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Water Level Management Using Ultrasonic Sensor(Automation)

Kodathala Sai Varun[1], Kandagadla Ashok Kumar[2], Vunnam Rakesh Chowdary[3], C. S. K. Raju[4]

[1,2,3]Electronics and Communication Department, GITAM Deemed to be university, Bengaluru – 561203, India
[4]Department of mathematics, GITAM Deemed to be university, Bengaluru – 561203, India

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Abstract- Majority of earth's surface is covered with water but less than 5% is useful. So water conserving has become a major issue so certain water management steps are to be taken. Measuring water level is an important task from government and residence side. Thus, existing management systems has to be updated [1]. In this paper, we investigate the water level management using ultrasonic sensor which detects the amount of water present in the tank and returns the percentage of water present in it. This system has an Arduino, motor pump, LCD display, over-head tank, resource tank, buzzer and an LED. All components are interfaced with the Arduino and works by automation as per uploaded code. We divided the over–head tank by mean of percentages likely 10%, 20%...100%. 10% is the condition of the tank where the quantity of water present in it is very less and finally 100% is maximum condition. We have to monitor and maintain the tank when the water in it is getting less, but in this we make use of a buzzer so whenever the water level percentage is about 10% the buzzer, makes sense and automatically the relay based motor starts and standstill up to reach of 100% of the tank. So no one is required to monitor the tank and for switching of the motor. The main thing we employed is echo, which can be easily understood by an example consider you are in a silent cave when you produce sound you will listen the same thing by high intensity and this is called echo. Like example the ultrasonic sensor has two small openings on it. In which one opening sends the high frequency sound pulse called as ultrasonic waves like a small speaker (sender) and other opening receives them like a small microphone (receiver) [2] the explanation can be better understood by fig (1).

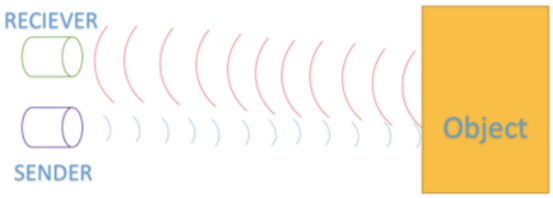


fig (1): Echo illustration

Keywords- Ultrasonic waves, echo, trig, Arduino, smart water, water level management, automation, relay, water level, trig, echo.

I. INTRODUCTION

The water level management has been a major issue so new methods has to be adopted to control the water level. Here our proposed system works better than existing system.

Existing system: The existing system works with many number of wires let us take a tank which is divided into percentages like 10%,20%, . . . 100%. Every wire is of different size kept at different percentages of the tank [3]. If the water present in the tank is 10% the water touches only one wire so LCD returns the amount of water present in it. This take much time in implementation. As water touches the wires may get damaged.

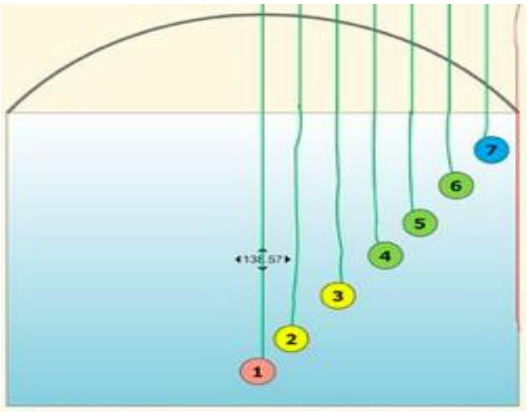


fig (2): existing system.

The above figure fig (2) shows the existing water level management system here in this system they hang the wires into water and each wire is connected to an LED. here the water is touching all 7 wires so the wire 7 returns that water

in tank is maximum the LED connected to the wire 7 will glow up, likely when the water level is only touching wire 1 similarly the connected LED will glow up and we will know the percentage of water present in the tank [4].

Proposed system: Here we'll present the basic idea of our proposal. This proposed system works under automation and contains the components like Arduino [5], ultrasonic sensor, motor pump, relay, led, buzzer and LCD in which each component has its own functionality but Arduino looks like heart of the project as all the components are interfaced with Arduino. The ultrasonic sensor plays major role in determining the water level present in the tank. This sensor is fitted under the lid of the tank and uses the concept called 'echo'. The sensor contains two small openings called trig and echo. The trig works like a small speaker in which it sends the ultrasonic waves and the echo acts as a small microphone [6] in which it receives the reflected waves which are sent by trig and this echo returns the distance. So by this we are known of water level in the tank through LCD. Another advantage of this proposed system is motor automation. We have designed a code that whenever the tank is getting low about of 10% the motor automatically starts and stops when the tank reaches to 90% so here no one required for controlling to motor this is the main advantage of proposed system. Since no component touches the water there is no chance of damage to the components whereas in the existing system contains wires that are placed in water which may cause damage.

The next coming part is working where the working the proposed system and circuit diagrams are explained and followed by observations in which main observations of this are written and followed by conclusions and references.

II. WORKING

The proposed system works making use of ultrasonic sensor to detect the water level in terms of percentage. As explained before ultrasonic sensor has two apparatus namely trig and echo. Trig is used to emit a sound wave to an object as it is known that when a sound wave strikes an object it bounces back with equal or more intensity which is called as echo. Echo part of ultrasonic sensor detects the reflected sound ray and returns the value according to that [7]. It usually measures the time duration between trig and echo of sound ray. The physical definition for velocity is defined as the rate of change of distance with time. If we neglect differentiation, velocity is given as ratio of distance to time. In this proposed system, the sound ray travel 2 times (Trig & Echo) [8].

$v = \frac{d}{t}$ (1) [Normal definition]

$v = 2\frac{d}{t}$ (2) [Proposed System]

from (2) 'd' is given as

$d = v\frac{t}{2}$ (3)

From experimental data it is clear that velocity of sound in air $v = 340\ m/s$

$d = 340 * \frac{t}{2}$ (4)

The proposes system schematic diagram is given in fig (3)

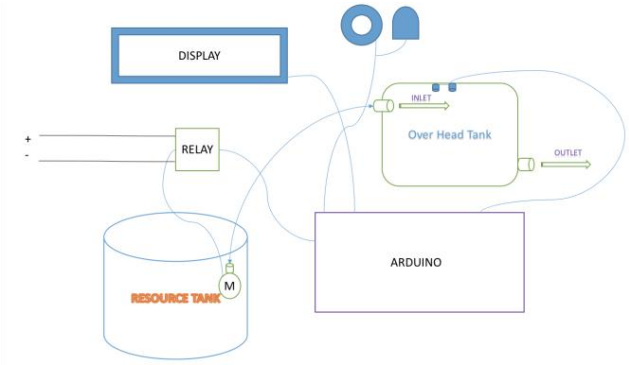


fig (3): Schematic project diagram

Ultrasonic Sensor detection:

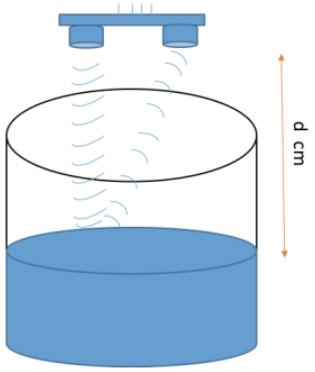


fig (4): Ultrasonic detection

Ultrasonic sensor detects the object and measures the distance by following echo principle in this proposed system, water is also considered as object when a sound ray strikes water it results in generation of echo which is detected by the echo part of ultrasonic sensor. The working of ultrasonic sensor is given in fig (4). By measuring the time duration distance is determined.

Steps required to monitor the results:

1. Scale preparation
2. Draft values
3. Measurement of time duration for complete tank fill by pump with constant voltage input
4. Implementation

- Scale Preparation:

By considering scale, we can resolve the complete water level in terms of percentages. The tank we measured without parallax error is of 20 cm in which each 10 % is 2cm of tank. The scale division in project is mentioned in fig (5)

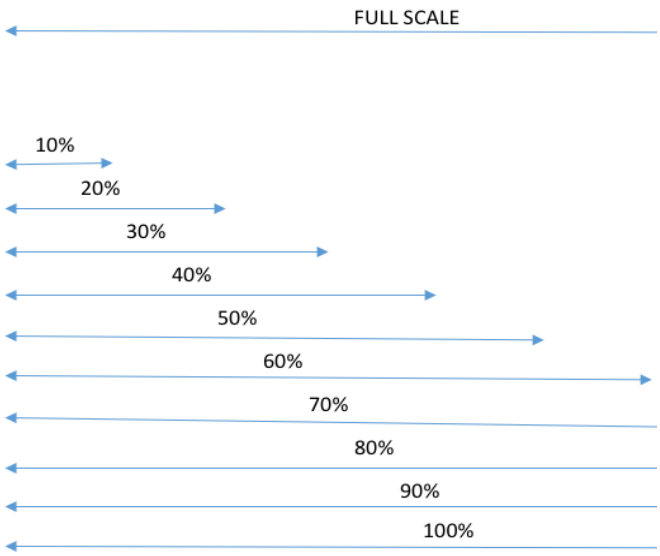


fig (5): Project scale division

- Draft values:

There will be no direct implementation of work without drafting corresponding values. So it is mandatory to draft the values before implementation. We managed to place a ultrasonic sensor at the top of overhead tank and measured the results using Arduino. After successful measurement of results, we can impart these results for automation of water level management. The results are given in Table (1).

Sl.no	Distance detected by Ultrasonic Sensor	Percentage
1	21 cm	10%
2	19 cm	20%
3	17 cm	30%
4	15 cm	40%
5	13 cm	50%
6	11 cm	60%
7	9 cm	70%
8	7 cm	80%
9	5cm	90%
10	3cm	100%

Table (1): Draft Values

- Measurement of time duration for complete tank fill by pump with constant voltage input:

It is required to do one-time setup for this proposed system that is calculation of time required for complete fill of tank by the adopted pump with constant input from the start to the end. According to this duration Motor turns on and off in later cases without man power. We monitored the working of DC 12V pump with two cases which are tabulated in table (2).

Sl.No	Input Voltage	Time taken
1.	6V	13 min 28s
2.	10V	3 min 22 s

Table (2): Voltage variation

- Implementation:

Implementation of work involves the circuit implementation, working of each component involved in the work. The circuit diagram is given in fig (6)

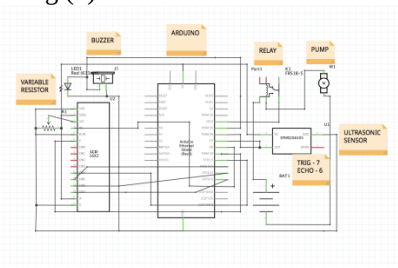
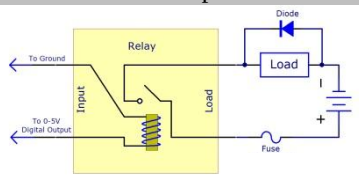


fig (6): Circuit Diagram

Components used:

- DC 12V Pump
- 5V 2 Channel Relay
- Piezo Buzzer
- LED
- Ultrasonic Sensor
- Arduino
- LCD
- Variable Resistor

5V 2 channel Relay is used as external switch for Arduino to power external supply to the DC 12 V pump. Relay [9] is usually in open condition it has continuous supply from Arduino board when a program is given to switch off the supply to relay then external switch is closed which powers external supply to the DC pump which is placed in resource tank. The relay is given in fig (7). The working of relay is given in fig (8).



```
#include<LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 10, 11, 12, 13);
const int trigPin = 7;
const int echoPin = 6;
const int buzzer =5;
const int relay = 4;
const int red = 3;
const int green = 2;
float duration, distance;
void setup() {
  lcd.clear();
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(relay, OUTPUT);
  pinMode(red, OUTPUT);
  pinMode(green, OUTPUT);
  Serial.begin(9600);
  lcd.begin(16,2);
}
void loop() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = (duration*.0343)/2;
  lcd.setCursor(0,1);
if( distance < 22 && distance > 19)
{
  lcd.print("TANK is 10%");
  digitalWrite(buzzer,HIGH);
  delay(2000);
  digitalWrite(buzzer, LOW);
  lcd.clear();
  digitalWrite(red, HIGH);
  digitalWrite(green, LOW);
}
if( distance < 20 && distance > 17)
{
  lcd.print("TANK is 20%");
    digitalWrite(relay,HIGH);
    digitalWrite(red, LOW);
    delay(2000);
    lcd.clear();
  }
  if( distance < 18 && distance > 15)
  {
    lcd.print("TANK is 30%");
    digitalWrite(relay,HIGH);
    delay(2000);
    lcd.clear();
  }
  if( distance < 16 && distance > 14)
  {
    lcd.print("TANK is 40%");
    digitalWrite(relay,HIGH);
    delay(2000);
    lcd.clear();
  }
  if( distance < 14 && distance > 11)
  {
    lcd.print("TANK is 50%");
    digitalWrite(relay,HIGH);
    delay(2000);
    lcd.clear();
  }
  if( distance < 12 && distance > 9)
  {
    lcd.print("TANK is 60%");
    digitalWrite(relay,HIGH);
    delay(2000);
    lcd.clear();
  }
  if( distance < 10 && distance > 7)
  {
    lcd.print("TANK is 70%");
    digitalWrite(relay,HIGH);
    delay(2000);
    lcd.clear();
  }
  if( distance < 8 && distance > 5)
  {
```

A variable resistor also known as potentiometer [10]. It is used to maintain the contrast level. It works by setting an appropriate voltage between VCC and VEE it can't be done using a single resistor. The value of potentiometer used is 10K ohms.

Conditions Required:
Condition 1: Pump must on when tank level is equal to 10%.
Condition 2: Tank must not be overloaded
Condition 3: Buzzer must on when tank reaches 10%
Condition 4: Green Led must glow when tank is above 90%
Condition 5: Red Led must glow when tank is below 10%
Condition 6: LCD must print tank levels
Program:


```
  lcd.print("TANK is 80%");
  digitalWrite(relay,HIGH);
  delay(2000);
  lcd.clear();
 }
 if( distance < 6 && distance > 5)
 {
  lcd.print("TANK is 90%");
  digitalWrite(relay,HIGH);
  digitalWrite(green, HIGH);
  delay(2000);
  lcd.clear();
 }
 if( distance < 5)
 }
```

Project images are displayed in fig (9)

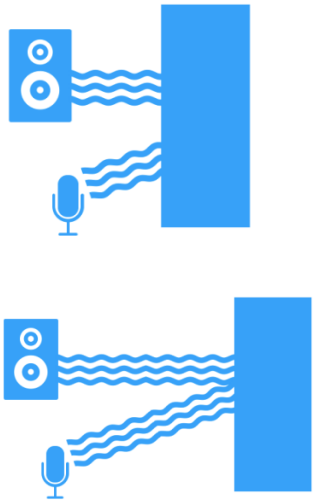
s

fig (9): Project Images

III. RESULTS

1. Water level is inversely proportional to the distance measured by ultrasonic sensor [11].
2. Time duration is directly proportional to the distance.
3. Lesser time duration results in higher water level
4. High time duration results in lowest water level
5. Water level management is monitored for mentioned conditions

```
{
  lcd.print("TANK is 100%");
  digitalWrite(relay,HIGH);
  delay(2000);
  lcd.clear();
  digitalWrite(green, HIGH);
 }
 if( distance > 20)
 {
  digitalWrite(relay, LOW);
  delay(202000);
  digitalWrite(relay,HIGH);
 }
```



IV. CONCLUSIONS

In the present situations, water necessity is very high. Population is growing linearly day by day but the necessities are not being fulfilled at the same rate. Among most dangerous problems water scarcity is major issue we need to resolve that problem at easiest way. The major problem behind this issue is negligence of humans. Tanks are being overloaded, due to improper maintenance this issue arises. So when we adopt the technologies like proposed system we can handle this issues [12]. Another aspect is that we are developing in all fields the present generation require automation for all this we need to adopt proposed system. The system is in appropriate in the areas where sound rays are produced with in the same frequency of ultrasonic sensor.

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Authors Profile

KODATHALA SAI VARUN, pursuing B.Tech degree (ECE Branch) in GITAM (Deemed to be University), Bengaluru campus. Participated in National Mathematics Day-2017 competition held in GITAM campus acquired first in poster presentation made on "Mathematical Model of Web Page Ranking" in group. Awarded by Prof. A S Vasudeva Murthy. Presented three papers as main author, published one research paper entitled "Mathematical treatment of enzyme kinetics using differential method" in IJARIIT, volume-4, issue-2, 2018.

KANDAGADLA ASHOK KUMAR, pursuing B.Tech degree (ECE Branch) in GITAM(Deemed to be University), Bengaluru campus Participated in National Mathematics Day-2017 competition held in GITAM campus acquired first in poster presentation made on "Mathematical Model of Web Page Ranking" in group. Awarded by Prof. A S Vasudeva Murth . Presented three papers as co-author, published one research paper entitled "Mathematical treatment of enzyme kinetics using differential method" in IJARIIT, volume-4, issue-2, 2018.

VUNNAM RAKESH CHOWDARY, pursuing B.Tech degree (ECE Branch) in GITAM (Deemed to be University), Bengaluru campus. Participated in National Mathematics Day-2017 competition held in GITAM campus acquired first in poster presentation made on "Mathematical Model of Web Page Ranking" in group. Awarded by Prof. A S Vasudeva Murthy. Presented three papers as co-author, published one research paper entitled "Mathematical treatment of enzyme kinetics using differential method" in IJARIIT, volume-4, issue-2, 2018.

This is **Dr. Chakravarthula S K Raju**, Obtained M.Sc (Applied Mathematics) from S.V.University, Tirupathi, India and completed Doctrol degree in VIT University, Vellore. I publshied 3 books (one main author and 2 co-author) and 30 research articles in peer revviewed ISI indexed international journals. As of now I had experience with theoretcial simulation of nanofluid, ferrofuild, non-Newtonain fluids with numerical modelling with C, Mathematica, MATLAB. I also worked as a reviewer of various interntional journals Plos One, Journal of Molecular Liquids, Informatics and Medicine: Unblocked, International Journal of Mechanical Sciences, Applied Mathematics and Computation, Advanced Powder Technology, Chinese Journal of Physics, Journal of Nanofluids, Alexandria Engineering Journal, Engineering Science and Technology an international Journal, Ain Shams Engineering Journal, Periodica Polytechnica Mechanical Engineering Journal and Computer Methods and Programs in Biomedicine. I presented/attended a research articles in National and International conferences and workshops. When I was researcher received Best researcher certification of appreciation from VIT university. At present, I am working as a Assistant Professor in GITAM School of Technology.

