Chapter 1

INTRODUCTION

1. INTRODUCTION

Internet of Things (IoT) is currently a technology of great significance worldwide. IoT is a platform which provides the physical devices present in the network embedded with electronics, software, sensors, actuators, and connectivity to connect and exchange information to address specific needs. IoT is when the internet and networks expand themselves to domains such as manufacturing, transportation, healthcare and security. An Embedded system is a combination of software and hardware which carries out a specific function within a larger system. The implementation of IoT with the help of embedded systems can help vastly with the management of water. Water management is the complete management of water resources under set policies and regulations. It is the activity of planning, developing, distributing and managing the optimum use of water. Water management is important to satisfy demands for water by allocating water on an equitable basis. The foundation of this project is based on Internet of Things (IoT) and Embedded System.

1.1 Background

Water, once an abundant natural resource, is becoming a more valuable commodity due to droughts and overuse. Hence, it is important to use a Tank Water Level Monitoring system to avoid overflow by intimating the level of water in the tank. Water controlling system implementation makes for a potential significance in home applications. The existing automated method of level detection is described as something which can be used to turn the motor device on/off to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. This helps enhance the water management system.

1.2 Purpose

The main aim of this system is to monitor the water level at rural areas so that they help in detecting the wastage of water and measures can be taken to avoid unnecessary overflowing of water in the areas where monitoring is a difficult task.

1.3 Problem Definition

Unexpected shortage of water supply is common phenomena especially in dense population such as in hostels, homes, Industries, hospitals, hotels, learning institutions and in many other places. Also when water pump is started there is always no idea when it gets filled up and sometimes there are situations where the pump keeps on pumping water to the tank and the water starts spilling out from the tank. This results in seepage of roofs and walls due to overflowing tanks, wastage of energy as well as wastage of water and those pose a biggest threat to the development of an economy.

1.4 Scope

The basics need of human being is water and it is one of the most important necesserty for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use and due to our negligence. Some other automated water level monitoring system is also offered so far but most of the method has some shortness in practice. We tried to overcome these problems and implemented an efficient automated water level monitoring and controlling system. Main intension of this research work is to establish a flexible, economical and easy configurable system which can solve water losing problems. In the near future as home automation web based water level monitoring and controlling system can be designed, through which the system can be controlled from any place via internet through mobile phone. This could have a substantial benefit from this research work for efficient management of water.

1.5 Proposed System

In accordance with our survey, we are trying to make a smart system for controlling the wastage of water by using an ultrasonic sensor to sense the level of water in tank. If the water tank is full or up to the maximum level the sensor will sense it and stop the system automatically. If the water tank is at the minimum level set by user, the sensor will sense it, activate the motor pump and stop at the maximum level. We can control this whole process using IoT.

1.6 Objectives

To implement a microcontroller based reminder system that monitors the level of water in the tank and automatically switch ON and OFF the water pump set depending on the tank water level.

- To design an automatic water monitoring system
- To model a Decision Support system that will monitor the level of water in the tank either it is LOW or HIGH using web browser.
- To prevent overflow and wastage of water by warning when the tank is about to brim since the demand of electricity is very high.
- To test, validate, and deploy the system.

1.7 Limitations

- The ultrasonic sensor needs to be checked periodically.
- Water should be available in overhead tank.

Chapter 2

LITERATURE SURVEY

2.1 Related Work

[1] Design of a Water Environment Monitoring System Based on Wireless Sensor Networks:
This paper is devoted to the explanation and illustration of our new design of water environment monitoring system, based on a wireless sensor network. The system generally includes three parts: hardware and software of data monitoring nodes, hardware and software of the data base station, and software for the remote monitoring centre. The system's measurement capacity ranges from 0 to 80 C on water temperature, with an accuracy of 0.5C; and from 0 to 14 on pH value, with an accuracy of 0.05. Sensors, applicable to different water quality, could be installed at the node to meet the monitoring demands in different water environments and to obtain different parameters.

[2] Smart Water Monitoring System Using Wireless Sensor Network at Home/Office:
This paper is about developing an efficient wireless sensor network (WSN) based on water monitoring system. There are two different ways to monitor the water: water level monitoring and water pipeline leakage monitoring. Finally, this is water monitoring system of smart homes/office research concept will be completed by using wireless sensor technology. By using the monitoring system, we can find a more optimal way to preserve the water, hence saving it for the present and the future generations.

[3] Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network:
Here, the proposed implementation of high power Zigbee based WSN for water quality monitoring system offering low power consumption with high reliability is presented. An important fact of this system is the easy installation of the system, where the base station can be placed at the local residence, close to the target area. And the monitoring task can be done by any person with minimal training at the beginning of the system installation.

2.2 Existing system

It is tedious process to on and off the water motor manually. This sometimes leads to wastage of water and also loss of time. In this project we will overcome these difficulties. This project enables automatic on and off of the water motor after specific levels using iot. Existing system had the problem turning water motor at specific time by a human, which sometimes lead to water overflow i.e water wastage.

Figure No.2.2.1 Existing system

Chapter 3

SYSTEM DESIGN

3.1 Architectural Diagram

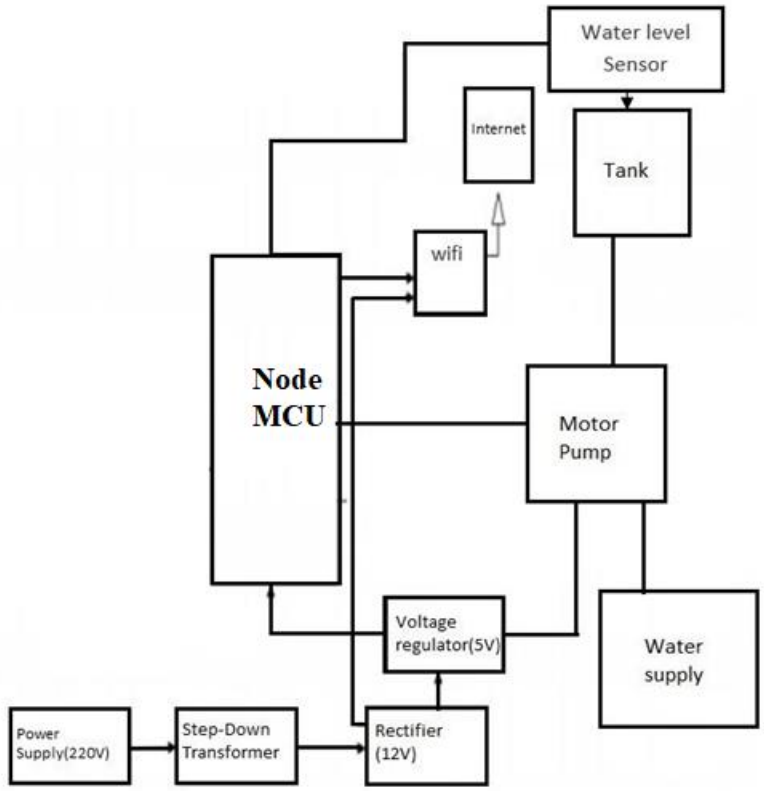

Fig. 3.1.1 Architectural Diagram

Node MCU is connected to an ultrasonic sensor(HC-SRO4), Wi-Fi module (ESP8266) that processes and transfers recorded data using sensors to the cloud. Wi-Fi module will trigger the Node microcontroller, which will get +5-volt DC supply from the supply voltage. Stored data is accessed by the user through the web. This enables the user to check the level of water. User logs in to the integrated website and set the minimum water level and maximum water level in the tank. Tank Water Level management is used to avoid overflow by intimating the level of water in the tank. Water controlling system implementation makes a potential significant presence in homes and offices. The existing automated method of level detection is based on measure of minimum and maximum level of water in the tank which facilitates the automatic switching ON/OFF of the motor. If minimum input water level value is reached, the Motor is turned ON. It begins to fill water in the tank until maximum input water level value is reached in the water tank. Once the maximum water level value is reached, the motor is turned off.

3.2 Flow Chart

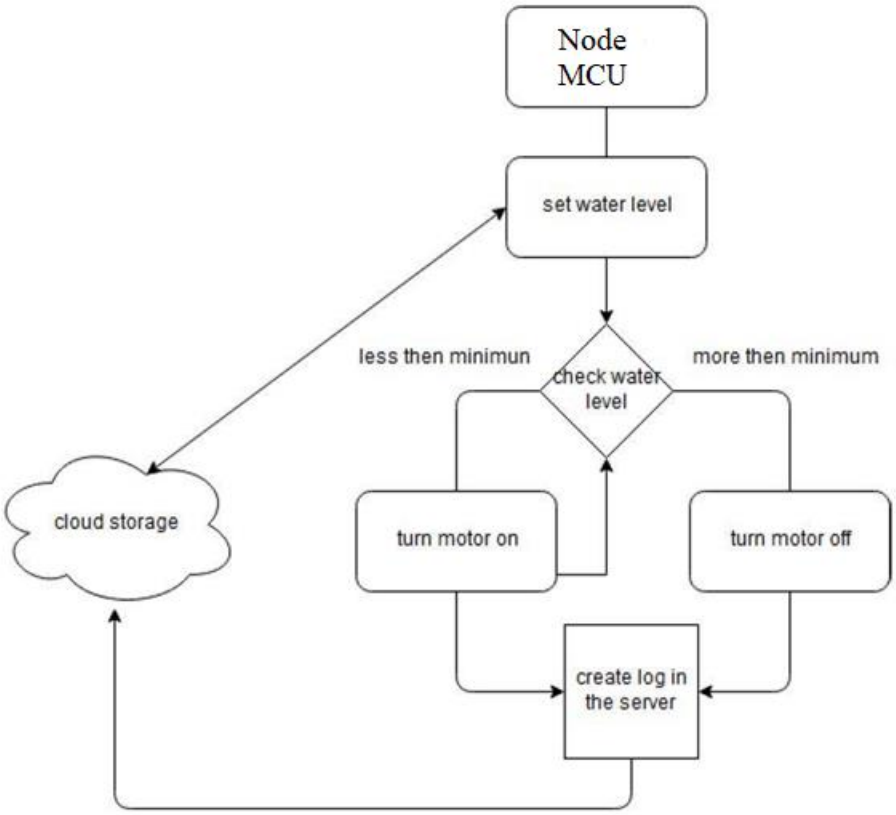

Fig. 3.1.2 Flow Chart

It shows the flow of the process that will be executed step by step.

Chapter 4

SYSTEM REQUIREMENTS

4.1 HARDWARE REQUIRENTS:

1. ESP 8266 Node MCU
2. HC-SR04 Ultrasonic Sensor
3. Relay
4. 5v water pump
5. Jumper Wires
6. Breadboard

4.2 SOFTWARE REQUIREMENTS:

1. Arduino IDE
2. Adafruit IO
3. Mqtt
4. HTML, JavaScript

Chapter 5

IMPLEMENTATION DETAILS

5.1 USER INTERFACE FRONTEND

Here, we have created a web server called as Adafruit, which provides a way to send Water level to web browser. The Adafruit IO is a web server. This tool stores the feeds of the sensor readings .

We have created a webpage which displays the results in form of water conainer. This web application is developed by using HTML language, JavaScript.

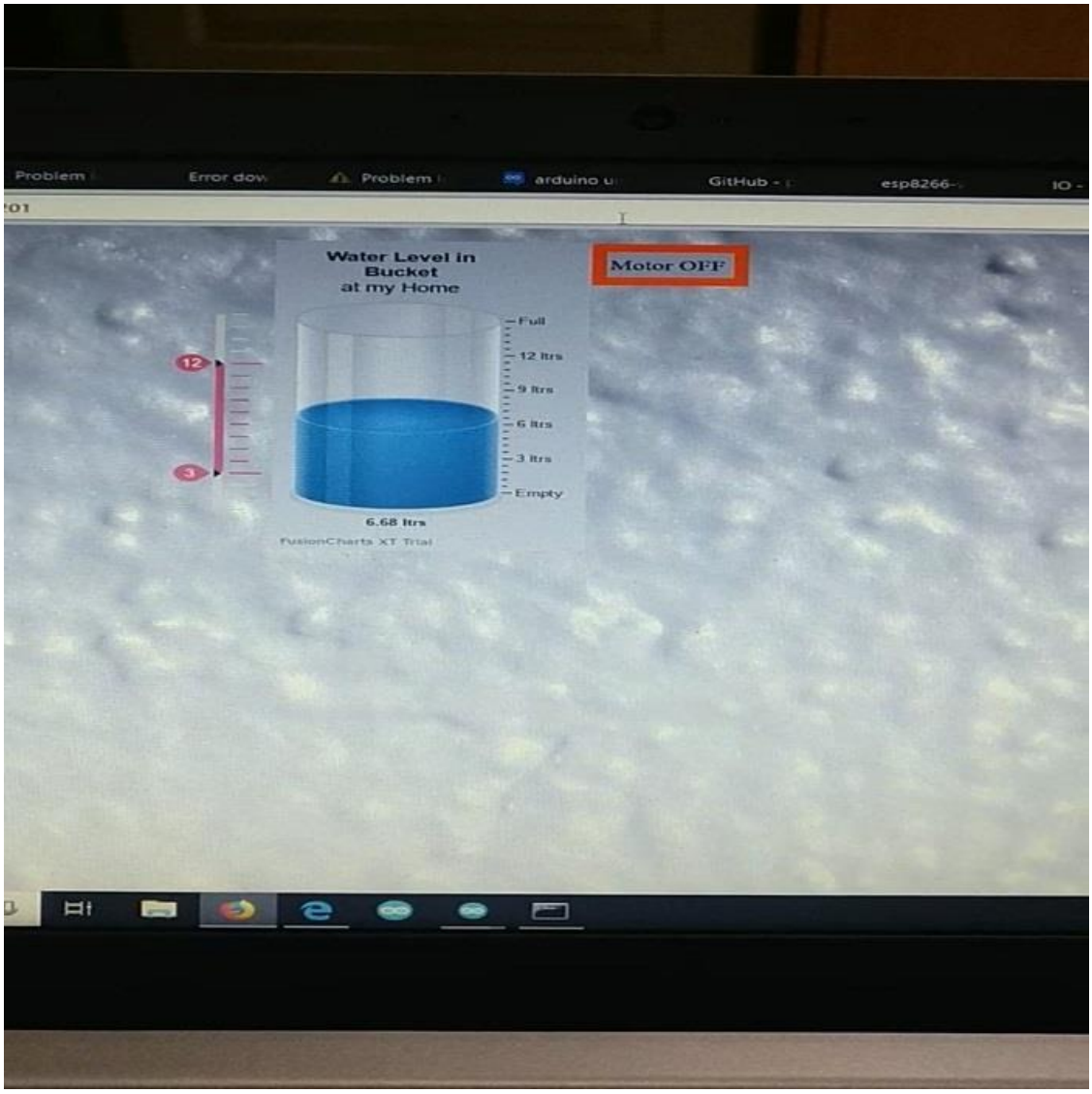

Figure 5.1 (a) Frontend

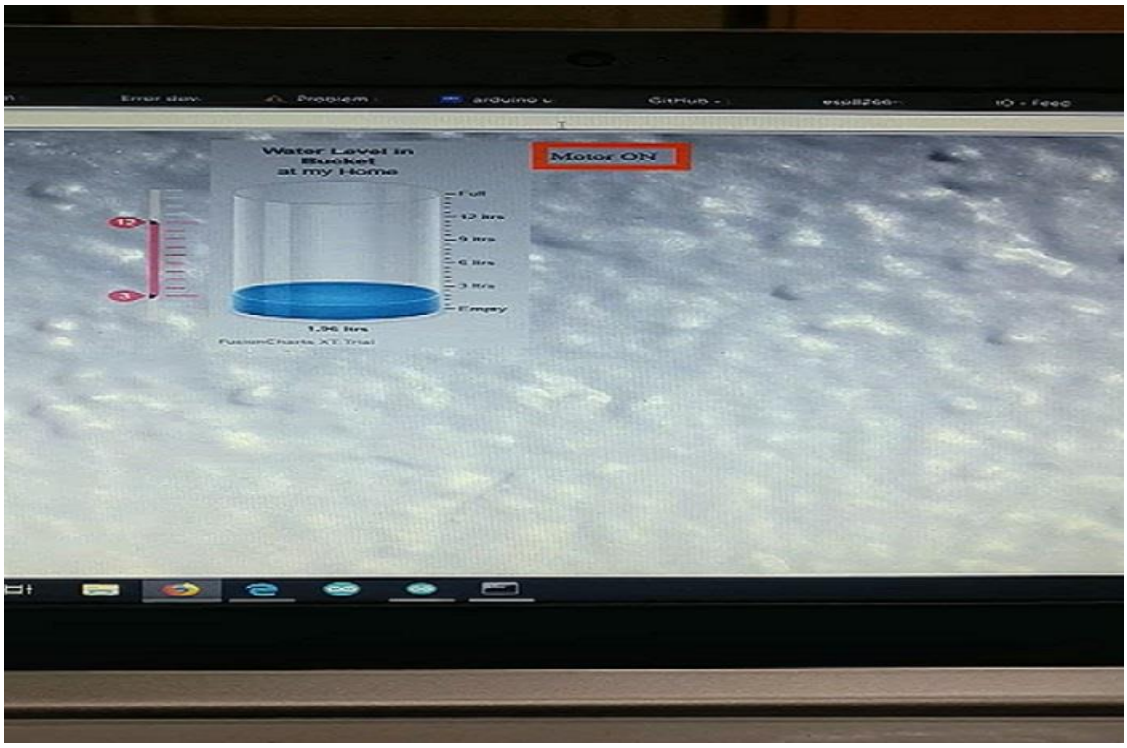

Figure 5.1 (b) Display in container

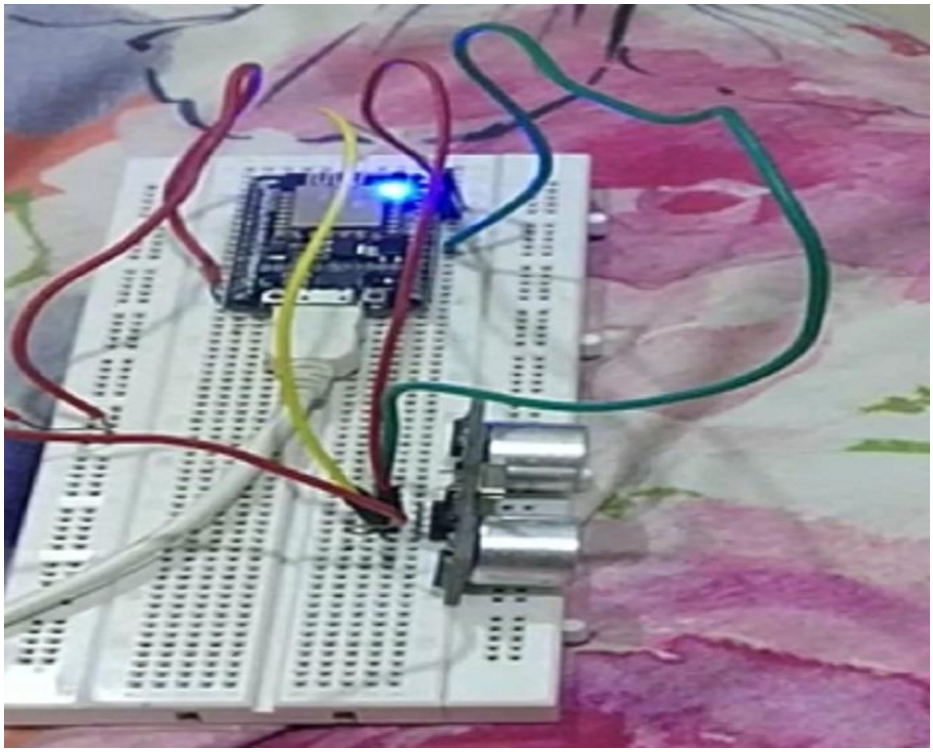

Figure 5.1 (c) Connection of ultrasonic sensor

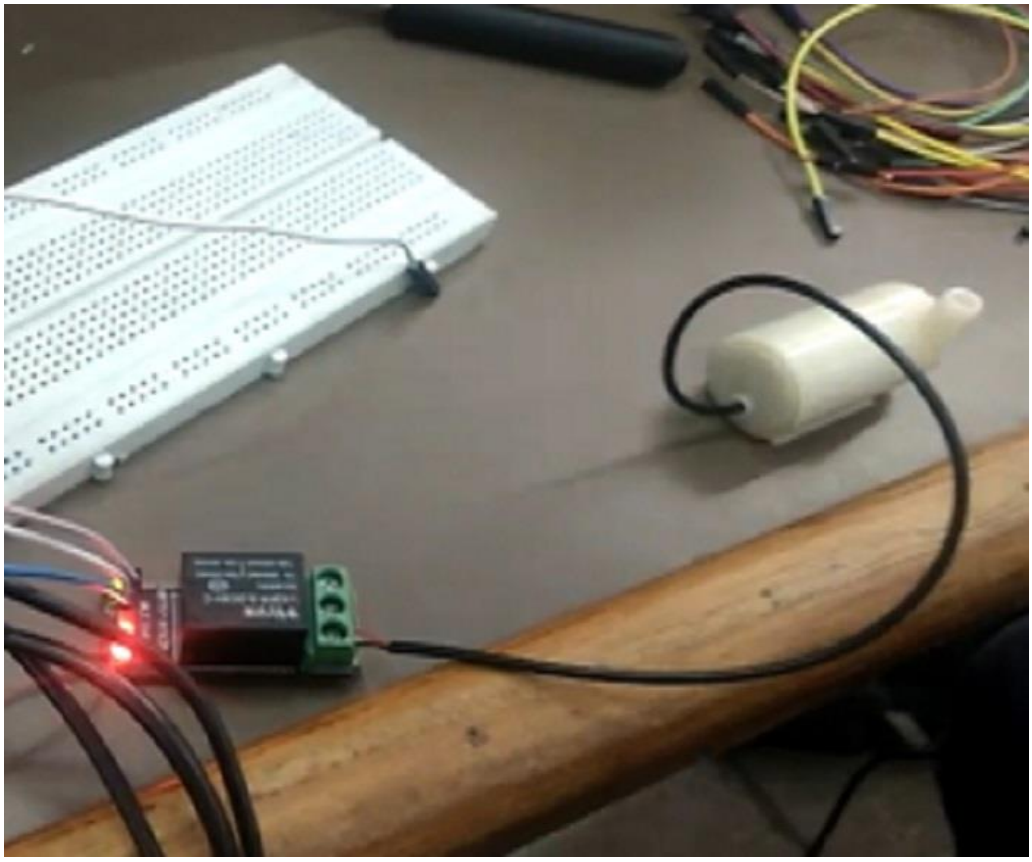

Figure 5.1 (c) Relay and water pump connection

Chapter 6

EXPERIMENTAL RESULTS

6. EXPERIMENTAL RESULTS

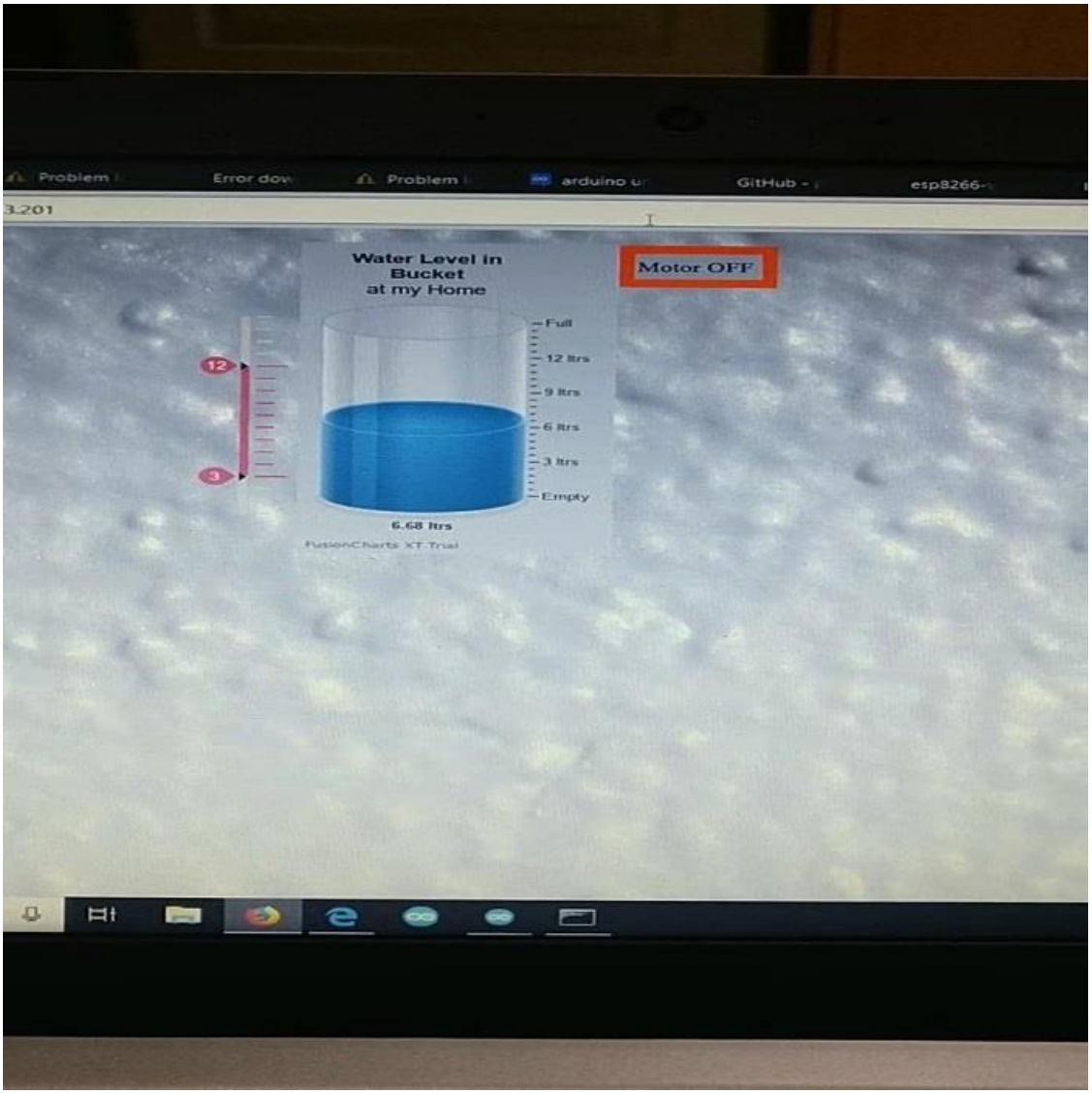

Figure 6.1(a) Output on web browser

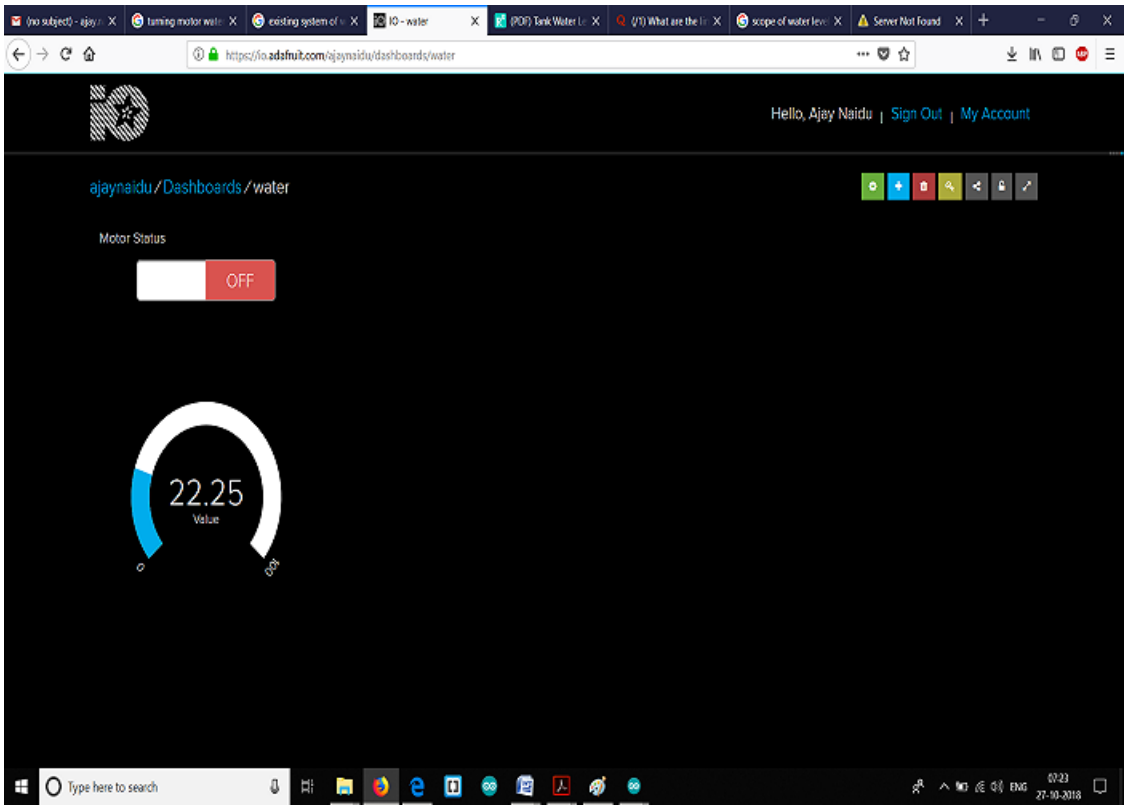

Figure 6.1(b) Output on web server

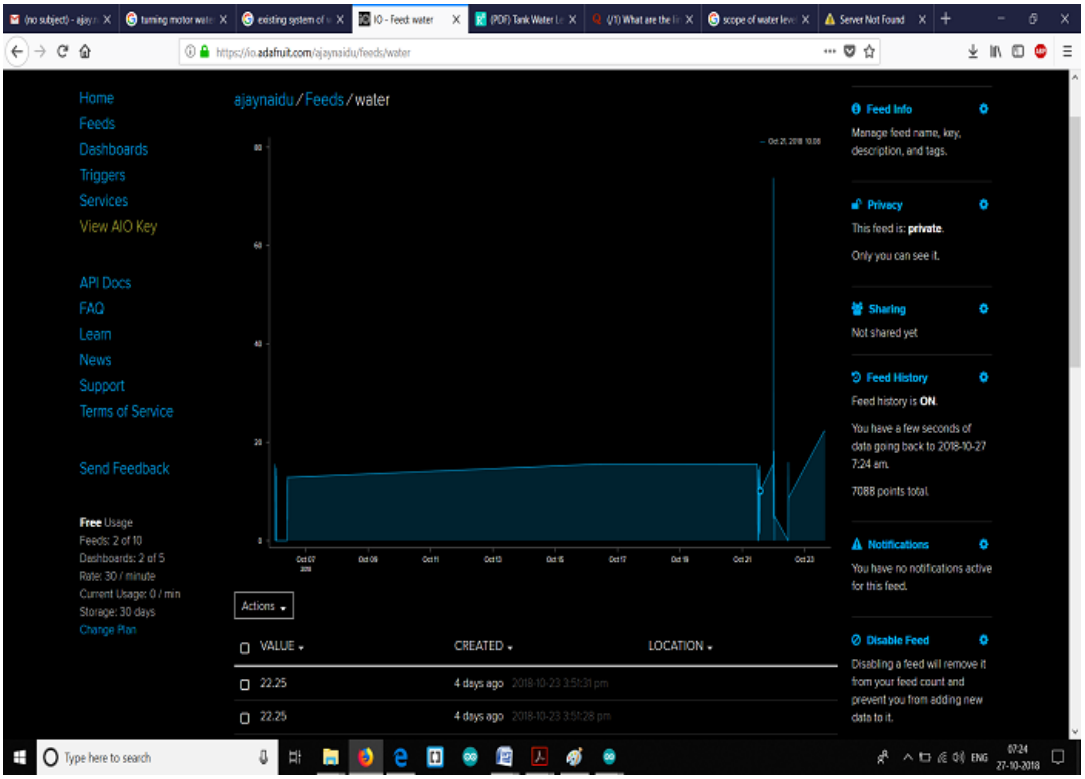

Figure 6.1(c) Output on web server

Chapter 7

CONCLUSION

The IoT is an important technological advancement which takes the internet and networks to everyday life domains like controlling home appliances, management of water intake and keeping the overall energy intake under control. It encapsulates several technologies such as information technology, cognitive sciences, communication technology, and low-power electronics. IoT creates a newer information society and knowledge economy. The development of the IoT brought into light many new challenges including the lack of fundamental theory supporting, unclear architecture, and immature standards. This concept has helped improve the basic outline of water management techniques by keeping the user up to date by storing the information regularly, obtained using certain variables with the help of network sensors. The existing automated method of level detection is based on measure of minimum and maximum level of water in the tank which facilitates the automatic switching ON/OFF of the motor. If minimum input water level value is reached, the Motor is turned ON. It begins to fill water in the tank until maximum input water level value is reached in the water tank. Once the maximum water level value is reached, the motor is turned OFF. The user can keep track of the usage of water and plan accordingly the range of water level to be administered. Thus, this device helps achieve certain level of optimal usage of water which in turn makes water management more effective.

Chapter 8

APPENDIX - CODE SAMPLE

```
#include <ESP8266WiFi.h>
```

```
#include <HCSR04.h>
#include <ESP8266WebServer.h>
#include "Adafruit_MQTT.h"
#include "Adafruit_MQTT_Client.h"
//create new adafruit IO feed and name it as 'water'
//uncomment these two lines and write your wifi ssid/password
const char* ssid = "class";
const char* password = "1234ajay";
//also uncomment and write here your own adafruit IO username and key.
#define AIO_USERNAME    "ajaynaidu"//replace it with your username
#define AIO_KEY         "cccaa139ce8f472c876c5f1e952b246d"//replace it with your key
//uncomment these lines as well, write radius of tank and total height in units of inches,
#define RADIUS 6
#define MAX_HEIGHT 12
//modify this line if you have to connect relay to some pin other than D4
#define MOTOR_CONTROL_PIN D4
//Connect trig of ultrasonic sensor at D1 and echo at D2, modify this line otherwise
UltraSonicDistanceSensor distanceSensor(D1,D2);  //D1 trig, D2=echo
//these are default water level limits, these values will be applied until on reset until user
sends new limits from webpage.
int waterLowerThreshold=4;
int waterUpperThreshold=18;


#define AIO_SERVER      "io.adafruit.com"
#define AIO_SERVERPORT  1883                   // use 8883 for SSL
float volume;
float liters;
// Create an ESP8266 WiFiClient class to connect to the MQTT server.
WiFiClient client;
// or... use WiFiFlientSecure for SSL
//WiFiClientSecure client;
```

```
// Setup the MQTT client class by passing in the WiFi client and MQTT server and login details.
Adafruit_MQTT_Client mqtt(&client, AIO_SERVER, AIO_SERVERPORT, AIO_USERNAME, AIO_KEY);
Adafruit_MQTT_Publish water = Adafruit_MQTT_Publish(&mqtt, AIO_USERNAME "/feeds/water");

/***************************** Sketch Code ************************************/

// Bug workaround for Arduino 1.6.6, it seems to need a function declaration
// for some reason (only affects ESP8266, likely an arduino-builder bug).
void MQTT_connect();


String inputString = "";         // a string to hold incoming data
String dataToSend="";
int waterDownCount=0,waterUpCount=0;

ESP8266WebServer server(80);
void handleRoot() {
server.send_P(200, "text/html;charset=UTF-8", index_html);
}

void handleLevelRequest(){
server.send(200,"text",String(liters));
}

void handleNotFound(){
String message = "File Not Found\n\n";
server.send(404, "text/plain", message);
```

```
}
void handleStatus()
{
if(digitalRead(MOTOR_CONTROL_PIN)==0)//MOTOR ON
server.send(200, "text/plain","on");
else server.send(200, "text/plain","off");
}
void handleRangeSetting(){
waterLowerThreshold=(server.arg(0)).toInt();
waterUpperThreshold=(server.arg(1)).toInt();
Serial.print(waterLowerThreshold);
Serial.print(":");
Serial.println(waterUpperThreshold);

server.send(200, "text/plain", "");
}

void measure_Volume()
{
float heightInch=0.393701*distanceSensor.measureDistanceCm();
Serial.println(heightInch);
if(heightInch>MAX_HEIGHT)
heightInch=MAX_HEIGHT;
if(heightInch<0)
heightInch=0;
volume=3.14*RADIUS*RADIUS*(MAX_HEIGHT-heightInch);//MAX_HEIGHT-
distance will give actual height,
liters=volume*0.0164  ;
Serial.println(liters);

if(liters<=waterLowerThreshold)
waterDownCount++;
```

```
else waterDownCount=0;

if(liters>=waterUpperThreshold)
waterUpCount++;
else waterUpCount=0;

water.publish(liters);



if(waterDownCount==3)
{//TURN ON RELAY
Serial.println("motor turned on");
digitalWrite(MOTOR_CONTROL_PIN,LOW);//Relay is active LOW
}
if(waterUpCount==3)
{//TURN OFF RELAY
Serial.println("motor turned off");
digitalWrite(MOTOR_CONTROL_PIN,HIGH);//Relay is active LOW
}
}
void runPeriodicFunc()
{
static const unsigned long REFRESH_INTERVAL1 = 2100; // 2.1sec
static unsigned long lastRefreshTime1 = 0;

if(millis() - lastRefreshTime1 >= REFRESH_INTERVAL1)
{
measure_Volume();
lastRefreshTime1 = millis();
}
}
```

```
void MQTT_connect() {
int8_t ret;

// Stop if already connected.
if (mqtt.connected()) {
return;
}

Serial.print("Connecting to MQTT... ");

while ((ret = mqtt.connect()) != 0) { // connect will return 0 for connected
Serial.println(mqtt.connectErrorString(ret));
Serial.println("Retrying MQTT connection in 5 seconds...");
mqtt.disconnect();
delay(5000);  // wait 5 seconds
}
Serial.println("MQTT Connected!");
}



void setup(void){
Serial.begin(115200);
delay(100);
pinMode(MOTOR_CONTROL_PIN, OUTPUT);
WiFi.begin(ssid, password);
Serial.println("");

while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.print("IP address:");
```

```
Serial.println(WiFi.localIP());

server.on("/", handleRoot);
server.on("/level",handleLevelRequest);
server.on("/configRange",handleRangeSetting);
server.on("/motor_status",handleStatus);

server.onNotFound(handleNotFound);

server.begin();
Serial.println("HTTP server started");
}

void loop(void){
runPeriodicFunc();

MQTT_connect();
server.handleClient();
}
```

Chapter 9

REFERENCES

[1] Smart Water Monitoring System Using Wireless Sensor Network at Home/Office MsT.Deepiga, Ms A.Sivasankari," Smart Water Monitoring System Using Wireless Sensor Network at Home/Office, ",International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 02 Issue: 04 | July-2015 ISSN: 2395-0072

[2] "IoT based Water Monitoring System: A Review "Pragati Damor1, Kirtikumar J Sharma2 International Journal of Advance Engineering and Research development (IJAERD) Volume 4 ,Issue 6, june -2017 e-ISSN: 2348 - 4470, print-ISSN: 2348-6406

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