

**CSE 3009-INTERNET OF THINGS**

**F2 SLOT**

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**SMART WATER LEVEL DETECTION IN TANKS**

ABSTRACT:

The project aims to collect the water height and give alert during times of high water level. It senses the data and sends it to cloud which processes the information and sends an alert to user if the water level has reached a certain maximum level.

First the sensor sends binary data whether or not the water level is rising or not and can measure the rate of increase or decrease by taking reading at regular intervals. The processing is done in cloud and the processed data is used to determine the next action to be taken.

PHYSICAL DESIGN:

Iot protocols:

PHYSICAL LAYER:

2G/3G MOBILE CONNECTION: This project uses mobile communication methodology to send data to cloud.

NETWORK LAYER:

6LoWPAN:IPV6 over Low Power Wireless Personal Area Network.Since the sensors use low power this protocol is best suited.

APPLICATION LAYER:

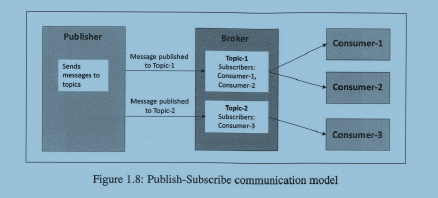
HTTP:this project uses HTTP GET method to publish and receive data.Data is sent in the URL.

LOGIAL DESIGN:

COMMUNICATION MODEL:

PUBLISH SUBSCRIBE MODEL:

The sensors keep on publishing data at regular intervals and the user/subscriber can receive it any time.



COMMUNICATION API:

REST based API:this model uses REST primarily because it can support many internet media types(JSON ,XML).JSON and XML are used as a format for exchanging data.

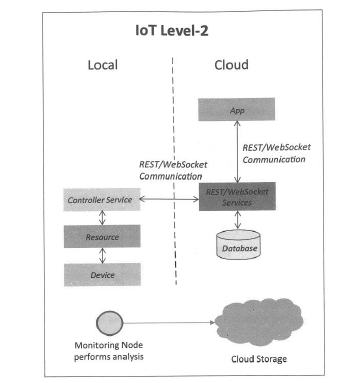
IOT ENABLING DEVICES:

CLOUD COMPUTING:

It is a nonfunctional,Data is sent to clouds for processing them and the processed data is sent from cloud.

IOT DEPLOYMENT LEVEL:

It is a level 2 model because the data is stored in cloud and processing in also done in cloud.



LITERATURE SURVEY:

N.Zachos at all in their research paper has implemented remote measuring station in present of wireless system for monitoring of water level. They have achieved an ultrasonic distance measuring system. In this the remote stations are considered as simple measuring units with a communication interface so that they may be operating under the control of base station. the advantages of their paper are no mechanical parts required, remarkable accuracy and resolution. The disadvantage of their paper the water level monitoring is developed slowly and it required temperature compension.

Zhou Yiming at all in their research paper has implemented the Wireless system for monitor and control of water level in greenhouse. They had used ZigBee network and several sensors nodes. The advantage is low cost and high network capacity.

Zulhani rasin at all in their paper elaborate the ZigBee network for water irrigation control monitoring system. They had used a various sensor node to detect the water level in the reservoir and it is based on the signal from the sensors, and a simple electronic circuit either open or close the gate controlling the flow of water. In their paper it is important to mentioned here, the circuit present in their project is on a conceptual scale and not yet in the form than can be directly applied to the available water irrigation controlling gate. The disadvantage of this paper that the battery needed in this project is operated only for 12 hours and require more human effort.

Nuno Brito at all in their paper has implemented control of water level in two tank without interaction. They had performed in a remote collaborative method. In this paper the system includes two tanks made in acrylic, a pump to circulate the water from the lower part of tank to the upper tank, two ultrasonic sensors was used for measuring both tank levels, and electronic valve to stop the flow of water between the upper level tank and the lower level tank and a manual valve for security purposes.

The disadvantage of this system ,it is not available with local or remote control configuration for demo purposes.

Zhang Zhi at all in their research paper elaborate the control and monitoring of water level in nuclear power plant. In this paper the Steam generator was used for water level control system which was the most important components of the nuclear power plant. In this paper it develop the performance assessment method for a class of SG level of water control systems, two PI controller system. A major contribution of this paper was to take the performance assessment technology into an industrial area, SG water level control in NPPs, where not much work has been done before.

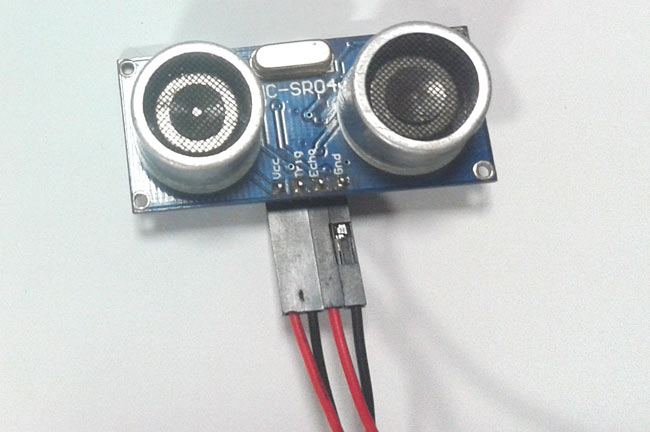
P. Komeswarakul at all in their paper has proposed automatic water monitoring system using microcontroller for dam. In this paper , the remote terminal unit (RTU) based on DSPIC30F4011 microcontroller was mainly designed to precisely measure, store and send instruments output to the computer server including real-time communication for dam behavior monitoring system. This system also provides the real-time information via reliable fiber-optic communication. The sensors installed into structure of dam and in reservoir to measure physical quantities of interests such as seepage flow, water level, deformation, pressure and temperature parameters. The aim of this paper presents the RTU that operates in the dam monitor system. The RTU based on DSPIC30F4011 microcontroller is mainly designed to precisely measure, store the analog value of instrument sensor devices related to dam behaviour. It is used to directly exchange data between computer and RTU via RS232 serial communication.

PROPOSED ARCHITECTURE/METHODOLOGY:

Components:

Ultrasonic Sensor:

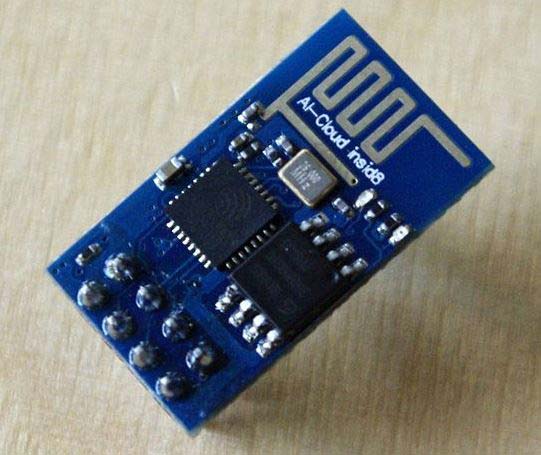
The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm or from 1 inch to 13 feet.  It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, we can calculate the distance.



The ultrasonic sensor has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino. The trig pin will send the signal and the Echo pin will be used to receive the signal. To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin.

### ESP8266 Wi-Fi Module:

ESP8266 is a Wi-Fi module which will gives **access to Wi-Fi or internet**. It is a very cheap device but it will make circuits very powerful. It can communicate with any microcontroller and make the projects wireless. It is in the list of most leading devices in the IOT platform. It runs on 3.3V and if you will give it 5V then it will get damage. The ESP8266 has 8 pins; the VCC and CH-PD will be connected to the 3.3V to enable the wifi. The TX and RX pins will be responsible for the communication of ESP8266 with the Arduino.



METHODOLOGY:

The idea behind all contactless methods is to measure distance between transceiver and fluid. The sensor transmits short ultrasonic pulse and we can measure travel time of that pulse from transceiver to liquid and back to transceiver. Ultrasonic pulse will bounce from liquid level since because change of density of ultrasonic pulse travel medium (ultrasonic pulse first travel through air and bounce of liquid with higher density than air). Because water has higher density, majority of pulse will bounce off.

Two disadvantages exist with ultrasonic method:

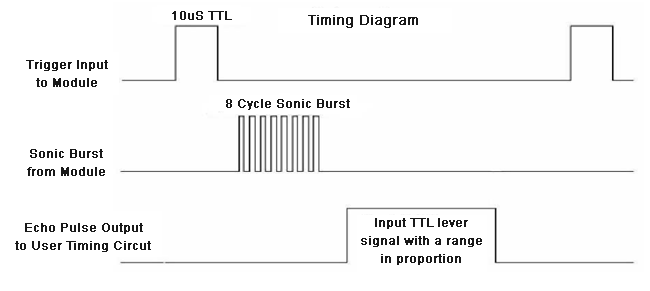
- 1st: because of pulse length there is small window that we cannot receive pulse with transceiver because transceiver is transmitting. This problem is simple to solve: sensor should be placed higher from maximum water level for few centimeters allowing receiver to start receiving.

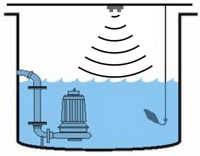
- 2nd: because of the beam width we are limited with tank diameter. If tank diameter is too small, signal could bounce of tank’s walls and could cause false readings.

This Arduino water level indicator uses an ultrasonic sensor or Ping sensor to determine the level of water in the tank. The Ping sensor measures distance using sonar. An ultrasonic (well above human hearing) pulse is transmitted from the unit and distance-to-target is determined by measuring the time required for the echo return. Output from the Ping sensor is a variable-width pulse that corresponds to the distance to the target.

Distance= (time x speed)/2.

Here we have divided the product of speed and time by 2 because the time is the total time it took to reach the obstacle and return back. Thus the time to reach obstacle is just half the total time taken.

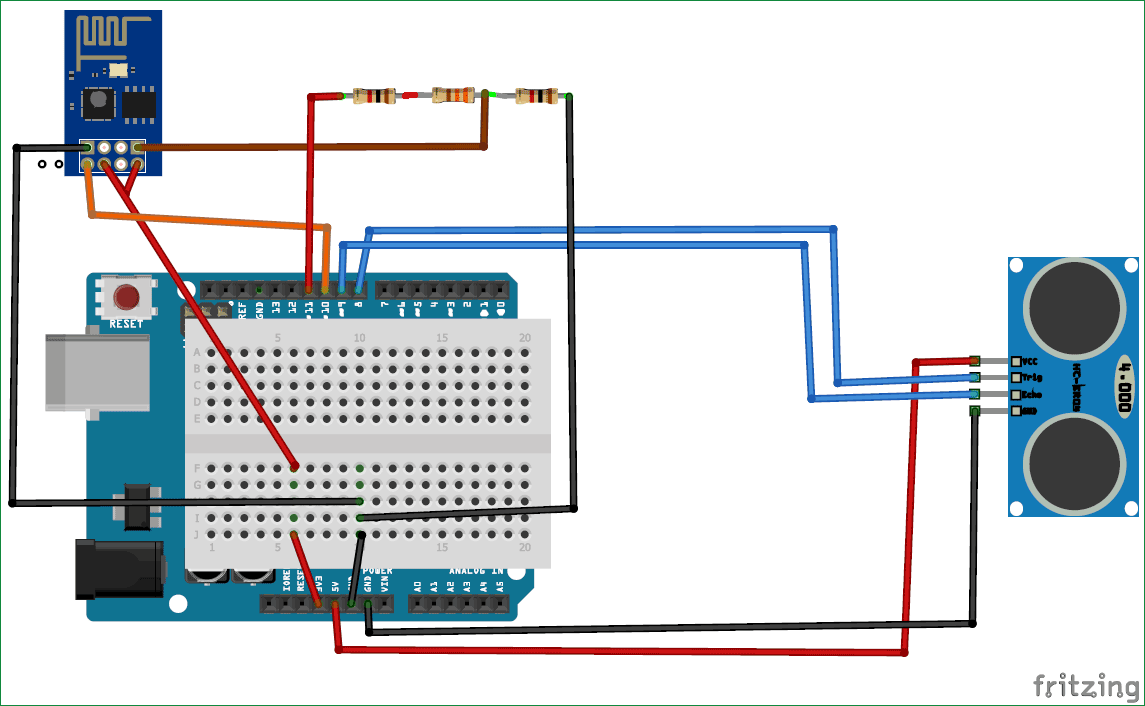




INNOVATIVE IDEA:

I have proposed to send the water level to a cloud that has a python code running on it.It will then send an SMS saying that the water level is high so that the concerned person can turn off the water tank .A python service called tornado handles the HTTP request while another module called twilio handles the SMS part.

CIRCUIT DIAGRAM:



SAMPLE CODE OF PROJECT:

Arduino code:

#include <SoftwareSerial.h>

#define DEBUG true

#define trigPin 13

#define echoPin 12

SoftwareSerial esp(2,3); // RX is pin 2, TX Arduino line is pin 3.

long duration, distance;

String ssid ="ujjwal";

String password="python@123";

String data;

String server = "waterlvl.herokuapp.com";

String uri = "/";

void setup()

{

Serial.begin(9600);

esp.begin(9600);

pinMode(trigPin, OUTPUT);

pinMode(echoPin, INPUT);

Serial.println("gong to reset");

reset();

Serial.println("reser done");

connectWifi();

}

void reset() {

esp.println("AT+RST");

delay(1000);

if(esp.find("OK")) Serial.println("Module Reset");

else

Serial.println("error in reser");

}

void connectWifi() {

String cmd = "AT+CWJAP=\"" +ssid+"\",\"" + password + "\"";

esp.println(cmd);

delay(4000);

if(esp.find("OK")) {

Serial.println("Connected!");

}

else {Serial.println("Cannot connect to wifi");

connectWifi();

}

}

void loop()

{

digitalWrite(trigPin, LOW);

delayMicroseconds(2);

digitalWrite(trigPin, HIGH);

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);

distance = (duration/2) / 29.1;

data = "level=" + distance;

httppost();

delay(4000);

Serial.println(distance);

}

void httppost () {

esp.println("AT+CIPSTART=1,\"TCP\",\"" + server + "\",80");//start a TCP connection.

if( esp.find("OK")) {

Serial.println("TCP connection ready");

} delay(1000);

String req = "GET /?" + data + " HTTP/1.1\r\nHost: " + server + "\r\nUser-Agent: Arduino\r\n\r\n";

String cip = "AT+CIPSEND=1,"+String(req.length());

esp.println(cip);

delay(500);

if(esp.find(">")) { Serial.println("Sending.."); esp.println(req);

}

// close the connection

if(esp.find("SEND OK")) { Serial.println("Packet sent");}

esp.println("AT+CIPCLOSE");

}

Python code:

from datetime import datetime

from tornado.ioloop import IOLoop

from tornado.web import RequestHandler, Application

from tornado.httpserver import HTTPServer

from tornado.gen import coroutine

from motor import MotorClient

from twilio.rest import Client

account\_sid = "XXXXXXXXXXXXXXXX"

auth\_token = "XXXXXXXXXXXXXXXXX"

client = Client(account\_sid, auth\_token)

db = MotorClient("mongodb://XXXXXXX:xXXXXX@ds159200.mlab.com:59200/iot")["iot"]

def send\_message(message):

client.messages.create(

to="+919790020828",

from\_="+13342139031",

body="Water level high - " + message,

)

class MainHandler(RequestHandler):

def get(self):

self.write("| Path | Method | Params|\n"

"| / | POST | level | To store the water level\n")

@coroutine

def post(self):

level = self.get\_argument('level')

yield db.level.insert({"level": level, 'date': datetime.utcnow()})

if int(level) >= 30:

send\_message(level)

self.write("Success\n")

settings = dict(

db=db,

# template\_path=os.path.join(os.path.dirname(\_\_file\_\_), "templates"),

# static\_path=os.path.join(os.path.dirname(\_\_file\_\_), "static"),

# debug=True

)

application = Application([

(r"/", MainHandler),

], \*\*settings)

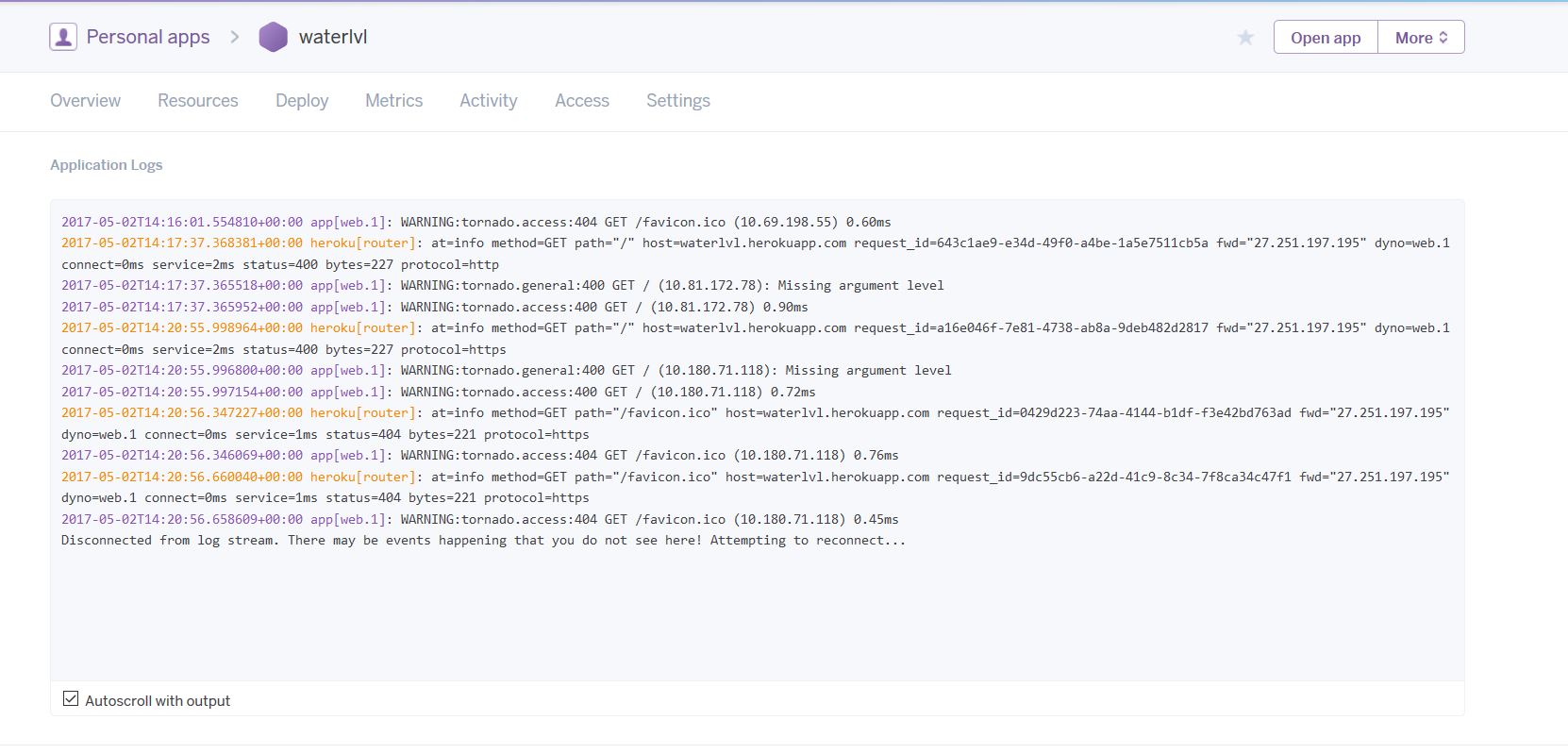
if \_\_name\_\_ == "\_\_main\_\_":

server = HTTPServer(application)

server.listen(8888)

IOLoop.current().start()

SNAPSHOTS:



CONCLUSION AND FUTURE SCOPE:

It can be concluded that Arduino circuit with ultrasonic sensor and Esp8266 module is an efficient way to automate water tanks since we need not go and check the water level each time ,which is a cumbersome task .Also we can also detect if water level is rising or not .If it is not rising it means there is a problem in the tank or there is a leakage in the tank.

In the future we can make the cloud run a machine learning algorithm so that from the previous water levels , we can predict at what water level will the motor be turned off. Based on this information,if we predict that the water is turned off beyond an acceptable limit, we can also send another SMS stating it and suggest that the water should be turned off soon.

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