Water Quality Analyzer using IoT

Manoharan.S, Sathiyaraj.G, Thiruvenkadakrishnan.K, Vetriselvan.G.V, Praveenkishor

Abstract: ***In the modern world, Water pollution is one of the major causes for various types of water-borne diseases such as dengue, cholera and malaria etc., for human beings. 40% of deaths in worldwide are caused by water pollutions. So, the quality of the drinking water needs to be measured in real time while it is supplied to consumers. In this article, author offered a design and expansion of a real time water quality measuring system at reduced cost using Internet of Things (IoT). To compute the physical and chemical parameters of the water such as temperature, pH, turbidity, conductivity (Total Dissolved Solids – TDS in ppm), and several sensors were used. The centralised system receives the measured values from various sensors over a period of time. Thorough the Wi-Fi system, the sensor output data is sent to the concern authority for further steps to improve the water quality. The water quality test carried out in the samples collected from various parts of the Coimbatore district.***

Keywords: Arduino UNO, Microcontroller 8051, GSM Module, IoT Module, Sensors, pH Measurement, Turbidity Measurement, Conductivity Measurement, Temperature Measurement, Centralised Monitoring System.

1. INTRODUCTION

Global warming was created in the 21st century due to increase in population. Because of this, there is no protection for the drinking water. In modern days, observing the water quality meets lot of consequences in real world, because of water resources are limited by global warming, increment of population, etc.

The most important factor, for human health and for socio-economic growth of country desires water. Not only for human beings, all the organisms, agriculture and industrialization need water is essential one.

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Across the world, water plays a major role because it satisfies all civilization demands but reserving portable water is rapid one and total amount of water present in the planet remains constant throughout the planet. Water resources is not handled properly in highly populated regions leads to discharge of toxic chemicals, climate changes, growing population, untreated sewage and other human activities. Results of scarcity problem and availability are inequitable, unsustainable and non-uniform spread of water throughout the planet additionally.

Most of the people in the world are using the ruined water with vector diseases unpredictable level of different pollutant for cooking and drinking. In this paper, we take India as an example for the most powerful nation and developing country in the world, as well as India faces more challenges on the economic side and growing of population. All the other developing countries give water as a basic requirement for 72% of the population lives and rural areas especially. Contaminated water supply deteriorated the safety for human and direct influenced by drinking. Infirmity and desolation leads to major caused by contaminated water. Hence, Water-Borne diseases such as dengue, cholera and malaria etc., are reduced for major health concerns. In India, infant mortality is major caused by diarrhoea. No proper cleaning of water and sanitation leads to 70% of diarrhoea cases.

II. LITERATURE INVESTIGATION

Akanksha Purohit and Ulhaskumar Gokhale [1] have applied a predictive approach for water quality measurement using GSM was studied. The standard of the water is measured by this system and the measured values are sent to the control center in a predefined time. The system consists with 8051 microcontroller and GSM.

Wireless Sensor Network (WSN) is presented by Dong He and Li-Xin Zhang [2] for wireless water Quality supervising Network and Remote Data Center. the water quality is sampled by the WSN and the results has been transferred to internet via GPRS date terminal unit (DTU) which has built with TCP-IP protocol. The sensor network is built in unity with Zigbee wireless communication agreement.

Dr. Seema Verma and Prachi [3] have suggested the wireless sensor network application in water quality measurement. For, pro-active water quality management, the Wireless Sensor Network (WSN) is mesmerized us, because of their real-world, nonstop and vibrant nature in early warning system. So this WSN can activate suitable alarm in dangerous situations.

Mo Deqing and Zhao Ying and Chen Shangsong [4] have projected a water quality measuring system; it consists with information communication unit, numerous sensors for water quality testing, data acquisition module with single-chip microcontroller unit, monitoring center. Water quality is detected without human intervention under the control of single-chip microcontroller using various parameters.

III. IMPLEMENTATION

System Design

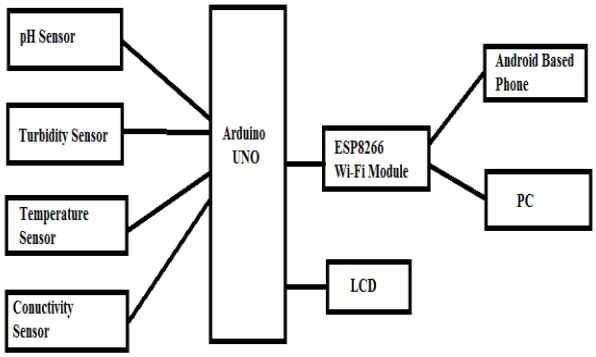

Fig. 1 Water Quality Monitoring System

The block diagram of the water quality measuring system is shown in fig.1 and different sensors which sense the qualities of water and then send to the microcontroller. After processing the various parameters of water, the microcontroller will send to the corresponding authority via Wi-Fi module ESP8266.

Circuit Diagram

The execution of the projected system is shown in Fig. 2. It consists of pH, temperature, electric conductivity (EC) and turbidity sensors. The sensor data's are processed in the Arduino module and shifted by means of the ESP8266 Wi-Fi data transfer unit to the main server. The authorized users can access this data by sorting their account using a User ID and password. The collected data is, undergoing various stages such as process, analysis, transmit and finally display the data in real time users. The ESP8266 is a self contained SOC Wi-Fi Module with integrated TCP/IP protocol stack. It permits the microcontroller unit to right of entry to the WiFi network. This low-cost Wi-Fi microchip is manufactured by M/S Espruino [5]. The Arduino microcontroller unit is based on embedded trace support and real time emulation. This ESP8266 uses serial transmitter/receiver (Tx/Rx) for sending and receiving the data in Ethernet buffers, and serial commands to uncertainty and modify the configurations of the Wi-Fi module.

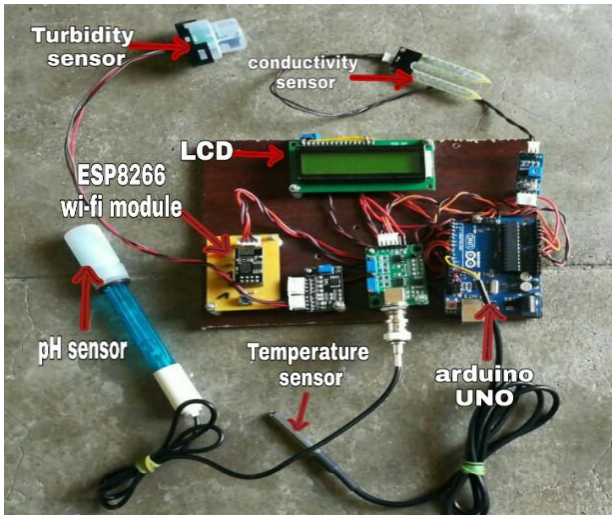

Fig. 2 Execution of the proposed project

This module is directly connecting the microcontroller, so we can start approaching the data up to the main server.

Components Description

Sensor

A sensor is a device which is used to detect and response to some type of input from the physical surroundings. The specific inputs are pressure, motion, heat, light, moisture or any other environmental phenomenon. Generally a signal may be produced as outcome which is changed to readable display in the sensor locality or transmitted by machine over a set-up for analyzing the signal for supplementary processing. The subsequent sensors are used in this research work.

pH Sensor

The pH level in the water is an pointer to give an indication about the amount of hydrogen ions forming in the certain quantity of water. An alkaline solution has less positively charged ions than the acidic solution, so it has the ability to produce an electric current. Due to this action, the pH meter might work as a voltmeter which measures the electric potential induced by the acidic solution. The pH difference is is measured by comparing the produced electric potential with the known value and it is deducted.

Turbidity Sensor

The turbidity level of water is measured by turbidity sensor which used to detect the water quality by measuring. It has the ability to detect the pendant particles in the water. This is done by measuring the light transmittance and scattering rate; it leads for the changes in the amount of total suspended solids (TSS) in water. If TSS increases which results increase in the liquid turbidity level. It proves that clean water contains low turbidity [6].

Temperature Sensor

The DS18B20 is a Digital Thermometer which offers 9 to 12-bit (configurable) temperature impression.

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Temperature revealing is the basis for all complex form of temperature compensation and control. The DS18B20 corresponds over a single Wire bus for data transfer with main server.

Electric Conductivity Sensor

The ability of a solution is to pass or carry an electric current is named as Conductivity of the solution. Specific conductivity measurement is important for determining the impurities in the water. Total dissolved solid particles (TDS) in the water, determines the amount of salts and minerals exist in the water.

IV. WORKING

The analog data's captured by all the four sensors are sent to the microcontroller through, Analog to Digital converter. After processing the digital information in micro controller unit where analysis done and the water quality is identified and those parameters were sent to the person who is operating with the instrument via SMS. The same will be displayed in the LCD display unit of the microcontroller. Through the Wi-Fi module, the web page is linked with the microcontroller. The central monitoring system receives the measured value. Based on the received data, the corporation authorities will take necessary action for their further decision. Through which, the water pollution and the water born disease will be controlled. Fig.3 indicates the displayed values of various water quality parameters. The simulation code is developed in Embedded-C software.

Fig. 3 output of water quality parameters

V. INTERNET OF THINGS (IoT)

Internet of Things is ecology system of linked physical substance whcih is available through the internet. The 'things' in IoT might be a human being with a heart monitor or an vehicle with built-in-sensors, i.e. substance that have been allotted with an Internet Protocol address and it has the skill to gather and move the data over a system without physical help or involvement. The embedded technology used in the substance makes them to work together with internal or external surroundings, which influence the results taken.

Thing Speak

Thing Speak™ is IoT analytics podium services which allow us to cumulative, imagine, and analyze the live data streams in the cloud. As a result, it is easy to transfer the data to Thing Speak from our device. Thing Speak can post the measured data to store in the cloud [8].So the instantaneous visualizations of real time live data and alerts will be given to the authorities using web services.

VI. RESULTS

ThingSpeak software permits the Authorized users to access the measured data by logging on as shown in Fig. 4. By providing the registered user ID and password, the parameters are displayed in real-time in the form of graphical representation. Fig 5(a, b, c, d) shows the measured various water parameters such as, Turbidity, Conductivity, Temperature, pH using IoT respectively for different date I the month of March and April 2019. The water samples were obtained from various parts such as Kurichi Lake, Sundakamuthur lake outer area and nearby valaangulam in Coimbatore district. The test was conducted several times to measure the water quality. Based on the above said data, the corporation authorities can take necessary action. Through which, the water pollution and the water born disease will be controlled in the district.

Fig. 4 Log in page of Thingspeak

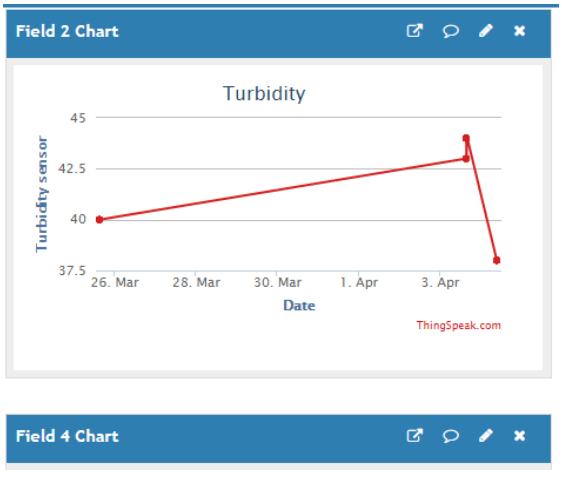

Fig. 5(a) Measurement of Turbidity

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Fig. 5(b) Measurement of Conductivity

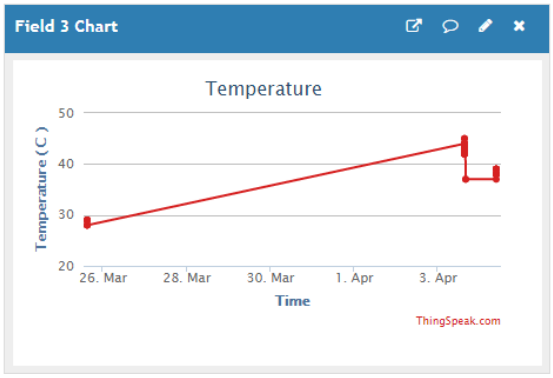

Fig. 5(c) Measurement of Temperature

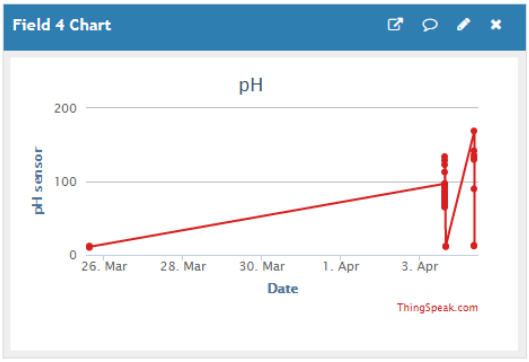

Fig. 5(d) Measurement of pH

VII. CONCLUSION

The water quality parameters such as pH, turbidity, temperature and electric conductivity are observed and tested in real time. Based on the measured data, corporation officials will track the pollution level occur in the water bodies. It will help them to take proper steps to control the pollution level within the threshold limit. Rapid actions can be taken to control tremendous levels of pollution like in the case of the Yamuna and Ganga rivers. The major advantage of the proposed work is, simple for installation and it can be placed very close to the target area. This device can be operated with less trained persons also.

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