REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

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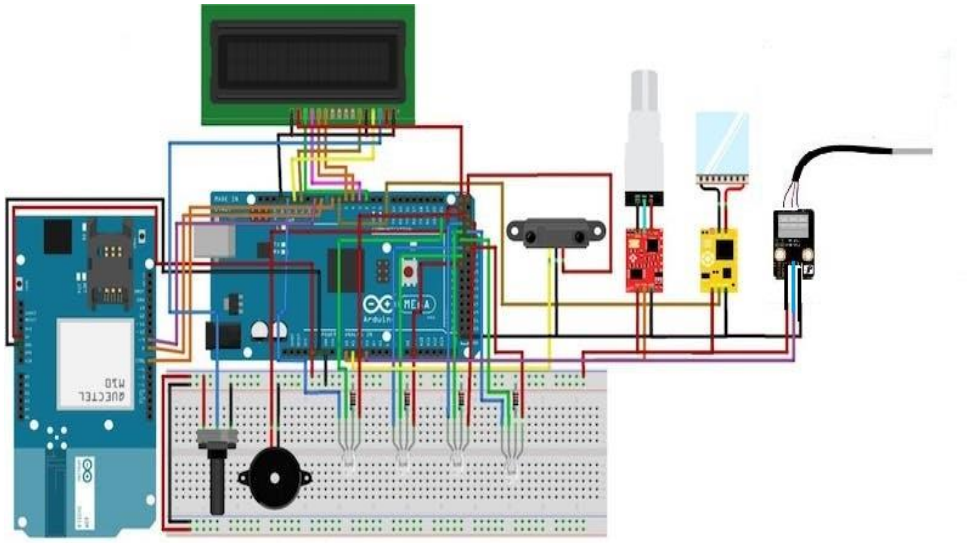
ABSTRACT :

Water pollution has been an increasing problem over the last few decades. Water personal satisfaction may be a standout amongst those primary variables with control wellbeing and the state of sicknesses. Rivers and waterways would those fundamental wellsprings about drinking water, which impressively rely on upon water personal satisfaction, and the corporation cleans the water pipes using bleaching powder and that leads to some diseases. The objective of this water quality monitoring system using internet of things is to find the quality of the water i.e. identifying the PH value and preventing from precautions. We are going to implement this project at public water tanks and drinking water reservoir.

CIRCUIT DIAGRAM :



COMPONENTS REQUIRED:

1. Arduino Mega Board.
2. (16 * 2) LCD display.
3. The 2 in one Temperature and PH sensor.
4. The Turrbidity Sensor.
5. A GSM shield.
6. An ultrasonic Sensor.
7. 4 RGB led.
8. A buzzer.

CODE:

```
include <OneWire.h>
#include <DallasTemperature.h>
#include <SoftwareSerial.h>
#include <NewPing.h>
#define SensorPin A2            //pH meter Analog output to Arduino Analog
Input 0
#define Offset 0.00            //deviation compensate
unsigned long int avgValue;     //Store the average value of the sensor
feedback

#define TRIGGER_PIN  23  // Arduino pin tied to trigger pin on ping
sensor.
#define ECHO_PIN     22  // Arduino pin tied to echo pin on ping sensor.
#define MAX_DISTANCE 200 // Maximum distance we want to ping for (in
centimeters). Maximum sensor distance is rated at 400-500cm.

NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); // NewPing setup of
pins and maximum distance.

unsigned int pingSpeed = 50; // How frequently are we going to send out a
ping (in milliseconds). 50ms would be 20 times a second.
unsigned long pingTimer;     // Holds the next ping time.

// Data wire is plugged into pin 2 on the Arduino
#define ONE_WIRE_BUS 6

SoftwareSerial mySerial(7, 8);

// Setup a oneWire instance to communicate with any OneWire devices (not
just Maxim/Dallas temperature ICs)
OneWire oneWire(ONE_WIRE_BUS);

// Pass our oneWire reference to Dallas Temperature.
DallasTemperature sensors(&oneWire);

#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

//const int pingPin =22;
int sensorPin = A0;
int blueled = 13;
int redled = 24;
int greenled = 25;
int tempblueled = 32;
int tempredled = 33;
int tempgreenled = 34;
int levblueled = 35;
int levredled = 36;
int levgreenled = 37;
int turbblueled = 38;
```

```
int turbredled = 39;
int turbgreenled = 40;
int buzzer = 31;
float phValue;
float temperatureC;
long duration, cm;

void setup(void)
{
  // start serial port
  Serial.begin(9600);
  pingTimer = millis(); // Start now.
  // Start up the library
  sensors.begin(); // IC Default 9 bit. If you have troubles consider
upping it 12. Ups the delay giving the IC more time to process the
temperature measurement
  lcd.begin(16, 2); //initilise lcd with num of coloums 16 ,by row 2.
  lcd.clear(); //clears lcd just incase there is anytin been displayed
  pinMode(blueled, OUTPUT);
  pinMode(redled, OUTPUT);
  pinMode(greenled, OUTPUT);
  pinMode(tempblueled, OUTPUT);
  pinMode(tempredled, OUTPUT);
  pinMode(tempgreenled, OUTPUT);
  pinMode(levblueled, OUTPUT);
  pinMode(levredled, OUTPUT);
  pinMode(levgreenled, OUTPUT);
  pinMode(turbblueled, OUTPUT);
  pinMode(turbredled, OUTPUT);
  pinMode(turbgreenled, OUTPUT);
  pinMode(buzzer, OUTPUT);
    digitalWrite(buzzer, LOW);
  //initialization();
}

void loop() {
  sensors.requestTemperatures(); // Send the command to get temperature
  Serial.println(sensors.getTempCByIndex(0));
    int reading = analogRead(sensorPin);

  // converting that reading to voltage,
  float voltage = reading * 5.0;
  voltage /= 1024.0;

  // now print out the temperature
  float temperatureC = (voltage - 0.5) * 100 ;
  PH();
    digitalWrite(blueled, LOW);
  digitalWrite(redled, LOW);
  digitalWrite(greenled, LOW);
  temperature ();
  digitalWrite(tempblueled, LOW);
  digitalWrite(tempredled, LOW);
  digitalWrite(tempgreenled, LOW);
```

```
  Water_level();
      digitalWrite(levblueled, LOW);
  digitalWrite(levredled, LOW);
  digitalWrite(levgreenled, LOW);
  turbidity();
   digitalWrite(turbblueled, LOW);
  digitalWrite(turbredled, LOW);
  digitalWrite(turbgreenled, LOW);
  send_sms();
  delay(4000);
  send_sms1();
    digitalWrite(greenled, LOW);
  digitalWrite(tempgreenled, LOW);
  digitalWrite(levgreenled, LOW);
  digitalWrite(turbgreenled, LOW);
  delay(8000);
}



////////////////////////////////////////////////////////////// FUNCTIONS
//////////////////////////////////////////////////////////////////////

void PH(){
  Serial.println(" ");
  lcd.clear( );
  digitalWrite(blueled, LOW);
  digitalWrite(greenled, LOW);
  digitalWrite(redled, LOW);
  digitalWrite(buzzer, LOW);
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("TAKING READINGS");
  lcd.setCursor(1,1);
  lcd.print("FROM PH SENSOR");
  Serial.println("Taking Readings from PH Sensor");
  PHblink();
  int buf[10];                //buffer for read analog
  for(int i=0;i<10;i++)       //Get 10 sample value from the sensor for
smooth the value
  {
    buf[i]=analogRead(SensorPin);
    delay(10);
  }
  for(int i=0;i<9;i++)        //sort the analog from small to large
  {
    for(int j=i+1;j<10;j++)
    {
      if(buf[i]>buf[j])
      {
        int temp=buf[i];
        buf[i]=buf[j];
        buf[j]=temp;
      }
    }
```

```
  }
  avgValue=0;
  for(int i=2;i<8;i++)                      //take the average value of 6
center sample
    avgValue+=buf[i];
  float phValue=(float)avgValue*3.8/1030/6; //convert the analog into
millivolt
  phValue=3.3*phValue+Offset;                      //convert the millivolt
into pH value
  Serial.print("pH:");
  Serial.print(phValue,2);
  Serial.println(" ");

  if(phValue >= 7.30){
    lcd.clear();
    digitalWrite(blueled, LOW);
    digitalWrite(greenled, LOW);
    digitalWrite(redled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.setCursor(1,0);//set cursor (colum by row) indexing from 0
    lcd.print("PH VALUE:");
    lcd.setCursor(10,0);
    lcd.print(phValue);
    lcd.setCursor(0,1);
    Serial.print("PH VALUE: ");
    Serial.println(phValue);
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("ALKALINITY HIGH");
    Serial.println("Water Alkalinity high");
    delay(3000);
   }

  if(phValue >= 6.90 && phValue <= 7.19){
    digitalWrite(blueled, HIGH);
    digitalWrite(greenled,LOW);
    digitalWrite(redled, LOW);
    digitalWrite(buzzer, LOW);
    lcd.clear();
    lcd.setCursor(1,0);//set cursor (colum by row) indexing from 0
    lcd.print("PH VALUE:");
    lcd.setCursor(10,0);
    lcd.print(phValue);
    lcd.setCursor(0,1);
    Serial.print("PH VALUE: ");
    Serial.println(phValue);
    lcd.setCursor(1,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER IS SAFE");
    Serial.println("Water Is  neutral (safe)");
  }

  if(phValue < 6.89){
    lcd.clear();
    digitalWrite(blueled, LOW);
    digitalWrite(greenled, LOW);
```

```
    digitalWrite(redled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.setCursor(1,0);//set cursor (colum by row) indexing from 0
    lcd.print("PH VALUE:");
    lcd.setCursor(10,0);
    lcd.print(phValue);
    lcd.setCursor(0,1);
    Serial.print("PH VALUE: ");
    Serial.println(phValue);
    lcd.setCursor(2,1);//set cursor (colum by row) indexing from 0
    lcd.print("ACIDITY HIGH");
    Serial.println("Water Acidity High");
    delay(3000);
   }

  delay(8000);
}


void temperature (){
  Serial.println(" ");
  lcd.clear( );
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("TAKING READINGS");
  lcd.setCursor(0,1);
  lcd.print("FROM TEMP SENSOR");
  Serial.println("Taking Readings from Temperature Sensor");
  TEMPblink();
  temp_check_surr();
  delay(4000);
  temp_check_water();
}


void temp_check_surr(){
  digitalWrite(tempblueled, LOW);
  digitalWrite(tempgreenled, LOW);
  digitalWrite(tempredled, LOW);
  digitalWrite(buzzer, LOW);
  int reading = analogRead(sensorPin);

  // converting that reading to voltage,
  float voltage = reading * 5.0;
  voltage /= 1024.0;

  // now print out the temperature
  float temperatureC = (voltage - 0.5) * 100 ;  //converting from 10 mv
per degree wit 500 mV offset
  //to degrees ((voltage - 500mV) times 100)
  lcd.clear();
  Serial.print("Surrounding Temperature: ");
  Serial.println(temperatureC);

  if(temperatureC > 50){
```

```
  digitalWrite(tempblueled, LOW);
  digitalWrite(tempgreenled, LOW);
  digitalWrite(tempredled, HIGH);
  digitalWrite(buzzer, HIGH);
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("SUR TEMP:");
  lcd.setCursor(9,0);
  lcd.print(temperatureC);
  lcd.setCursor(14,0);
  lcd.print("*C");
  lcd.setCursor(0,1);
  Serial.print("Surrounding Temperature: ");
  Serial.print(temperatureC);
  Serial.println(" degree C");
  lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
  lcd.print("SURR TEMP HIGH");
  Serial.println("Surrounding Temperature high");
  delay(3000);
 }

if(temperatureC >= 10 && temperatureC <= 50){
  digitalWrite(tempblueled, HIGH);
  digitalWrite(tempgreenled,LOW);
  digitalWrite(tempredled, LOW);
  digitalWrite(buzzer, LOW);
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("SUR TEMP:");
  lcd.setCursor(9,0);
  lcd.print(temperatureC);
  lcd.setCursor(14,0);
  lcd.print("*C");
  lcd.setCursor(0,1);
  Serial.print("Surrounding Temperature: ");
  Serial.print(temperatureC);
  Serial.println(" degree C");
  lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
  lcd.print("SURR TEMP NORMAL");
  Serial.println("Surrounding Temperature normal");
}

if(temperatureC < 10){
  digitalWrite(tempblueled, LOW);
  digitalWrite(tempgreenled, LOW);
  digitalWrite(tempredled, HIGH);
  digitalWrite(buzzer, HIGH);
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("SUR TEMP:");
  lcd.setCursor(9,0);
  lcd.print(temperatureC);
  lcd.setCursor(14,0);
  lcd.print("*C");
  lcd.setCursor(0,1);
  Serial.print("Surrounding Temperature: ");
  Serial.print(temperatureC);
```

```
    Serial.println(" degree C");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("SURR TEMP LOW");
    Serial.println("Surrounding Temperature low");
    delay(3000);
   }
  delay(8000);
}


void temp_check_water(){
  lcd.clear();
  digitalWrite(tempblueled, LOW);
  digitalWrite(tempgreenled, LOW);
  digitalWrite(tempredled, LOW);
  digitalWrite(buzzer, LOW);
  sensors.requestTemperatures(); // Send the command to get temperature
  Serial.print("Water Temperature: ");
  Serial.println(sensors.getTempCByIndex(0));

  if(sensors.getTempCByIndex(0) > 40){
    digitalWrite(tempblueled, LOW);
    digitalWrite(tempgreenled, LOW);
    digitalWrite(tempredled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WAT TEMP:");
    lcd.setCursor(9,0);
    lcd.print(sensors.getTempCByIndex(0));
    lcd.setCursor(14,0);
    lcd.print("*C");
    lcd.setCursor(0,1);
    Serial.print("Water Temperature: ");
    Serial.print(sensors.getTempCByIndex(0));
    Serial.println(" degree C");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER TEMP HIGH");
    Serial.println("Water Temperature high");
    delay(3000);
  }

  if(sensors.getTempCByIndex(0) >= 15 && sensors.getTempCByIndex(0) <=
40){
    digitalWrite(tempblueled, HIGH);
    digitalWrite(tempgreenled,LOW);
    digitalWrite(tempredled, LOW);
    digitalWrite(buzzer, LOW);
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WAT TEMP:");
    lcd.setCursor(9,0);
    lcd.print(sensors.getTempCByIndex(0));
    lcd.setCursor(14,0);
    lcd.print("*C");
    lcd.setCursor(0,1);
```

```
    Serial.print("Water Temperature: ");
    Serial.print(sensors.getTempCByIndex(0));
    Serial.println(" degree C");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER TEMP NORMAL");
    Serial.println("Water Temperature normal");
  }

  if(sensors.getTempCByIndex(0) < 15){
    digitalWrite(tempblueled, LOW);
    digitalWrite(tempgreenled, LOW);
    digitalWrite(tempredled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WAT TEMP:");
    lcd.setCursor(9,0);
    lcd.print(sensors.getTempCByIndex(0));
    lcd.setCursor(14,0);
    lcd.print("*C");
    lcd.setCursor(0,1);
    Serial.print("Water Temperature: ");
    Serial.print(sensors.getTempCByIndex(0));
    Serial.println(" degree C");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER TEMP LOW");
    Serial.println("Water Temperature low");
    delay(3000);
  }
  delay(8000);
}


void Water_level() {
    Serial.println(" ");
  digitalWrite(levblueled, LOW);
  digitalWrite(levgreenled, LOW);
  digitalWrite(levredled, LOW);
  digitalWrite(buzzer, LOW);
  lcd.clear( );
  lcd.setCursor(2,0);//set cursor (colum by row) indexing from 0
  lcd.print("READINGS FROM");
  lcd.setCursor(0,1);
  lcd.print("WATER LEVEL SENS");
  Serial.println("Taking Readings from Water Level Sensor");
  LEVblink();
  level_check();
  delay(8000);
}


void level_check(){
  digitalWrite(levblueled, LOW);
  digitalWrite(levgreenled, LOW);
  digitalWrite(levredled, LOW);
```

```
  digitalWrite(buzzer, LOW);

    // Notice how there's no delays in this sketch to allow you to do
other processing in-line while doing distance pings.
  if (millis() >= pingTimer) {   // pingSpeed milliseconds since last
ping, do another ping.
    pingTimer += pingSpeed;      // Set the next ping time.
    sonar.ping_timer(echoCheck); // Send out the ping, calls "echoCheck"
function every 24uS where you can check the ping status.
//delay(1000);
}
}

void echoCheck() { // Timer2 interrupt calls this function every 24uS
where you can check the ping status.
  // Don't do anything here!
  if (sonar.check_timer()) { // This is how you check to see if the ping
was received.
   if(sonar.ping_result / US_ROUNDTRIP_CM > 7){
    digitalWrite(levblueled, LOW);
    digitalWrite(levgreenled, LOW);
    digitalWrite(levredled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.clear( );
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL:");
    lcd.setCursor(12,0);
    lcd.print(sonar.ping_result / US_ROUNDTRIP_CM);
    lcd.setCursor(14,0);
    lcd.print("cm");
    lcd.setCursor(0,1);
    Serial.print("Water Level: ");
    Serial.print(sonar.ping_result / US_ROUNDTRIP_CM);
    Serial.println("cm");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL LOW");
    Serial.println("Water Level low");
    delay(3000);

  }

  if(sonar.ping_result / US_ROUNDTRIP_CM >= 5 && sonar.ping_result /
US_ROUNDTRIP_CM <= 7){
      digitalWrite(levblueled, HIGH);
  digitalWrite(levgreenled, LOW);
  digitalWrite(levredled, LOW);
  digitalWrite(buzzer, LOW);
    lcd.clear( );
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL:");
    lcd.setCursor(12,0);
    lcd.print(sonar.ping_result / US_ROUNDTRIP_CM);
    lcd.setCursor(14,0);
    lcd.print("cm");
```

```
    lcd.setCursor(0,1);
    Serial.print("Water Level: ");
    Serial.print(sonar.ping_result / US_ROUNDTRIP_CM);
    Serial.println("cm");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL NORMAL");
    Serial.println("Water Level normal");
  }

  if(sonar.ping_result / US_ROUNDTRIP_CM < 5){
    digitalWrite(levblueled, LOW);
    digitalWrite(levgreenled, LOW);
    digitalWrite(levredled, HIGH);
    digitalWrite(buzzer, HIGH);
    lcd.clear( );
    lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL:");
    lcd.setCursor(12,0);
    lcd.print(sonar.ping_result / US_ROUNDTRIP_CM);
    lcd.setCursor(14,0);
    lcd.print("cm");
    lcd.setCursor(0,1);
    Serial.print("Water Level: ");
    Serial.print(sonar.ping_result / US_ROUNDTRIP_CM);
    Serial.println("cm");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER LEVEL HIGH");
    Serial.println("Water Level high");
    delay(2000);
       }
  }
 }

/*long microsecondsToCentimeters(long microseconds)
{
  return microseconds / 29 / 2;
}
*/

void turbidity() {
  Serial.println(" ");
  digitalWrite(turbblueled, LOW);
  digitalWrite(turbgreenled, LOW);
  digitalWrite(turbredled, LOW);
  digitalWrite(buzzer, LOW);
  lcd.clear( );
  lcd.setCursor(1,0);//set cursor (colum by row) indexing from 0
  lcd.print("READINGS FROM");
  lcd.setCursor(0,1);
  lcd.print("TURBIDITY SENSOR");
  Serial.println("Taking Readings from turbidity Sensor");
  TURBblink();
  int turbidityValue = analogRead(A1);
  float turbidityV = turbidityValue/100;
```

```
Serial.print("Turbidity level: ");
Serial.println(turbidityV);

if( turbidityV > 9){
  digitalWrite(turbblueled, LOW);
  digitalWrite(turbgreenled, LOW);
  digitalWrite(turbredled, HIGH);
  digitalWrite(buzzer, HIGH);
  lcd.clear( );
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("TURBI LEV:");
  lcd.setCursor(11,0);
  lcd.print(turbidityV);
  lcd.setCursor(14,0);
  lcd.print("NTU");
  lcd.setCursor(0,1);
  Serial.print("Turbidity Level: ");
  Serial.print(turbidityV);
  Serial.println("NTU");
  lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
  lcd.print("WATER VERY CLEAN");
  Serial.println("Water Very Clean ");
  delay(3000);
}

if( turbidityV >= 6 && turbidityValue/100 <= 9 ){
  digitalWrite(turbblueled, HIGH);
  digitalWrite(turbgreenled, LOW);
  digitalWrite(turbredled, LOW);
  digitalWrite(buzzer, LOW);
  lcd.clear( );
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("TURBI LEV:");
  lcd.setCursor(10,0);
  lcd.print(turbidityV);
  lcd.setCursor(13,0);
  lcd.print("NTU");
  lcd.setCursor(0,1);
  Serial.print("Turbidity Level: ");
  Serial.print(turbidityV);
  Serial.println("NTU");
  lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
  lcd.print("WATER NORM CLEAN");
  Serial.println("Water Clean ");
}

if( turbidityV < 6){
  digitalWrite(turbblueled, LOW);
  digitalWrite(turbgreenled, LOW);
  digitalWrite(turbredled, HIGH);
  digitalWrite(buzzer, HIGH);
  lcd.clear( );
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("TURBI LEV:");
```

```
    lcd.setCursor(11,0);
    lcd.print(turbidityV);
    lcd.setCursor(14,0);
    lcd.print("NTU");
    lcd.setCursor(0,1);
    Serial.print("Turbidity Level: ");
    Serial.print(turbidityV);
    Serial.println("NTU");
    lcd.setCursor(0,1);//set cursor (colum by row) indexing from 0
    lcd.print("WATER VERY DIRTY");
    Serial.println("Water Very Dirty ");
    delay(3000);
   }
  delay (8000);
}


void initialization(){
  lcd.setCursor(0,0);//set cursor (colum by row) indexing from 0
  lcd.print("INITIALIZING ALL");
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS.");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS..");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS...");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS....");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS.....");
  delay(3000);
  lcd.setCursor(0,1);
  lcd.print("PARAMETERS......");
  Serial.println("Initializing All Parameters........");
  delay(8000);
  Serial.println("Initializing Done.");
  lcd.clear();
  lcd.setCursor(1,0);
  lcd.print("INITIALIZATION");
  lcd.setCursor(6,1);
  lcd.print("DONE  ");
  delay(2000);
}

////////////////////////////////////////////////////// SMS FUNCTION
//////////////////////////////////////////////////////////////////
```

```
void send_sms(){
  lcd.clear();
  lcd.setCursor(2,0);//set cursor (colum by row) indexing from 0
  lcd.print("ATTENTION!!! ");
  lcd.setCursor(2,1);
  lcd.print("SENDING SMS ");
  String temp;
  String lev;
  String phm;
  String turb;
  int turbidityValue = analogRead(A1);
  float turbidityV = turbidityValue/100;

  int buf[10];                //buffer for read analog
  for(int i=0;i<10;i++)       //Get 10 sample value from the sensor for
smooth the value
  {
    buf[i]=analogRead(SensorPin);
    delay(10);
  }
  for(int i=0;i<9;i++)        //sort the analog from small to large
  {
    for(int j=i+1;j<10;j++)
    {
      if(buf[i]>buf[j])
      {
        int temp=buf[i];
        buf[i]=buf[j];
        buf[j]=temp;
      }
    }
  }
  avgValue=0;
  for(int i=2;i<8;i++)                      //take the average value of 6
center sample
    avgValue+=buf[i];
  float phValue=(float)avgValue*3.8/1030/6; //convert the analog into
millivolt
  phValue=3.3*phValue+Offset;

    if(sensors.getTempCByIndex(0) > 40){
    temp = String("HIGH");
    }
    if(sensors.getTempCByIndex(0) >= 10 && sensors.getTempCByIndex(0) <=
40){
    temp = String("NORMAL");
    }
    if(sensors.getTempCByIndex(0) < 10){
     temp = String("LOW");
    }

    if(sonar.ping_result / US_ROUNDTRIP_CM > 8){
    lev = String("LOW");
```

```
    }
    if(sonar.ping_result / US_ROUNDTRIP_CM >= 5 && sonar.ping_result /
US_ROUNDTRIP_CM <= 8){
    lev = String("NORMAL");
    }
    if(sonar.ping_result / US_ROUNDTRIP_CM < 5){
    lev = String("HIGH");
    }

    if(phValue >= 7.30){
    phm = String("ALKALINE");
    }
    if(phValue >= 6.90 && phValue <= 7.19){
    phm = String("NORMAL");
    }
    if(phValue < 6.89){
     phm = String("ACIDIC");
    }

    if(turbidityV >= 6 && turbidityValue/100 <= 9){
    turb = String("CLEAN");
    }
    if(turbidityV < 6){
    turb = String("DIRTY");
    }

  mySerial.begin(19200);  //Default serial port setting for the GPRS modem
is 19200bps 8-N-1
  mySerial.print("\r");
  digitalWrite(buzzer, LOW);
  digitalWrite(blueled, LOW);
  digitalWrite(greenled, LOW);
  digitalWrite(redled, LOW);
  delay(1000);                    //wait for a second while the modem
sends an "OK"
  mySerial.print("AT+CMGF=1\r");    //Because we want to send the SMS in
text mode
  delay(1000);
  mySerial.print("AT+CMGS=\"+233540518223\"\r");    //Start accepting the
text for the message
  delay(1000);
  mySerial.print(temp);
  mySerial.print(" \r");
  mySerial.print("WATER TEMPERATURE= \r");   //The text for the message
  mySerial.print(sensors.getTempCByIndex(0));
  mySerial.print("*C\r");
  mySerial.println("\r");
  mySerial.print(lev);
  mySerial.print(" \r");
  mySerial.print("WATER LEVEL= \r");   //The text for the message
  mySerial.print(sonar.ping_result / US_ROUNDTRIP_CM);
  mySerial.print("cm\r");
  mySerial.println("\r");
  mySerial.print(phm);
```

```
  mySerial.print(" \r");
  mySerial.print("WATER PH VALUE= \r");   //The text for the message
  mySerial.print(phValue);
  mySerial.println("\r");
  mySerial.print(turb);
  mySerial.print(" \r");
  mySerial.print("WATER TURBIDITY= \r");   //The text for the message
  mySerial.print(turbidityV);
  mySerial.print("NBT\r");

  digitalWrite(greenled, HIGH);
  digitalWrite(tempgreenled, HIGH);
  digitalWrite(levgreenled, HIGH);
  digitalWrite(turbgreenled, HIGH);
  delay(3000);
  /*lcd.clear();
  lcd.setCursor(5,0);//set cursor (colum by row) indexing from 0
  lcd.print("SMS SENT ");
  lcd.setCursor(2,1);
  lcd.print("SUCCESSFULLY ");*/
  mySerial.write(0x1A);  //Equivalent to sending Ctrl+Z
}

void send_sms1(){
  lcd.clear();
  lcd.setCursor(2,0);//set cursor (colum by row) indexing from 0
  lcd.print("ATTENTION!!! ");
  lcd.setCursor(2,1);
  lcd.print("SENDING SMS ");
  String temp;
  String lev;
  String phm;
  String turb;
  int turbidityValue = analogRead(A1);
  float turbidityV = turbidityValue/100;

  int buf[10];                //buffer for read analog
  for(int i=0;i<10;i++)       //Get 10 sample value from the sensor for
smooth the value
  {
    buf[i]=analogRead(SensorPin);
    delay(10);
  }
  for(int i=0;i<9;i++)        //sort the analog from small to large
  {
    for(int j=i+1;j<10;j++)
    {
      if(buf[i]>buf[j])
      {
        int temp=buf[i];
        buf[i]=buf[j];
        buf[j]=temp;
      }
    }
```

```
  }
  avgValue=0;
  for(int i=2;i<8;i++)                      //take the average value of 6
center sample
    avgValue+=buf[i];
  float phValue=(float)avgValue*3.8/1030/6; //convert the analog into
millivolt
  phValue=3.3*phValue+Offset;

    if(sensors.getTempCByIndex(0) > 40){
    temp = String("HIGH");
    }
    if(sensors.getTempCByIndex(0) >= 10 && sensors.getTempCByIndex(0) <=
40){
    temp = String("NORMAL");
    }
    if(sensors.getTempCByIndex(0) < 10){
     temp = String("LOW");
    }

    if(sonar.ping_result / US_ROUNDTRIP_CM > 8){
    lev = String("LOW");
    }
    if(sonar.ping_result / US_ROUNDTRIP_CM >= 5 && sonar.ping_result /
US_ROUNDTRIP_CM <= 8){
    lev = String("NORMAL");
    }
    if(sonar.ping_result / US_ROUNDTRIP_CM < 5){
    lev = String("HIGH");
    }

    if(phValue >= 7.30){
    phm = String("ALKALINE");
    }
    if(phValue >= 6.90 && phValue <= 7.19){
    phm = String("NORMAL");
    }
    if(phValue < 6.89){
     phm = String("ACIDIC");
    }

    if(turbidityV >= 6 && turbidityValue/100 <= 9){
    turb = String("CLEAN");
    }
    if(turbidityV < 6){
    turb = String("DIRTY");
    }

  mySerial.begin(19200);  //Default serial port setting for the GPRS modem
is 19200bps 8-N-1
  mySerial.print("\r");
  digitalWrite(buzzer, LOW);
  digitalWrite(blueled, LOW);
  digitalWrite(greenled, LOW);
```

```
  digitalWrite(redled, LOW);
  delay(1000);                    //wait for a second while the modem
sends an "OK"
  mySerial.print("AT+CMGF=1\r");    //Because we want to send the SMS in
text mode
  delay(1000);
  mySerial.print("AT+CMGS=\"+233265188849\"\r");    //Start accepting the
text for the message
  delay(1000);
  mySerial.print(temp);
  mySerial.print(" \r");
  mySerial.print("WATER TEMPERATURE= \r");   //The text for the message
  mySerial.print(sensors.getTempCByIndex(0));
  mySerial.print("*C\r");
  mySerial.println("\r");
  mySerial.print(lev);
  mySerial.print(" \r");
  mySerial.print("WATER LEVEL= \r");   //The text for the message
  mySerial.print(sonar.ping_result / US_ROUNDTRIP_CM);
  mySerial.print("cm\r");
  mySerial.println("\r");
  mySerial.print(phm);
  mySerial.print(" \r");
  mySerial.print("WATER PH VALUE= \r");   //The text for the message
  mySerial.print(phValue);
  mySerial.println("\r");
  mySerial.print(turb);
  mySerial.print(" \r");
  mySerial.print("WATER TURBIDITY= \r");   //The text for the message
  mySerial.print(turbidityV);
  mySerial.print("NBT\r");

  digitalWrite(greenled, HIGH);
  digitalWrite(tempgreenled, HIGH);
  digitalWrite(levgreenled, HIGH);
  digitalWrite(turbgreenled, HIGH);
  delay(3000);
  lcd.clear();
  lcd.setCursor(5,0);//set cursor (colum by row) indexing from 0
  lcd.print("SMS SENT ");
  lcd.setCursor(2,1);
  lcd.print("SUCCESSFULLY ");
  mySerial.write(0x1A);  //Equivalent to sending Ctrl+Z
}

void PHblink() {
  digitalWrite(blueled, HIGH);
  delay(1000);
  digitalWrite(blueled, LOW);
  delay(1000);
  digitalWrite(blueled, HIGH);
  delay(1000);
  digitalWrite(blueled, LOW);
  delay(1000);
```

```
  digitalWrite(blueled, HIGH);
  delay(1000);
  digitalWrite(blueled, LOW);
  delay(1000);
   digitalWrite(blueled, HIGH);
  delay(1000);
  digitalWrite(blueled, LOW);
  delay(1000);
}

void TEMPblink() {
  digitalWrite(tempblueled, HIGH);
  delay(1000);
  digitalWrite(tempblueled, LOW);
  delay(1000);
  digitalWrite(tempblueled, HIGH);
  delay(1000);
  digitalWrite(tempblueled, LOW);
  delay(1000);
  digitalWrite(tempblueled, HIGH);
  delay(1000);
  digitalWrite(tempblueled, LOW);
  delay(1000);
   digitalWrite(tempblueled, HIGH);
  delay(1000);
  digitalWrite(tempblueled, LOW);
  delay(1000);
}

void LEVblink() {
  digitalWrite(levblueled, HIGH);
  delay(1000);
  digitalWrite(levblueled, LOW);
  delay(1000);
  digitalWrite(levblueled, HIGH);
  delay(1000);
  digitalWrite(levblueled, LOW);
  delay(1000);
  digitalWrite(levblueled, HIGH);
  delay(1000);
  digitalWrite(levblueled, LOW);
  delay(1000);
   digitalWrite(levblueled, HIGH);
  delay(1000);
  digitalWrite(levblueled, LOW);
  delay(1000);
}

void TURBblink() {
  digitalWrite(turbblueled, HIGH);
  delay(1000);
  digitalWrite(turbblueled, LOW);
  delay(1000);
  digitalWrite(turbblueled, HIGH);
```

```
  delay(1000);
  digitalWrite(turbblueled, LOW);
  delay(1000);
  digitalWrite(turbblueled, HIGH);
  delay(1000);
  digitalWrite(turbblueled, LOW);
  delay(1000);
   digitalWrite(turbblueled, HIGH);
  delay(1000);
  digitalWrite(turbblueled, LOW);
  delay(1000);
}
```