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IoT based Automatic Water Overflow Detection

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***Abstract*—Water is one amongst the basic necessary survival elements which we needed in our day to day life. So we must be save every drop of water. In order to solve this issue here developed a system that automatically control water tank overflow. This has a variety of features to control the water pump depending on the amount of water in the storage system. An ultrasonic sensor positioned on the storage tank is utilized to detect the water level. This sensor is used to determine when the water level in the overhead tank is higher or lower. The Arduino Uno controller is used to automate the process of pumping water to the overhead storage tank. In accordance with the information received, it operates the sensors that measure the water level and turns on and off the pump. A 16x2 LCD is used for the purpose of displaying the crucial information. Detailed evaluation of functioning of the system has shown good performance in terms of efficiency, connectivity and response.**

***Index Terms*— IOT, Arduino, Ultrasonic Sensor, LCD.**

I. INTRODUCTION

In everyday life, water is the main element either for domestic or commercial purpose. Excessive water wastage has become a serious issue, which is affecting our environment. Due to excessive wastage, water shortage may lead to many environmental problems such as climate change, droughts, increasing pollution and increasing human demands. As fresh water is not abundantly available, so it is very important for proper use and management of water. There is an immediate focus on the wastage of water across various sectors such as residential, industrial or commercial areas.

A low cost system can be developed using the basic components like an Arduino Uno and appropriate sensors. An ultrasonic sensor positioned on the storage tank can be utilized to detect the water level. To automate the process of pumping water to the overhead storage tank and for the overall control an Arduino Uno has been used in this work.

A microcontroller board called Arduino UNO shown in fig.1 is based on the ATmega328P. It contains 6 analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. An ultrasonic sensor as shown in fig.2 is a piece of technology that uses ultrasonic sound waves to detect the distance to a target item and then turns the reflected sound into an electrical signal.

A submersible water pump shown in fig.3 is a centrifugal water pump powered by a motor that rotates an impeller that pushes water outwards. The motor is housed in a waterproof seal and is tightly coupled to the water pump it drives. Fig 4 shows a 16x2 LCD display used for communicating the level of water in the tank to the

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Fig. 1: Arduino UNO

Fig. 2: Ultrasonic Sensor

user and action to be taken. The display consists of 2 lines that can each display 16 characters. Each character on this LCD is presented using a 5x7 pixel matrix. There are 224 different characters and symbols that can be displayed on the 16 x 2 intelligent alphanumeric dot matrix displays.

Fig. 3: Water Pump

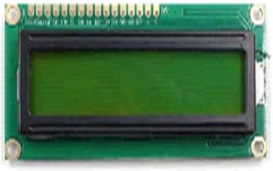

Fig. 4: 16x2 LCD Display

II. Related Works

This section presents a brief survey on the existing literature relevant to water overflow detection and alerting. Gupta et.al., [1] outline a system in their study for identifying water pipeline leaks using data from water flow sensors. Their model uses a microprocessor that receives an electrical signals produced by the water flow sensor and water detector for decision making. A computer based control system for controlling the exploitation of water has been discussed by Shakmak & Al-Habaibeh, [2]. In their work sensors are used to detect and control the water level in tank can pump. The information from the sensor used by the Arduino for controlling the motor. The work reported by AyobJohari et.al [3] involves using a water flow reading metre to automatically extract each individual water meter's flow consumption reading. With the help of the water flow reading, this work attempts to automatically extract each individual water meter's flow consumption reading. Next, it uploads the extracted water flow data to a cloud platform over an internet connection for analysis and data visualization. Ashome & Ashok [4] proposes a SMS alert based model using mobile middleware application to communicate with the users.

Prowl et.al [5] in their work proposes the use of multiple sensors controlled using an Arduino board for detecting the overflow of water. A Raspberry Pi based detection system has been discussed by Jain [6] in their paper. The system implemented on a remote webhost for leakage detection in water distributed network systems. Nachman, & Madden[7] introduces a design of an electronic system for automatic control of water pump motors that are used at homes to fill the overhead tanks with municipal water. A wireless sensor network based system for pipeline monitoring is presented by Stoianov et.al, [8] in their work which uses an alarm system to warn the customer in case of an overflow.

From the survey it can be observed that most of the work on water overflow detection is concentrated towards the use of an IoT based technology. The work proposed in this paper also uses Arduino and sensors for developing a customized automatic water overflow detection system.

III. Methods

An overall architecture of the system proposed is given in fig 5. Ultrasonic sensors are part of the performing system's sensing component. Arduino Uno is provided with the sensing data. The Arduino Uno is designed in such a way that when the water level falls below a certain threshold, the alarm and pump will immediately turns on. When the water falls below the predetermined level, the buzzer begins to chime. When the water level reaches a certain point, the controller activates the pump, which begins pumping the water and will continue to fill the tank without incident. The pump automatically turns off once the tank is filled with water. This technique in the proposed system avoids the pump from running dry.

Fig 6 shows the circuit diagram for the simulation. The ground and the same 5 volt supply are linked to the ground pin and the ultrasonic sensor is connected to the digital pins. Ultrasonic waves are reflected and received

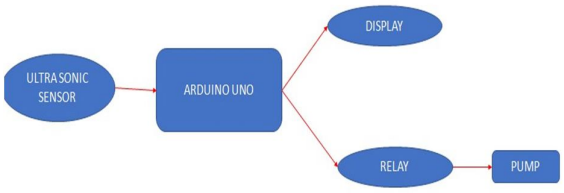

Fig. 5: Block Diagram of Automatic Water Overflow Alerting System

by the receiving end after being delivered through the transmitter end. The amount of water still in the tank is determined by calculating the reflection's time delay and converting it into a digital signal.

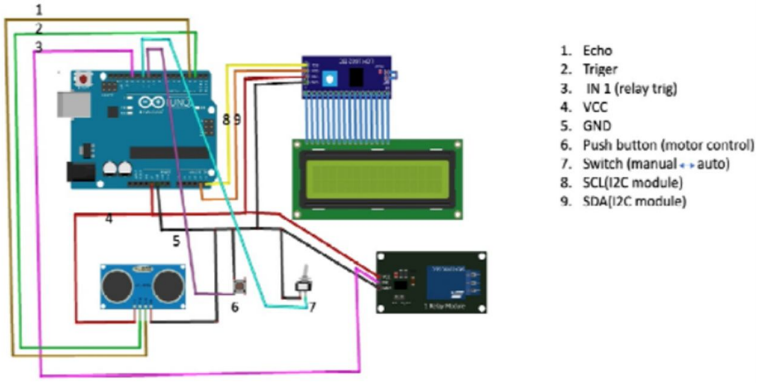

Fig. 6: Circuit diagram for the simulation

The process in detecting and displaying the water level and action to be taken is as given below
STEP1:- The ultrasonic sensor measures the distance and end to Arduino.
STEP2:-Arduino IDE runs and classifies and collects the sensor datas.
STEP 3:-The water level is maintained with the help of ultrasonic sensor and water pump.
STEP 4:-The sensor values are checking in every time and displaying.
STEP 5:-switch on the pump if the water level reaches below 20%.
The detection of this process in terms of flowchart is given in fig. 7 for ease of understanding.

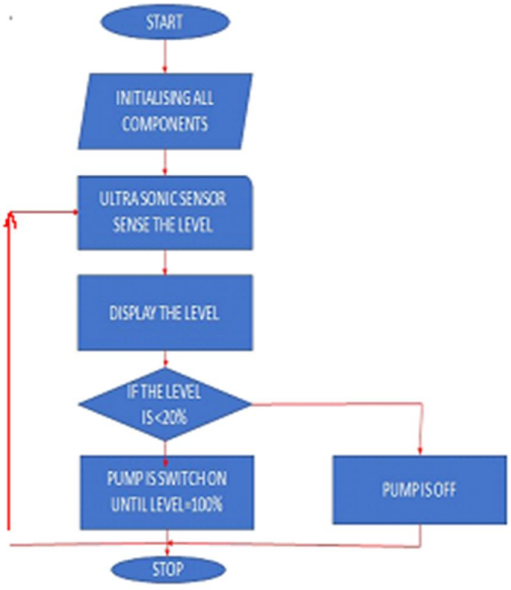

Fig. 7: Flow chart

IV. Results & Discussions

This section presents the experimental setup as shown in fig.8. The data from the sensors are given for processing to Arduino and based on the preset threshold the user is informed whether the pump has to be ON or OFF accordingly, along with a display of water level in the tank. Fig. 9 & 10 shows display given on the 16X2 LCD.

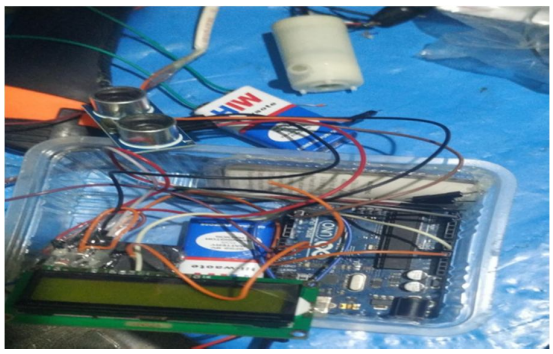

Fig. 8: Experimental setup

Fig. 9: Display of Initial Water level

Fig. 10: Display of Final Water level

The user is informed when the tank is around 93% filled, taking into consideration the time that would be required for manually offing the pump or the circuitry delay that would be involved in case of automatic turn off. This would ensure that there is no overflow and hence no wastage of water.

V. Conclusion

In this work development of an automatic system for detecting the overflow of water that can be modeled at a very low cost has been presented. This would be very useful for household/college where overflow is a common issue. The system is modeled using an IoT based approach comprising of an Arduino uno and ultrasonic sensors. The level of water in the overhead tank and the ON/OFF of the pump is displayed using a 16x2 LCD. Detailed evaluation of functioning of the system has shown good performance in terms of efficiency, connectivity and response.

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