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Implementation of Water Salinity Tester as a quantitative tool to determine the Total Dissolved Solids in water

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ABSTRACT. In the past few years, a water quality testing system has been commonly used in almost every country which is known to have issues related to water contamination. The old system uses the physical inspection of water by taking numerous samples from different water sources. These samples are then verified in the research laboratory using diagnostic technologies. Such techniques are time taking and are not deemed as powerful. Furthermore, new techniques not only inspect the physical qualities of water but also measure the total amount of germs and other infectious items present in the water. Old methods of water testing have drawbacks like complex processing, long result time & low accuracy etc. So, to eradicate all these issues, we must find out an economical and fast way to determine the quality of water. Such a device is called a "Water Salinity Tester (WST)". WST is a device that is used to calculate the amount of Total Dissolved Solids (TDS) in water. The reason for developing this sort of tool is to provide equipment that can help the users to measure the salinity of water so that it can be controlled if the salinity increases to a certain limit. The tool can be used both domestically and industrially.

Keywords; TDS, WST.

INTRODUCTION

In this paper, we will describe all the things which are important in defining the above-said system. The project is a Wi-Fi-based Water Salinity Tester (WST) that calculates the amount of TDS. It consists of a device whose probes are placed into the water under examination. These terminals are controlled by the Arduino which senses the current flow in the water. As we know, the higher the number of ions in water, the higher the current flow so these values are processed through numerous formulas to find out the exact amount of TDS in water. These values are sent over to the OLED display and uploaded to the

website in the real-time using a Wi-Fi module. The Arduino is a microchip that controls all the information from the terminals to the OLED display/website. The whole process accommodates a device that works steadily and gives the values quickly. It helps in reducing testing time and improves the possibility of controlling the boiler or any domestic appliance which uses water.

2.TOOLS AND TECHNIQUES

Hardware used with complete technical specifications.
The equipment used in this project are:

- Arduino UNO/MEGA/NANO.
- OLED display.
- Wi-Fi module.
- Breadboard.
- wires.
- Teflon tube AISI 302.
- Twine of thickness 1 mm.

These items are readily available in the market.

2.1. Arduino Uno board

The Arduino Uno is a microcontroller board that is based on a PIC microprocessor. It is the brain of the whole circuit. The voltage values from the probes in the water and the TDS values which are displayed on LCD are calculated and transferred by this device Fig.2.1 demonstrates the functions and elements of the Arduino boards.

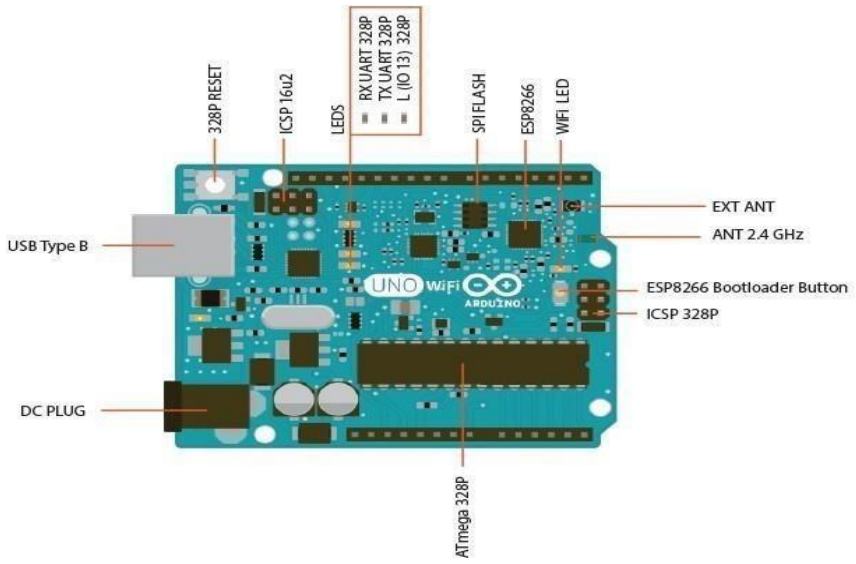

Fig. 2.1. Arduino Uno board

2.2. Wi-Fi Module

Wi-Fi module is used to send the Data over to the website's main database which will then display the values to the specific page on the website.

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2.3. LCD

In this project, we will be using a 0.96-inch bicolor OLED display. It is very efficient in displaying items. Furthermore, it has more rows and columns than the old 16x2 LCDs which are junky and consume more power.

3.SOFTWARE AND SIMULATION TOOLS USED

The software used in this project are listed here.

- Arduino IDE
- Proteus
- PCB Wizard

3.1. Arduino IDE

Arduino IDE is an open-source integrated circuit technology built on software and hardware. These boards can read inputs and turn them into a suitable output.

3.2. Proteus

Proteus is simulation software that 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.

4.METHODOLOGY

Before the installation of the WST sensor, the device is tested to be waterproof so the water cannot seep in due to numerous reasons. The device is positioned on the wall close to the condensate water pipe.

With the help of a drill, a hole is drilled at the top of the pipe then the probes are inserted and placed firmly into the water mainstream through nuts and bolts. Fig. 4.1 shows the device connected to a dyeing machine.

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

Fig- 4.1 Dyeing machine

Fig- 4.2 Connection of sensor probes in condensate water pipe

4.1 Analysis procedures

To calculate the correct values, the probes are designed in such a way so that they are anti-corrosive and resistant to heat and pressure. As the probes are constantly dipped into the mainstream water, we can calculate the TDS values anytime we want. As for the wireless connectivity, we are also able to check the values on the go.

4.2 Implementation procedure

4.2.1 Details about the hardware

Conductors used in these probes are made up of AISI-302 material. The reason for using such type of material is due to its properties to withstand high temperatures and pressures. The probes are fitted into the Teflon pipe due to its insulating capabilities.

This item is manufactured using CNC machines. Fig. 4.1 suggests the probe and the Teflon tubing along with the nut to tighten the joint. Fig. 4.2 indicates the dimensional view of the sensor.

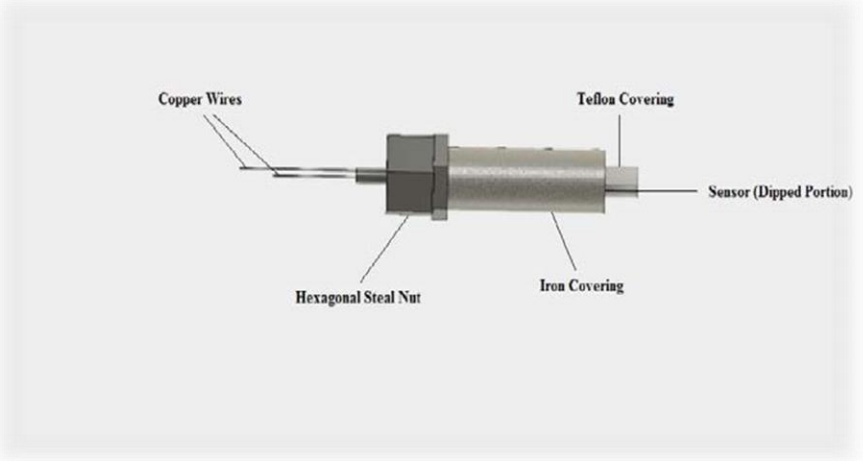

Fig- 4.1. Sensor diagram

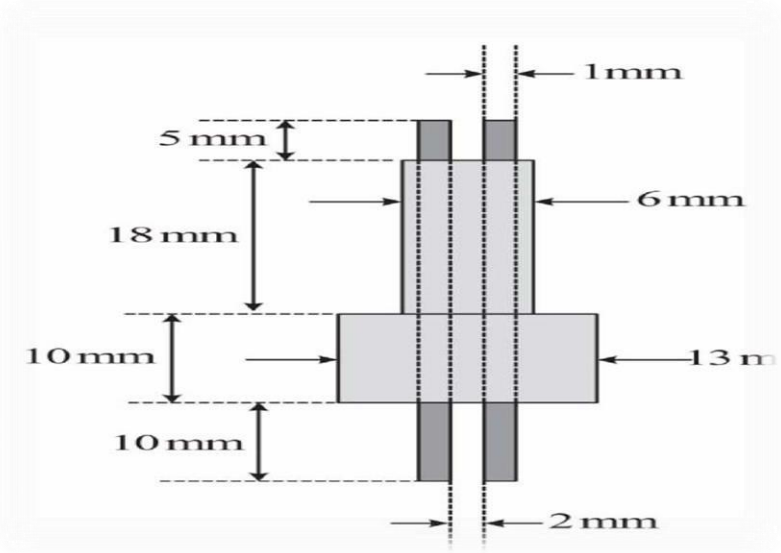

Fig- 4.2. Sensor diagram

5.RESULTS AND DISCUSSION

5.1 Presentation of the findings

The device was placed in various places including Shahkam Industries and other private industries. The experimental apparatus was installed at the dyeing machine 6T-5. The experiment was conducted on the pipeline where the condensate water flows towards

the boiler at high temperatures. Fig.5.1 shows the behavior of hardness of water concerning total dissolved solids in PPM.

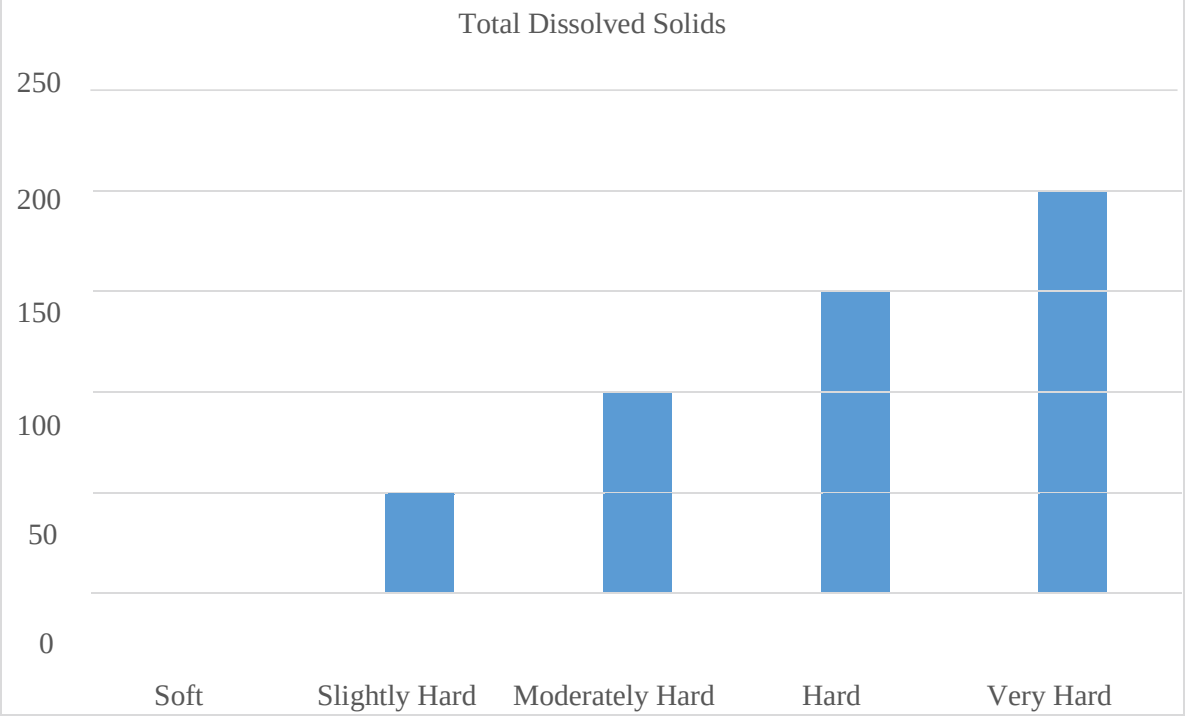

Fig. 5.1 Total dissolved solids

5.2 Results of water quality of boiler feed water

Detail of one day reading is given in table 5.1.

Day	Date	Time	Value	Boiler No
1	2/7/2018	12:00 AM	326	1
1	2/7/2018	1:00 AM	328	1
1	2/7/2018	2:00 AM	329	1
1	2/7/2018	3:00 AM	328	1
1	2/7/2018	4:00 AM	328	1
1	2/7/2018	5:00 AM	325	1
1	2/7/2018	6:00 AM	345	1
1	2/7/2018	7:00 AM	350	1
1	2/7/2018	8:00 AM	324	1
1	2/7/2018	9:00 AM	324	1
1	2/7/2018	10:00 AM	348	1
1	2/7/2018	12:00 PM	348	1
1	2/7/2018	1:00 PM	347	1
1	2/7/2018	2:00 PM	345	1
1	2/7/2018	3:00 PM	347	1

The manual TDS meter measures values best at low temperatures <45 degrees centigrade, but this system can measure TDS values even at a high temperature above 100 degree centigrade. If the boiler temperature rises above 50^{o} C, it is very difficult for the operator to calculate TDS directly through the mainstream water.

FUTURE SCOPE

This device can be altered in the future depending upon the company's need. We have added support for the GSM module, Different Types of LCD configs, Stronger Wi-Fi Modules, and wireless control systems to shut down the whole system if the values vary abnormally. The website can display the data to various companies at the same time with the login and password facility available so it is both seamless and private at the same time, making it easy to download the data to use in reports or other paper works. WST can be purchased from the authorized dealer, and after signing up and synchronizing the device, TDS values are available on the given login and password to be downloaded online so that it would be a simpler way to measure and monitor TDS values.

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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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