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GSM Based Advanced Water Salinity and TDS Monitoring System

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ABSTRACT

In the past ten years, water quality testing system has been widely used in almost every country which are known to have problems connected to ecological contamination. Which can be regarded to have problems related to ecological infection. The old structures of water satisfactory checking out contain the bodily series of samples from numerous places. These samples are verified in the research laboratory using diagnostic technologies. Such techniques are time taking and cannot be considered powerful. Furthermore, modern practices encompass an examination of numerous sorts of parameters of water first-rate inclusive of bodily and chemical. Vintage- style methods of water best size have drawbacks like a complex process, long time for effects, low measurement of accuracy, and uneconomical. Accordingly, there's a need of regular tracking of water quality constraints in actual-time. WST is a device used to

measure the range of salts found in water. It works at the fundamental postulate of Total Dissolved Salts (TDS). The reason for developing this sort of tool is to provide equipment which can help the users to stumble on the salinity of water so that it could be handled if salinity is improved up to a certain restriction. The tool can be used each domestically and industrially.

Keywords; Arduino, Pilot Sensor Network, GSM, TDS, WST.

INTRODUCTION

In this paper, we will get aware with the essential thoughts driving the task and the element that manual or affect the project. The project is a GSM-based totally water saltiness analyzer that gauges the all-out broke up salts or TDS. The terminals in the water collect and get the facts into Arduino which similarly methods the statistics and utilizations numerical equations to find out the TDS esteem and sends the information via GSM module and showcases the bearing on facts at the lcd board in the ongoing. The Arduino is going approximately as a microchip and controls the development of information from the terminals to the liquid crystal display/GSM module. The whole undertaking accommodates a touchy device that works steadily and gives the records in a rush. It facilitates in waiting for the future consequences depending on the statistics received. This assignment will detect the nearness of salt per million portions of water. The degree of salts may be efficiently discovered utilising the conductance approach or through the opposition of water. Two checks shaping a potentiometer is ready within the association. The voltage is applied over the tests and the competition is measure using Ohm's regulation. The whole equation managing need to be viable in Arduino. The closing well

worth may be applied to find out the conductance of the water then it very well may be applied to discover the estimation of TDS. The estimations of TDS found utilising the above-said manner, we can send the data both to expose on liquid crystal display or at the versatile display screen within the SMS structure making use of GSM modem. As a heater produces steam, any impurified material present within the kettle or the feed water might be accumulated inside the boiler. At the same time as doing as such, we confirm the distinctive feature of the warmth flow and the whole profitability of the boiler. As the steam vanishes, the measure of TDS ascends in the evaporator water. Within the event that TDS fixation gets excessively excessive, the vestige of the kettle will occur. This will make unaffected damage to the structure thru rust and affidavit on warmth transmission surface.

Many works were done on this type of project already and some of them related to the project are listed below:

Seyed Kamal din et al [1] In this technology the manufacturing of the TDS measuring system is so as it can recompense the bad consequence of temperature. The process of the TDS regulation is through the present and nonstop control of a mixing valve. Ashish Thakre et al [2] discuss the development of a RO water purifier with an attached TDS indicator that can be used for the subsequent treatment of drinking and industrial water in Bhandara, Maharashtra (21.17 ° N 79.65 ° E), India. Ioan Alexandru Ivan et al [3] TDS contraptions are meters for measuring the conductivity of water. Unpolluted water naturally displays a very low conductivity (0.006585 mS/m) at Targoviste (44 ° 55'27 "N 25 ° 27'24" E), Romania. Nchimunya Chaamwe et al [4] The checkup of water quality is a very significant responsibility that would assure clean and harmless water to end-users in Wuhan (30°35'N 114°17'E) in China. checkup of water excellence is vital to control the physical, biochemical and organic features of water. Ruan Yue et al [5] This technology grants a quality checking system using Pilot Sensor Network (PSN) process driven by a solar panel. To check the quality of water in various fields and in the meantime, a new system style containing scattered sensor nodes and a common station is recommended. Mohammad Rafiqul Islam et al [6] More than 100 drinking water mills (pet bottles) are connected in Dhaka (23 ° 42'N 90 ° 22'E) in Bangladesh in a brief period. They sell intake water to the community through confection supplies and other stores in various locations, counting bus and train positions. NRG Walton et al [7] show that TDS are not effortlessly calculable, excluding under controlled circumstances in a trustworthy test site. A common substitute way is to use the electrical conductivity (EC) analysis and multiply it factor (usually 0.7) to get the wanted TDS outcome. P. Lambrou et al 2010 [8] This article presents the project and growth of a cheap real-time checkup system for the quality of intake water at drinking sites. The organization consists of several electrochemical and visual devices combined into the pipes and focuses on low cost, light mass, and long-term reliable process.B. Menaka Devi et al 2014 [9] Assessing the quality of water in large water distribution systems involves taking random water samples and analyzing them in the laboratory. Since this process is time-consuming and labor-intensive, this paper presents an approach to automatically determine water quality using low-cost and conducted sensors. Masaki Hayashi 2003 [10] This article inspects the EC temperature relationship of normal waters with very dissimilar compositions and families. The relationship between temperature and TDS was somewhat non-ideal from temperature 0 to 30 °C, but the linear equation well satisfied the relationship. The temperature recompense factor matching to 25 ° C extended from 0.0117 to 0.0179. Stephen Schoenholtz et al 2006 [11] Raised TDS can be poisonous to river animals by producing osmotic pressure and upsetting some regulatory capacity of the body. Several previous lessons have decided that the poisonousness of TDS is a function of the ionic configuration of the solution as well as the TDS. Mohammad Rafigul Islam et al 2017 [12] In the various zones of Dhaka (23° 42'N 90° 22'E) Bangladesh, drinking water is treated by the reverse osmosis purification system for consumption purposes. Most water treatment businesses fill the 500 ml, 1,000 ml, 2,000 ml, and 5,000 ml flasks with this treated water and sell broadly in diverse parts of Bangladesh. B. Mintz et al 2015 [13] There is no dependable information on the conceivable fitness effects related to the incorporation of TDS in drinking water. The consequences of initial epidemiological lessons advise that even low levels of TDS in drinking water may have useful effects, even though opposing effects have been stated in two limited studies. Anna F Rusydi 2018 [14] Conductivity (EC) and TDS are water class constraints used to define the amount of salinity. These two limits are connected and usually stated by a simple calculation: TDS = k EC (in 25 0 C). The procedure of procurement TDS from a water example is more composite than that of the EC. Q. Salillas et al 2017 [15] This study aimed to develop a device that can monitor the water quality of water refilling stations at manila (14° 35'N 121° 00'E) in Philippine. It also aimed to automate the manual operation of monitoring the product water. The study utilized the developmental and descriptive methods. Abdul Aziz et al 2008 [16] It is originated that the present physical aquatic quality monitoring involves slow procedure is time-consuming. To ease the difficulties produced by the physical monitoring and the lack of a real system for prawn farming, a distant aquatic quality monitoring for prawn farming pond is planned.M. M. Akhtar et al 2013 [17] This study is done in Lahore. The second-largest city of Pakistan is facing groundwater pollution come from several bases which covers very complex poisonous essentials such as landfills, wastewater sanitation, river, business, and farming sectors. Due to the lack of organization resources, rules, and implementation of environmental laws correctly are making groundwater organizations inappropriate for the public.

2.TOOLS AND TECHNIQUES

Hardware used with complete technical specifications

This project consists of Arduino Uno chip, Gsm module 6900a, bread board, wires (woman to male and male to woman), Teflon tube, tests of AISI 302 material, twine of thickness 1 mm. These contraptions are effectively accessible within the market. For, progressively specific estimation of absolute broke up salts, TDS exam has been performed on an excessive temperature coloring gadget 6T-5 which condensate water at 130°C.Given underneath is the list of additives used on this task.

2.1. Arduino Uno board

The Arduino Uno is a microcontroller board which is built on the datasheet. It has 14 digital enter and output pins, 6 analog inputs, USB meeting for strength deliver and a reset button.Via the usage of input pins, it gets the information from mechanical sensor that is dipped within the water.It calculates the statistics and through output pins send the statistics to the next level. Fig.2. 1 demonstrations the functions and elements of the Arduino boards



2.2.GSM Modem

Gsm is used to establish communication between a mobile phone and processors. GSM modem needs a sim card to be operated. It works over a specified network array. Fig. 2.2 A Gsm module is connected to the Arduino. The sim card on GSM modem upon getting digit command by SMS from Arduino refer that information to the microcontroller through serial communication. While the program is performed in the Arduino.



Fig- 2.2 Gsm module interfaced with Arduino

2.3. Bread Board

A bread board is used as a unit for making the circuits and they require absolutely no soldering. Fig. 2.3 show a simple bread board which is used in this experiment.



Fig. 2.3 Bread board

2.4. wires

Female to male and male to male wires are used for making the circuit. These wires are used to connect Arduino with Gsm module and bread board. It has 150mm long and 0.1-inch width.Fig. 2.4 shows the male to female wires and Fig. 2.5 shows the board for assembling the apparatus



Fig- 2.4 male to female wires



Fig- 2.5 Wooden Board for Equipment Placement

3.Software and simulation tools used

The softwares used in this project are listed here

1) Arduino

- 1) Proteus
- 2) PCB Wizard

3.1. Arduino

Arduino is an open-source integrated circuit technology display place built on software and hardware. These boards can read inputs and turn them into a suitable output (Fig 3.1).



Fig .3.1. Arduino's Interface Proteus

Proteus (Fig 3.2) is a simulation software which is used to check the stability of the circuit under examination. The projects are first created using Proteus software and then tests are performed to find out whether the project is feasible or not. This is an economical option because you have the choice to add as many items in your project as you want without having to purchase them physically, also they are helpful in the sense that they can detect any false connection and error in the circuit which can be checked and removed.



Fig.3.2.Proteus Interface

4. PCB Wizard

PCB Wizard is also a simulation software which mainly focuses on the design and creation of PCBs. It creates the connection on the PCB in the most effective way possible so that there are no connectivity issues related to wiring



Fig .3.3. PCB Wizard's Interface

4.METHODOLOGY

While the sensor for TDS measuring is manufactured before the installation makes positive the sensor is water-

proof. The gadget is positioned on the wall close to the condensate water pipe. With the help of a drilling gadget, a hollow is made at the higher aspect of the pipe. Then the probes of the sensor are fixed in the pipe with the assist of nuts, bolts, and welding. Fig. 4.1 indicates the death device 6T-5. The sensor is set up in this machine's condensate water pipe for the dimension of TDS of condensate water.



Fig- 4.1 Dying machine

Fig.4.1,4.2& 4.3. shows the place of pipe on which probes of sensor are mechanically fixed in the pipe for the measurement of TDS of water.



Fig- 4.2 Connection of sensor probes in condensate water pipe

Fig. 4.3 shows the complete installation of TDS measuring sensor, which calculate the TDS and send it to the android mobile app



Fig- 3.4 complete installation

4.1 Analysis procedures

To calculate the electric conductivity of water in the created association, a probe is preferred to be designed and offers the skill to be water resistant and resistant towards erosion. It is in all likelihood to calculate the TDS fee of water in actual-time for excessive temperature and nonstop with the aid of connecting those probes in condensate water that leaves the mechanism.

4.2 Implementation procedure

4.2.1 Details about hardware

Conductors used in these probes are made up of AISI 302 material. The gathering of this fabric for the electrodes is due to its capacity to hold its houses in opposition to excessive temperature, erosion, and immiscibility with air. The set of these electrodes is placed internal a Teflon pipe. Teflon is nominated right here due to its insulating overall performance

In opposition to the electrical current, safety from damage to probes because of water glide and it may undergo excessive temperature. This cowl is manufacturing unit-made by means of machining in CNC machines. Fig. 4.1 suggests the mechanical sensor with the complete setup. Fig. 4.2 indicates the dimensional view of the sensor.



Fig- 4.1. Sensor diagram





4.2.2 Details about software/ algorithms

Formula for TDS is

Where EC is the electrical conductivity,

1 EC =____(2) R

R is the resistance in water and if the value of resistance is high it means that electrical conductivity is low and vice versa.

ke is a constant in the series of 0.55-0.8, which is determined

according to the water properties or the areas which is under consideration.

In step with the water homes or the areas which are below attention.

Programming

#include <ESP8266WiFi.h>

#include <MAX6675_Thermocouple.h>

#include <Adafruit_GFX.h>

#include <ESP_Adafruit_SSD1306.h>

#include <Wire.h>

const char* ssid = "TDS Online";

const char* password = "value engineering";

const char* host = "www.valueengineering.ltd";

int number = 0;

#define OLED_RESET 4

int analogPin = 0;

int raw = 0;

int Vin = 5;

float Vout = 0;

float R1 = 1000;

float R2 = 0;

float buffer = 0;

float cond;

int TDS;

float EC25;

long cnt1 = 0, cnt2 = 0;

int ktcSO = 12;

int ktcCS = 13;

int ktcCLK = 14;

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MAX6675_Thermocouple ktc(ktcCLK, ktcCS, ktcSO);

Adafruit_SSD1306 display(OLED_RESET);

int T = ktc.readCelsius();

void setup() {

delay(100); // This delay is needed to let the display to initialize

display.begin(SSD1306_SWITCHCAPVCC, 0x3C); // Initialize display with the I2C address of 0x3C

display.clearDisplay(); // Clear the buffer

display.setTextColor(WHITE); // Set color of the text

display.dim(0); //Set brightness (0 is maximun and 1 is a little dim)

display.setCursor(32, 0);

display.setTextSize(1);

display.print(".....");

display.setCursor(50, 10);

display.setTextSize(1);

display.print("VALUE");

display.setCursor(32, 25);

display.setTextSize(1);

display.print("ENGINEERING");

display.setCursor(32, 30);

display.setTextSize(1);

display.print(".....");

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display.setTextSize(1);

display.setCursor(5, 50);

display.println("CONNECTING TO WIFI..");

Serial.begin(115200);

delay(100);

Serial.println();

Serial.println();

Serial.print("Connecting to ");

Serial.println(ssid);

//delay(500);

display.begin(SSD1306_SWITCHCAPVCC, 0x78 >> 1);

display.display();

delay(500);

display.clearDisplay();

WiFi.begin(ssid, password);

while (WiFi.status() != WL_CONNECTED) {

delay(500);

Serial.print(".");

```
}
```

Serial.println("");

Serial.println("WiFi connected");

Serial.println("IP address: ");

Serial.println(WiFi.localIP());

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```
Serial.print("Netmask: ");
Serial.println(WiFi.subnetMask());
Serial.print("Gateway: ");
Serial.println(WiFi.gatewayIP());
}
void loop() {
raw = analogRead(analogPin);
 {
 buffer = raw * Vin;
  Vout = (buffer) / 1024.0;
 buffer = (Vin / Vout) - 1;
 R2 = R1 * buffer;
                                                      5.
  cond = 1000 / (R2 * 2.88);
 EC25 = cond /(1 + 0.019 * (T - 25.0));
  TDS = 1000 * 0.7 * EC25 * 2.5;
 if (TDS < 10)
  {
  TDS = 0;
  }
 }
float t = TDS;
displayData();
Serial.print("connecting to ");
```

Serial.println(host);

```
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```

```
const int httpPort = 80;
```

if (!client.connect(host, httpPort)) {

Serial.println("connection failed");

display.setCursor(4, 10);

display.setTextSize(1);

display.println("NOT CONNECTED TO WEB");

return;

}

```
String url = "/api/TDS/insert.php?Temp=" + String(ktc.readCelsius())+ "&Value="+ String(t);
Serial.print("Requesting URL: ");
Serial.println(url);
client.print(String("GET ") + url + " HTTP/1.1\r\n" +
    "Host: " + host + "\r\n" +
    "Connection: close\r\n\r\n");
delay(500);
```

while (client.available()) {

```
String line = client.readStringUntil('\r');
```

Serial.print(line);

```
}
```

Serial.println();

Serial.println("closing connection");

Delay (1000);

displayData ();

display.setCursor (4, 15);

display.setTextSize (1);

display.println (".....CONNECTED.....");

delay(54000) //change this to change the delay

//////////////DATA

void displayData() {

int T = ktc.readCelsius();

display.setTextSize(1);

display.setCursor(10, 0);

display.println(" VALUE ENGINEERING");

display.setTextSize(2);

display.setTextColor(WHITE);

display.setCursor(10, 30);

display.print((char)248);

display.print("C:");

display.print(T);

display.setCursor(10, 50);

display.print((char)248);

display.print("TDS:");

display.println(TDS);

display.display();

display.clearDisplay();

}

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5.

Installation of equipment

When the sensor for TDS measuring is manufactured before the installation make sure sensor is water proof. Equipment is placed on the wall near the condensate water pipe. With the help of drill machine a hole is made on the upper side of the pipe. Then the probes of the sensor are fixed in the pipe with the help of nuts, bolts, and welding.

5.RESULTS AND DISCUSSION

5.1 Presentation of the findings

Experiments were performed in Shahkam Industry Lahore pvt limited. The experimental apparatus was installed at the dying machine 6T-5. Experiment was conducted on the pipe line where the condensate water flows towards boiler at high temperature.Fig.5.1 shows the behavior of hardness of water with respect to total dissolved solids in PPM.





It is shows that water has soft behavior below 50ppm. At 50 water shows slightly hard behavior.

From 50 to 100 it has moderately hard behavior. From 100 to 150 it is hard. From 150 to 200 it shows very hard behavior.

5.2 Results of water quality of boiler feed water

Detail of one day reading are given in the table 5.1

Day	Date	Time	Value	Boiler No
1	2/7/2018	12:00 AM	35,1	1
1	2/7/2018	1:00 AM	43,2	1
1	2/7/2018	2:00 AM	87,3	1
1	2/7/2018	3:00 AM	90,4	1
1	2/7/2018	4:00 AM	138,5	1
1	2/7/2018	5:00 AM	94,6	1
1	2/7/2018	6:00 AM	86,7	1
1	2/7/2018	7:00 AM	135,8	1
1	2/7/2018	8:00 AM	149,9	1
1	2/7/2018	9:00 AM	110,10	1
1	2/7/2018	10:00 AM	66,11	1
1	2/7/2018	11:00 AM	129,12	1
1	2/7/2018	12:00 PM	147,13	1
1	2/7/2018	1:00 PM	193,14	1
1	2/7/2018	2:00 PM	229,15	1
1	2/7/2018	3:00 PM	155,16	1
1	2/7/2018	4:00 PM	81,17	1
1	2/7/2018	5:00 PM	161,18	1
1	2/7/2018	6:00 PM	69,19	1
1	2/7/2018	7:00 PM	134,20	1
1	2/7/2018	8:00 PM	182,21	1
1	2/7/2018	9:00 PM	85,22	1
1	2/7/2018	10:00 PM	96,23	1
1	2/7/2018	11:00 PM	137,24	1

Table 5.1 Detail of one day reading

Fig 5.2 suggests that during the first hour of operating, TDS value is every day in range when one hour passed temperature rises and TDS fee exceeds from fifty and maintain on increasing commonly even as in the fourth hour of working an unexpected increase of TDS price occurs because of the unexpected upward thrust of temperature within the boiler. At some point of the hour, fifth cooling begins which indicates a surprising drop in TDS value and it goes on decreasing still as much as the sixth hour of labor. Inside the 7th hour of running temperature rises and TDS cost once more shoots and continues on growing till the 7th hour of work. As the 8th hour starts gadget cool down and TDS

once more drops suddenly due to sudden drop in temperature, from hour 9 to onward up to hour twelve it maintains on growing and highest TDS cost is achieved at hour twelve because of the addition of raw water, and TDS cost shoots as much as 250. At hour 13 cooling of the machine takes location and TDS drops due to a drop in temperature.



Time in hours

Fig- 5.2 Time versus TDS

detail of second day readings is given below in the table-5.2

Table- 5.2 detail of readings

Dav	Date	Time	Value	Boiler No
2	3/7/2018	12:00 AM	42,1	1
2	3/7/2018	1:00 AM	49,2	1
2	3/7/2018	2:00 AM	87,3	1
2	3/7/2018	3:00 AM	90,4	1
2	3/7/2018	4:00 AM	161,5	1
2	3/7/2018	5:00 AM	54,6	1
2	3/7/2018	6:00 AM	99,7	1
2	3/7/2018	7:00 AM	115,8	1
2	3/7/2018	8:00 AM	149,9	1
2	3/7/2018	9:00 AM	160,10	1
2	3/7/2018	10:00 AM	66,11	1
2	3/7/2018	11:00 AM	149,12	1
2	3/7/2018	12:00 PM	135,13	1
2	3/7/2018	1:00 PM	91,14	1
2	3/7/2018	2:00 PM	146,15	1

2	3/7/2018	3:00 PM	155,16	1
2	3/7/2018	4:00 PM	81,17	1
2	3/7/2018	5:00 PM	161,18	1
2	3/7/2018	6:00 PM	77,19	1
2	3/7/2018	7:00 PM	134,20	1
2	3/7/2018	8:00 PM	102,21	1
2	3/7/2018	9:00 PM	85,22	1
2	3/7/2018	10:00 PM	96,23	1



Fig 5.3 suggests that in the first hour of running, TDS price is ordinary in range whilst one hour handed temperature rises up and TDS cost exceeds from fifty and keep on increasing usually at the same time as in the fourth hour of operating an unexpected growth of TDS value takes place due to unexpected upward thrust of temperature in the boiler.

The referred to machine degree and monitors the TDS values of high-temperature commercial flowing water. The manual TDS meter measures values best at low temperatures <45 degrees centigrade, but this system has the ability to measure TDS values even at a high temperature >100 stages centigrade. Whilst the temperature inside the boiler rises to 50 ranges centigrade then it's far not possible for someone to take guide readings. It minimizes protection risks and minimizes the chances of injuries and deaths due to overheating. This device is completely underneath control and offers readings in step with requirement, this system has the ability to degree readings after each hour however manually that is not possible to take readings using TDS meters

CONCLUSION

Manual TDS measuring is the time taking process and it additionally desires less than 70°C temperature due to the fact if the temperature is better than this guide TDS meter cannot degree efficaciously however performance increased by means of an actual-time monitoring gadget for the commercial excessive-temperature water device. Moreover, continuous monitoring of the TDS variety makes it smooth to reveal the hardness of water before any threat, so that is the easiest way to address any water device for protection functions. It can store money, time, risks and expenses like exertions value and preservation value, and many others.

FUTURE SCOPE

In the future, this machine may be changed, depending upon the necessities. The application makes use of to deliver TDS values can directly introduce into google play keep or app save, this TDS measuring machine may be purchase from the market, and supporting app may be down load on line so that it'd be a simpler way to measure and monitor TDS values regionally and industrially as properly. The second one advice is ready the material, Teflon may be replaced with iron or steel to get a right junction with jogging water pipeline because metallic to metallic junction thru welding is simpler than Teflon(nonmetal) to the metallic junction.

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Authors Contribution

All authors contributed equally in designing, data collection, assimilation and writing of this manuscript and the final version was read and approved by all authors.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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