductive connections between the elements in contact. Theoretically, they have zero resistance and provide perfect connections. On the breadboard, they look like nice coloured jumper wires.



Fig. -4: Connecting Wires

3.3.5 RELAY

In order to isolate two circuits electrically and to connect them magnetically relays are used. They are very useful in switching from one circuit to another when they are completely separated. The relays comprise of an input and an output section. The input section has a coil which produces magnetic field when a small voltage from an electrical circuit is applied. This applied voltage is known as the operating voltage.



Fig. -5: Relay

3.4 SOFTWARE REQUIREMENTS

3.4.1 ARDUINO IDE SOFTWARE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, MAC OS, Linux). The source code for the IDE is released under the GNU (General Public License) version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution.

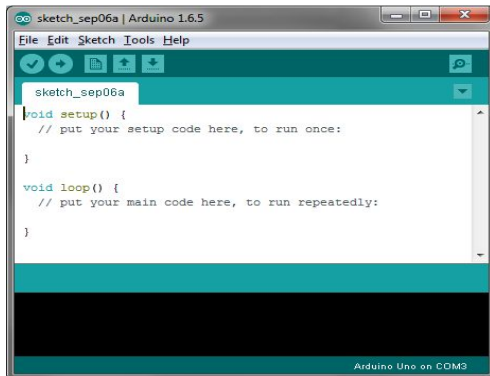


Fig. -6: Arduino Software IDE

3.4.2 ARDUINO LANGUAGE

The compiler software is hosted on a computer separate from the Arduino UNO. The job of the compiler is to transform the program provided by the program writer (filename.c and filename.h) into machine code (filename.hex) suitable for loading into the processor. Once the source files (filename.c and filename.h) are provided to the compiler, the compiler executes two steps to render the machine code.

4. SYSTEM DESIGN AND IMPLEMENTATION

4.1 BLOCK DIAGRAM

As shown in block diagram, ultrasonic sensor module's "trigger" and "echo" pins are directly connected to pin 12 and 13 of arduino. "GND" and "VCC" pins are connected to GND of bread-board and 5V of arduino. A seven segment display is connected with arduino. Out of 10, the 8 pins i.e. a, b, c, d, e, f, g and DP segment (decimal Point) are connected to digital pins i.e. 9, 6, 4, 3, 2, 8, 7 and 5 of arduino. The pin 3 and 8 are internally connected to form a common pin. This pin should be connected to GND(common cathode) or 5V(common anode) depending upon the type of the display. Relay is also connected to pin of arduino through ULN2003 for turning ON or turning OFF the water motor pump.

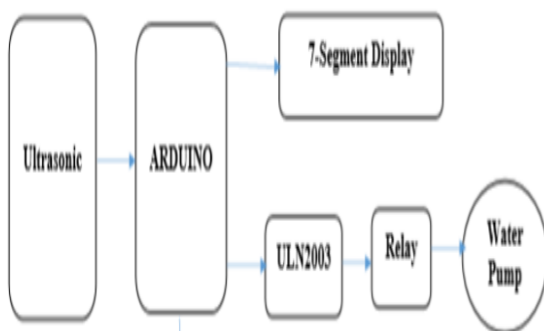


Fig. -7: Block Diagram

When the circuit is switched ON, the ultrasonic sensor transmits the generated sound signal to the bottom of the water tank which is the target and whose water level is to be measured. The signal after touching the base of the tank is reflected back and is received by the receiver of the ultrasonic sensor. The time taken through the entire journey of the transmitted signal is recorded. The output obtained is the required distance.

4.2 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a graphical representation of the "flow" of data through an information system. DFD can also be used for the visualization of data processing. Automatic water level indicator and controller system uses two sensors at two levels of the tank, i.e. one at the higher level of the tank and the other at the lower level of the tank.

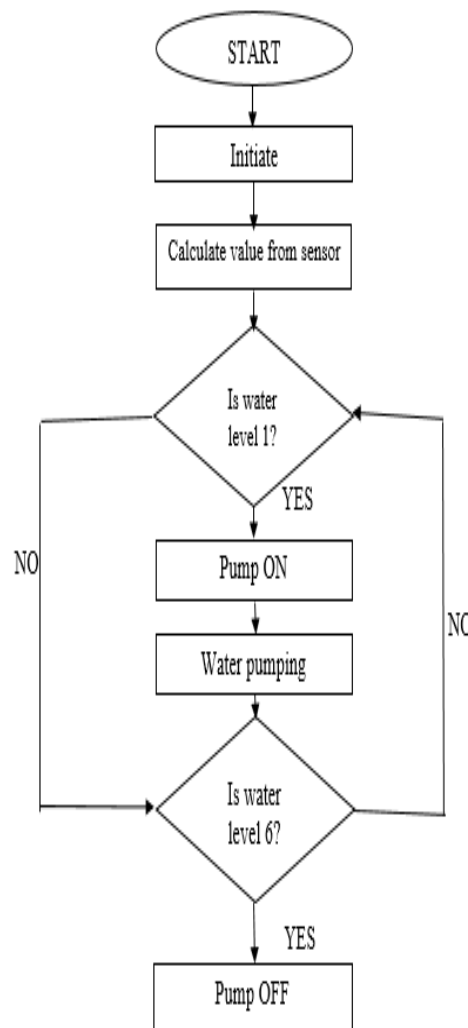


Fig. -8: Flowchart of the proposed system

If measured level is below the threshold level of 2cm then the tank becomes empty then seven segment display indicates "1", water pump will automatically be switched

OFF. Henceforth, When the water reaches a particular level of the seven segment display indicates "1", which will automatically pump ON and which will indicating the tank is full.

5. RESULTS AND SNAPSHOTS

This chapter contains the snapshots of the graphical user interface (GUI) of the proposed system showing the interface and the intermediate results.

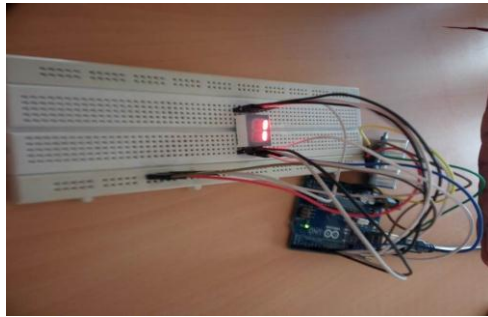


Fig. -9: Water Level 1 Representation

The Fig. 9 shows the water level 1 representation by the ultrasonic sensor and the Arduino interface. When the sensors detects water level 1, it helps in automatically turning the pump ON.

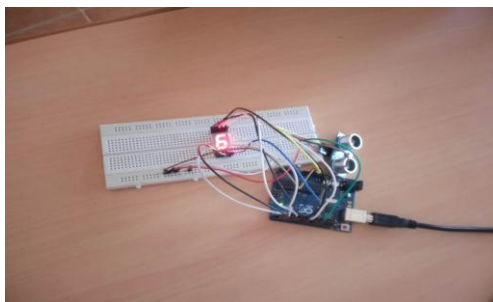


Fig. 10:- Water level 6 Representation

The Fig. 10 shows the water level 6 representation by the ultrasonic sensor and the Arduino interface. When the sensor detects water level 6, it helps in automatically turning the pump OFF.

6. 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.

7. FUTURE ENHANCEMENTS

The automatic water level indicator and controller using Arduino project can also be installed with pH sensors which will help to regulate the acidity or alkalinity of the water.

REFERENCES

- [1] Asaad Ahmed Mohammed ahmed Eltaieb and Zhang Jian Min, Automatic Water Level Control System, International Journal of Science and Research (IJSR), Volume 4 Issue 12, December 2015.
- [2] Beza Negash Getu and Hussain A. Attia, Automatic Water Level Sensor and Controller System, ©2016 IEEE.
- [3] Priya J, Sailusha Chekuri, water level monitoring system using IoT, International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 12, Dec-2017.
- [4] Madhurima Santra, Sanjoy Biswas, Sibasis Bandhpadhyay and Kaushik Palit, Smart Wireless water level Monitoring & Pump controlling System, International Journal of Advances in Scientific Research and Engineering (IJASRE), Vol. 03, Issue 4, May -2017.
- [5] K. Santhosh Kumar, G. Mukesh, K. Deepti, Microcontroller based Automatic Water level Control System, International Refereed Journal of Engineering and Science (IRJES) Volume 4, Issue 11, November 2015.
- [6] Sanam Pudasaini, Anuj Pathak, Sukirti Dhakal and Milan Paudel, "Automatic Water Level Controller with Short Messaging Service (SMS) Notification", International Journal of Scientific and Research Publications, Volume 4, Issue 9, September 2014.