**18CSE462J INTRODUCTION TO INTERNET**

**OF THINGS**

S EMESTER VII

**A PROJECT REPORT**

On

**IOT BASED WATER LEVEL MONITORING SYTEM**

*Submitted in partial fulfilment for the award of the degree*

Of

BACHELOR OF TECHNOLOGY

in

## COMPUTER SCIENCE AND BUSINESS SYSTEMS

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# FACULTY OF ENGINEERING AND TECHNOLOGY

**DEPARTMENT OF DSBS**

SEMESTER–VII / CSBS

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# **BONAFIDE CERTIFICATE**

Certified that this is the bonafide record of work done by

\_\_\_\_\_\_\_\_ of **VII semester** B.Tech., COMPUTER

SCIENCE AND BUSINESS SYSTEMS during the academic year 2022- 2023 in the **18CSE462J-INTRODUCTION TO INTERNET OF THINGS** Laboratory.

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Submitted for the practical examination held on\_\_\_\_\_\_\_\_\_\_\_\_ at SRM Institute of Science and Technology, Kattankulathur, Chennai-603203.

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**Examiner – 1 Examiner – 2**

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**Abstract:**

Here we are also going to use the same non-contact method because of its convenience and accuracy in reading water level.

When we decide to make any water level indicator project the first thing that comes to our mind is the electrodes that are we are going immerse in the water. Traditionally several metallic electrode are immersed in the water at different levels and some voltage is passed. The problem with this method in a long run is that, no matter how the electrodes were refined before installing, it will get corroded due to electrochemical reaction due to passing of electric current through water which reacts with some minerals present in the water and it is a bad idea to consume such contaminated water.

The resolution of the reading is limited to how many electrodes immersed in the water. The ultrasonic based measurement overcomes all the disadvantages that arise due to utilizing traditional electrode method. The accuracy of readings is +/- 3mm and can be used to tanks that are up to 4 meter deep.

In this project we are building a water level monitoring system which can log water level data of an overhead or an underground tank to an IoT cloud called Thingspeak where we can monitor the current level of water and consumption overtime. We are using GSM module (SMS) and ultrasonic sensor to render water level of a tank, here we are using IoT and the same ultrasonic technology to measure water level precisely.

**Introduction:**

IOT stands for "Internet of Things," which refers to connecting physical objects or things to the digital world by installing various sensors and software connected to a central hub that measures the standard and boundary of the real world as they change and has the ability to create a database of the readings or values gathered. Once the data gets to the cloud, software processes it and then it decides to perform an action, such as sending an alert or transfer of data without the need of the user. The Internet of Things refers to inter-connecting and inter-relating objects, devices and people through wireless network, it rose itself as the new business technique in different sectors. Our daily lives involve the usage of IOT devices to monitor and manage the mechanical, electrical, and electronic systems found in houses, buildings, and other structures.

IoT can communicate without the need for a human. In the healthcare, transportation, and automotive industries, some early Internet of Things applications have already been created. IoT technologies are at their infant stages; however, many new developments have occurred in the integration of objects with sensors in the Internet. Many issues are involved in the development of IoT, including infrastructure, communications, interfaces, protocols, and standards.

A critical requirement of an IoT is that the devices in the network communicate with one another. IoT system architecture must guarantee the operations of IoT, which connects the physical and the virtual worlds. Many factors go into the design of IoT architecture, including networking, communication, processes, and so on. In designing the architecture of IoT, the extensibility, scalability, and operability among devices should be taken into consideration. Due to the fact that things may move and need to interact with others in real-time mode, IoT architecture should be adaptive to make devices interact with other dynamically and support communication amongst them. In addition, IoT should possess the decentralized and heterogeneous nature. For the Fire and Life Safety industry, this means that IoT devices literally give occupants and first responders alike faster, better notification of when possible dangerous activity is around. Basically, these devices allow for alerts to be responded to and dealt with in a more effective, and most importantly, safer and possibly life-saving way.

IoT is a current trend that leads the next generation Internet-based information architecture that involves integration of social networks and inter-object communications.

IoT is emerging as an Internet-based industrial information architecture used to facilitate information flows among supply chain networks around the world. The significance of IoT to supply chain management lies in streamlining supply chain operations, providing real time information, and tracking business processes at various stages. Many new opportunities in applying IoT to supply chain management are available today or can be foreseen in near future.

IoT technology today has a wide range of applications in every industry. Numerous devices are now working on the IoT concept. The Internet of Things connects about 27 billion devices. By 2030, it is anticipated to rise by more than 100 billion.

* **Smart Home:**The smart home automation includes saving energy. Lights and fans can be switched off automatically when leaving home. Devices like Siri, Alexa would be very helpful for people with disabilities.
* **Medical and Healthcare:**It can be used for automated health monitoring systems that should notify in case of emergency. Many hospitals are prepared to create smart beds for their patients. Fitbit bands, which can also measure pulse rate, blood pressure, and so on.
* **Transportation:** In the field of transportation, the concept of IoT can be applied for smart traffic control, vehicle tracking, automated toll collection, smart parking, etc. will save the efficient time of the public.
* **Agriculture:** In order to increase productivity, farmers can adopt smart farming. These IoT devices will help to check the favorable weather for crops.
* **Environment Monitoring:** IoT applications would be helpful for proper environment monitoring, different hazards like tsunami, earthquake can be controlled by early detection.

The growth of Iot technology increased when The COVID-19 pandemic accelerated the advancement of remote monitoring, smart home devices, and data analysis solutions. Companies are vying to provide superior artificial intelligence solutions. These frequently call for an IoT-related network of cutting-edge sensors and edge computers. IoT networks are more effective than centralized systems at completing some jobs.

Safety is one of the most crucial aspects of human life. The awareness of risks and potential dangers in and around human settings that may cause bodily harm or even death is referred to as safety. There are several threats and potential perils that endanger the safety of countless

Due to exploitation of water resources and speeding of climate change due to human activities, water becoming a luxury these days and keeping tab on water consumption is a necessity now. We know that water conservation starts from a family and a person in a family can easily track their water consumption either by observing day to day activities or checking water level of their overhead tank every day.

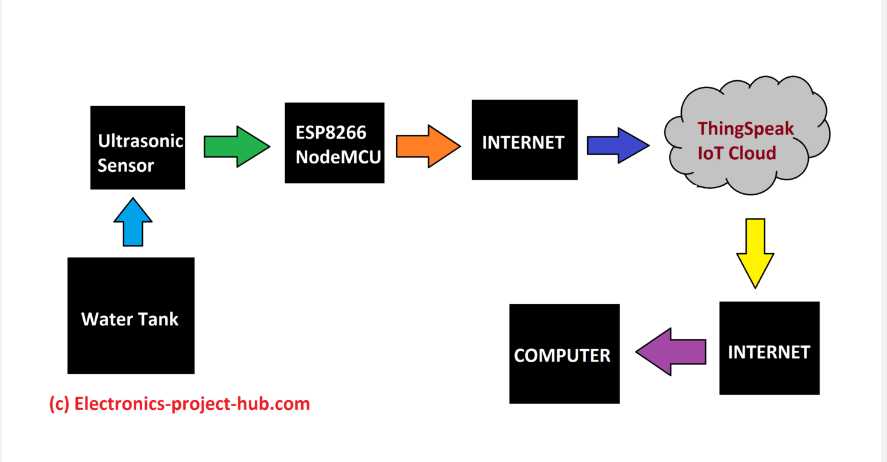
But for a municipal government who is concerned about the areas they governing cannot track each and every family’s water consumption by physically sending a person every day. Instead they can check level of municipal supply tanks where the level of water is direct reflection of water consumed by the people in the area. Again we have to deploy several people to take readings of tens of municipal overhead tanks several times a day.

It is a human nature to get inert sometimes or many times and one could manipulate the readings and could push the idea of water consumption of an area in wrong direction and this could also delay the water supply because the actual water level could vary significantly from the manipulated readings which could lead to unexpected shutdown of water supply.

**Literature Survey:**

* This Project mainly focuses on minimizing water and electricity wastage by building an efficient automated water pump. Some sophisticated automation materials have been established in order to set some works automatically such as Arduino microprocessor, which enables to control the electrical circuits logically.
* The ultrasonic sensors used, will automatically turn on the machine in the water tank and it will be turned off automatically after the water tank is fully filled by the water. As there are many ways to create a water level controller so in case
* There is an overview of the Efficient Automatic Water Control Level Management it is also implemented by Arduino and ultrasonic sensor. Although it is a bit expensive system as it involves a Wi-Fi module. Resulting the things can be controlled through an mobile application making it more accessible from anyplace. This system also have a help in saving time .It also use relay module to break or join contact with given circuit based on the input given.
* This paper deals with a modern Canal Control System. In this particular paper the author is presenting optimistic indicator for canal control system. One faces lot of problems while selecting an appropriate indicator for canal system, so here is the one with optimized indicator for the canal system.
* This simple water level indicator uses a simple circuit to get the details of the water level of the tank. The system has only used sensors and cables to get results but this does not contain a software to retrieve data. The following figure shows the main circuit diagram of the system

**Architecture Diagram:**



In this project we are building a water level monitoring system which can log water level data of an overhead or an underground tank to an IoT cloud called Thingspeak where we can monitor the current level of water and consumption overtime. We are using GSM module (SMS) and ultrasonic sensor to render water level of a tank, here we are using IoT and the same ultrasonic technology to measure water level precisely.

**Required Components:**

**Hardware :**

Nodemcu esp8266

Ultrasonic sensor

Micro USB Cable

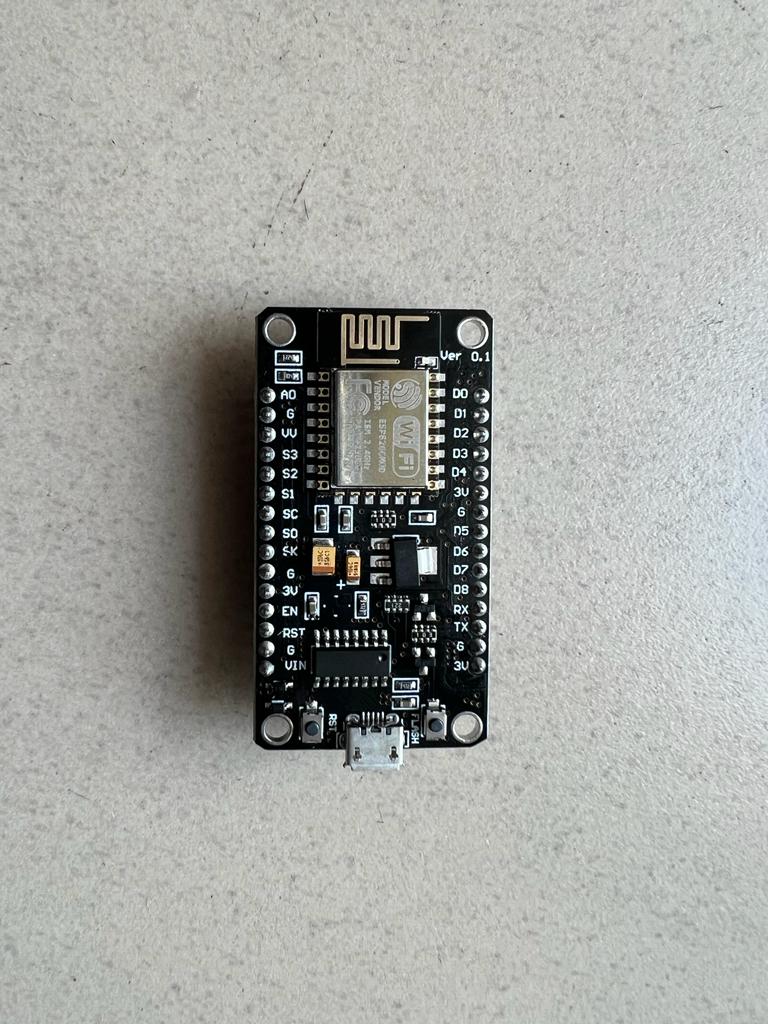
Jumper Wires

**Software:**

Arduino IDE

Thingspeak

**Nodemcu esp8266**



The name "NodeMCU" combines "node" and "MCU" (microcontroller unit). It is an open source single board microcontroller-based IOT platform that is inexpensive. It has a storage capacity of 4MB and 128kB of memory. It originally included hardware based on the ESP-12 module and firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC. The Lua programming language is employed by the firmware. A circuit board acting as a dual in-line package (DIP) that incorporates a USB controller with a smaller surface-mounted board holding the MCU and antenna is the prototyping hardware that is frequently utilised. Access to the GPIO (General Purpose Input/Output) is also made available. This esp8266-12E or simply esp-12E chip is a member of the esp-xx series. There are 15 modules ranging from esp01 to esp15. These are mostly used for IoT applications due to their small form factor and low price.

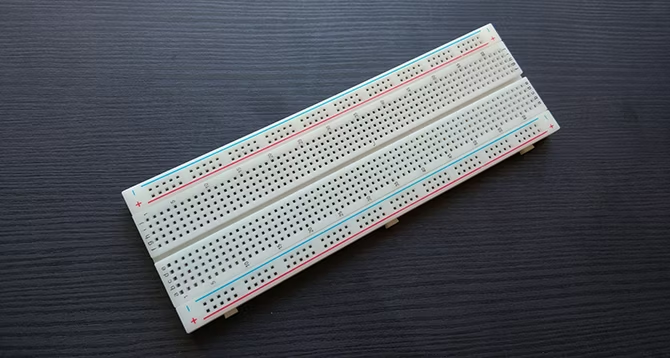
GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance.

The general features of this board are as follows:

* Easy to use
* Programmability with Arduino IDE or IUA languages
* Available as an access point or station
* practicable in Event-driven API applications
* Having an internal antenna
* Containing 13 GPIO pins, 10 PWM channels, I2C, SPI, ADC, UART, and 1-Wire

**Breadboard**

The TA breadboard is a straightforward tool that enables you to build circuits without using solder. They can have different designs and come in different sizes.



Temporary circuits are constructed using a breadboard, often known as a plugblock. Designers may quickly remove and change components thanks to its usefulness. It is helpful for someone who wants to construct a circuit to show how it works before reusing the parts in another circuit. A blank board has connections already. With the addition of a straightforward jumper at the centre point, the horizontal rows can be joined to form a whole row. Markings in either red, blue, or black are used to identify these rows.

**Micro usb cable**

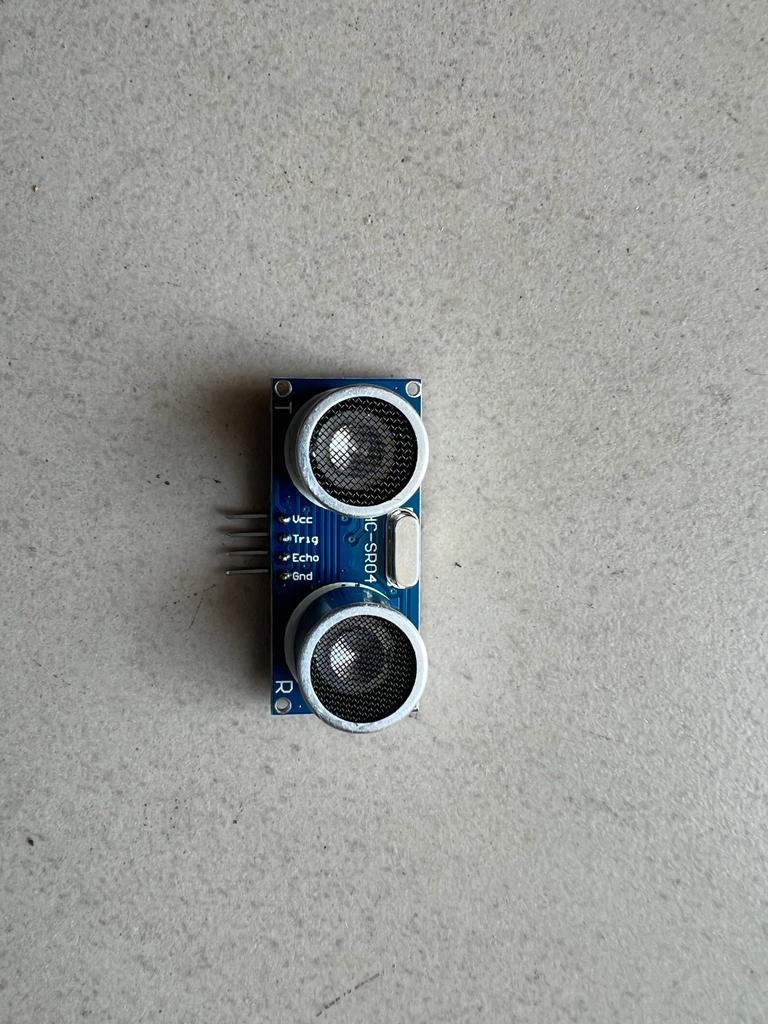


A micro USB is a scaled-down version of the Universal Serial Bus interface designed for connecting small and portable devices like smartphones, MP3 players, printers, digital cameras, and GPS units.

The plug, housing, contacts, and printed circuit board are the four essential components of the micro USB connector.

To handle the electrical currents and communications required for quicker data transfer, the micro USB cable has a single twisted pair.

**Ultrasonic Sensor**



-

|  |  |  |
| --- | --- | --- |
| **Pin No:** | **Pin Name:** | **Description** |
| 1 | Vcc | This pin powers the module, typically the operating voltage is +5V |
| 2 | Ground | Used to connect the module to system ground |
| 3 | Trig | Trigger is the part from where the ultrasonic waves are emitted |
| 4 | Echo | Echo will receive the reflected ultrasonic waves from the container |

**Arduino IDE:**

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. There are currently two versions of the Arduino IDE, one is the IDE 1.x.x and the other is IDE 2.x. The IDE 2.x is new major release that is faster and even more powerful to the IDE 1.x.x. In addition to a more modern editor and a more responsive interface it includes advanced features to help users with their coding and debugging. The programs that are written with this software are referred to as sketches. C or Cpp languages are mostly used for coding in this software.

**The Arduino Integrated Development Environment** - or Arduino Software (IDE) - connects to the Arduino boards to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino.

**Thingspeak:**

ThingSpeak is an IoT examination stage administration that permits you to total, picture and break down live information streams in the cloud. With the capacity to execute MATLAB code in ThingSpeak you can perform online analysis and handling of the information as it comes in. ThingSpeak is regularly utilized for prototyping and evidence of idea IoT frameworks that require examination.

ThingSpeak Key Features:

• ThingSpeak permits you to total, visualize and analyze live information streams in the cloud. A portion of the critical capacities of ThingSpeak including the capacity to:

• Effectively design gadgets to send information to ThingSpeak utilizing well known IoT conventions. • Visualize your sensor information continuously.

• Able to access by outside sources.

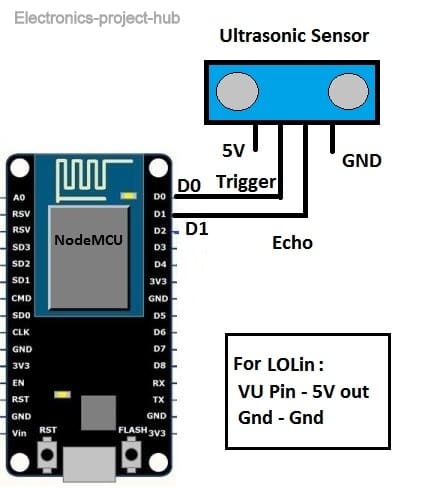
• Utilize the force of MATLAB to sort out your IoT information.

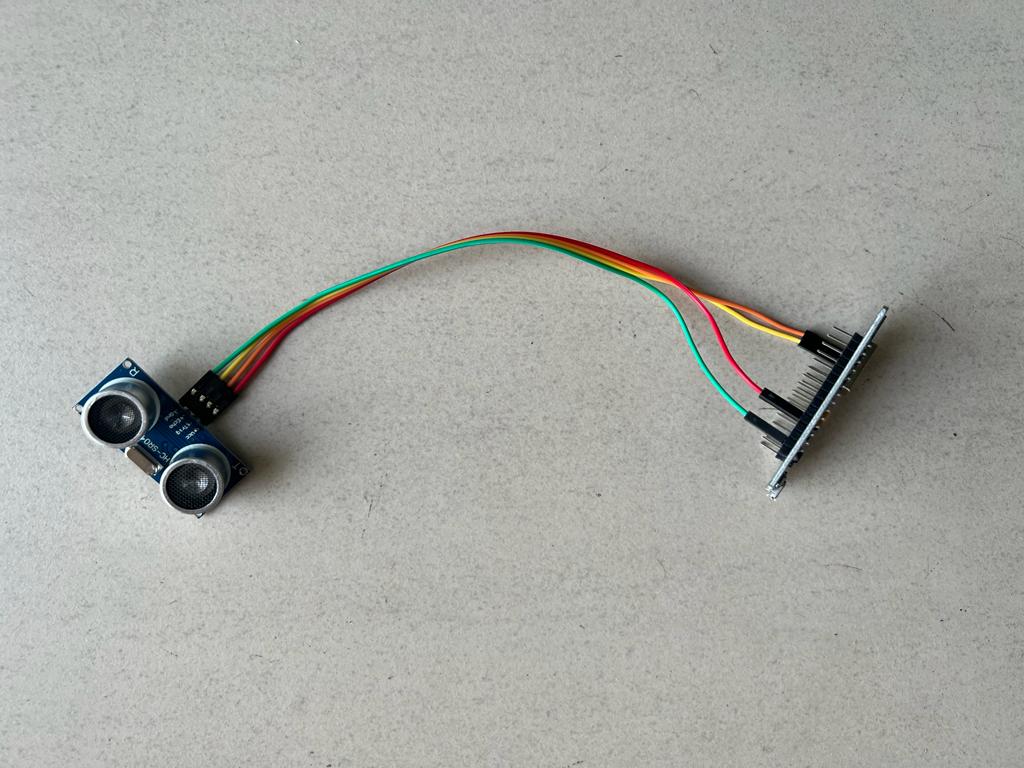
• Run your IoT examination consequently founded on timetables or occasions.

• Model and develop IoT frameworks without setting servers or creating web programming.

• Naturally follow up on your information and convey utilizing outsider administrations like Twilio or Twitter

**Circuit Diagram:**





**CODE:**

#include "ThingSpeak.h"

#include <ESP8266WiFi.h>

//----------- Enter you Wi-Fi Details---------//

char ssid[] = "Bharadwaj Uppala"; //SSID

char pass[] = "12345679"; // Password

//-------------------------------------------//

// --------------- Tank details --------------//

const int total\_height = 21.5; // Tank height in CM

const int hold\_height = 18;// Water hold height in CM

//-------------------------------------------//

//----- minutes -----//

int minute = 1; // Data update in min.

//------------------//

//----------- Channel Details -------------//

unsigned long Channel\_ID = 1896763; // Channel ID

const int Field\_number = 1; // To which field to write data (don't change)

const char \* WriteAPIKey = "KZD9625X1AX3ASWZ"; // Your write API Key

// ----------------------------------------//

const int trigger = 16;

const int echo = 5;

long Time;

int x;

int i;

int distanceCM;

int resultCM;

int tnk\_lvl = 0;

int sensr\_to\_wtr = 0;

WiFiClient client;

void setup()

{

Serial.begin(115200);

pinMode(trigger, OUTPUT);

pinMode(echo, INPUT);

WiFi.mode(WIFI\_STA);

ThingSpeak.begin(client);

sensr\_to\_wtr = total\_height - hold\_height;

}

void loop()

{

internet();

for (i = 0; i < minute; i++)

{

Serial.println("System Standby....");

Serial.print(i);

Serial.println(" Minutes elapsed.");

delay(20000);

delay(20000);

delay(20000);

}

measure();

Serial.print("Tank Level:");

Serial.print(tnk\_lvl);

Serial.println("%");

upload();

}

void upload()

{

internet();

x = ThingSpeak.writeField(Channel\_ID, Field\_number, tnk\_lvl, WriteAPIKey);

if (x == 200)Serial.println("Data Updated.");

if (x != 200)

{

Serial.println("Data upload failed, retrying....");

delay(15000);

upload();

}

}

void measure()

{

delay(100);

digitalWrite(trigger, HIGH);

delayMicroseconds(10);

digitalWrite(trigger, LOW);

Time = pulseIn(echo, HIGH);

distanceCM = Time \* 0.034;

resultCM = distanceCM / 2;

tnk\_lvl = map(resultCM, sensr\_to\_wtr, total\_height, 100, 0);

if (tnk\_lvl > 100) tnk\_lvl = 100;

if (tnk\_lvl < 0) tnk\_lvl = 0;

}

void internet()

{

if (WiFi.status() != WL\_CONNECTED)

{

Serial.print("Attempting to connect to SSID: ");

Serial.println(ssid);

while (WiFi.status() != WL\_CONNECTED)

{

WiFi.begin(ssid, pass);

Serial.print(".");

delay(5000);

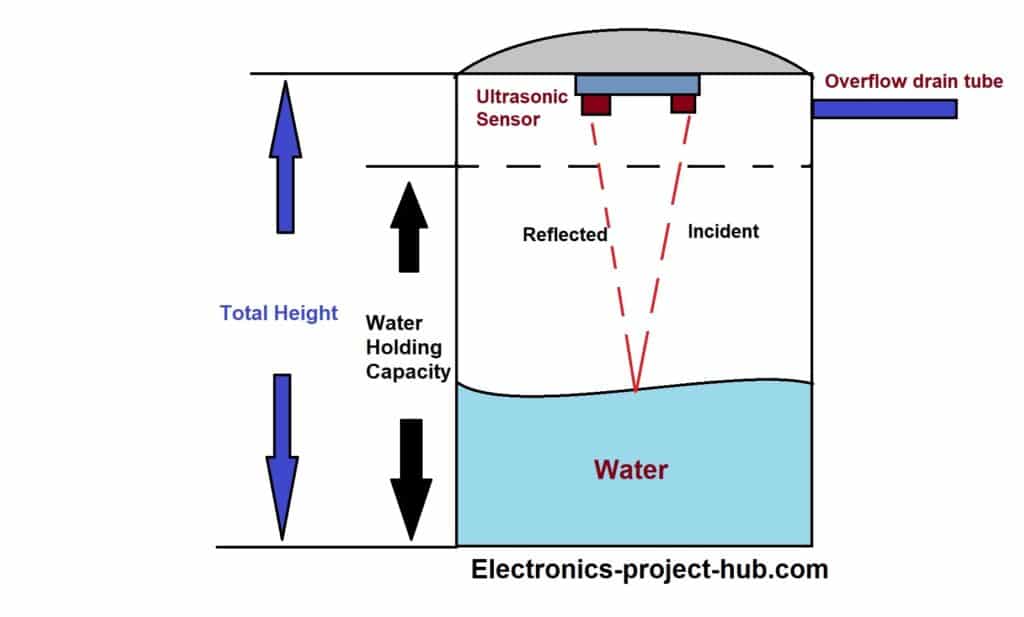
}

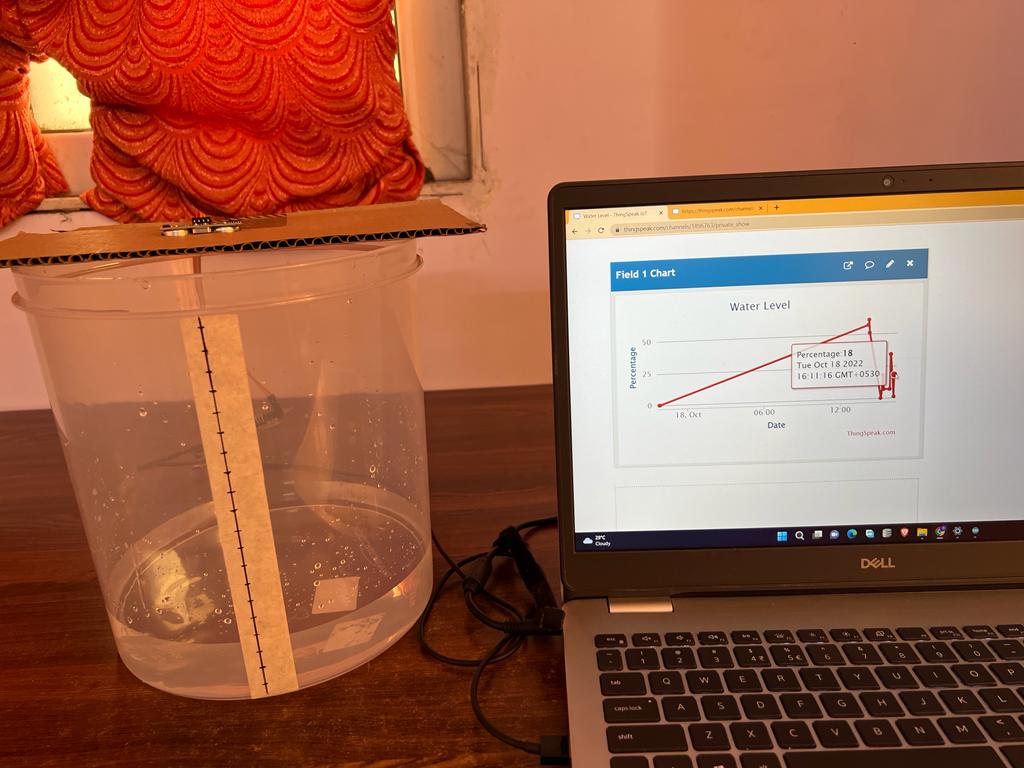
Serial.println("\nConnected.");

}

}

**Implementation:**







Get to know the capacity of the container here the redline represents the total length of the container, where as the green line represents max capacity till which we want the water to be held by the container.

**Connections:**

First, We use a breadboard to build or test a circuit before finalizing a circuit design. Take breadboard and insert a Nodemcu ESP8266 12-E Development Board into it. First of all, connect the Vin pin to the positive rail on the breadboard.

Then connect GND Pin to the negative rail of the breadboard.

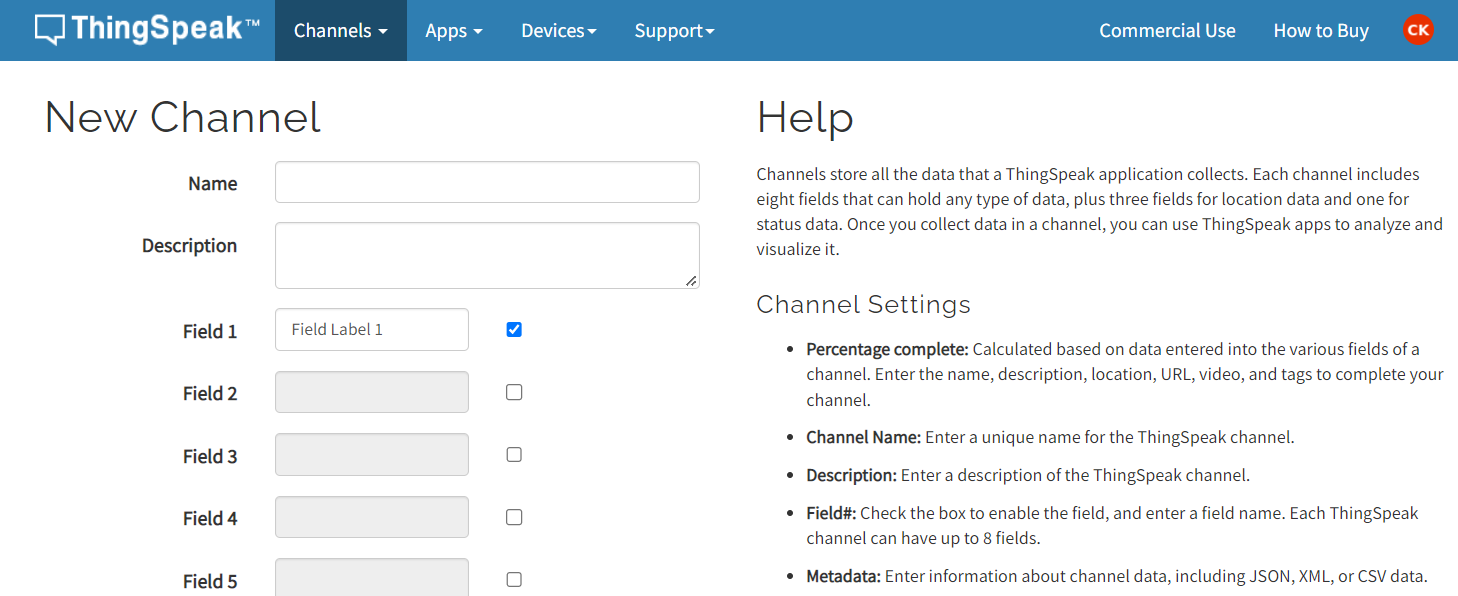
And to interface with MQ2 ultrasonic sensor connect analog pin A0 of ultrasonic sensor to analog pin A0 of the nodemcu.

Ground GND of ultrasonic sensor to the GND of nodemcu. And connect the VCC of MQ2 to the Vin of nodemcu.

After the circuit connections assembled on the breadboard. Code should be uploaded.

**Setting Thingspeak & Getting API Key:**

1. Go to [**https://thingspeak.com/**](https://thingspeak.com/) and create an account if you do not have one. Login to your account.
2. Create a new channel by clicking on the button. Enter the basic details of the channel. Then Scroll down and save the channel.



1. Then go to API keys copy and paste this key to a separate notepad file. You will need it later while programming.

Now the code should be uploaded to nodemcu by using Arduino ide by choosing the board nodemcu esp8266 and port and then compile the code and then upload the code to the nodemcu.

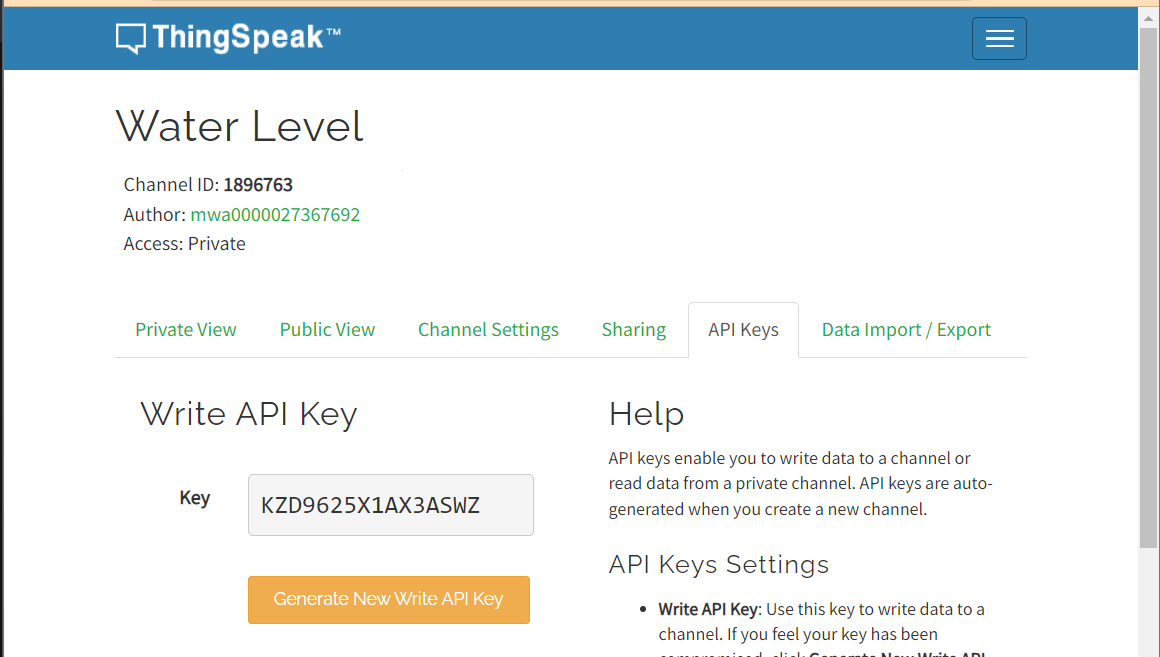
Once code uploading is done open the serial monitor to see whether the wifi is connected or not. Make sure the baud rate should be 115200. If wifi is connected then you can see the water level displayed in percentage and data will be sent to thingspeak.

Open the thingspeak channel and select pubic/private view. Here you can see the data uploaded after the interval of 15 seconds.

If the water level goes beyond the threshold then the user is notified with a tweet through thingspeak server.

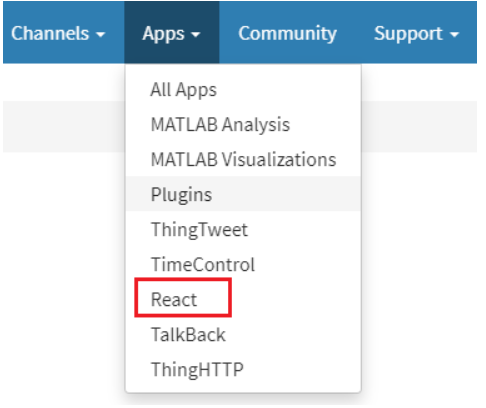
To send twitter notification from thingspeak. First we have to connect with the twitter account.

And then To do so, go to your ThingSpeak channel and click on **Apps > ThingTweet > Link Account**.

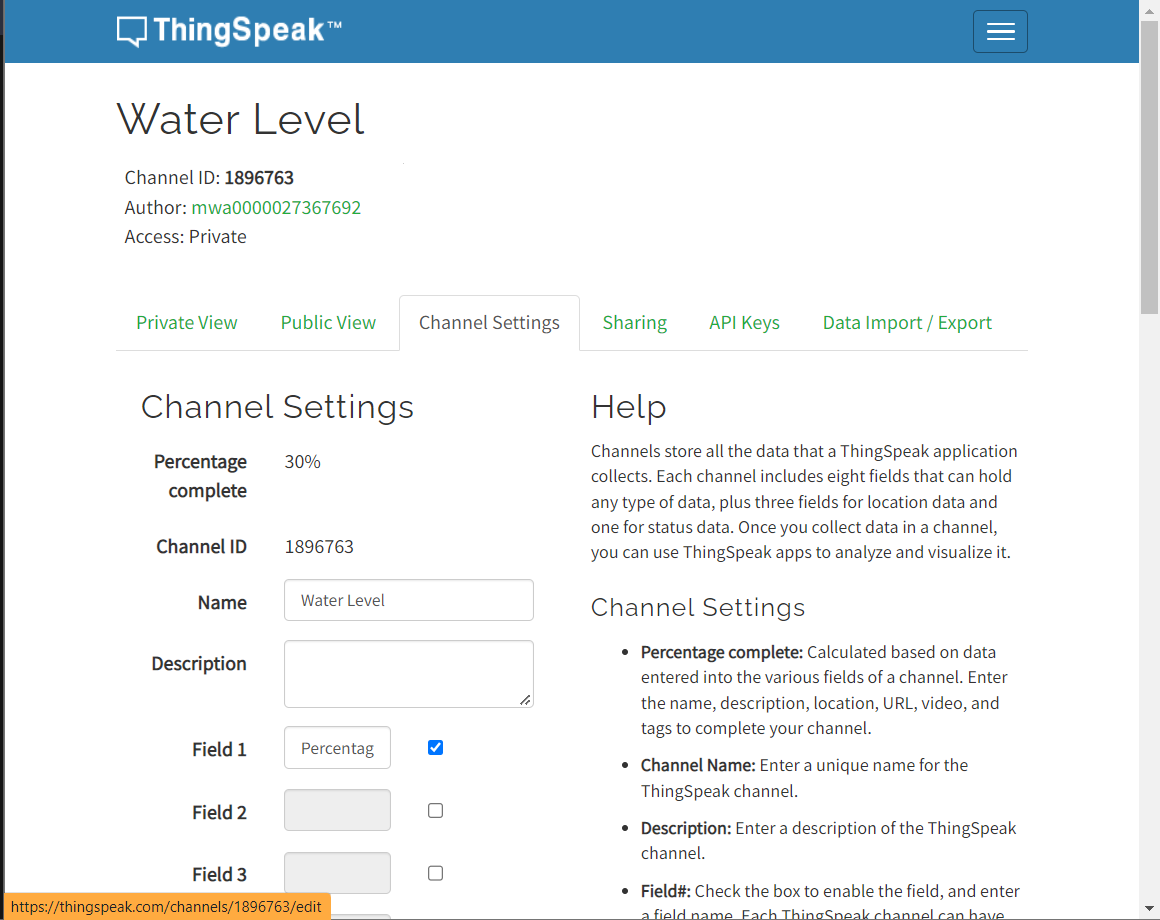
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In next window enter your twitter username and password and click on ‘Authorize app.’ Now, as you authorized the **ThingTweet**, it can read and post tweets on your timeline.

Go back to ThingSpeak channel and then click on **Apps > React > New React**.

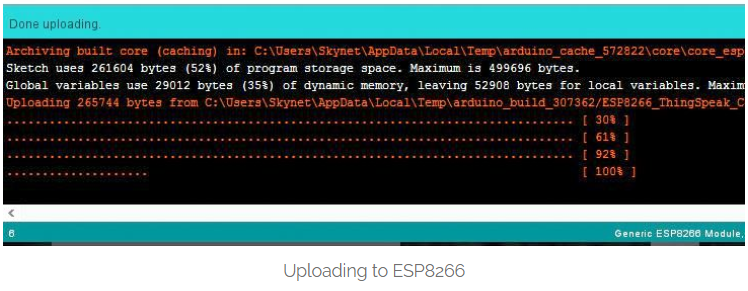


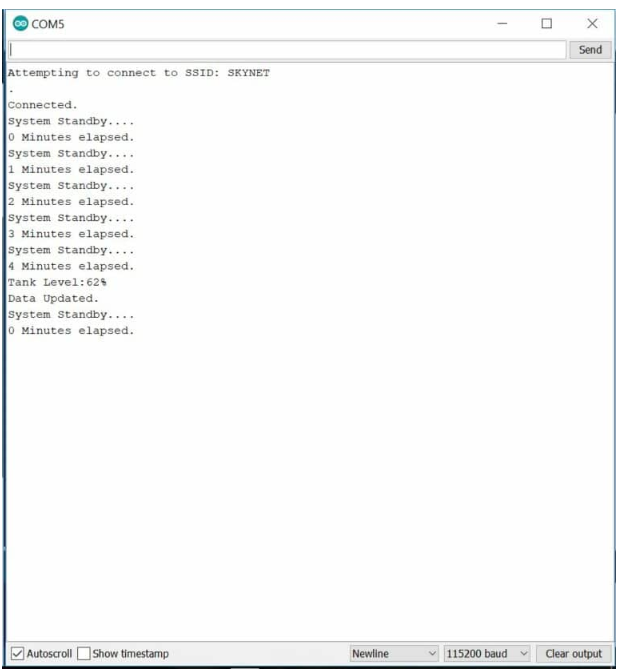
In React window fill the details. In condition, tab choose Numeric because we want to send a tweet for a specific numeric value, in condition tab choose the channel name, field and select when you want to run the React.



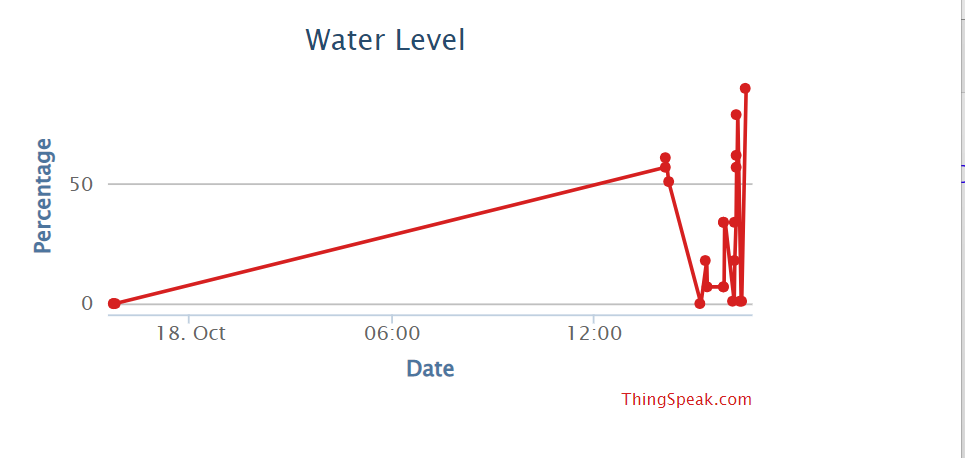
Save the React and run the code. Now, whenever the water level value goes past the required level, it will send a notification to your applications. You can change the notification frequency by changing the Test Frequency.

**Results:**





**Output in the Arduino ide**

****

**Output in Thingspeak**

An IoT system consists of sensors/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors/devices without the need for the user.

But if user input is needed or if the user simply wants to check in on the system, a user interface allows them to do so. Any adjustments or actions that the user makes are then sent in the opposite direction through the system: from the user interface, to the cloud, and back to the sensors/devices to make some kind of change.

That’s how an IoT system works at a high level. Now we’ll take a deeper dive into each of these components to explain what they are, how they work, and important considerations for your organization as you consider building and/or implementing IoT solutions.

**Conclusion:**

By installing IoT based water level monitoring systems in all the important municipal water tanks the local government can know the level of water in real time and they can fill the tank on time and also can understand the consumption of water in the area. The collected data can be sent to higher level governments where they can draw national level conclusions on water consumption.

IoT based water level monitoring system can also be installed on individual houses / apartments so that one can check water level of their tank in real time from their own comfort and also track their consumption overtime.

Industries and Applications

* Irrigation
* Flood Monitoring
* Open Channel Flow
* Sea Level Monitoring
* Streams, Rivers, Ponds
* Wastewater
* Water tank level
* Waste water
* Tidal monitoring
* Ocean wave monitoring
* Towing tanks

**Refernces:**

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[3] https://www.researchgate.net/publication/3430936\_An\_ultrasonic\_sensor\_for\_distance\_measurement\_in\_automotive\_applications

[4]

https://www.biz4intellia.com/water-level-monitoring/#:~:text=IoT%2Dbased%20water%20level%20monitoring%20provides%20automatic%20detection%20of%20liquid,status%20of%20the%20liquid%20levels.