WATER QUALITY MONITORING SYSTEM USING IOT

A PROJECT REPORT

Submitted by

GOKULPRASANTH M	**1517104705**
KAVIHASAN S	**1517104711**
LOKESH PK	**1517104712**

in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRICAL AND ELECTRONICS ENGINEERING

SONA COLLEGE OF TECHNOLOGY(AUTONOMOUS), SALEM- 636005

ANNA UNIVERSITY:CHENNAI 600025

APRIL 2021

SONA COLLEGE OF TECHNOLOGY
(AUTONOMOUS)
ANNA UNIVERSITY : CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report titled **WATER QUALITY MONITORING SYSTEM USING IOT"** is the bonafide work of **GOKULPRASANTH M (1517104705), KAVIHASAN S (1517104711)** AND **LOKESH PK (15171047012)"** who carried out the work under my supervision.

SIGNATURE	**SIGNATURE**
Dr. S. PADMA, M.E., Ph.D.,	**Dr. R.SHIVAKUMAR,M.E.,Ph.D.**,
HEAD OF THE DEPARTMENT	**SUPERVISOR**
	PROFESSOR
Department of EEE,	Department of EEE,
Sona College of Technology,	Sona College of Technology,
Salem – 636 005.	Salem – 636 005.

Submitted for the Project Viva-Voce Examination held on __________________

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

I feel honoured to place warm salutation to **Sona College of Technology and Department of EEE,** which has given the opportunity to obtain the chaired goal of beckoning professional.

I am deeply indebted and express my profound thanks to our honourable Principal **Dr. S.R.R. SENTHIL KUMAR, M.E., Ph.D.,** Sona College of Technology, Salem for his valuable support and encouragement.

I express my heartfelt thanks to **Dr. S. PADMA, M.E., Ph.D.**, Professor and Head, Department of Electrical and Electronics Engineering, Sona College of Technology, Salem for inspiration and valuable suggestion for carrying out this endeavour.

I extremely thankful to my project supervisor **Dr. R. SHIVAKUMAR, M.E., Ph.D.**, Department of Electrical and Electronics Engineering for his enthusiastic and persistent guidance rendered throughout the completion of the work.

I wish to thank our Project Co-ordinator **Prof. M. PORKODI, M.E.,** Associate Professor and our Class Counsellor **Prof. MADHUBALAN S, M.E., Ph.D.,** Assistant Professor Department of Electrical and Electronics Engineering, for his kind support in completion of my project.

I am also grateful to all **Teaching and Non-Teaching faculty members** of the Electrical and Electronics Engineering Department and friends for their help and co-operation in successful completion of this project work.

TABLE OF CONTENTS

ABSTRACT

Now a day's water pollution is one of the biggest fears for the green globalization. To prevent the water pollution, first we have to estimate the water parameters like pH, turbidity, temperature and Soil Moisture Sensor as the variations in the values of these parameters point towards the presence of pollutants. In this paper we design and develop a low cost system for monitoring of the water quality in IoT. At present, water parameters are detected by chemical test or laboratory test, where the testing equipments are stationary and samples are provided to testing equipments. Thus the current water quality monitoring system is a manual system with tedious process and is very time consuming. In order to increase the frequency, the testing equipments can be placed in the water resources and detection of pollution can be made remotely. This paper proposes a Sensor-Based Water Quality Monitoring System which is used for measuring physical and chemical parameters of the water. The parameters such as Temperature, pH, Soil Moisture and Turbidity of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino UNO model can be used as a core controller. Finally, the sensor data can be viewed on SMS using GSM Modem. The uniqueness of our Project is to obtain the water monitoring system with high frequency, high mobility, and low powered.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATIONS

GSM	-	Global System for Mobile Communication
IOT	-	Internet Of Things
SIM	-	Subscriber Identity Module
SMS	-	Short Message Service
MCU	-	Micro Controller Unit
UHF	-	Ultra High Frequency
IDE	-	Integrated Development Environment
USB	-	Universal Serial Bus
PWM	-	Pulse With Modulation
RAM	-	Random Access Memory
SCL	-	Serial Clock Line
SDA	-	Serial Data Line
PH	-	Potential of Hydrogen

CHAPTER 1

INTRODUCTION

1.1 GENERAL

The pollution in water is increasing day by day, and many researchers and scientists are trying to solve the problem by checking and maintaining the quality of water. This paper focuses mainly on the quality checking of water. The aim of the paper is to test the water quality so that it will be n real time to keep human life safe from the polluted water. Analyzing the condition and checking whether the water is favorable for the living beings and plants is the main target. There are different kinds of the available water quality measuring device on the market, ranging from cheap to expensive ones and house to industrial applications. Water Tester ,Water quality Meter by generic, Play X-STORE Water Quality Meter ,APEC Water Systems Digital Meter and Started Filter Tester. Devices are very costly and hard to understand for the consumer and might be affordable but cannot fulfill the needs of quality checking ineffective and fast ways. And these water testers measure either turbidity or pH, but none of them measures the pH, turbidity, Soil Moisture Sensor as well as the temperature of the water. Some other water quality testers only measure the pH of water. If all the parameters are available in the device, then that device is not affordable for common people. Since it is not available on the market, this project includes all three required parameters for checking the quality of water in affordable cost. This paper will check the value of pH, Turbidity, Soil Moisture Sensor and Temperature of the water and determines whether the water is suitable for the normal use.

1.2 OBJECTIVE OF STUDY

The objective of this system is to develop a water quality monitoring system that aids in continuous measuration of water conditions. Their contribution during this is that the system level integration of biosensors sensing element signal processing and sensing element information management.Their syetem was designed to measure a suite of biologically relevant physiochemical parameters in fresh water.They measure temperature, intensity level,pH element electrical conduction.Total dissolved solid,salinity,dissolved oxygen there parameters provide insights into the current status of changing water conditions and assist in identifying pollution sources.

1.3 SHORT BLOCK DIAGRAM

Figure 1.1 Short Block Diagram

1.4 EXPLANATION

Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids in water increases, the water's turbidity level increases. A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates to more alkaline. A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. Soil Moisture Sensor is used to measure the volumetric water content of soil. Arduino acts as Microcontroller ,it Processes the data from sensors and sends the SMS to the Client whenever The Sensor Readings are reaches the Particular level, it sends SMS command to GSM Modem ,Gsm module Process the data and sends SMS to the particular numbers.

1.5 LITERATURE SURVEY

- Nikhil Kedia, highlights the entire water quality monitoring methods, sensors, embedded design, and information dissipation procedure, role of government, network operator and villagers in ensuring proper information dissipation.

- Niel Andre Cloete et.al, In this paper the development of a a low-cost, wireless, multi-sensor network for measuring the physicochemical water parameters; enabling real-time monitoring, is presented.

- Pradeepkumar M, system consists of Turbidity, pH &Temperature sensors of water quality testing Arduino microcontroller data acquisition module, information transmitted an module, monitoring center and other accessories.

- Jayti Bhatt and Jignesh Patoliya , In this system we present the design of IoT Based Water Quality Monitoring System that monitor the quality of water in real time.

CHAPTER 2

EXISTING SYSTEM

2.1 INTRODUCTION FOR EXISTING SYSTEMS

The water quality monitoring system was previously developed; in that system they used various sensors to measure water quality. For monitoring purpose they used Bluetooth and zigbee technology. But both communication technologies have some disadvantages like they have short distance for communication so the user should be within the range for monitoring parameters. The data from the sensors are transmitted from the server, couldn't be uploaded to the cloud server which is due to disconnection at the node during transmitting data from sensors. In this system there is problem lagged data is send Registred Mobile numbers using GSM technology. For setting up this technology it requires more amount of hardware and it is very costly. Also in that system there is no alert indication when parameters are abnormal.

2.2 PROBLEMS

Now a day's water is polluted due to many reasons. In this current system, the equipment cost is high, and it takes a lot of time to process. Traditional methods have the drawbacks such as long waiting time for results high cost, low measurement precision, and complicated methodology.

So with the implementation in the technology, we use different methods and techniques to check the quality of water. There is a disadvantage in the existing system that the system has high complexity and low performance.

These samples are analyzed at the well-equipped laboratories. At these laboratories, samples of raw water, filter water and treated water are taken for analysis, these analysis can be performed by human intervention which for specific period only. The disadvantage of this system is, water is not monitoring seamlessly, and it always needs a human intervention.

2.3 IDEA TO RECTIFY

Turbidity is the measure of a number of particles in the water. We used Turbidity Sensor for measuring the Turbidity which is shown in Figure 5. Turbidity is measured in Nephelometric Turbidity Units (NTU). It is taken as the optical property of water and is an expression of the amount of the light that is scattered by the suspended particles in the water when a light is shined through the water sample. As the intensity of scattered light is increased, the turbidity increases. The temperature sensor (DS18B20) used for measuring the temperature of water. This is shown in Figure 5.When the accurate measurement is needed, we should always consider the temperature. The increase in temperature of water increases the ionization rate .For example, pH value as well as turbidity changes with the change in Temperature. pH is temperature dependent, when the temperature goes up, the rate of ionization increases and vice versa. Temperature plays a vital role when measuring water quality. The SparkFun Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out. pH sensor is a sensor which detects pH value of water. The term “pH” set off from Latin and is an acronym for “potential hydrogenii” or “the power of hydrogen”. pH is the hydrogen-ion concentration in water-based solutions, which indicates the acidity and alkalinity in the solution.

CHAPTER 3

PROPOSED SYSTEM

3.1 DETAILED BLOCK DIAGRAM

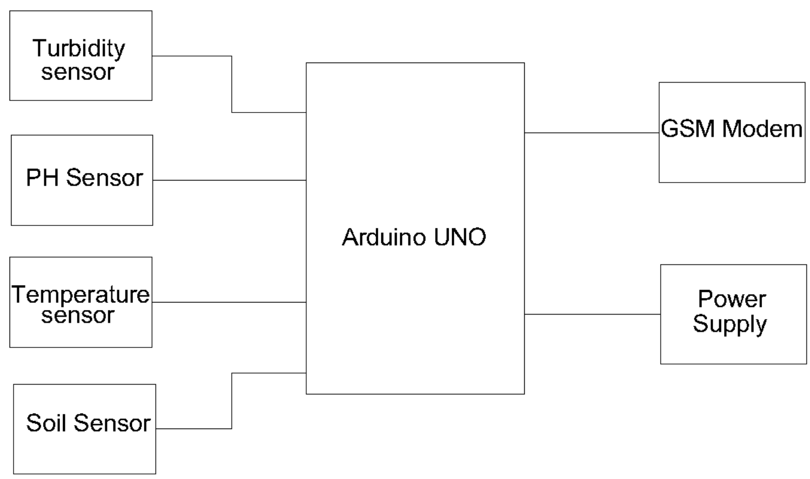


Fig 3.1 Detailed Block Diagram

The proposed method is used to overcome the drawbacks present in existing method. Here we are using Arduino UNO as core controller and various sensors to monitor the water Quality. The block diagram of our system is shown in Figure Arduino UNO to manage various types of equipments including sensors and so on. We are connecting different sensors Arduino UNO to monitor the conditions of water. Arduino UNO will access the data from different sensors and then processes the data. The sensor data was send to SMS 30 seconds once using GSM Modem.

3.2 COMPONENTS

S NO.	APPARATUS	TYPE/ RANGE	QUANTITY
1	Trubidity Sensor	SEN0189	1
2	Arduino UNO	ATMEGA320	1
3	Soil Moisture Sensor	SEN-13322	1
4	GSM Module	12V	1
5	DC Adapter	12V/1.5A	1
6	pH Sensor	SEN0161	1
7	Temperature Sensor	DS18B20	1
8	Voltage Regulator IC	7805,09	Each 1
9	Connecting Wires	-	-

Table 3.1 Components

3.2.1.1 ARDUINO-BOARD DESCRIPTION

A physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to Arduino is an open-source platform used for building electronics projects. Arduino consists of both write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible package. AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

3.2.1.2 ARDUINO UNO

The microcontroller that has been used for this project is from Arduino Uno and is shown in the figure 3.2. The Arduino Uno is a microcontroller board based on the ATmega328.It has 20 digital Input/ Output pins (of which 6 can be used as PWM and 6 can be used as analog inputs), a 16MHZ resonator, USB connection ,a power jack, an in circuit system programming(ICSP) header and reset button .The Arduino has a large support community and an extensive set of support libraries and hardware add-on “shields”, making it a great introductory platform for embedded electronics. There is an IOREF pins next to the reset pin, which is duplicate of 5V pin. Functions like pin Mode () and digital Write () are used to control the operations of digital pins while analog Read () is used to control analog pins.

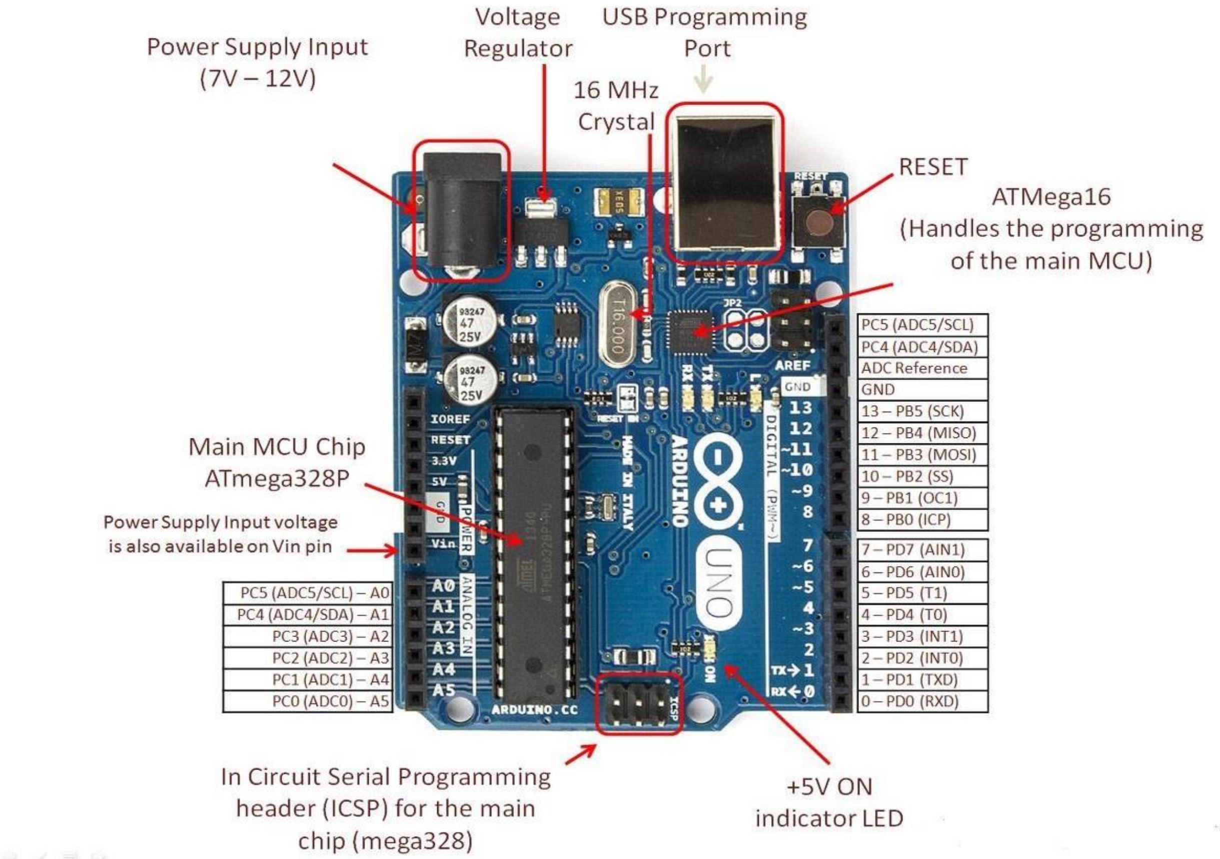


Figure 3.2 Pin diagram of the Arduino Uno

3.2.1.3 ARDUINO UNO SPECIFICATIONS

Arduino Uno has 14 digital input/output pins each pin specification shown in the table 3.1.

S.NO	ARDUINO UNO	SPECIFICATION
1	Microcontroller	Microcontroller: ATmega328P Analog Input pins:6
2	Operating Voltage	5V
3	Input Voltage	7-12V
4	Digital I/O pins	14(of which 6 provide PWM output)
5	PWM digital I/O pins	6
6	DC Current per I/O pin	20Ma
7	DC Current for 3.3V pin	50 Ma
8	Flash Memory	32KB(ATmega328P)
9	SRAM	2KB
10	EEPROM	1KB
11	Clock Speed	16 MHZ
12	LED-BUILTIN	13

Table 3.2 Specifications of Arduino Uno.

Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required.

3.2.2.1 TURBIDITY SENSOR

Figure 3.3 Turbidity Sensor

Turbidity is the measure of a number of particles in the water. We used Turbidity Sensor(SEN0189) for measuring the Turbidity which is shown in Figure. Turbidity is measured in Nephelometric Turbidity Units (NTU). It is taken as the optical property of water and is an expression of the amount of the light that is scattered by the suspended particles in the water when a light is shined through the water sample. As the intensity of scattered light is increased, the turbidity increases.

Pin details	Sensor Board Pin	Function
1	VCC	5V
2	GND	Ground
3	A0	Analog output Pin (0~4.5V)
4	D0	Digital Outputt (High/Low)

Table 3.3 Pin Configuration of Turbidity Sensor

During the period of low flow, many rivers are a clear green color, and turbidity is low, usually less than 10 NTU. During rainstorm, floods, water flows fast and mixes with the different particles, which makes the turbidity of water high.

High Turbidity has effect in the lakes, rivers and ponds. Because of the turbidity lakes and ponds are filled faster with the solid particles and causes aquatic life in danger for habitat. These kind of particles provide the place which could be suitable for the pollutants, mostly metals and bacteria. This is the reason why turbidity measurements can be used as an indicator of possible pollution in a water body.

The sensor operates on the principle that when the light is passed through a sample of water, the amount of light transmitted through the sample is dependent on the amount of soil in the water. As the soil level increases, the amount of transmitted light decreases. The turbidity sensor measures the amount of transmitted light to determine the turbidity of the wash water. These turbidity measurements are sent to the dishwasher controller, which makes decisions on how long to wash in all the cycles.

These decisions are made on the basis of a comparison between clean water measurements (taken at the beginning of the wash cycle) and the wash water turbidity measurement taken at the end of each wash cycle. By measuring the turbidity of the wash water, the dishwasher can conserve energy on lightly soiled loads by only washing as long as necessary. This will result in energy savings for the consumer.

3.2.3.1 TEMPERATURE SENSOR

Figure 3.4 Temperature Sensor

The temperature sensor (DS18B20) used for measuring the temperature of water. This is shown in Figure 5.When the accurate measurement is needed, we should always consider the temperature. The increase in temperature of water increases the ionization rate .For example, pH value as well as turbidity changes with the change in Temperature. pH is temperature dependent, when the temperature goes up, the rate of ionization increases and vice versa. Temperature plays a vital role when measuring water quality.

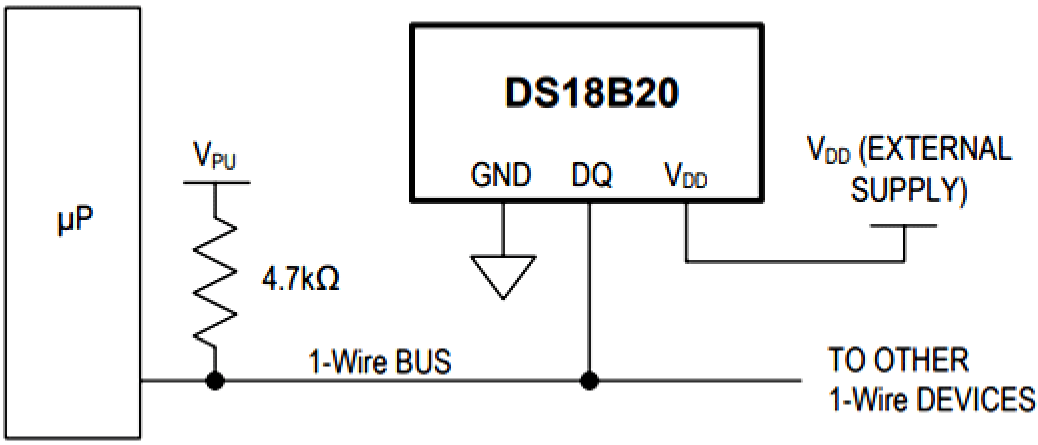


Figure 3.5 Temperature Working details

Most PIR modules have a 3-pin connection at the side or bottom. The pinout may vary between modules so triple-check the pinout! It's often silkscreened on right next to the connection (at least, ours is!) One pin will be ground, another will be signal and the final one will be power. Power is usually 3-5VDC input but may be as high as 12V. Sometimes larger modules don't have direct output and instead just operate a relay in which case there is ground, power and the two switch connections.

No:	Pin Name	Description
1	Ground	Connect to the ground of the circuit
2	Vcc	Powers the Sensor, can be 3.3V or 5V
3	Data	This pin gives output the temperature value which can be read using 1-wire method

Table 3.4 Temperature Pin configuration

3.2.3.2 TEMPERATURE SENSOR FEATURES

- Programmable Digital Temperature Sensor
- Communicates using 1-Wire method
- Operating voltage: 3V to 5V
- Temperature Range: -55°C to +125°C
- Accuracy: ±0.5°C
- Output Resolution: 9-bit to 12-bit (programmable)

3.2.3.3 TEMPERATURE SENSOR APPLICATIONS

- Measuring temperature at hard environments
- Liquid temperature measurement
- Applications where temperature has to be measured at multiple points

3.2.4.1 GSM SIM300

Figure 3.6 GSM Model

3.2.4.2 GSM MODEM – SIM 300

This document describes the hardware interface of the SIMcom SIM300 module that connects to the specific application and the air interface. As SIM300 can be integrated with a wide range of applications, all functional components of SIM300 are described in great detail.

3.2.4.3 FEAUTURES OF GSM KIT

- This GSM modem is a highly flexible plug and play quad band GSM modem for direct and as integration to rs232.
- Supports features like voice, data/fax, SMS, GPRS and integrated TCP/IP stack.
- Control via at commands.
- Use ac – dc power adaptor with following ratings · dc voltage : 12v /1a.
- Current consumption in normal operation 250ma, can rise up to 1amp while transmission.

3.2.4.4 APPLICATION INTERFACE

All hardware interfaces except rf interface that connects SIM300 to the customers' cellular application platform is through a 60-pin 0.5mm pitch board-to-board connector. Sub-interfaces included in this board-to-board connector are described.

- Power supply
- Dual serial interface
- Two analog audio interfaces
- SIM interface
- Electrical and mechanical characteristics of the board-to-board connector are specified. There we also order information for mating connectors.

3.2.4.5 PRODUCT CONCEPT

Designed for global market, SIM300 is a tri-band GSM/GPRS engine that works on frequencies eGSM 900 MHz, dcs 1800 MHz and pcs1900 MHz. SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes cs-1, cs-2, cs-3 and cs-4. With a tiny configuration of 40mm x 33mm x 2.85 mm , SIM300 can fit almost all the space requirement in your application, such as smart phone, pda phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers boards except the RF antenna interface. Two audio channels include two microphones inputs and two speaker outputs. This can be easily configured by at command. SIM300 provide rf antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is murata mm9329-2700. And customer's antenna can be soldered to the antenna pad. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5ma in sleep mode. The SIM300 is integrated with the TCP/IP protocol, extended TCP/IP at commands are developed for customers to use the TCP/IP protocol easily

- Two serial ports can help you easily develop your applications.

3.2.5.1 PH SENSOR

3.7 pH Sensor

pH sensor (SKU:SEN0161) is a sensor which detects pH value of water The term "pH" set off from Latin and is an acronym for "potential hydrogenii" or "the power of hydrogen". pH is the hydrogen-ion concentration in water-based solutions, which indicates the acidity and alkalinity in the solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. Analog pH sensor is designed to measure the pH value of a solution and show the acidity or alkalinity of the substance. It is commonly used in various applications such as agriculture, wastewater treatment, industries, environmental monitoring, etc. The module has an on-board voltage regulator chip which supports the wide voltage supply of 3.3-5.5V DC, which is compatible with 5V and 3.3V of any control board like Arduino. The output signal is being filtered by hardware low jitter. The unit that we use to measure the acidity of a substance is called pH. The term "H" is defined as the negative log of the hydrogen ion concentration. The range of pH can have values from 0 to 14. A pH value of 7 is neutral, as pure water has a pH value of exactly 7. Values lower than 7 are acidic and values greater than 7 are basic or alkaline.

Glass membranes

Glass membranes are made from an ion-exchange type of glass (silicate or chalcogenide). This type of ISE has good selectivity, but only for several single-charged cations; mainly H+, Na+, and Ag+. Chalcogenide glass also has selectivity for double-charged metal ions, such as Pb2+, and Cd2+. The glass membrane has excellent chemical durability and can work in very aggressive media. A very common example of this type of electrode is the pH glass electrode.

Crystalline membranes

Crystalline membranes are made from mono- or polycrystallites of a single substance. They have good selectivity, because only ions which can introduce themselves into the crystal structure can interfere with the electrode response. This is the major difference between this type of electrodes and the glass membrane electrodes. The lack of internal solution reduces the potential junctions. Selectivity of crystalline membranes can be for both cation and anion of the membrane-forming substance. An example is the fluoride selective electrode based on LaF3 crystals.

Ion-exchange resin membranes

Ion-exchange resins are based on special organic polymer membranes which contain a specific ion-exchange substance (resin). This is the most widespread type of ion-specific electrode. Usage of specific resins allows preparation of selective electrodes for tens of different ions, both single-atom or multi-atom. They are also the most widespread electrodes with anionic selectivity. However, such electrodes have low chemical and physical durability as well as "survival time". An example is the potassium selective electrode, based on valinomycin as an ion-exchange agent.

3.2.6.1 SOIL SENSOR

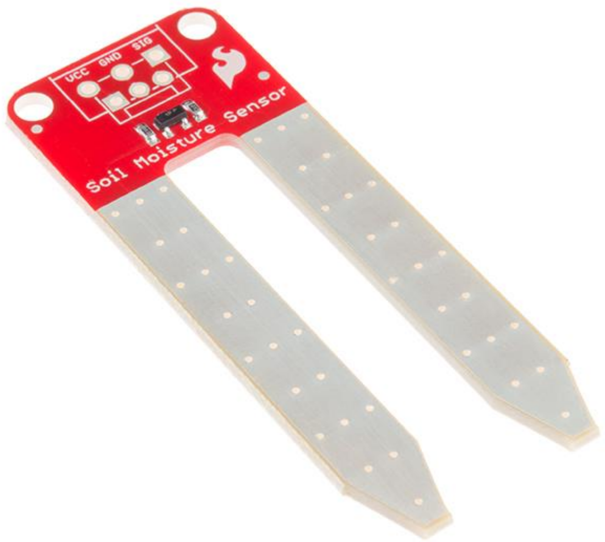


Figure 3.8 Soil Sensor

The SparkFun Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out.

To get the SparkFun Soil Moisture Sensor functioning all you will need is to connect the VCC and GND pins to your Arduino-based device (or compatible development board) and you will receive a SIG out which will depend on the amount of water in the soil. One commonly known issue with soil moisture senors is their short lifespan when exposed to a moist environment. To combat this, we've had the PCB coated in Gold Finishing (ENIG or Electroless Nickel Immersion Gold). We recommend either a simple 3-pin screw pin terminal or a 3-pin jumper wire assembly (both can be found in the Recommended Products section below) to be soldered onto the sensor for easy wiring.

3.2.6.2 SOIL SENSOR PIN CONFIGIURATION

Pin Number	Pin Name	Description
1	VCC	The Vcc pin powers the module, typically with +5V
2	GND	Power Supply Ground
3	DO	Digital Out Pin for Digital Output.
4	AO	Analog Out Pin for Analog Output

Table 3.5 Soil Sensor Pin configuration

3.2.6.3 APPLICATIONS OF SOIL SENSOR

- Gardening
- Irrigation Systems
- Used in Controlled Environments

3.3 ASSEMBLING OF COMPONENTS

The hardware model of the project has been implemented by using Arduino Uno, Turbidity sensor, Ph sensor, Soil Sensor, Temperature Sensor And GSM SIM300 module. The Turbidity sensor is used to measure the amount of light that is scattered by the suspended solids in water. Temperature Sensor is connected to Arudino Analog pin. GSM module is used to send SMS Alert to The user mobile number. Ph sensor is connected to Arduino's analog pin it gives values of PotentialHydrogen value of Water, Soil Sensor is used to detect The Soil and Water Moisture Contents,

CHAPTER 4

IMPLEMENTATION AND RESULTS

4.1 CIRCUIT DIAGRAM

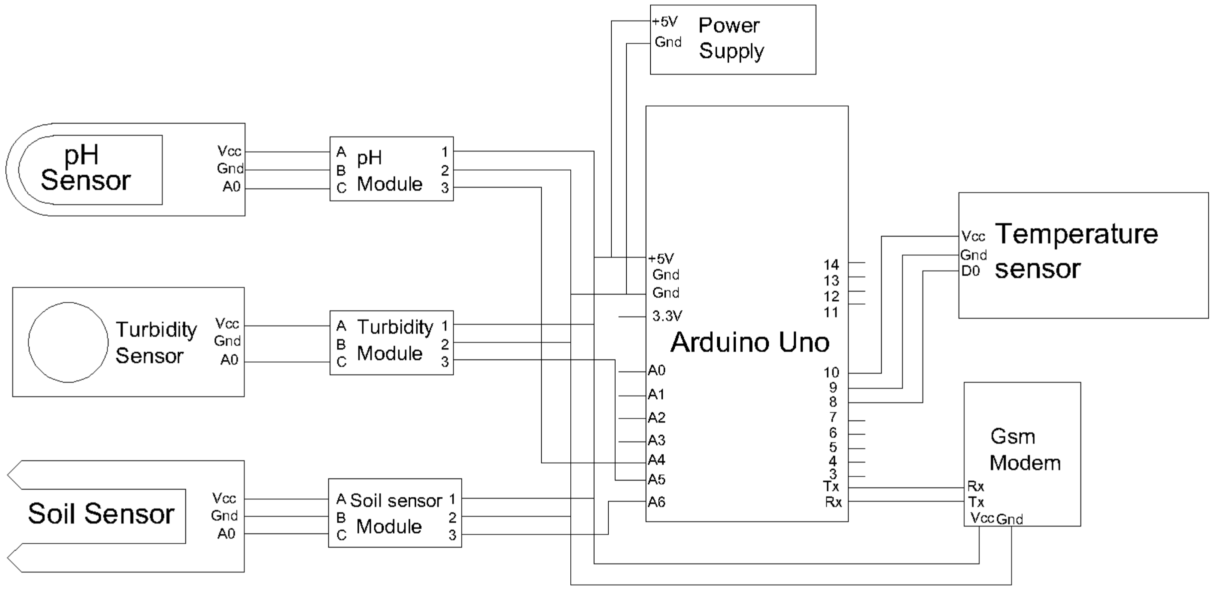


Figure 4.1 Circuit diagram

4.2 OPERATION OF THE SYSTEM

The system uses Arduino UNO board which forms the main heart of the system, the different sensors are interfaced to the Arduino. Turbidity is the measure of a number of particles in the water. We used Turbidity Sensor for measuring the Turbidity which is shown in Figure 5. Turbidity is measured in Nephelometric Turbidity Units (NTU). It is taken as the optical property of water and is an expression of the amount of the light that is scattered by the suspended particles in the water when a light is shined through the water sample. As the intensity of scattered light is increased, the turbidity increases. The temperature sensor (DS18B20) used for measuring the temperature of water. This is shown in Figure 5.When the accurate measurement is needed, we should always consider the temperature. The increase in temperature of water increases the ionization rate .For example, pH value as well as turbidity changes with the change in Temperature. pH is temperature dependent, when the temperature goes up, the rate of ionization increases and vice versa. Temperature plays a vital role when measuring water quality. pH sensor is a sensor which detects pH value of water. The term “pH” set off from Latin and is an acronym for “potential hydrogenii” or “the power of hydrogen”. pH is the hydrogen-ion concentration in water-based solutions, which indicates the acidity and alkalinity in the solution. The SparkFun Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out.

4.3 RESULT

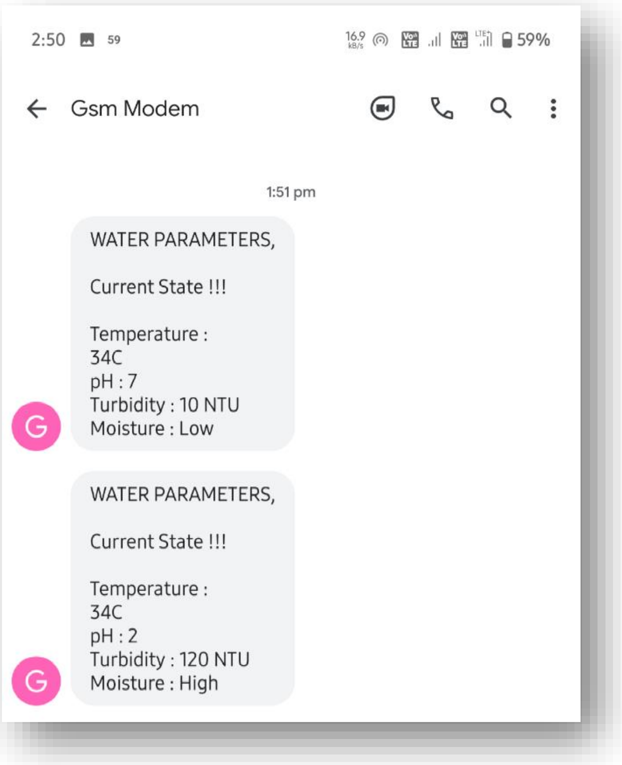


Figure 4.2 SMS notification Alerts

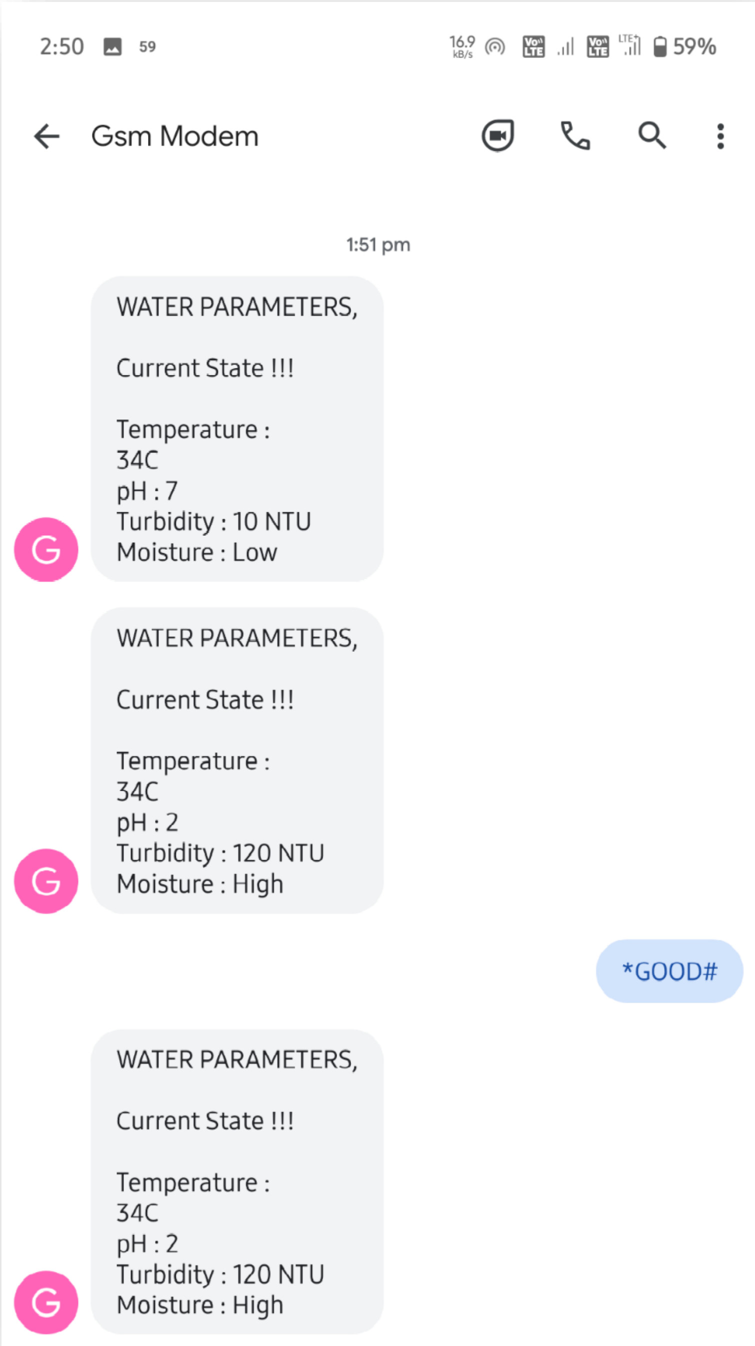
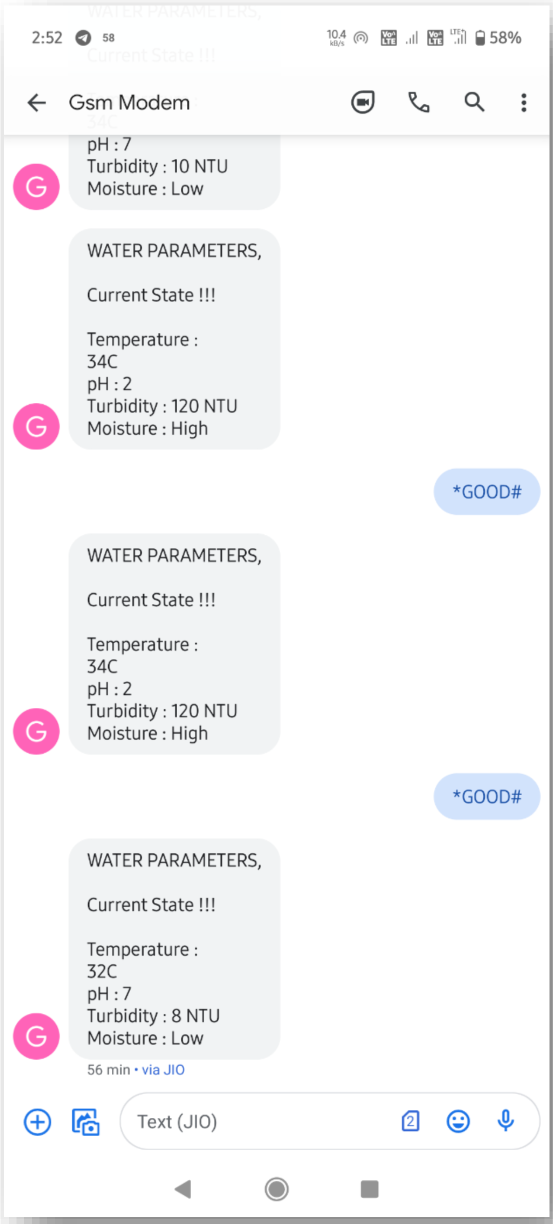


Figure 4.3 Manual Command SMS Notification

If user Send Manually SMS command to Gsm modem, it Send back the current status of the Sensor Parameters to the user



In our system four sensors are connected Temperature, pH, Soil Sensor and Turbidityare connected to the Arduino UNO. These four sensor measures of Temperature, pH, Soil Sensor and Turbidity parameters of the water when they dipped in water. Then Arduino UNO will access the data from these sensors and process the data, finally sends the data to registred user using SMS. which shows the readings of all the sensors measuring Temperature, pH, Soil Sensor and Turbidity levels of Water from different resources.

CHAPTER 5

CONCLUSION

5.1 SUMMARY

IoT Based Low Cost System for Monitoring of Water Quality in Real Time" focused on analyzing the water quality with high performance, real time and accurate. In our proposed system we have measured Soil Sensor, Temperature, Turbidity and pH values of water with the help of Arduino UNO and various Sensors. In future, the parameters like conductivity, hardness, chloride, ammonia, iron, fluoride etc also considering water quality measurement and these values are used to check the purity of the water for many purposes such as drinking water and daily requirements.

5.2 ADVANTAGE

- Due to automation it will reduce the time to measure the parameters.
- This is economically affordable for common people.
- Low maintenance.
- Prevention of water diseases.

5.4 APPLICATIONS

- This system is used in commercial and domestic use.
- Mainly helpful for Water Supply Agencies.
- For health department to identify the reason of water diseases.

CHAPTER 6

APPENDICES

6.1 APPENDIX 1
FIGURE OF THE CIRCUIT

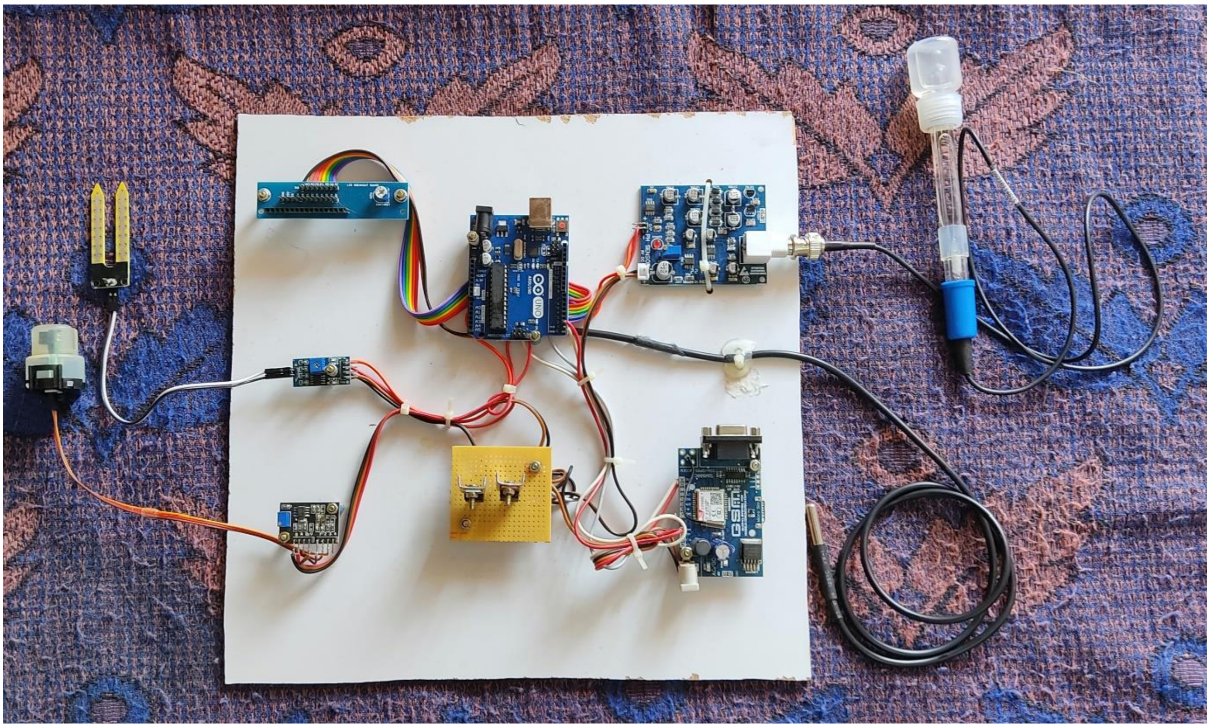


Figure 6.1 Model Picture

6.2 APPENDIX 2
ARDUINO CODE

```
# Arduino Code
#include <OneWire.h>
#include <DallasTemperature.h>
#include <ArduinoJson.h>
OneWire oneWire(2);
DallasTemperature temp_sensor(&oneWire);
float calibration_value = 21.34;
int phval = 0;
```

```
unsigned long int avgval;
int buffer_arr[10], temp;
void setup()
{
  Serial.begin(9600);
  temp_sensor.begin();
}
StaticJsonBuffer<1000> jsonBuffer;
JsonObject& root = jsonBuffer.createObject();
void loop() {
  for (int i = 0; i < 10; i++)
  {
    buffer_arr[i] = analogRead(A0);
    delay(30);
  }
  for (int i = 0; i < 9; i++)
  {
    for (int j = i + 1; j < 10; j++)
    {
      if (buffer_arr[i] > buffer_arr[j])
      {
        temp = buffer_arr[i];
        buffer_arr[i] = buffer_arr[j];
        buffer_arr[j] = temp;
      }
    }
  }
  avgval = 0;
  for (int i = 2; i < 8; i++)
    avgval += buffer_arr[i];
```

```
  float volt = (float)avgval * 5.0 / 1024 / 6;
  float ph_act = -5.70 * volt + calibration_value;
  temp_sensor.requestTemperatures();
  int moisture_analog=analogRead(A1);
  int moist_act=map(moisture_analog,0,1023,100,0);
  root["a1"] = ph_act;
  root["a2"] = temp_sensor.getTempCByIndex(0);
  root["a3"] = moist_act;
  root.printTo(Serial);
  Serial.println("");
}
```

NodeMCU Code:

```
#include<ESP8266WiFi.h>
#include<WiFiClient.h>
#include<ESP8266WebServer.h>
#include <ArduinoJson.h>
const char* ssid = "admin";//Replace with your network SSID
const char* password = "12345678";//Replace with your network password
ESP8266WebServer server(80);
String page = "";
int data1, data2, data3;
void setup()
{
  Serial.begin(9600);
  WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED)
  {
  delay(500);
```

```
  Serial.print(".");
  }
  Serial.println(WiFi.localIP());
  server.on("/", []()
  {
    page = "<html><head><title>IoT Design</title></head><style type=\"text/css\">";
    page += "table{border-collapse: collapse;}th {background-color:  green ;color: white;}table,td {border: 4px solid black;font-size: x-large;";
    page += "text-align:center;border-style: groove;border-color: rgb(255,0,0);}</style><body><center>";
    page += "<h1>Smart Aquaculture Monitoring using IoT</h1><br><br><table style=\"width: 1200px;height: 450px;\"><tr>";
    page += "<th>Parameters</th><th>Value</th><th>Units</th></tr><tr><td>PH Value</td><td>"+String(data1)+"</td><td>N/A</td></tr>";
    page += "<tr><td>Temperature</td><td>"+String(data2)+"</td><td>Centigrade</td></tr><tr><td>Moisture</td><td>"+String(data3)+"</td><td>%</td>";
    page += "<meta http-equiv=\"refresh\" content=\"3\">";
    server.send(200, "text/html", page);
  });
  server.begin();
}
void loop()
{
  StaticJsonBuffer<1000> jsonBuffer;
  JsonObject& root = jsonBuffer.parseObject(Serial);
  if (root == JsonObject::invalid())
  {
    return;
```

```
    Serial.println("invalid");
  }
  data1 = root["a1"];
  data2 = root["a2"];
  data3 = root["a3"];
  Serial.println(data1);
  Serial.println(data2);
  Serial.println(data3);
  server.handleClient();
}
```

REFRENCES

[1] Poonam J. Chavan, Manoj Mechkul, (April 2016),"IoT Based Water quality Monitoring" IJMTER Journal, Vol 3, pp.746-750.

[2] Mithali Borbade, Shruti Danve, (June 2015), "Real Time Water Quality monitoring system" IJIRCE journal, Vol 3, pp. 5046-5068,.

[3] Vaishnavi V, Daigovane, Dr.M.A. Gaikwad ,(2017), "Water quality monitoring system based on IoT" Research India publication on Vol 10, pp. 1107 1116,.

[4] Pradeepkumar M. Manisha J.Praveen Sha R. Proiserin V. Suganya Devi K, (March 2016), "The real time monitoring of water quality in IoT Environment" IJIRSET, Vol 5, pp. 4419-4427.

[5] Aaina Venkteshwaran, Harsha Menda P. Prof. Priti Bodar, (April 2017), "An IoT based system for water quality monitoring" IJRCCE journal, pp. 2510-2515.