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Research Article

Design and Implementation of IOT based real time Monitoring System for safe drinking water using Arduino uno

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ABSTRACT: In the field of information and technology, the Internet of Things (IoT) is a relatively new paradigm. Its goal is to make life easier and more comfortable for people by giving simple methods and procedures for doing daily chores. Pollution, particularly water pollution, has become one of the biggest concerns confronting governments around the world in recent years. The increased number of factories and vehicles resulted in the discharge of filthy water and chemicals into rivers, seas, and ponds. As a result, it is critical to continuously monitor water quality in order to take quick action to combat water contamination. The general composition of water in terms of its chemical, physical, and biological aspects is referred to as water quality. Water is a finite natural resource that is vital to human survival. The goal of this study was to develop a low-cost IoT-based system for monitoring water quality in real time. The system is designed and implemented with the help of arduino and sensors (pH, turbidity, temperature and ultrasonic). The Arduino-style board and Nodemcu with built-in Wi-Fi for sending sensor data over the internet.
Keywords: IoT, wifi, cost-effective.

I. INTRODUCTION

There were many inventions in the twenty-first century, but at the same time, pollution, global warming, and other issues arose, and as a result, there is no clean drinking water for the world's pollutants. Water quality monitoring in real time is becoming more difficult as a result of global warming, limited water resources, population growth, and other factors. As a result, better approaches for monitoring water quality metrics in real time are required[1]. The parameters of water quality The concentration of hydrogen ions is measured by pH. It indicates whether or not the water is acidic or alkaline. Water with a pH of 7 is pure; water with a pH of less than 7 is acidic, and water with a pH of more than 7 is alkaline. The pH scale ranges from 0 to 14. It should be between 6.5 and 8.5 pH for drinking. Turbidity is a measurement of how many suspended particles are visible in water. Collera says that the higher the turbidity, the greater the risk of diarrhoea. If the turbidity is low, the water is safe to drink. The DHT-11 sensor detects how hot or cold the water is. Ultrasonic sensor is a device that measures the flow of water. The manual collection of water is one of the classic ways of water quality monitoring.

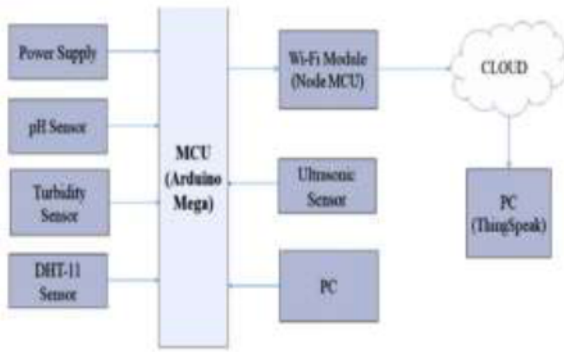

Fig.1: Water quality monitoring related to cloud

Freshwater is a global resource that is a gift from nature and vital to agriculture, industries, and human life on the planet. Drinking water facilities are currently confronted with new real-world issues. Due to limited drinking water resources, high financial demands, rising population, rural urbanisation, and inappropriate exploitation of maritime resources, People's water quality has deteriorated dramatically as a result of salt extraction. Chemicals in manufacturing, construction, and other businesses, as well as fertilizers in farms and the direct discharge of polluted water from industry into surrounding water bodies, have all played a significant role to the deterioration of global water quality, which has become a major issue Even as a result of containment water, various water born are increasing day by day, resulting in the death of many people

II.LITERATURE REVIEW

Lambrou etal. (2014) the creation and deployment of a portable, mobile, cost-effective, and dependable water level control system were presented. The authors employed two radio frequency (RF) transceivers and a transmitter positioned on the tank and sump at the location where they wished to check the water quality. The radio frequency transceivers (RF transceivers) used for wireless connection with the internet server. Unless the water in the bottle is drained or overflowing, the system is entirely programmed by the user with the help of a microcontroller. The sensor array is used to monitor dissolved oxygen, tumble, pH, temperature, and other characteristics. Because of the wireless system, installation costs are decreased.

Prasad et al. (2015) the smart Water Quality Monitoring (WQM) and this article show a device for Fiji that uses IoT and remote sensing technologies. Fiji's Pacific Islands require regular data collection and analysis for water quality monitoring, as well as uploading this data to a server. The authors used Internet of Things (IoT) and remote sensing technologies to assess water quality. Remote sensing can improve the accuracy of present measurements. Throughout the test period, the system proved its usefulness by providing reliable and consistent data using IoT for real-time water monitoring. These authors' system also included a GSM module for sending data to a mobile user through SMS.

Omar Faruq et al. (2017) this study describes a microcontroller-based water quality monitoring system for those living on the fringes of Bangladesh, where safe drinking water is scarce. The gadget is highly accurate and sensitive to a variety of water characteristics, including temperature, turbidity, and hydrogen potential. The information was presented on the LCD monitor. Finally, each parameter value is compared to predefined equipment in this work, and sensor values and error are determined.

III. EXISTING SYSTEM

Internet of things (IoT) is relatively a new paradigm in the area of information and technology. It aims at making life easier and more comfortable by providing easy ways and mechanisms to handle day to day tasks effectively. In recent years, the pollution especially water pollution has become one of the major issues that is faced by countries around the world. The increase of amount of factory and vehicle had caused the emission of plague water and chemical to the river, sea and pond

IV. PROPOSED SYSTEM

The system under discussion is an IoT-based water quality monitoring system that uses sensors to detect cloudiness, acidity, temperature, and level in various water samples. Figure 4.1 depicts the proposed system's architecture, which includes sensors for pH, turbidity, temperature, and ultrasonic to monitor various water parameters they're connected to an Arduino board and nodemcu with built-in Wi-Fi capabilities. ThingSpeak IoT-based Platform is used to send and save data to the cloud. Temperature and ultrasonic sensors are digital, whereas pH and turbidity sensors are analogue. This system can be used in any sector, as well as in the household, a retail mall, a university campus, and a laboratory. According to the statistics collected.

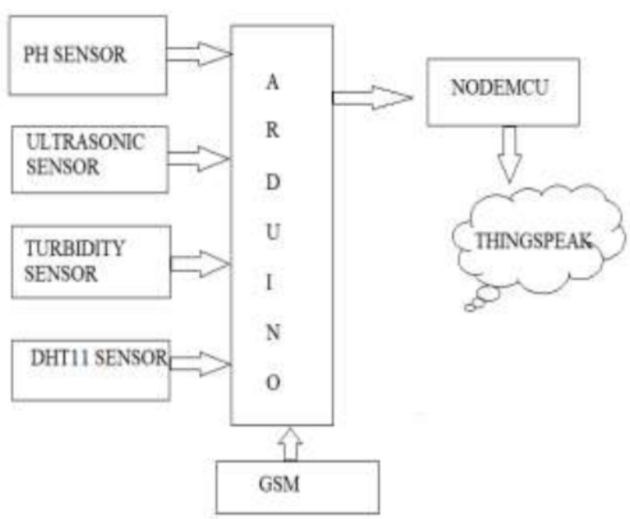

Fig 4.1: Block diagram

Different parameters of water have been examined using various types of sensors in order to ensure safe drinking water, as shown below:

Turbidity sensor: Turbidity is a measurement of how cloudy water is. The degree to which water loses its transparency is measured by turbidity. It is regarded as a reliable indicator of water quality. Turbidity prevents submerged aquatic vegetation from receiving the light it requires. Because suspended particles at the surface facilitate the absorption of heat from the air, it can also raise surface water temperatures over normal.

Fig 4.2: Turbidity sensor

pH sensor: The acidity or alkalinity of a solution is measured by the pH of that solution. The pH scale is a logarithmic scale with a range of 0 to 14, with 7 being the neutral point. A basic or alkaline solution has a number more than 7, while an acidic solution has a value less than 7. It runs on a 5V power supply and is simple to connect to an Arduino. pH levels should be between 6 and 8.5.

Fig 4.3: pH sensor

Ultrasonic sensor: For these applications, ultrasonic sensors are dependable and cost-effective equipment. The sensor is positioned over the water when it is in use. It sends out a sound pulse that reflects off the water's surface and measures the time it takes for the echo to return to determine the distance to the water.

Fig 4.4:ultrasonic sensor

DHT11 Sensor

This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor capability. It is integrated with a high-performance 8-bit microcontroller. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sensor for wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high performance.

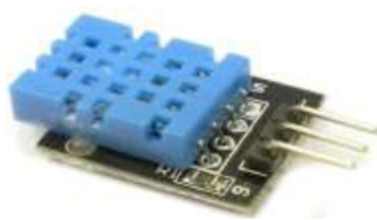

Fig 4.5:dht11 sensor

GSM:

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

Fig 4.6: GSM

V. RESULTS

The Arduino microcontroller board is based on the ATmega328P microcontroller. There are 14 digital input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button on the board. It comes with everything you'll need to get started with the microcontroller. Arduino Software (IDE) was the first Arduino releases, which have since been superseded by subsequent versions. The Arduino Uno board is the first of a series of USB Arduino boards and the platform's reference model; see the Arduino index of boards for a comprehensive list of current, historical, and obsolete boards.

The system's entire design is built mostly on IOT, a relatively new notion in the development world. The hardware and software components are the two main components. The hardware element includes sensors for measuring real-time values, an arduino atmega328 for converting analogue values to digital values, and an LCD for displaying sensor output. A Wi-Fi module connects the hardware and software. We created a software programme based on embedded c language.

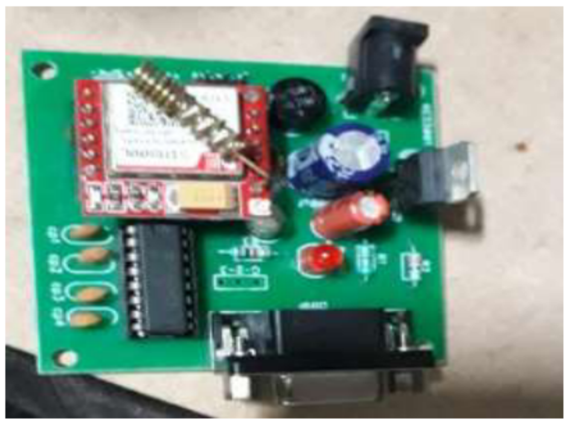

Fig: 5.1

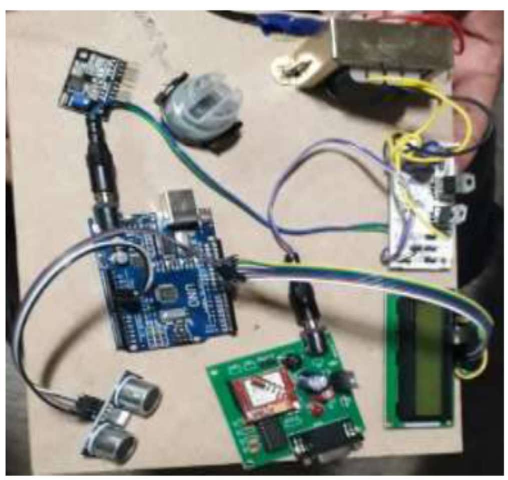

Fig: 5.2

Fig: 5.3

We have monitored results for water parameters including pH, turbidity, temperature, level at ThingSpeak. Time to receive sensor values on ThingSpeak IoT based cloud service, can depends upon parameters such as sensor manufacturer, environmental conditions, speed of internet etc. Each sensor is placed into various water samples with samples of known pH, turbidity, temperature and level values. It was observed that sensors also changed values accordingly which were displayed on ThingSpeak graphical web-based interface.

• Water pH results When sensor is placed into different water sample with different pH that present then pH sensor takes some time to measure it and value is settled. Response time of pH sensor is approximately 1 minute. The pH of acidic water is below 7, pH of basic water is above 7. The pH of pure water is equal to 7. It is drinkable if pH of water remains in between 6.5 and 7.5.

Fig: 5.4

• Water turbidity results Turbidity measures transparency of water therefore if water becomes muddier then turbidity increases the below figure shows the result of water turbidity. Response time of turbidity sensors is approximately 5 to 10 seconds. As long as turbidity sensor is inside same water sample, turbidity values are constant but while turbidity sensor is taken outside muddy water then turbidity values sharply goes down and soon after it rises up because of new water sample and shows new turbidity value.

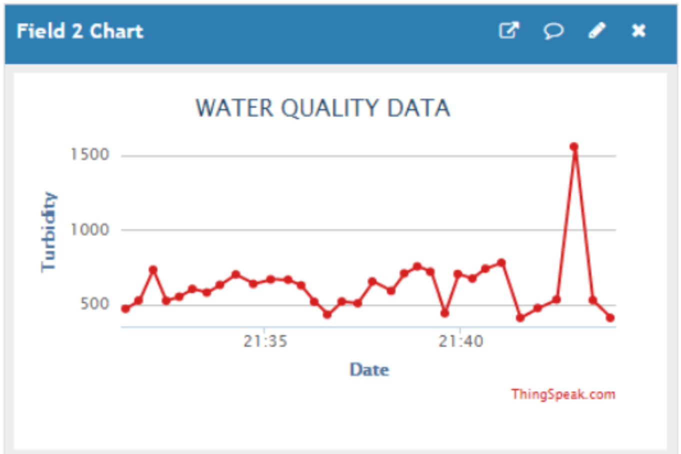

Fig: 5.5

• Water temperature results Response time of temperature sensor is even less than 5 seconds. As soon as temperature of water changes it settles down its value within few seconds. This figure shows temperature results for different samples.

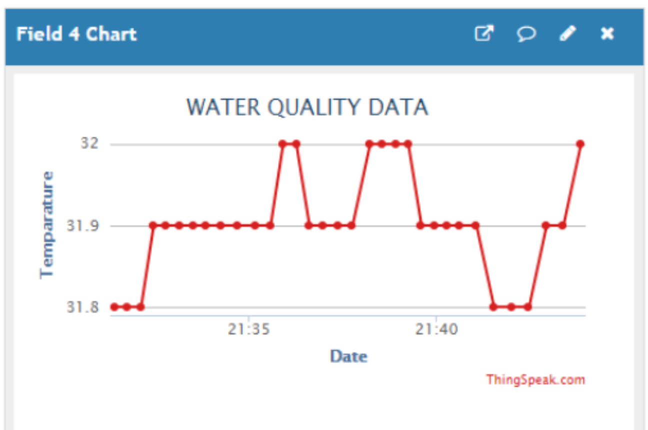

Fig: 5.6

• Water level results Water level monitoring provides distance in centimeters about available space in water tank. It depends upon size of tank. In presented work 100 cm long tank has been used. Below Figure shows different values for different water levels. Result of completely filled tank should be zero.

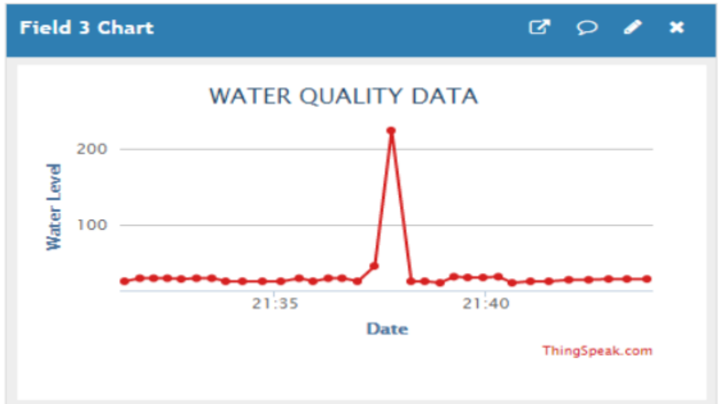

Fig: 5.7

- Channel status:
  This gives an information regarding the water quality and quantity whether the water is Having the ph is good or not ,turbutity of the water,water level in the containor.

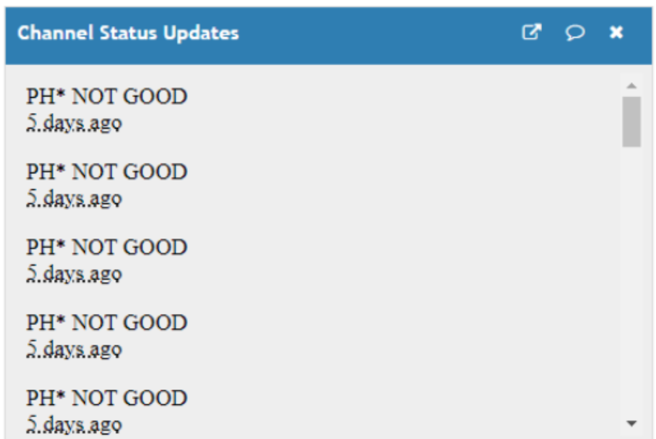

Fig: 5.8

GSM send the message to mobile phone which is registered.

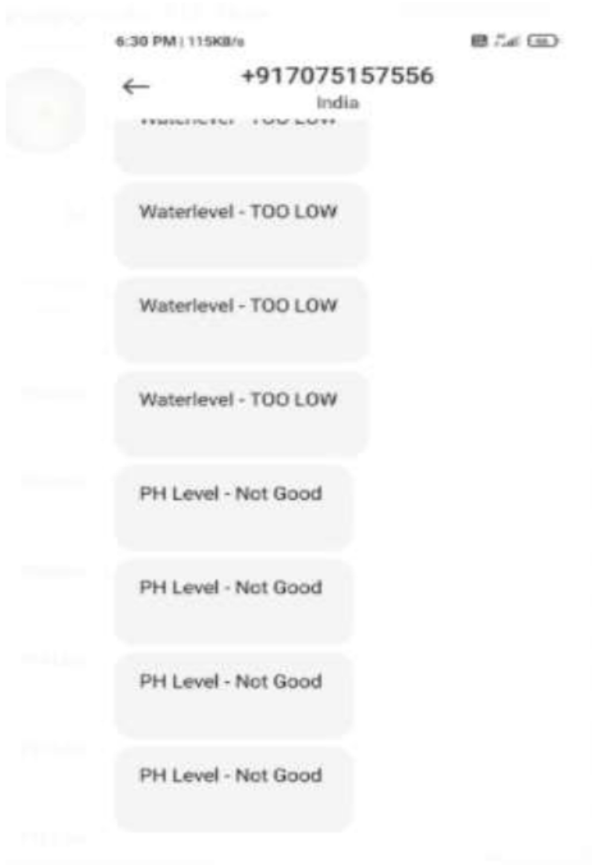

Fig: 5.9

VI. CONCLUSION

The solution for an IoT-based water quality monitoring system is presented in this project. The IoT-based technique of water quality monitoring is quick, cost-effective, and gives real-time findings. It may be simply applied in homes, industries, water filter plants, and hospitals to provide low-cost service anywhere, at any time. The project hardware includes the setup of four distinct types of sensors, including pH, turbidity, ultrasonic, and temperature sensors, as well as an Ardunio board and nodemcu with internet connection. The results showed that sensors were able to detect water quality indicators correctly, and data from the sensors was successfully sent to the ThingSpeak IoT-based cloud for water quality monitoring via an internet connection on PC. ThingSpeak IoT-based cloud server updates four sensors data every fifteen seconds for free; for more sensors and a faster refresh rate, one may either buy such a service or create one themselves. Previous study, to the best of our knowledge, did not assess cost effectiveness or time savings for a water quality monitoring system. Through GSM(**G**lobal **S**ystem for **M**obile Communication) gets the message to mobile.

Future Scope:

- In future we use IOT concept in this project
- Detecting the more parameters for most secure purpose
- Increase the parameters by addition of multiple sensors
- By interfacing relay we controls the supply of water

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