I. Project Title: SMART WATER TANK MONITORING SYSTEM

II. Team 3 members

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IV. Objectives

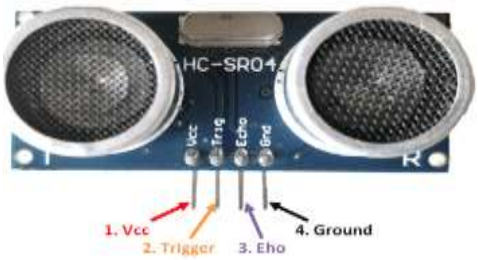
- To reduce human efforts in water tank monitoring and ensuring its efficiency with online water tank level monitoring using smart phone or web interface.
- To stop wasting water by immediately switching off the water pump once the tank is full
- To save money that was charged for the water wasted

V. Requirements

A. Hardware Requirements

1. Ultrasonic sensor

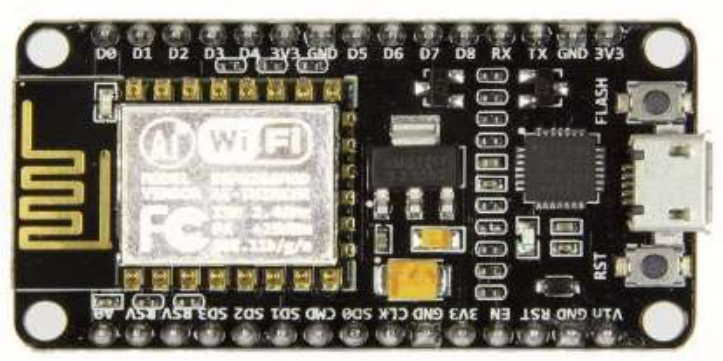
Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target which is water in the tank. Ultrasonic Sensors measure the distance to the target which is water in the tank by measuring the time between the emission and reception.



Source: https://components101.com/ultrasonic-sensor-working-pinout-datasheet

2. **Node MCU ESP8266**:

   This is the processing unit of the system. It receives the data from connected ultrasonic sensor telling the level of water in tank by mean of distance, then analyses information and take decision including to automatically switch ON or switch OFF the water Pump.



   Source: https://www.elektor.com/nodemcu-microcontroller-board-with-esp8266-and-lua

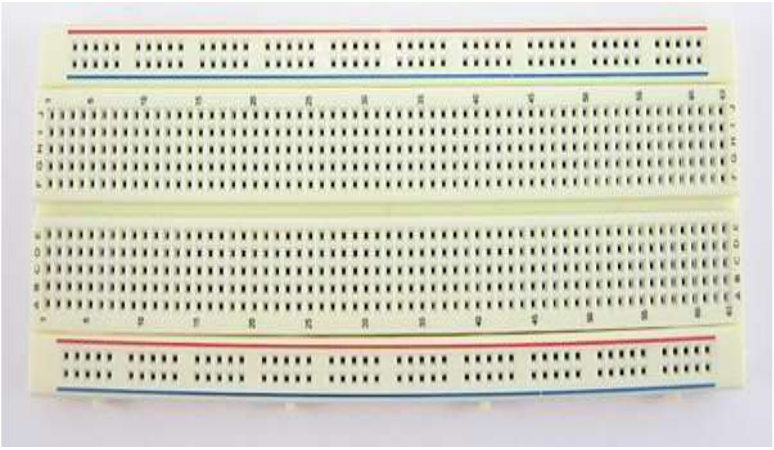
3. **Water pump**: is a tool used for pumping the groundwater to fill a water tank.

   Source: https://ly.rsdelivers.com/product/rs-pro/eot0136/rs-pro-230-v-submersible-water-pump-216l-min/1241949

4. **Electronic relay**: The electronic relay is a type of an electronic switch that opens or close the circuit contacts by using low powered electronic component without any mechanical operation. This device is used to connect or disconnect the electrical power supply to the water pump.

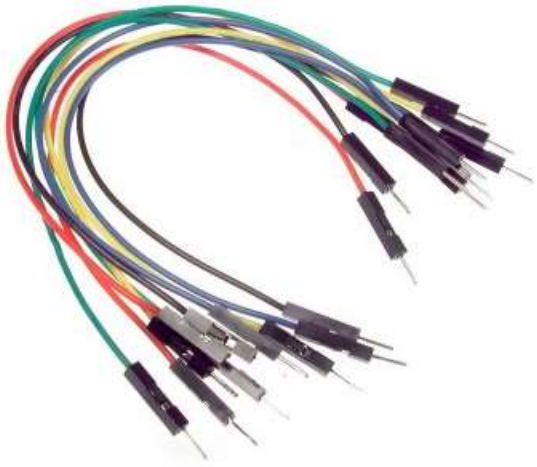
Source:https://www.jaycar.us/solid-state-relay-4-32vdc-input-240vac-40a-switching/p/SY4084

5. **Breadboard:** A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit. it is used in our project to add additional circuitry to the NodeMCU ESP8266. The breadboard has two power rails on each side for both power and ground connections. The break in the middle makes it easy to mount integrated circuits to the breadboard.



Source: https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard

6. **Jumper wires:** Jumper wires are used for making connections between items on the breadboard and the NodeMCU 8266 header pins. We used them to wire up our circuit.



Source: https://www.exploringarduino.com/parts/jumper-wires/

7. A smartphone

The smartphone is needed as the user interface that is able to support the blynk app. This is a well-designed interface builder. It works on both iOS and Android.

B. Software Requirements

i. **Arduino IDE**: This is a cross-platform application that is used to write and upload programs to Arduino compatible boards. In this project, This IDE have been used to write instructions telling the MCU ESP 8266 what to do based on the system function requirements.

ii. **Blynk Mobile App**: With Blink mobile app, the user can have the data wirelessly from the system wherever he/she is, via his/her smart phone.

iii. **Firebase:** The Firebase Real-time Database is a cloud-hosted database that lets us store data in real-time. Real-time syncing makes it easy for user to access the data from any device, be it web or mobile.

VI. Methodology

A. Steps for circuit connection on the breadboard

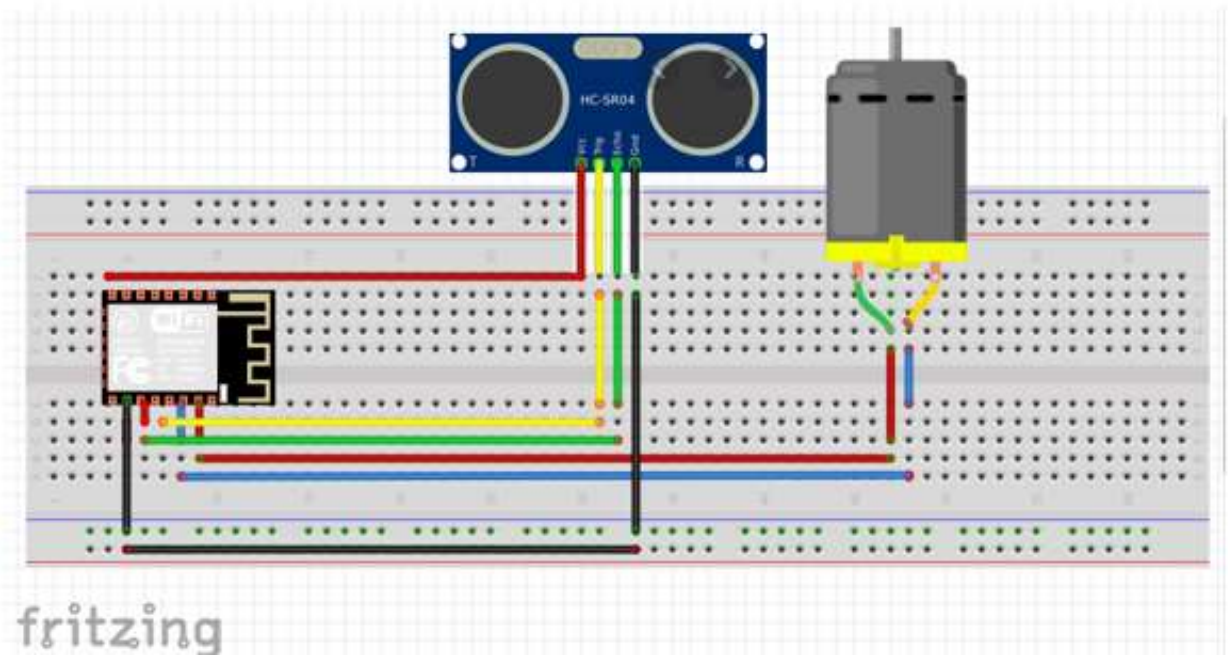
- Connect the ultrasonic sensor to the nodeMCU ESP8266 (respecting the 4 pins of ultrasonic sensor and their respective functions)
- Connect the water pump (actuator) to specific pin of the nodeMCU ESP8266 without forgetting the connection to ground
- Using a micro USB cable connect the nodeMCU ESP8266 to the PC or Laptop containing the verified program code, upload it and observe the readings from the Sensor via the serial monitor.

B. Steps for connection to blynk

- Download the blynk app from playstore and intall it in the smartphone
- Open it and create your account
- Create a new project
- Choose your hardware (Select the hardware model you will use)
- Auth token (**Auth Token** is a unique identifier needed to connect our hardware to the smartphone. Every new project created, will have its own Auth Token. Auth Token is automatically obtained on email after project creation.)
- Add a widget
- Run the project

C. Circuit Diagram (Drawn using flitzing) and its working principle

i. Circuit Diagram



ii. Working Principle

This circuit contains an ultrasonic sensor that detects the level of water in the tank and sends its output to the node MCU ESP8266 which processes that information. According to the conditions set in the program code i.e when the water level detected is less or equal to twenty centimeters (>=20cm) and less or equal to seventy centimeters (<=70cm) the pump will be off. The water pump will be on when the water level in the tank is greater or equal to 70cm and greater or equal to 20cm, the Node MCU will send the signal to the relay which in turn will switch on or off the power to the water pump. The Node MCU 8266 will also send the data provided by the sensor to blynk cloud via a WiFi connection to allow the user to view the data on his/her smartphone.

iii. Program code

```
#define BLYNK_PRINT Serial
```

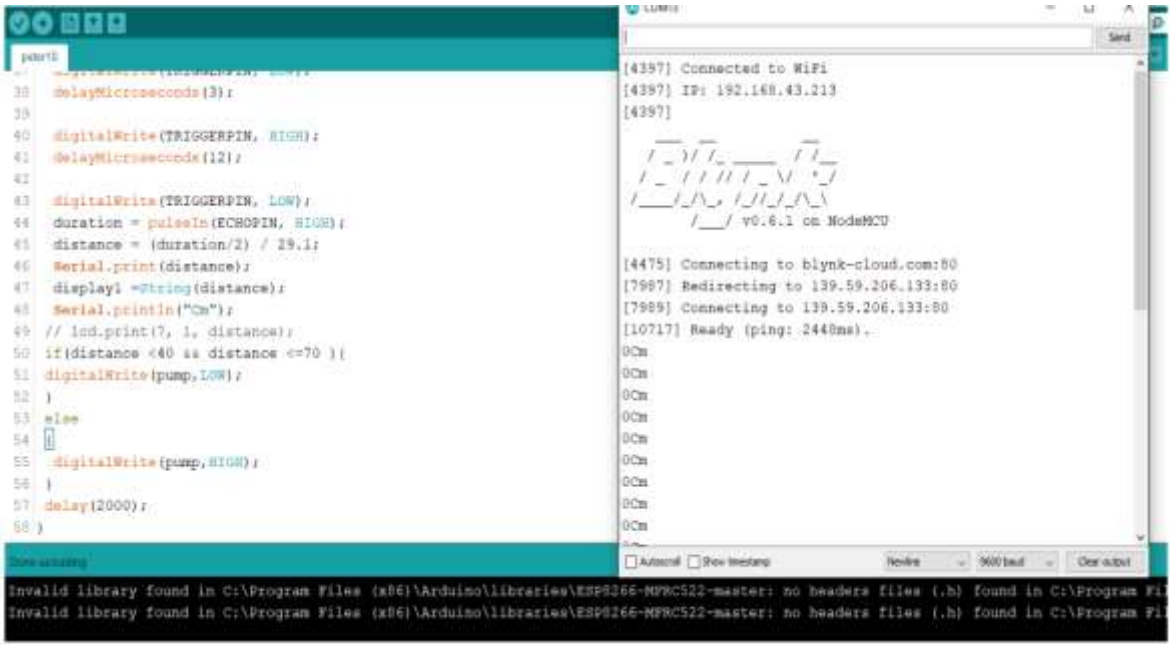
```
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "ys-bgddnk15mukxdN_G1x8BXdTeVuBLc";
char ssid[] = "peter1";
char pass[] = "147147147";
#define TRIGGERPIN D1
#define ECHOPIN    D2
#define pump  D4
BlynkTimer timer;
long distance;
long duration;
String display1;
void sendSensor()
{
 Blynk.virtualWrite(V1, display1);
 delay (200);
}
void setup()
{
 // Debug console
 pinMode(pump,OUTPUT);
 Serial.begin(9600);
pinMode(TRIGGERPIN, OUTPUT);
```

```
 pinMode(ECHOPIN, INPUT);
 Blynk.begin(auth, ssid, pass);
 // You can also specify server:
 //Blynk.begin(auth, ssid, pass, "blynk-cloud.com", 80);
 //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8080);
 timer.setInterval(1000L, sendSensor);
}
void loop()
{
 Blynk.run();
 timer.run();
long duration, distance;
  digitalWrite(TRIGGERPIN, LOW);
  delayMicroseconds(3);
  digitalWrite(TRIGGERPIN, HIGH);
  delayMicroseconds(12);
  digitalWrite(TRIGGERPIN, LOW);
  duration = pulseIn(ECHOPIN, HIGH);
  distance = (duration/2) / 29.1;
  Serial.print(distance);
  display1 =String(distance);
  Serial.println("Cm");
 // lcd.print(7, 1, distance);
```

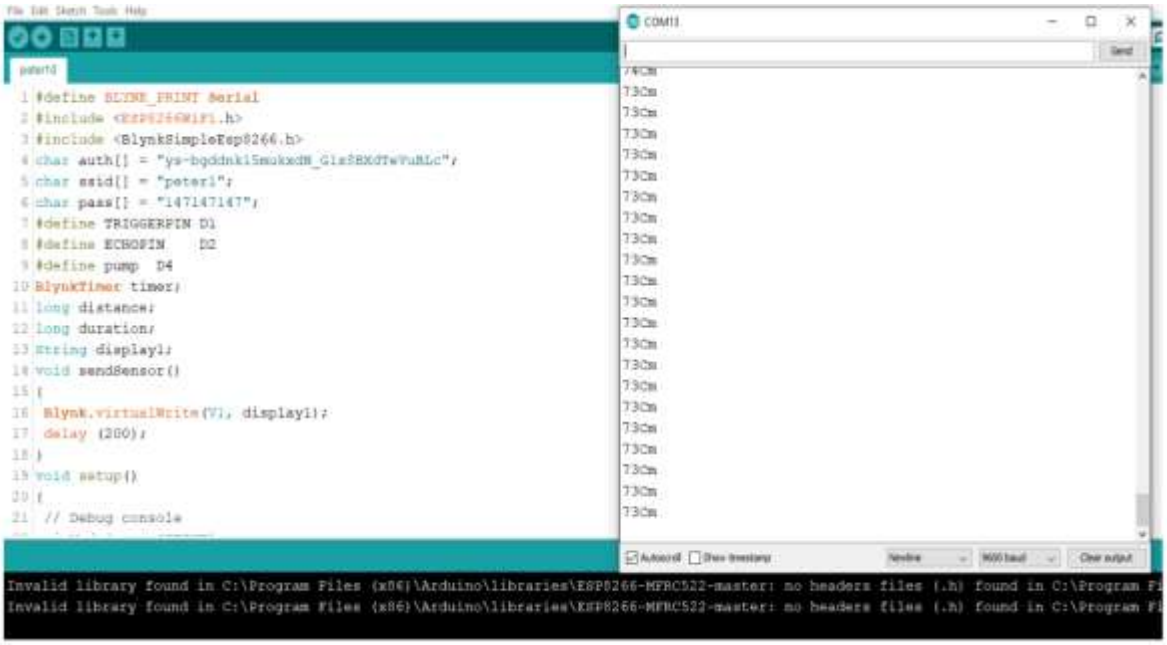
```
if(distance <20 && distance <=70 ){
digitalWrite(pump,LOW);
}
else
{
 digitalWrite(pump,HIGH);
}
delay(2000);
}
```

VII. Snapshots (For the circuit done and the output screen after running the code in serial monitor ,in blynk, in firebase)

1. Node MCU is connecting to Blynk



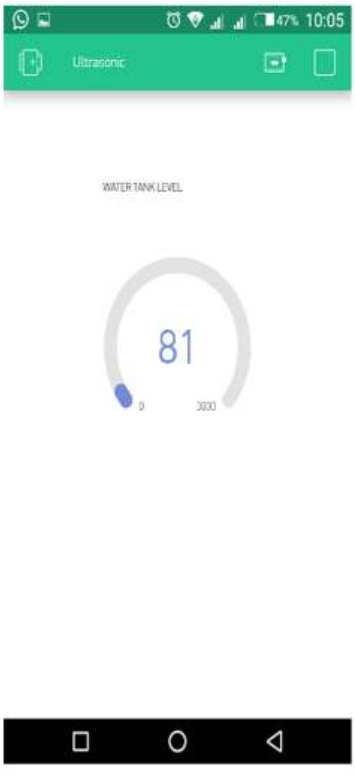
2. Data on Serial Monitor



3. Data on Blynk

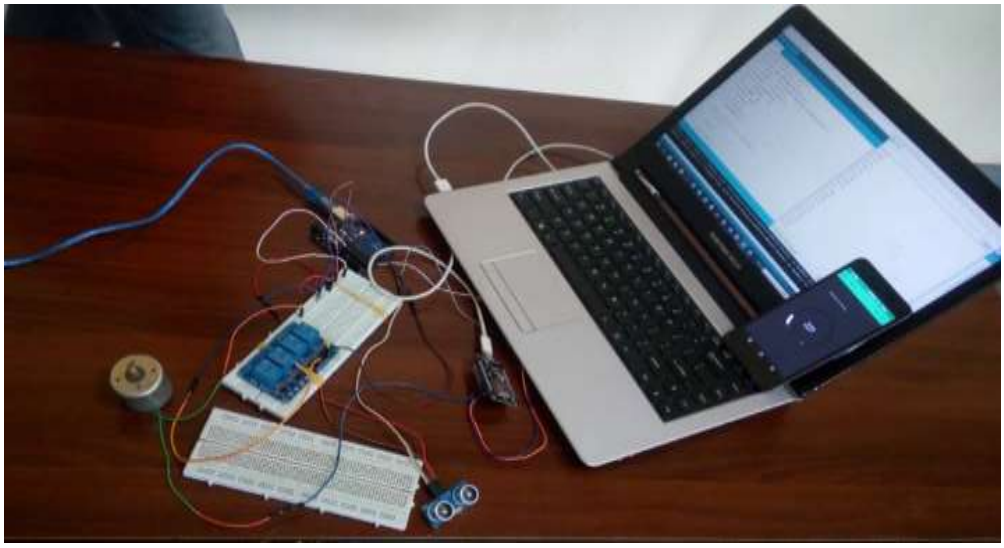
Picture 1: Pump OFF

Picture 2: Pump OFF



Picture: Pump ON

4. System Prototype



Applications of our project

This project can be applied in residential buildings, hotels, public and private institutions, schools etc, serving in water storage and backup.

Team Members Photo

References

1. https://components101.com/ultrasonic-sensor-working-pinout-datasheet
2. https://www.elektor.com/nodemcu-microcontroller-board-with-esp8266-and-lua
3. https://ly.rsdelivers.com/product/rs-pro/eot0136/rs-pro-230-v-submersible-water-pump-216l-min/1241949
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5. https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard
6. https://www.exploringarduino.com/parts/jumper-wires/