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Water Level Indicator using Embedded Platform- An Experimental Validation

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Abstract: ***In this arduino based intermediate water level indicator and controller project , we are going to measure the water level by using ultrasonic sensor. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves which is also known as ECHO. When the sound waves are transmitted in environment then they return back to the origin as ECHO, after striking on any obstacle. We have to calculate the travelling time of sounds which results in distance. This concept is used in our water controller project and the water motor pump is automatically turned on when water level in the tank becomes low***

Keywords: water level indicator, ultrasonic sensor, ECHO, tank, embedded.

I. INTRODUCTION

Water is the most essential element to life on earth .safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients[1].However some observers have estimated that by 2025 more than half of the world population will be facing water based vulnerability .The presence of water level indicator in a reservoir can help control wastage and water inadequacy in such reservoir .We can also save the water to some extent by using level indicator in our overhead tank and control the overflow of water. The house where we live in has an overhead tank which is about 30feet from the ground level. But, everyone who has a water tank above knows the kind of problems that they face[2]. Firstly, there is no system to track the water in the tank. Then there come a secondary problem that is when their water pump is started they have no idea when it gets filled up and sometimes there are situations where the pump keeps on pumping water to the tank and the water starts spilling out from the tank .We were getting board going up the rooftop to check whether the tank has filled or the water level was below to start the pump .There is wastage of energy as well as wastage of water .To tackle this problem in electronics way ,a new device known as water level indicator came into existence. The water level indicator employs a simple mechanism to detect and indicate the water level in an overhead tank or any other water containers[3]**.** Water level indicator is an application which detects the level water then triggers the pump and blows alarm and vice versa they are useful devices and play an important role in various industries such as automobile, irrigation, and also at homes or whenever water is pump either underground or overhead.

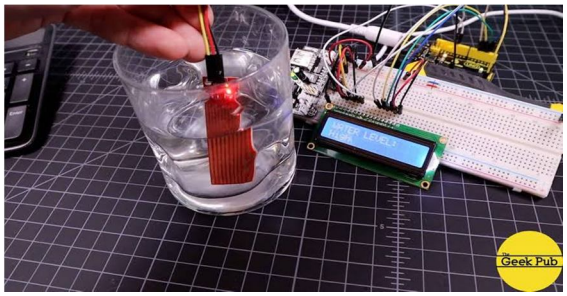

Fig.1 water level indicator

A water level indicator is used to show the level of water in an overhead tank, this keeps the user informed about the water level at all the time and avoids the situation of water running out when it is most needed .Indicator circuit also have alarm feature,it not only indicate amount of water Present in overhead tank but also gives an alarm when the tank is full. The purpose of a water level indicator is to gauge and manage water level in a water tank. The control panel can also be programmed to automatically turn on a water pump once level get too low and refill the water back to adequate level. Water level indicator is used to overcome overflow problems, to prevent wastage of water, to prevent wastage of energy, for sustainable use of water and judicious use of electricity, attention and observation.

Let me explain in a simple way what happens when you turn on water pump, water starts to get pumped from underground reservoir from pipes to your water tank .In the tank there will be sensors .So ,the water starts to get filled in the tank and when the water level in the tank starts to rise up ,the sensor that is installed in the tank starts to get activated indicating the water level in the tank .And finally when it reaches to its top there will be a visual display as well as sound from the unit indicating that the water has filled in the tank and one can be alerted that the tank has been filled up and the water pump has to be switched off saving the electricity bill as well as overflow of water from the tank.

II. LITERATURE SURVEY

We gathered this information, In order to achieve high level of accuracy of our developed module, the module at the point of installation must be calibrated. The module error margin of 0.17% by maximum is evaluated; to overcome this error we attributed that to fact that temperature and humidity of the environment and the position of the ultrasonic sensor affect the accuracy of the ultrasonic sensor[4]. Moreover the performance evaluation of the system was connected to 12V, 5amp electric water pump. The maximum was set at 99.83% whereas the minimum was 0.17% of the volume holding capacity of the tank. The pump was connected through the control unit while the ultrasonic sensor was strategically positioned above the water inlet level and free from uncontrolled turbulence of the water from inlet. If the water level attained the programmed highest level, the control unit switched OFF the pump. In case of lowest level testing, water is drained continuously until the lowest level was reached, then the control unit switched the pump ON. Figure shows the Transmitter (T: up) and Calibration Receiver (R: down) of the Ultrasonic sensor It is interesting to know that we can fix the lowest level of the water at around 50% of the volume holding capacity of the tank so that the system can always maintain water level. Thus, the module real timely regulates water level between these two situationally determined limits as long as there was power supply to all the units working as a system. This project is used on the need of water level controller in irrigation in agriculture. It says that every crop requires different amount of water and this can be done by using automatic water level controller which will also help in reducing wastage of water. Water level in the system is controlled automatically. The controller operates on a battery power. The system will automate the process by placing a single sensor unit in the tank that will periodically take measurements of the water level and will control the motor automatically[5]. This system eliminates the efforts of people for daily filling of the tank and checks for overflow. 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[6]. 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.

III. SYSTEM DESIGN

A Water Level Monitoring System basically consists of……

A. Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc . The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

B. Ultrasonic sensor-HC-SR04

An HC-SR04-Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave. Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the human audible range. They are based on three physical principles: time of flight, the Doppler effect, and the attenuation of sound waves.

C. Resistor (330ohm)

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit, Resistance is measured in ohms, and in the given project we use the following resistors: 1k, 10k, 100k ohms resistors .In this experiment we use a 330ohm resistor.

D. Active Buzzer

An active buzzer will generate a tone using an internal oscillator, so all that is needed is a DC voltage. A passive buzzer requires an AC signal to make a sound. It is like an electromagnetic speaker, where a changing input signal produces the sound, rather than producing a tone automatically.

IV. IMPLEMENTATION

This can be done in 2 ways

A. By Real Time Hardware

In this Water level monitoring using ultra sensor, we use an ultrasonic sensor-HC-SR04 to detect the level of the water and we display the level of the water of using 5LED's ,these LEDs will display the level of the water when an level of the water is detected by an ultrasonic sensor -HC-SR04 and this data is then send to the arduino UNO, now the arduino will process the data and sends the power to LEDs according to the water level ,and the LEDs will glow according to the water level and displays the level of the water level.

Fig.2 system setup of real time hardware

…..Now the connections of this circuit are, First we connect the ultrasonic sensor to the arduino by connecting the VCC pin to the +5v terminal of the arduino and Ground pin to the Ground terminal of the arduino ,and now its trigger and echo pins 2&3 are connected to the digital terminals 6&7 of the arduino .Second we connect the 5LEDs to the arduino by using the 5-330ohm resistors ,as by connecting the first LED in series with the resistor 330ohm and this pair is connect to the analog terminal-4 of the arduino, and second LED in series with the resistor 330ohm and this pair is connect to the analog terminal-3 of the arduino ,and third LED in series with the resistor 330ohm and this pair is connect to the analog terminal-2 of the arduino ,and fourth LED in series with the resistor 330ohm and this pair is connect to the analog terminal-1 of the arduino, and fifth LED in series with the resistor 330ohm and this pair is connect to the analog terminal-0 of the arduino,

This is the real time hardware implementation of the Water level monitoring using ultra sensor,

B. By Tinkercad

By using this simulation software we simulate a water level monitoring system ,which consists of an Arduino, ultrasonic sensor, active buzzers, LCD display, and a pot. In this circuit first the ultrasonic sensor measures the level of the water and sends the data of the water level to the Arduino Uno, this Arduino will process the data from the ultrasonic sensor and gives the o/p processed data to the LEDs and LCD display, by which we get the level of the water is indicated by the LEDs and the level of water is also displayed in the LCD display

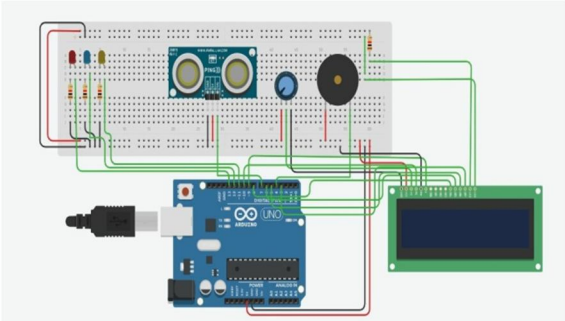

Fig.3 system setup of tinkercad

…. Now the connections of this circuit are,

First we connect the ultrasonic sensor to the Arduino by connecting the VCC pin to the +5v terminal of the Arduino and Gnd pin to the Gnd terminal of the Arduino, and now its trigger 3 are connected to the digital terminal 7 of the Arduino .Second, we connect the 3LEDs to the Arduino by using the 3-330ohm resistors,as by connecting the first LED in series with the resistor 330ohm and this pair is connect to the digital terminal-11 of the Arduino, and second LED in series with the resistor 330ohm and this pair is connect to the digital terminal-12 of the Arduino, and third LED in series with the resistor 330ohm and this pair is connect to the digital terminal-13 of the Arduino .Third we connect the LCD display to the Arduino by connecting its data pins to the Digital pins of the Arduino .Fourth we connect the active buzzer to the Arduino by connecting its -ve terminal to the digital terminal 8 of the Arduino.

V. RESULT

To design this we used materials of low cost. We tried to design the system in such a way that the components are easily available and when connected together it will prevent the wastage of water .The whole system operates automatically. So it does not require any expert person to operate it. This system shows the different water level indications through LED's

Fig. 4 indication of Water Level Below 50%

Fig.5 indication of Water Level At 50%

Fig .6 indication of Water Level Above 50%

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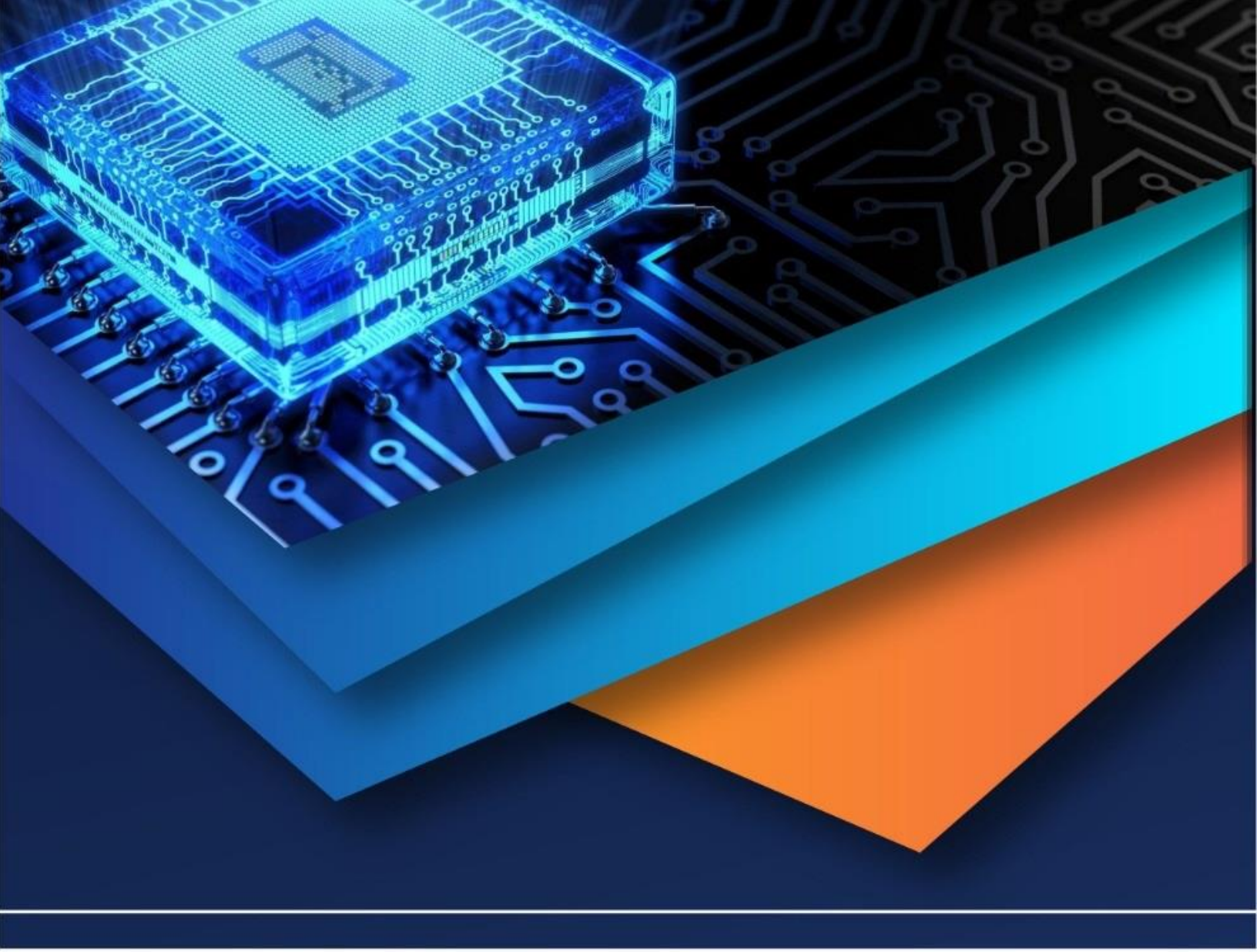

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