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Arduino Based Smart Phone Liquid Level Monitoring System Using Ultrasonic Sensor

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ABSTRACT
This paper provides a detailed study on how to develop the Arduino UNO based smartphone-based liquid level monitoring system. In recent years, the ATMEL company has been able to develop Arduino by creating Arduino UNO. In our project, we use the Arduino UNO R3 to measure the liquid level and monitor it using the smartphone based on the Bluetooth module and we can read the output level on the I2C LCD screen. It can measure any type of liquid as we use an ultrasonic sensor instead of the float sensor. we designed a wireless water level monitoring system based on Arduino. It consists of an Arduino, an ultrasonic sensor, and a Bluetooth module. The Arduino receives the level information from the sensors and tracks the liquid level with predefined level indicators. The Bluetooth module receives the command from Arduino and the command will be transferred to the registered mobile phone via Bluetooth. In addition, we put a buzzer as an additional indicator.

Keywords: Arduino Uno, Bluetooth Module, Ultrasonic Sensor, Buzzer, I2C LCD Display.

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I. INTRODUCTION

One of the biggest problems that most countries face is the problem of water scarcity in the world. The shortage is mainly due to the waste of water. Water waste must be controlled to save the environment and water resources. The water level monitoring system is one of the techniques to deal with the control of water waste. Observe the water level and provide information to registered users wirelessly. In view of this, the water level monitoring system based on the Bluetooth module is an innovative idea that will inform users about the level of the liquid and prevent it from overflowing. The water level monitoring system is an automatic process to detect and indicate the water level in tanks, elevated cisterns or other storage containers, etc. All families store water in elevated tanks using motor pumps. When water is stored in the tank, no one can identify the water level and no one can know when the water tank will fill up. Therefore, there is an overflow of water in the tank, resulting in a waste of energy and water. To solve these types of problems, monitors and water level control systems are implemented using wireless technology, which will transmit information to the smartphone, telephone and indicate the water level in the elevated tanks. Additionally, water level monitoring and alarm circuits can be used in factories, chemical plants, electrical substations, and other liquid storage systems. In this paper we discussed through various researches what development has been done in the smartphone based liquid level monitoring System using Arduino and our proposed work regarding the following paper will be easy for measure level of the liquid and monitoring the liquid in real-time. For that we are going to use Arduino in this project. [1].

II. GOALS

To design of Smartphone based liquid level monitoring system and remotely monitor liquid level inside the tank/reservoir in real-time based on Arduino UNO and also to display the level of liquid on smartphone as well as the I2C LCD display. [2].

III. OBJECTIVES

- To acquire knowledge and experience with the Arduino UNO board and Bluetooth module as well as the Ultrasonic sensor module.
- To monitor the level of the liquid in real-time.
- To design circuit for Smartphone based liquid level monitoring system that will use to remotely monitor liquid level with using the Smartphone based Arduino UNO.
- To acquire knowledge on the circuit connection and programming cods.

❖ To learn how to write the report and prepare presentation about the project.
❖ To program the Arduino UNO base on the components of the project and testing it.
❖ To connect the Bluetooth module with smartphone and cheek the display
❖ We will aim to acquire knowledge of teamwork and partnership teamwork in order to finish the project, and we intend to continue to grow the project in the future. [2].

IV. BLOCK DIAGRAM

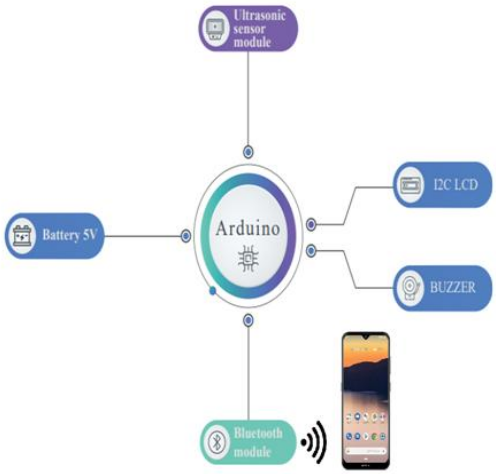

Fig. 1: Block Diagram

The premise is that we can monitor the level of the liquid from my smartphone without having to view the level of the liquid or even go near the tank. We connect the Arduino to our smartphone through Bluetooth using an Android software (created by the MIT App Inventor website). So, in this method, we can keep track of the liquid level for various types of liquid and its current state.

V. CIRCUIT DIAGRAM

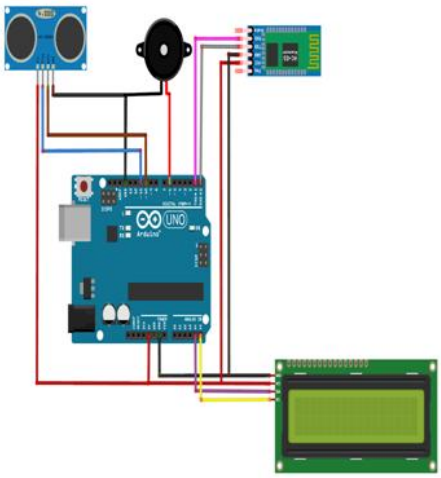

Fig.2: Circuit Diagram

The Vcc, GND, Trig, and Echo pins are all located on the ultrasonic module (HC-SR04). With a range precision of up to 3mm, it can provide non-contact measurements in the range of 2cm to 400cm.Because the Trig pin on the HC-SR04 is an input pin to the Arduino Uno, which is connected to pin number 11 on the Arduino, and because it can provide a high signal of 10 seconds (microseconds). After triggered the HC-SR04. It will automatically send out 8 pulses (sonic bursts pulses) at 40 kHz; these 8 sonic bursts will hit the liquid, and the wave will return to the sensor; the Arduino will read the echo pin (which is connected to pin number 10 in the Arduino) to determine the time (in seconds) it takes between triggering and receiving the echo, which is the output pin. The Arduino can calculate the distance in this way because the speed of sound is approximately 340 meters per second (m/s). The Bluetooth module has four terminals, two of which are the positive (Vcc) and negative (GND) terminals of the HC-06, which are linked to the positive (5V) and negative (GND) pins of the Arduino, as shown in the circuit diagram. RXD and TXD are the third and fourth terminals, respectively, and are connected to TXD and RXD in Arduino. In this circuit, we utilize a Bluetooth module to save data from the Arduino (which is the level of liquid measured by the HC-SR04 and calculated by the Arduino program) and then communicate it wirelessly to our smartphones, where it will be displayed using the (levelmonitoring.apk) app. The level of the liquid is sensed by Arduino and shown on the I2C LCD, as shown in the circuit diagram. Four pins on the I2C LCD (Liquid Crystal Display) are connected to the Arduino. The ground pin (GND) is connected to the Arduino's ground pin, while the provided power pin (Vcc) is connected to the Arduino's 5V output. Only the Serial Data pin (SDA) and the Serial Clock pin have survived (SCL). SDA is connected to the A4 pin, which is used to send and receive data. In addition, this Buzzer is a two-terminal gadget. What is the difference between the positive (attached to pin 6 on the Arduino) and negative terminals (Which is connected to GND in the Arduino). This is used to alert you when the tank level rises or falls above or below the specified limit.

VI. CALIBRATION PROCEDURE

As the HC-SR04 emitting an ultrasonic wave and counting the time it takes for the echo to return, the ultrasonic sensor can determine the distance between the sensor and the liquid. So, during the first calibration we have to measure the height of the empty tank to know the height (H) of the tank and how can withstand to max and min level of the liquid. So, it done by emitting waves from the ultrasonic and it will reach the tank's

bottom and is reflected to the Echo pin. The value of the H only once needs to be modified. As illustrated in Fig 3 the ultrasonic sensor will be mounted in the top of the tank.

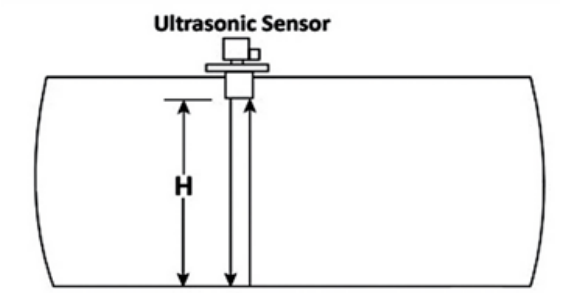

Fig.3: Empty tank

As illustrated in Fig 4 as the tank is half filled with the liquid that mean up to the h and the wave is reflected off the liquid surface and detects the depth of empty space (y) above the liquid in this circumstance. In order to now the value of the liquid on the tank we calculated by subtracting the height of the air gab (y) from total height of the tank (H) to get (h) which is the height of the liquid in the tank. We have to change the total height of the tank (H) and the maximum and the minimum vale of the liquid based on the tank. From the cod of the Arduino.

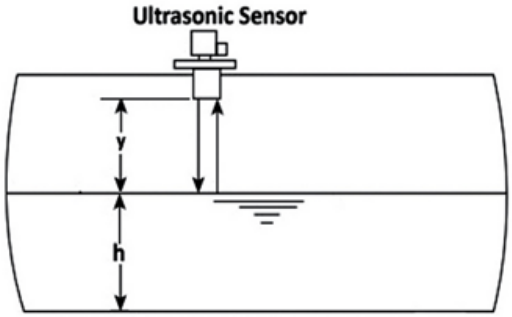

Fig.4: Tank filled to a specific level with liquid (h)

VII. RESULTS & DISCUSSION

The Arduino based smartphone based liquid level monitoring system is implemented in companies to monitoring of the different type of liquids with help Arduino program. The project is put to the test in real time to see how successful it is and the results of the project As well as, it has been noted that the project detects the liquid level in the tank and also saves time in determining the liquid level. The results in the table based on 24 cm tank.

Case 1: Liquid at low value

The level of the liquid in the tank is shown in the Fig.5. The value under this state needs to be check. The output of the monitoring the liquid under low level is shown in the Fig 6 and 7. The level of liquid is displayed in the I2C LCD and the Smartphone respectively.

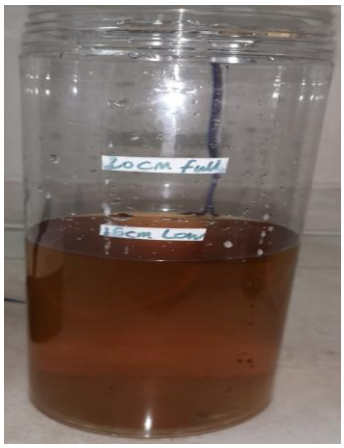

Fig.5: Low level of the liquid in the tank

Fig. 6: Low level of the liquid in the I2C LED display

Fig.7: Low level of the liquid in the Smartphone

Case 2: Liquid at Normal Value

The level of the liquid in the tank is shown in the Fig.8. The value under this state is under the recommended level. The output of the monitoring the liquid under normal level is shown in the Fig 9. and 10. The level of liquid is displayed in the I2C LCD and the Smartphone respectively.

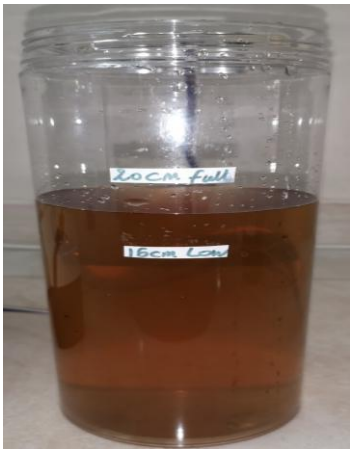

Fig.8: Normal level of the liquid in the tank

Fig.9: Normal level of the liquid in the I2C LED

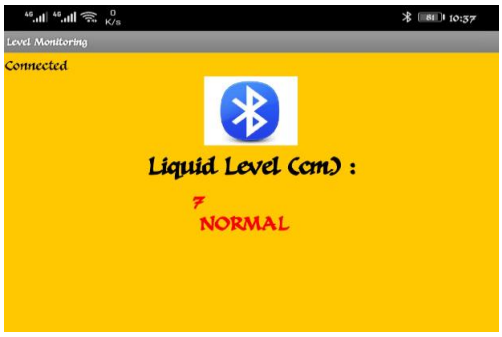

Fig.10: Normal level of the liquid in the Smartphone

Case 3: Liquid at High Value

The level of the liquid in the tank is shown in the Fig.11. The value under this state needs to be check. As well as, do the maintenance required as it's in the dangerous zone. The output of the monitoring the liquid under high level is shown in the Fig.12. and 13. The level of liquid is displayed in the I2C LCD and the Smartphone respectively.

Fig.11: High level of the liquid in the tank

Fig.12: High level of the liquid in the I2C LED display

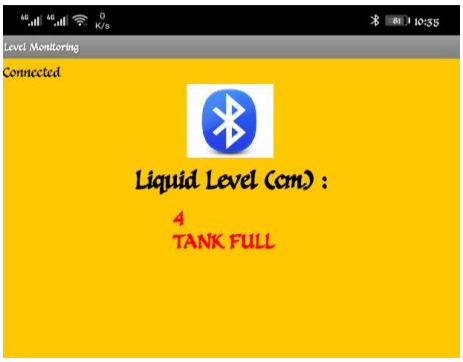

Fig.13: High level of the liquid in the Smartphone

VIII.CONCLUSION

This paper describes "Smartphone Based Liquid Level Monitoring System Using Arduino". It has been implemented using hardware components like Arduino UNO, Bluetooth module, I2C LCD and ultrasonic sensors. Here, we can monitor the levels of water present in any tank or container by that we can control the water flow. Furthermore, it is observed certain water levels through I2C LCD and Smart Phone via Bluetooth Module. It is designed for three different level like initial, normal and tank

full stages. The sensed data from the sensor will be automatically sent to Bluetooth connection to the smart phone. By using this system, any type of liquid level value can be controlled. Thus, being a cost effective and simple strategy to monitor the water level system.

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