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Urban District-Based Water Quality Mentoring by using IOT

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***Abstract* - Potable water become a scarce resource, due to the combined effects of overpopulation, pollution and climate change. Thus, monitoring the quality of water is very important, especially the water supplied to homes through the liquefaction network. Hence this research that takes place to assess the quality of water supplied to the consumer in a residential neighborhood as an indicator of the quality of river water, the efficiency of water purification plants, and the validity of water transmission pipes in the liquefaction networks. And the analysis of the degree of water salinity, which depends on the electrical conductivity of the water supplied from the main filtration stations in the city of Mosul, which are the new Al-Aysar project and the unified Al-Ayman project, by selecting four sampling sites in the residential neighborhood in a way that covers the geographical area of the neighborhood. Four samples were taken daily with a fixed time difference from any site for a month. All readings were uploaded to Thing Speak cloud space for storage and analysis. The results of the study showed that the water quality is within the natural limits, less than (200 mg/l), and this is evidence that the water quality on both sides of the city is good and suitable for human consumption.**

Keywords: Urban, Water, Quality Mentoring, IOT, Internet of things.

I. INTRODUCTION

Research and studies on water, its nature and properties have paid great attention to the importance of water as a substance of the means of survival and a clear indication of life. Water is an essential pillar of life, the basis of existence and a support for all aspects of survival. Fresh water constitutes a very small part that does not exceed (2%) of the total water on earth, which It covers (75%) of the Earth's surface and this importance comes mainly with regard to man and his life because it is the source of drinking water for him. Water constitutes a large percentage of the content of the living matter of the cell in all living organisms, both plants and animals, and a medium for vital interactions that take place only through dissolution, as well On the other hand, it contains a lot of elements and salts that cause the survival of the organism and its continuation of life. The need, in proportion to the civilizational development in various fields of life, called for the existence of filtration plants that secure safe water for humans, with constant interest in monitoring the quality of the water produced by these stations.

Water is an essential element for the survival of the human race. Its range of uses means it's always in steady demand. The water supply mainly comes from large reservoirs of water such as lakes, streams, and the ocean itself. As such, it is good practice to monitor their quality to ensure they are suitable for human consumption. Current water quality monitoring is often performed in conventional laboratories but is time consuming and prone to inaccuracy [1].

The project is concerned with examining and monitoring the quality of water (salts) for a geographical spot within the city of Mosul, through the use of an Arduino chip, salinity sensors, and temperature measurement, connecting them via the Internet of Things, and analyzing the results within the Thing Speak platform.

II. BACKGROUND OF THE PROBLEM

Water pollution is one of the major causes of many waterborne viruses like dengue, cholera, malaria, etc., for human ancestors. 40% of deaths worldwide are caused by water pollution. Therefore, the quality of drinking water is intended to be evaluated in real time [2]. The use of technology, including the Internet of things, has become necessary to develop any work related to the daily life of citizens and in various scientific and applied fields, as the Internet of things provides an ideal work environment for data transfer and device communication, while providing the possibility of communication over distances Far across the World Wide Web between them and their contacts with people.

III. SYSTEM DESIGN

Currently in our country, water is analyzed manually by taking samples from water projects and sending them to the laboratory for investigation, and this is expensive and takes time to detect contamination. The proposed work reduces

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human intervention by using the Internet of Things and makes drinking water testing available in every home at a very low cost and eases of use by the user with the possibility of issuing an alert on the transformer devices in the event of any contamination in the water.

The connection between the device and the home wireless network is to transfer data to the user via the Internet or by creating a private local network.

IV. PROPOSED SYSTEM

The main objective is to develop a system for continuous monitoring of the quality of drinking water within cities using a wireless sensor network with low cost, low energy consumption, and accuracy in detecting the rates of dissolved salts in the water, turbidity, and other pollutants.

The following are the most important objectives of the idea (1) to measure the rates of water pollutants such as salts, pH, dissolved oxygen, turbidity, and others, using the sensors available in a place far from the Internet of Things (2) and to collect data from various devices and sensors and send them to the cloud via a wireless channel (3) Simulation and evaluation Results to monitor water quality (4) The possibility of placing a device in each house to monitor water quality and displaying the results on site via a screen installed in the device (5) The possibility of adding a service to send short messages to the person concerned with monitoring water quality in the event of contamination or a rise in the percentage of salts above the level natural.

The detailed diagram of the water quality monitoring system is shown in Figure 1.

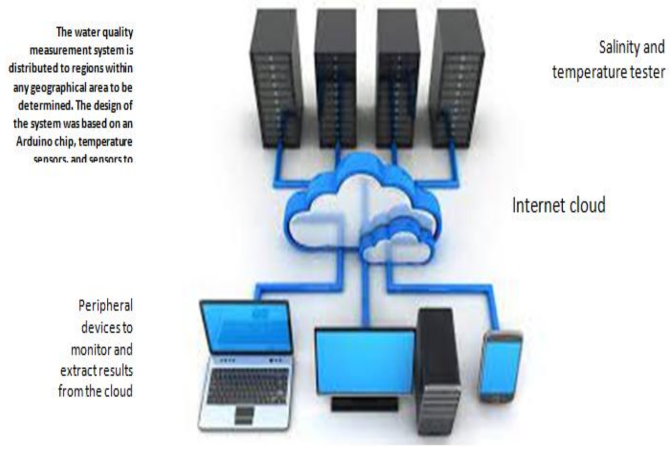

Figure 1: Proposed system

A) ESP32 Chip

It is a series of low-cost, energy-efficient systems with precise control with an integrated Wi-Fi function that contains many inputs and outputs that can deal with different sensors, switches and control systems, and is characterized by its ease of programming. It is an open source chip.

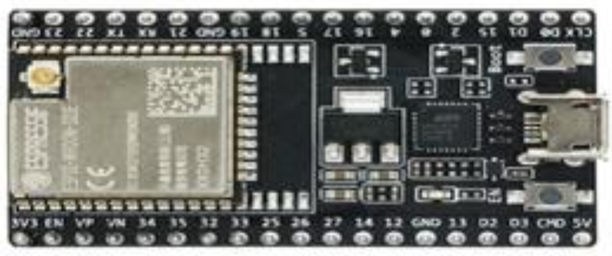

Figure 2: ESP32 card

B) TDS Sensor

The TDS water turbidity sensor and the value of conductivity through which it is possible to know how many milligrams of dissolved solids in the tested water very easily to reflect the extent of cleanliness or purity of the measured water sample. The sensor works with AC technology inside to avoid polarization on the sensor sensors, and thus no damage or corrosion occurs, as shown in Figure (3).7 DS18B20 temperature sensor.

Figure 3: Salinity sensor

C) DS18B20 temperature sensor

It is a single wire programmable temperature sensor from maxim Integrated. It is widely used for temperature measurement in tough environments such as chemical solutions, mines or soils, etc. The sensor constriction is durable and waterproof, making installation easy. It can measure a wide temperature range from -55°C to +125°C with an appropriate accuracy of ±5°C. Each sensor has a unique address and only requires one pin of the MCU to transmit data so it's a very good option for measuring temperature at multiple points without compromising a lot of your digital pins on the microcontroller as in figure(4).

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Figure 4: The temperature sensor

D) Parts of the system

The system consists of an Esp32 card, which contains the central processor that was programmed through the Arduino IDE program to identify the parts associated with it and related to the project, which are the DS18B20 temperature sensor and the TDS salt sensor, where the components were connected to each other as shown in Figure (5), where the terminals were connected The voltages of the temperature and salt sensors are to the terminals of the Esp32 card No. 1, which is the positive polarity, and the ground end of them has been connected to the terminal No. (2) in the card, and the data reading end of the temperature sensor is connected to the terminal (IO35) and the data end of the salinity sensor to the terminal No. (IO25) in the card Esp32 A resistor of 4.7 k is also placed on both ends of the temperature sensor as protection between the positive terminal of the sensor and the data transmission line.

V. SOFTWARE

With regard to programs, the Arduino C programming language is used, through which the chip is recognized and dealt with and all components of the system, in addition to the use of the Internet of Things (TingSpeak) cloud to save and process data continuously. The project's software requirements include programming the ESP32 chip using the Arduino IDE environment in addition to the ThingSpeak program. The data is via the USBCOM port, which is determined by the Arduino IDE program, and libraries and programming codes for the project are added via the aforementioned program and in the C++ language.

VI. THE MECHANISM AND METHOD OF THE PROPOSED SYSTEM

In the proposed system, the ESP32 is the central device that connects the input and output devices. Figure (3) shows how the proposed system works, as the system starts by taking inputs from the TDS sensors, salinity and temperature, then the system measures water salinity and temperature and displays them simultaneously via USBCOM, and the data is saved and updated Measurement of water quality salinity in the ThingSpeak IoT cloud, and then the data is described through graphs that are displayed on the main interface of the application.

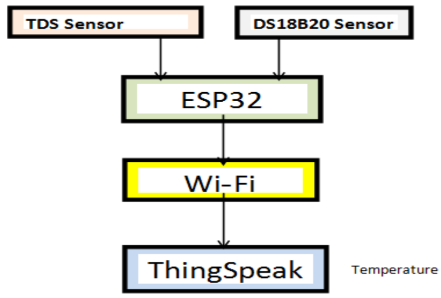

Figure 5: Block diagram of the salt inspection organization

VII. DATA ANALYSIS WITHIN THE THINGSPEAK PLATFORM

The platform enables real-time aggregation, visualization, and analysis of data streamed to the cloud Some of the core capabilities of the platform include the ability to visualize sensor data in real time (b) aggregate data on demand from external sources (c) harness the power of MATLAB to make sense of IoT data (d) build IoT systems without setting up servers or developing web software [6].

VIII. TESTING MECHANISM AND CONCLUSION

Samples of drinking water were examined for four sites within a specific geographical area in one of the neighborhoods of the city of Mosul (where the sites were chosen randomly, taking into account their regular distribution over the geographical area in terms of the beginning and end of the liquefaction water distribution lines) for a period of thirty days from 1/8 to 30/8 and for the periods so that the test times were divided into four times from 6 to 12 noon (a) from 12 noon to 6 pm (b) from 6 pm to 12 at night (c) from 12 at night to 6 am.

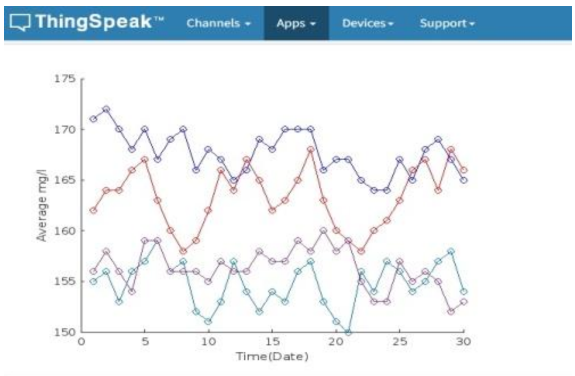

Figure 6: Represents the results of water salinity measurement for four time periods in one location

The average salinity of the site for all time periods, which ranges from Between 158 and 164, which is an indicator of water quality, being less than 300 mg / liter, as shown in Figure 7.

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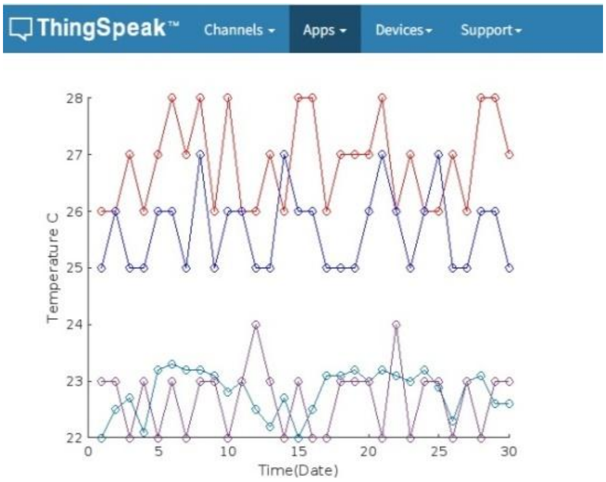

Figure 7: Average salts for all time periods

Equivalent temperatures for all measurements of salts were also measured and the extent of the effect of temperature changes on the accuracy of measuring water quality, as it is related to a direct relationship, as shown in figure 8.

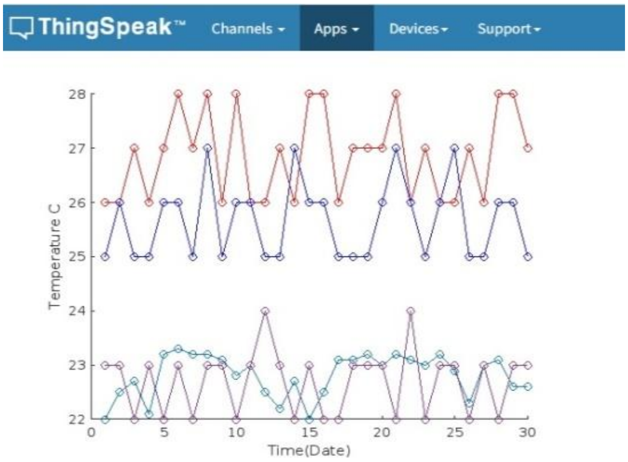

Figure 8: The effect of temperature changes on the accuracy of measuring water quality

Readings of salinity and temperature were obtained for all sites, and the average was extracted to know the quality and suitability of water in the area where the test was conducted, as shown in Table 1.

Table 1: Measurement of salinity rates for sites

The Heat	Salts			
Average	Average	Max	Min	Period
22.81	154.76	159	150	6-12 hours1
26.86	163.33	168	158	12-6 pm1
25.66	167.66	172	164	6-12 pm 1
22.70	156.30	160	152	6-12 am 1
22.50	159.50	163	158	6-12 am 2
27.20	172	167	168	6-12 pm 2
25.66	164.66	168	162	6-12 pm 2
22.56	156.90	165	153	6-12 am 2
22.73	164.06	168	160	6-12 am 3
27	175.13	178	171	12-6 pm 3
25.83	168.16	171	165	6-12 pm 3
22.66	162.13	167	158	6-12 am 3
22.53	177.56	180	175	6-12 am 4
27.26	185.06	189	182	12-6 pm 4
25.73	180.50	182	179	6-12 pm 4
22.60	176.26	179	174	6-12 am 4
	167.733	Salinity rate of water quality within the geographical area from which samples were taken		

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