“Smart Water Level Detection Using IEEE 802.15.1”

T. E. Information Technology

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CERTIFICATE

This is to certify that the project entitled **Smart Water Level Detection Using IEEE 802.15** is a bonafide work of **Hrutik Naik (12), Shrumi Dedhia (13), Ashwini Dubbewar (14), Meet Joshi (15)** submitted to the University of Mumbai towards completion of mini project work for the subject of Sensor Network Lab.

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Supervisor/Guide

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HOD-IT

Examiners

1.----------

2.----------

Date: 12/05/2021

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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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 a water tank. It is also possible to check the level of the water using a sensor so that whenever the water goes below, the pump gets turned ON automatically. Also when there is overflow of water in a water tank it uses a 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.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

1.1 Description

Water is a universal solvent which plays an important role in everyday life.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 freshwater resources.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.

1.2 Problem Formulation

The objective of the project is to measure 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.

1.3 Motivation

The water is wasted at each and every outlet knowingly or unknowingly which adds up to a huge amount in the end. Water management is only possible, if the user is aware of the quantity of water he uses and the quantity available to him. Hence avoiding wastage of water is essential.

1.4 Proposed solution

The main purpose of the system is to provide continuous water level measurements.This is done with the help of ultrasonic sensor to monitor the water level in a tank.This information is sent to on central arduino of the system via radio waves which is further sent on to user’s phone to through Bluetooth. Another part of the system controls the flow of water. This data is also sent to users' phones through the same strategy. If the water level is reached to a certain threshold value, the relay stops/starts the motor.

1.5 Scope

As we know in many apartment buildings there is a problem of the overhead tank getting overflowed causing a short circuit or someone forgetting to start the water supply to fill the tank.Thus, it ensures that this system contributes to solve these two problems.

REVIEW OF LITERATURE

1. **"Wireless Automatic Water Level Controller"**

Water is one of the essential needs for the survival of all human beings, animals and plants. The water overflow from the overhead tanks in the houses, commercial properties, educational institutions and agricultural farms increase the percentage of water wastage. To avoid such wastages implementation of an automatic water level controller becomes a key factor which further reduces human intervention. In this work, an automatic water level controller using bluetooth wireless technology and Ultrasonic water level sensor is proposed. The study of automatic water level controller using wireless technology and wired technology was carried out separately. The results indicated that the automatic water level controller using wireless technology was superior in comparison with wired technology which was further validated with the help of different parameters.

2. **"Automatic Water Level Sensor and Controller System"**

In this paper, things investigated are the design of a water level sensor device that is able to detect and control the level of water in a certain water tank or a similar water storage system. The system firstly senses the amount of water available in the tank by the level detector part and then adjusts the state of the water pump in accordance with the water level information. This electronic design achieves automation through sequential logic implemented using a flip flop. A seven segment display and a relay-based motor pump driving circuit are part of this integrated design. The water pump automatically turns on and starts filling the tank when the water level is empty or level ONE and turned-off and stop filling the tank when water level reaches maximum-level NINE; furthermore, the water pump will remain in its standstill state from level EIGHT down to TWO when the the level is decreasing due to water consumption.

3. **“Design And Implementation Of Wireless Based Water Level Monitoring System Using Arduino And Bluetooth”**

In this paper, they design a micro control based wireless water level monitoring system. It consists of an Arduino and Bluetooth module. The Arduino receives the level information from the sensors and tracks the water level with predefined level indicators. The Bluetooth module receives the command from Arduino and the same will be transferred to the registered mobile through Bluetooth. Moreover, we place a buzzer as an additional indicator. Finally, we demonstrate different water level settings, tracking and SMS & buzzer alerts. Thus, the proposed system monitors and controls the excess flow of water and saves power consumption.

4. **“Automatic Water Level Indicator And Controller Using Arduino”**

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 the water tank. It is also possible to check the level of the water using a sensor so that whenever the water goes below, the pump gets turned ON automatically. Also when there is overflow of water in a water tank it uses a 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.

Sr. No.	Author	Title	Description
1.	Suraj S, Bharath V, Sridhar N.K [1]	"Wireless Automatic Water Level Controller "	[1] Water level is recorded using an ultrasonic sensor and then classified into four categories,on the basis of these four categories it is decided if the water should be filled in the overhead tank or not. A bluetooth module and relay module are used to implement the circuit.
2.	Beza Negash Getu, Hussain A. Attia [2]	"Automatic Water Level Sensor and Controller System"	The system [2] firstly senses the water level in the tank, which is achieved through a sequential logic implemented using a flip-flop.A LED module and relay module are also used.Water starts and stops filling based on the nine threshold values set.
3.	Mrs. Teetla Asha, Mrs.Vidadala Srija[3]	"Design And Implementation Of Wireless Based Water Level Monitoring System Using Arduino And Bluetooth"	[3] A micro controller based wireless water level monitoring system, which consisted of major hardware devices like ATMEGA328 controller, Bluetooth module, LCD display. The ultrasonic sensor was used as water level sensors to measure the level of water.
4.	Ms. Pooja K, Ms. Kusumavathi, Ms. Pavithra[4]	"Automatic Water Level Indicator And Controller Using Arduino"	[4] In the "Water Level Indicator and Controller using the 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.

RESEARCH GAPS AND DISADVANTAGES

Research Gaps:

- Less availability of water level sensors in the market.
- Complexity of the system.
- Difficult to implement on a large scale.
- Water level sensors can get corroded after some time

Disadvantages:

- Cost is high if tanks are more than 1 km apart in which case repeaters are required. Sometimes might not work when on medium level. [1]
- Water level sensor is used which can be corroded after some time.[2]
- Cannot be implemented if the source and tanks are far from each other[2]
- There are only 4 water levels, the system could have more accurate water levels.[3]
- If the taps are far apart then, this system cannot be used.[4]

PROBLEM STATEMENT AND OBJECTIVES

Problem Statement:

To develop a system to deal with a problem that many apartments and buildings have of the overhead water tank getting overflowed causing wastage of water and also short circuits.

Objectives:

The following objectives are to be focused and achieved at the end of the project:

- To make a reliable water level controller using as few resources as possible.
- To study the controller model and observe its characteristics.
- To compare the controller with the conventional controllers available in the market.
- To propose any ideas or improvements that can lead to future development of the controller.

SYSTEM DESIGN

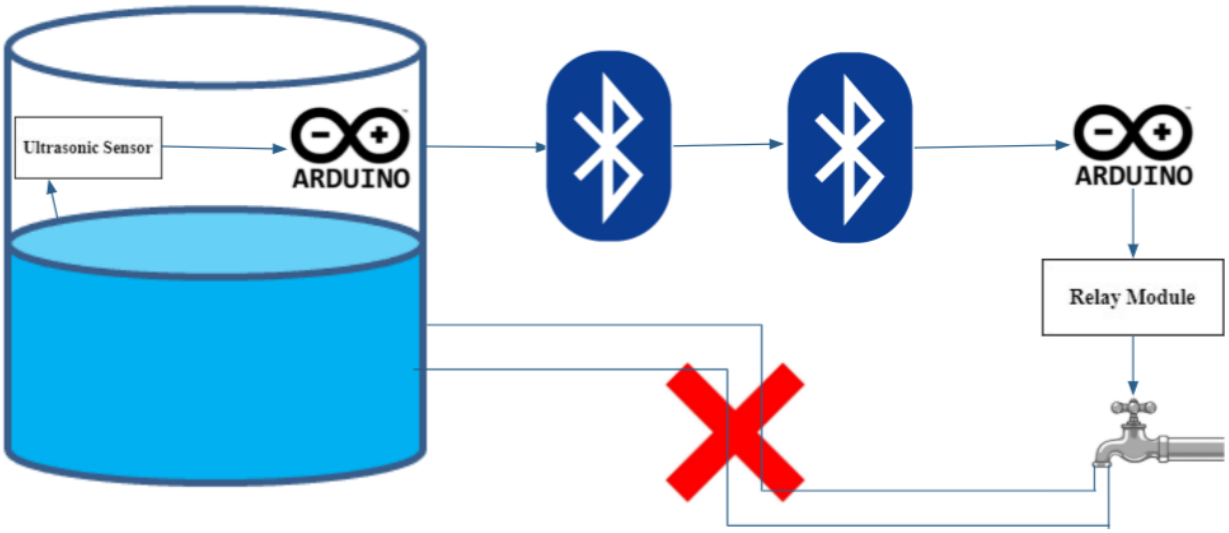


Fig 1: Block Diagram of the System

Description:

1. Node 1:

This node will act as the central node(Master Node) for the network. A bluetooth module (HC 05) and an ultrasonic sensor (HC - SR04) will be attached to it. The ultrasonic sensor will allow this node to measure the level of the water . The received data will be used to start or stop the water supply by sending a command to the second node

2. Node 2:

This node is known as the (Slave Node) of the Network . It consists of a Bluetooth module (HC 05) and a relay module.This node receives data from the master node and if the water level is full it switches the relay off and if the water level is low it switches the relay on.

CIRCUIT DIAGRAMS

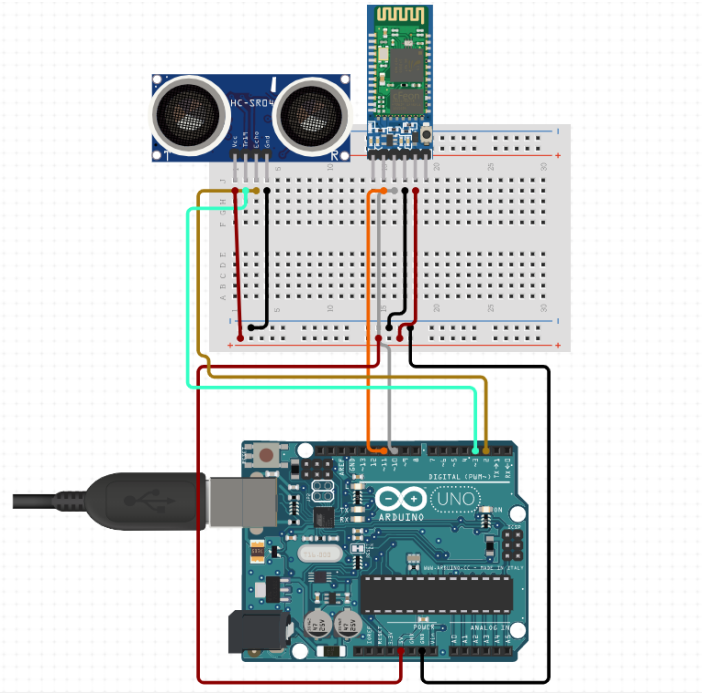


Fig 2 :Node 1 circuit diagram

Node 1 Pin Configuration:

Table 1 : Pin Configuration of Node 1

Component	**Component's Pin**	**Microcontroller(Arduino UNO)**
Ultrasonic sensor	Trig Pin	Digital 9
	Echo Pin	Digital 10
	Vcc	+5V
	Gnd	Gnd
Bluetooth Module	Rxd	Tx(1)
	Txd	Rx(0)
	Vcc	+5V
	Gnd	Gnd

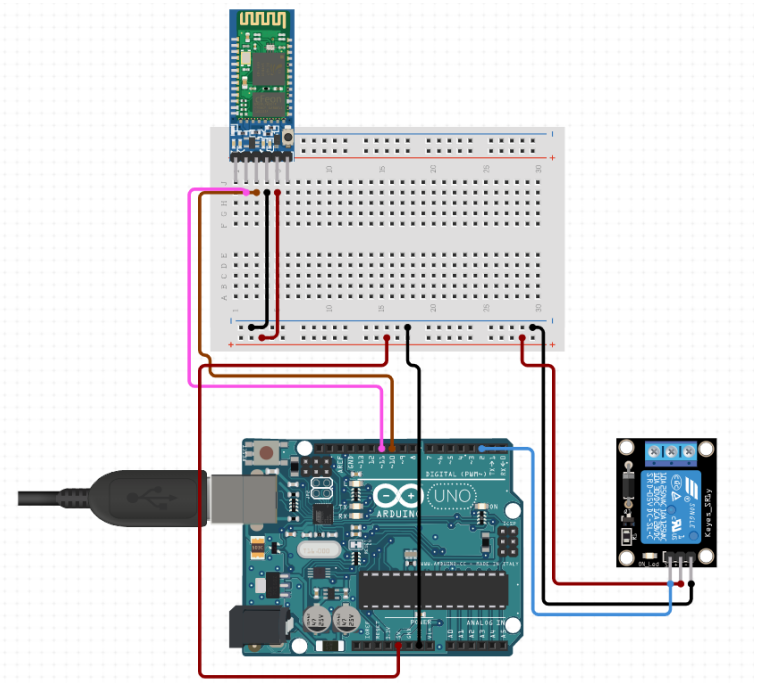


Fig 3: Node 2 circuit diagram

Node 2 Pin Configurations:

Table 2 : Pin Configuration of Node 2

Component	Component's Pin	Microcontroller(Arduino UNO)
Relay Module	In	Digital 3
	Vcc	+5V
	Gnd	Gnd
Bluetooth Module	Rxd	Tx(1)
	Txd	Rx(0)
	Vcc	+5V
	Gnd	Gnd

SYSTEM REQUIREMENTS

Table 3 : Hardware Requirements

Hardware Requirements	Price(INR)
Arduino UNO	660
Ultrasonic Sensor HC-SR04	150
Jumper Wires	30
Bluetooth Module HC-05	500
Resistor Box	85
Breadboard	140
Relay	200
Water Pump	160

Table 4 : Software Requirements

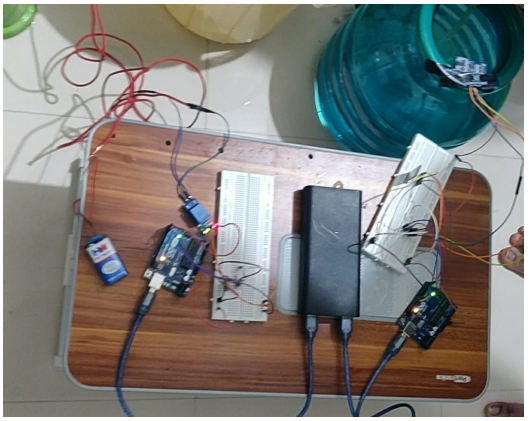
Software Requirements	Price(INR)
Arduino Ide	Open Source
Windows Os / Mac Os	Open Source

Total Cost	1925(INR)

IMPLEMENTATION AND RESULTS

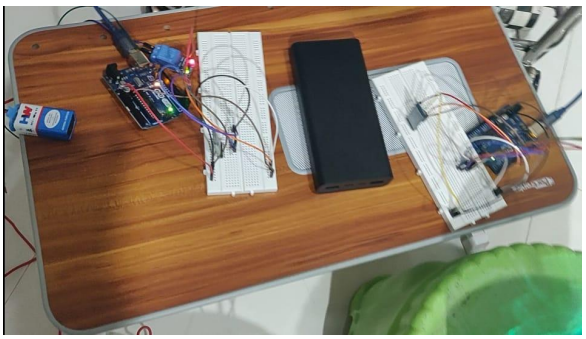
Fig 4:Flowchart of the system

Output:



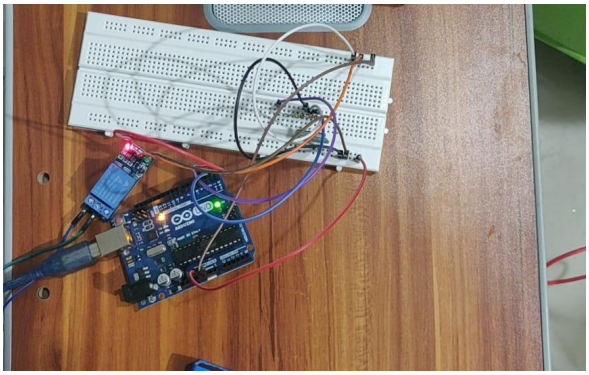
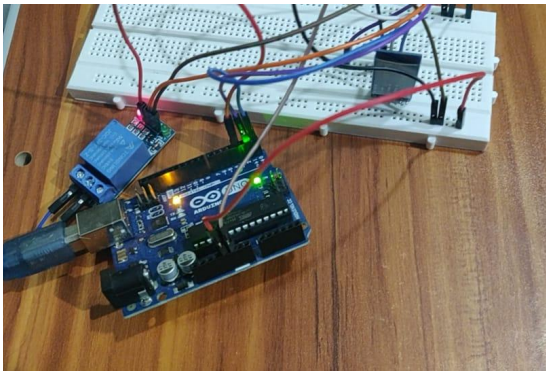
Complete System

Water filling as below threshold level

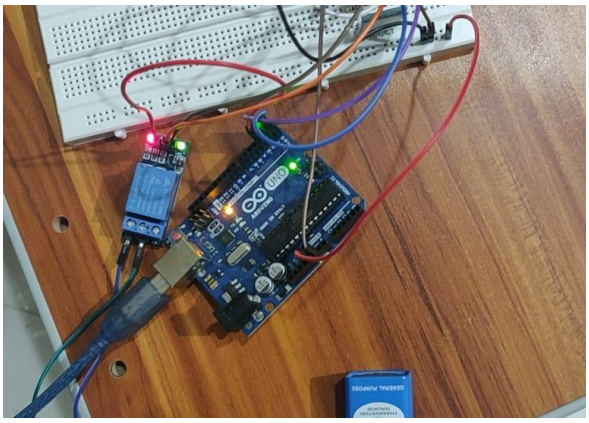
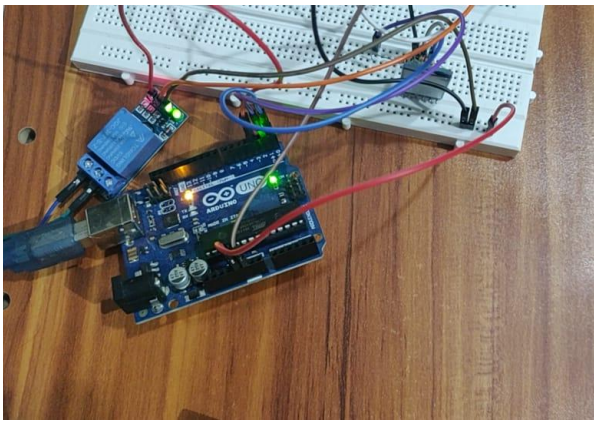


Pin connections of both nodes

Water Pump for water supply

Relay getting cut off as upper threshold value is reached.

Relay getting turned on again as the lower threshold of water level is reached.

Codes:

Master Node (Transmitter)

```
const int trigPin = 9;
const int echoPin = 10;
long duration;
int distanceCm, distanceInch;
int oldValue = 0 , newValue = 0;
void setup()
{
  Serial.begin(38400);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}
void loop()
{
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distanceCm = duration * 0.0340 / 2;
  newValue = distanceCm;
  if(newValue != oldValue)
  {
    //Serial.print("Distance: ");
    Serial.print(distanceCm);
```

```
 //Serial.println(" cm");
   oldValue = newValue;
  }
  Serial.print("distance in cm: ");
  Serial.print(distanceCm);
  Serial.print("  ");
  int ay = distanceCm;
  if(ay<8)
  {
   Serial.write('H');
   }++++++++++++++++++
  else if(ay>20){
   Serial.write('L');
     }
  delay(500);
}
```

Slave Node (Receiver):

```
byte BRState = 0;
byte BLState = 0;

void setup(){
 Serial.begin(38400);
 pinMode(3,OUTPUT);
}
void loop(){
   if(Serial.available()>0)
  {
   BRState = Serial.read();
  }
  if(BRState == 'H'){
   digitalWrite(3,HIGH);
   Serial.print("Water Level High");
   }
  else if(BRState == 0){
   Serial.print("Normal Water Level");
  }
  if(Serial.available()>0)
  {
   BLState = Serial.read();
  }
  if(BLState == 'L'){
   digitalWrite(3,LOW);
   Serial.print("Water Level Low");
  }
  else if(BLState == 0){
   Serial.print("Normal Water level");  }
}
```

CONCLUSION

The nucleus of the project is controlling the water tank by connecting to a bluetooth device when the tank is about to be full and to start the water supply when the water is less than the threshold.Water level controller is a simple yet effective way to prevent wastage of water. Its simplicity in design and low cost components make it an ideal piece of technology for the common man.It has been implemented using hardware components like Arduino, Bluetooth module,Relay Module and sensors. Here, we can monitor the levels of water present in any tank or container by controlling the water flow.

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