IMPROVING THE WATER QUALITY MONITORING SYSTEM BY USING IOT

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ABSTRACT

Water quality system is a concept where issue of globally polluted water can be solved with the help of IoT by monitoring the quality of water. The internet of Thing (IoT) is used in different areas of research for monitoring, collecting and analyzing data from remote sites. This paper presents is based on reconfigurable interface device for water quality monitoring (WQM) in an IoT environment. In the proposed work, Arduino uno is used as a core controller. The system mainly focuses on IoT which is new scenario to make the city smart with different applications. Proposed system consists of Arduino used as minicomputer, different sensors such as water level sensor, pH sensor, temperature sensor, CO_2 sensor, turbidity sensor are used. Sensors collect the data and send it to Arduino uno. This system will estimate quality of water by continuous monitoring and controlling it with the help of central server, which is possible by using this system.

Keywords: *Water quality monitoring(WQM), Arduino uno, water level sensor, pH sensor, temperature sensor,CO_2 sensor, turbidity sensor.*

I.INTRODUCTION

As the Internet of Things (IoT) involves every aspect of human daily chores nowadays, the applications of IoT bring the potential resolutions in healthcare services, education, smart building, environmental monitoring and additional chapters of modern living. Recently, the environmental monitoring technology has been increasingly important due to the climate change, natural disasters and natural hazards [1-3]. The environmental monitoring application consists of multiple sensors that detect and monitor sensor data in IoT environments [4]. Therefore, low power consumption and low-cost sensors are important criteria in the implementation of network in IoT. For environmental monitoring applications, the number of sensors deployed in IoT is the primary factor of high cost for better replacement and servicing. Therefore, the selection of hardware components such as sensors, microprocessor and wireless communication protocol is the priority issue for the implementation of energy-constraint sensor nodes in a remote environment. The system needs to be user friendly, flexible and affordable. Hence, the selection of software is also important.

In order to ensure the safe supply of the drinking water the quality needs to be monitored. The proposed work presents a design and development assistance for monitoring of the water quality in IoT, the system consists of several sensors which is used for measuring physical and chemical parameters of the water parameter such as temperature pH, turbidity, CO2 of the water. The measured value from the sensor can be processed by the microcontroller. The Arduino uno can be used as a core controller. In this work main focus is on continuous and real-time monitoring of water in IoT platform. Internet of things is nothing but the network of physical objects embedded with electronic sensor software and network connectivity. Monitoring can be done from anywhere as central office. Using free server data continuously pushed on cloud so we can see data in real-time operation using different sensors with Microcontroller Arduino as minicomputer can monitor data and also control operation from server with efficient client server communication. IOT-based smart water quality monitoring system presents smart sensor interface device for water quality monitoring system in an IoT environment. This system detects and display various parameters of water level continuously. Thus, for making drinking water fit for human consumption, it has to free from sediments, minerals, bacteria's etc. which affects the human health of human being.

Traditional method of water quality involves the manual collection of water sample at different locations, followed by laboratory analytical techniques in order to characterize the water quality. Such approach takes longer time and no longer to be considered efficient. Although the current methodology analyzes the physical, chemical and biological agents, it has several drawbacks. Therefore, there is a need for continuous water quality monitoring in real time. In the present work the proposed approach design and develop a robust system for monitoring of the water quality using IOT environment. Where IOT describes the network of physical objects things that are embedded with sensors software and other technologies for the purpose of connecting and exchanging data with the other devices and systems over the internet [5].

II Related Work

Cho Zin Myint [6] et. al. Propose smart WQM system of single chip solution to interface transducers to sensor network using FPGA is presented with wireless method by using a wireless XBee module. The results of the five parameters of water quality are verified that the system achieved the reliability and feasibility of using it for the actual monitoring purposes. The proposed system will assist in protecting the ecological environment of water resources. The smart WQM system minimizes the time and costs in detecting water quality of a reservoir as part of the environmental management. The WSN network will be developed in the future comprising of more number of nodes to extend the coverage range.

M Cho Zin [7] et. al. Wireless real-time WQM system in IoT has been designed and implemented to measure five water parameters. The system achieves high execution speed as the water data is detected

within 1 or 2 minutes after the switched is on and the system executes parallel processing. The proposed system exceeds the performance of the existing microcontrollers-based WSN design by utilising the FPGA SoC board. The experimental results of the proposed design offer reliable outcomes which are lowcost, low power consumption, strong communication ability, and reliable real-time measurement. The current system can be additionally upgraded by integrating additional sensors for a broader measuring area.

Jinfeng and Shun [8] designed an aquaculture water quality monitoring system using MSP Microcontroller and zigbee wireless module. The system collects, transmits, displays and queries the water quality parameters such as temperature, dissolved oxygen concentration, pH value and water level.

Vijayakumar and Ramya [9] designed a real time water quality monitoring system in IoT environment. The system consists of multiple sensors to monitor water parameters and raspberry pi B+ model as the main controller.

Akila et al. [10] proposed the water quality monitoring system that detects the pH and temperature of the river water using sensors and Arduino board.

Libeliums [11] Initiatives have been taken all over the globe to develop projects based on sampling water to aid in controlling marine environments. Libeliums Smart water device monitors the status of an aquarium's health in Europe. It specifically monitor parameters like pH, electro conductivity, oxidation / reduction potential and temperature. A cloud-based solution developed to help in monitoring data in real time providing a fast and effective reaction in case of risiamo abnormalities.

Postolache et al. [12] developed embedded software to monitor water quality using PIC Microcontroller, MPLAB and C compiler. In the proposed system, the software for data communication, data logging and graphical representation of the water quality data was developed in LabVIEW software. A similar example to that of this project can be seen in the coastal water pollution monitoring initiatives in the Gulf of Kachchh with the only difference being in terms of it having a much larger scope and vastly more expensive protocols deployed to counter the effects of the industrial development. Furthermore, locally there have been projects based around the conservation of the coral reefs. The mamanuca environment society's Biannual sea water monitoring program has been around for 4 years whereby tests are carried out on seawater for fecal coliform bacteria, salinity and nutrients which helps in ascertaining the health of the surrounding reefs. Research indicates that projects of this nature are developed on a large scale with generous funding from reputable organizations. There is little indication of small scale and inexpensive projects that have a similar role in places like marine jetties, cities and industrial rivers to preserve aquaculture and public health. By applying a strategic, cheap and methodical technique this project hopes to achieve this in an effort to sanitize our oceans.

III. Proposed Methodology

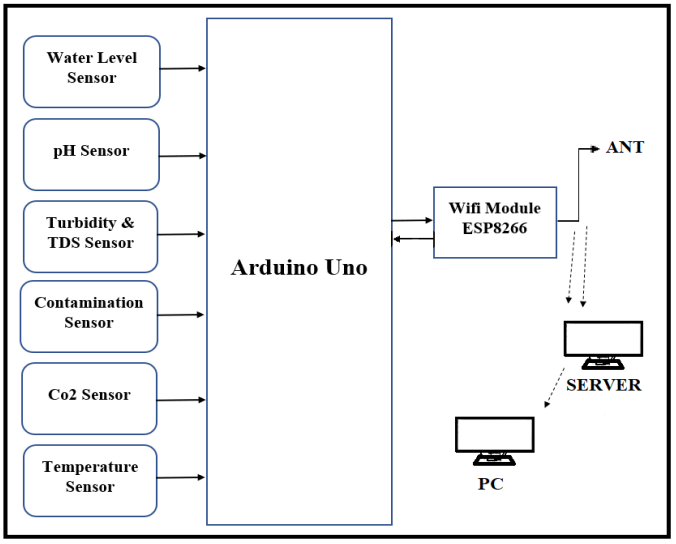

Figure 3.1: Block diagram of Proposed System

In this, we present the theory on real time monitoring of water quality in IoT environment. The overall block diagram of the proposed method is explained. Each and every block of the system is explained in detail. In this proposed block diagram consist of several sensors (water level, temperature, pH, turbidity and TDS, Contamination,Co2) is connected to core controller. The core controller are accessing the sensor values and processing them to transfer the data through internet. Ardunio is used as a core controller. The sensor data can be viewed on the internet wi-fi system. pH sensor: The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with arduino.The normal range of pH is 6 to 8.5.

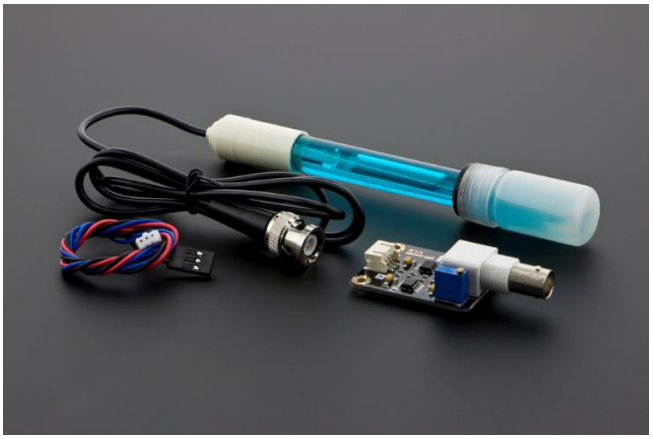

Fig3.2: pH sensor

Turbidity sensor: Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

Fig3.3 : Turbidity sensor

Temperature sensor: Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature.

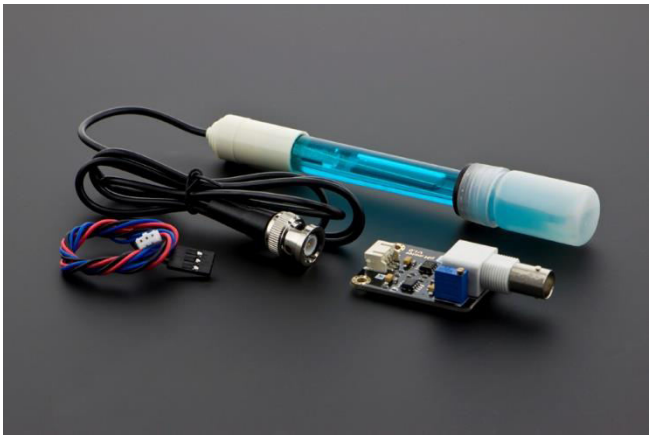

Fig 3.4: pH sensor

Arduino Uno: Arduino is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards .

Fig3.5: Arduino uno

- **Execution Flow of model**

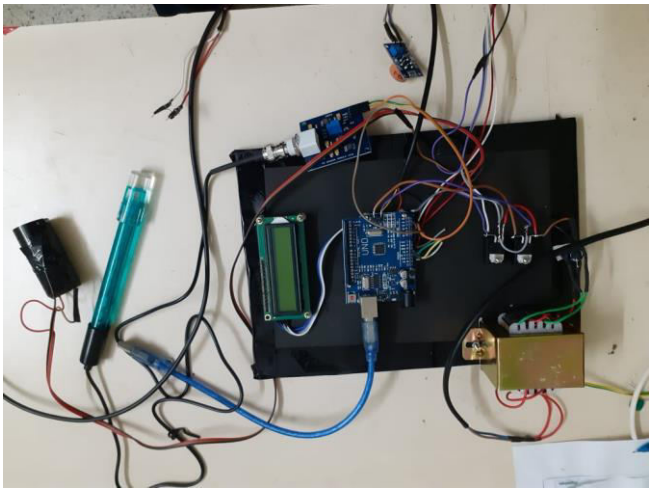

Fig3.6: Execution Flow of Model

The whole design of the system is based mainly on IOT which is newly introduced concept in the world of development. There is basically two parts included, the first one is hardware & second one is software. The hardware part has sensors which help to measure the real time values, another one is arduino atmega328 converts the analog values to digital one, & LCD shows the displays output from sensors, Wi-Fi module gives the connection between hardware and software. In software we developed a program based on embedded c language. The PCB is design at first level of construction and component and sensors mounted on it. BLYNK app is installed in the android version to see the output. When the system get started dc current given to the kit and arduino and WIFI gets on. The parameters of water is tested one but one and their result is given to the LCD display. The app went provided with hotspot gives the exact

value as on LCD display shows on kit. Thus like this when the kit is located on any specific water body and WIFI is provided we can observe its real time value on our android phone anywhere at any time.

IV. RESULT

We have identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities are shown in figure. In this implementation model we used ATMEGA 328 with Wi-Fi module. Inbuilt ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated. After sensing the data from different sensor devices, which are placed in particular area of interest. The sensed data will be automatically sent to the web server, when a proper connection is established with sever device.

The output on the LCD display can be seen as shown in following figure. The reading for PH, Temperature (In Celsius),Turbidity and Level are available on the liquid crystal display

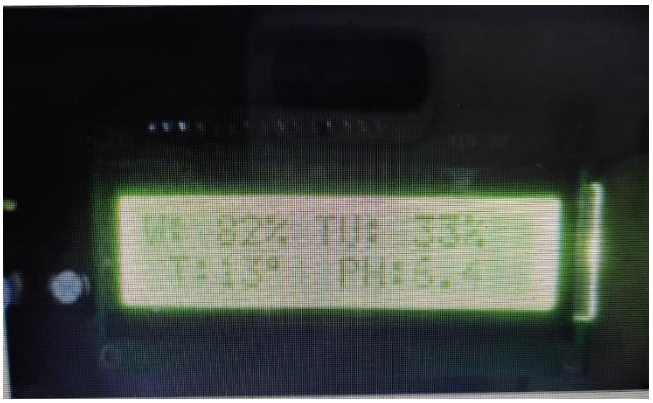

Fig 4.1: Sensors Readings on LCD (for water sample)

Observation Table

Water Sample	Sample 1	Sample 2	Sample 3
Parameter			
PH	6.4	7.4	11
Temperature(in celcius)	13	0	100
Turbidity	33%	11%	57%
Level	82%	82%	82%
Remarks	Acidic water	Drinkable water	Harmful water

In this work, we are using different types of water and have used sensors like pH, Pt100, Turbidity and Level. These sensors sense the respective parameter of waste water and send to processor. The processor takes the
values on Liquid Crystal display (LCD) and our system also displays these values on GUI of VB through wireless module.

V.CONCLUSION

Due to the impact of polluted water globally tremendous changes are taking place towards development of a smart sensor interface device for water quality monitoring system in an IoT environment. IOT-based smart water quality monitoring system is designed and developed a reliable and efficient technique to monitor quality of water by continuous monitoring and also controlling it from a central server. The system minimizes the time and cost in detecting water quality of reservoir as part of the environmental management. This system detects and display various parameters of water level continuously for making drinking water fit for human consumption. The develop system will provide low-cost and low operating time as a solution to continuous water monitoring.

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