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WATER QUALITY MONITORING SYSTEM USING IOT

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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 worldwideare 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, Humidity, pH, turbidity. Water contamination is likely the best dread for the green globalization. To guarantee the made sure about stock of the drinking water the quality should be screen tirelessly. In this paper we present a course of action and progress of an effortlessness framework for nonstop checking of the water quality in IOT(internet of things).The structure include several sensors knows about assessing physical and creation parameters of the water. The parameters, for example, Thermo, PH, turbidity, Humidity. The cognizant attributes from the sensors can be set up by the center controller. The ATMEGA328 model can be utilized as a center controller. Finally, the sensor information can be seen on internet utilizing WI-FI framework. The controlling device for the automation in the project is a Microcontroller. The data sent from PC over Wi-Fi will be received by Wi-Fi module connected to Microcontroller. All components are associated to microcontroller Arduino. Arduino ATMEGA328 micro controller used to process input and produce output by using ARDUINO IDE with Embedded C programming and operated through Regulatedpower supply which gives 5v of DC voltage to all hardware modules.

Keywords: Water quality management, Internet of things, Arduino controller, pH sensor, Turbidity sensor.

1. Introduction

Water plays a vital role in the creation of human beings and other natural phenomena. About80% of diseases in the developing country are caused by the consumption of polluted water. As weall know, water is not only used for drinking purposes, it has other uses too such as; economic aspects, industrial sites, agriculture, fishing, and other constructive activities. The quality of wateris mainly affected by physical, chemical, and biological aspects. The main sources of water are lakes, rivers, glaciers, groundwater, rainwater, etc. Water is available in every part of the earth whether it is polluted or not. About 80 percent of Earth's land iscovered by water. In our day-to-day life water plays one of the most important roles for living beings on earth. Quality of water is getting very serious attention in our generation. So, to live a healthy and prospective life, checking the water quality is very important. In the past, water quality has been measured by taking the water samples and sending themto the laboratories, and examining them, which is very costly, time-consuming, and involves more human resources. This process will not provide real-time data and lead us to the impure quality of water. The proposed water quality monitoring systems consisting of a microcontroller withcommon sensors are compact and very useful for to measure the pH, turbidity, temperature and humidity of the water, continuous and real-time data. In summary, the introduction of a water quality monitoring system is an essential step towards ensuring the safety and

sustainability of water resources. It provides crucial information that can be used to manage and protect water quality and ensure that water resources are used responsibly. In the current era, we are moving towards making our cities as the smart cities, due to the lot of technological research and inventions over the decades. So the current era is said to be era ofinventions, era of development, era of globalization and the era of smartness etc. But the counter side of the same is that the current era of the pollution, global warming, insecurity and miserable health factors. The main causes for this are the ignorance of people & government sector and the deficient water quality monitoring system, which results in serious health issues.

2. LITERATURE SURVEY

Pasika and Gandla (2022) [1] proposed a monitoring system which consists of a number of sensors usedto measure several quality parameters like turbidity, pH value, water level in the tank, dampness of the adjoining environment and temperature of the water. The sensors are interfaced with the Microcontroller Unit (MCU) and additional processing is executed by the Personal Computer (PC). The acquired data will be directed to the cloud by means of Internet of Things (IoT) based ThinkSpeak ap-aplication for monitoring the quality of the water under test. As a future directive, work should be extended for analyzing some other parameters such as nitrates, electrical conductivity, dissolved oxygen in the water and free residual chlorine. Mukta et al (2021) [2] developed an IoT based Smart Water Quality Monitoring (SWQM) system which helps in incessant measurement of quality of water on the basis of four different parameters of water quality i.e., pH, temperature, turbidity and electric conductivity. Four different sensors are coupledto Arduino Uno in order to sense the quality parameters. The data collected from all the four sensorsare communicated to a desktop application which is developed in .NET platform and the extracteddata are matched with the standard values. On the basis of the collected data from sensors, the developed SWQM model will efficaciously examine the water quality parameters by employing fast forest binary classifier for classification of the sample of water under test is whether potable ornot. Konde and Deosarkar (2021) [3] proposed a method for developing a Smart Water Quality Monitoring (SWQM) system with reconfigurable sensor interface device using IoT environment. Sensors, Field Programmable Gate Array (FPGA) board, Zigbee based wireless communication module were usedin the proposed model. Six different water quality parameters like turbidity, pH, humidity, water level, water temperature and carbon dioxide (CO2) on the surface of water were considered in real-time. The proposed method will provide assistance in guarding the safer and balanced environmentof water bodies. The SWQM system reduces the cost and time in determining the quality of water in water resources as part of managing environmental and ecological balance. In the suggested future work, WSN network will be developed involving of additional number of nodes to encompass the coverage area.

Amruta and Satish (2021) [4] proposed a Solar Powered Water Quality Monitoring system by employing wireless Sensor Network. Underwater Wireless Sensor Network (UWSN) is the elementary component in the water quality monitoring using wireless sensor network (WSN) technology whichis powered by photovoltaic panels or solar panels. For monitoring quality of water in real-time overvarious locations, exceptional system architecture is proposed that consists of a base station and distributed sensor nodes. All the nodes and base stations are linked with the use of Zigbee WSN technology. Designing and implementing a prototype model by using a node which is power- driven by solar panel and WSN technology is a perplexing task. The collected data at each node such as turbidity, oxygen level and pH values from different sensors will be sent to the base station throughWSN. The collected data from the different locations can be shown in some readable form and analysis can be done at base station using various simulation tools. This developed novel water quality monitoring system has various advantages like consumption of less power, no carbon

emission and higher limberness. Sughapriya et al (2021) [5] developed a method for determining the quality of water using IoT and different sensor modules. This system uses different sensors for monitoring the water quality by determining pH, turbidity, conductivity and temperature. The Arduino controller used will access the sensor data. With the use of IoT, the collected data is analyzed, and the pollution of water can be investigated by a stringent mechanism. Additionally, the developed system sends alerts and notifications to the people and apprehensive authorities about the quality of water. The task of waterquality monitoring could be achieved by with people having less training also. Installation of the water quality monitoring system could be achieved effortlessly adjacent to the water resources (target area). The proposed developed model comprises of different sensors that compute qualityparameters of water in real- time for immediate plan of action. Also the developed model is accurate, economical and requires less manpower. Unnikrishna Menon et al.(2022)[6] proposed a method for water quality monitoring in rivers which is developed based on wireless sensor networks that aids in incessant and remote monitoring of waterquality parameters. In this system, wireless sensor node is designed to monitor the pH of water continuously, which is the key parameter that affects the water quality. The sensor node design primarily consists of a processing module, signal conditioning module, power module and wirelesscommunication module. The sensed data from the pH sensor is communicated to the base station with the use wireless communication module i.e., using Zigbee module after the necessary signal processing and signal conditioning techniques. The circuit is developed for the sensor node by designing, simulating and the hardware prototype is built with the use of suitable circuit components. This minimizes requirement of power for the system and a low cost platform is provided for monitoring the water quality of water resources.

Prasad et al.(2020) [7] developed a method for smart water quality monitoring system in Fiji, by employing remote sensing and IoT technology. The quality parameters used to analyze water are Oxidation and Reduction potential (ORP) and Potential Hydrogen (pH). With efficacious implementation of this approach of monitoring, an early warning system for water pollution will be developed with a completely implemented system using numerous monitoring stations. The study of water quality in Fiji Islands is also presented which necessitates recurrent data collection network for water quality monitoring using IoT and Remote Sensing. The comparative study is presented for various parameters like Turbidity, pH, temperature and Conductivity. The developed system has demonstrated its effectiveness by providing precise and reliable values in real-time water monitoring. Four water sources were examined at hourly intervals over a stipulated time interval of 12 hours to validate the accuracy of measurement of the developed system. The obtained results are compared with the probable values. The relationship between temperature withconductivity and pH are also witnessed for samples of all four water sources. GSM technology was efficaciously implemented for sending alarm on the basis of reference parameters to the end user for instant action intended for ensuring water quality. Furthermore, the reference parameters acquired from all the four various water sources are used for building classifiers that are used for performing automated analysis of water through Neural Network Analysis. Jerom B. et al(2019)[8]. proposed a Smart Water Quality Monitoring System based on IoT using Cloud and Deep Learning methods for monitoring the water quality of various water resources. In traditional methods, the procedure of monitor ring implicates collecting the sample of water manually from different water resources, trailed by testing and analysis in the laboratory. This process is usually ineffectual since this process is strenuous and consumes more time and it will not give results in realtime. There should be continuous monitoring of quality of water for ensuringsafe supply of water to the end users from any water resources or water bodies. Henceforth, designing and developing a cost effective system for real-time monitoring water quality using the IoT is a requisite. Monitoring quality of water in water

resources using IoT aids for combating issues related to environment and improves the wellbeing and standard of living of all living beings. The developed system helps in monitoring the water quality persistently by using IoT devices and Node-MCU. The built-in Wi-Fi module associated with Node-MCU facilitates connectivity of internet, and transmits the data measured from the sensor to the Cloud. The designed prototype monitors a number of contaminants present in the water. Various sensors are utilized for measuring different parameters for assessing the water quality from water resources. The obtained results are stowed in the Cloud and deep learning techniques are employed for predicting if the water under test is potable or not.

Geetha and Gouthami(2019)[9] developed a low powered and naiver solution for monitoring quality of in-pipe water based on IoT. The developed model is used to test samples of water and the data collected from the sensors is uploaded over the internet is analyzed. This model is less complex and low cost smart water quality monitoring system with a core controller having built-in Wi-Fi module for monitoring quality parameters like turbidity, conductivity and pH. The developed system comprises of an alerting facility for informing the users on deviance of water quality parameters. The implementation facilitates sensors to provide data over the internet to the end customers. The setup used for experiment can be enhanced by integrating algorithms for incongruity detection in quality of water. Sengupta et al. (20218)[9]proposed a cost effective technique for monitoring water quality and controlling in real-time using IoT. The proposed system comprises of different sensors like temperature sensor, turbidity sensor and pH sensor that are interfaced with Raspberry Pi via an Analog-to-Digital Converter (ADC). Based on the data obtained from various sensors and processing of data by the Raspberry Pi, the solenoid valve will be directed to either continue or stop the flow of water from the overhead tank to houses using relay mechanism. This entire process takes place automatically without human intervention thus saving the time to handle the situation manually. Finally its checks for weather water quality parameters are desired range or not. These all devices are low cost flexible and high efficiency. Kumar and Samalla(2018)[10] proposed a cost effective system to monitor quality of water in realtime using IoT. The designed system used various sensors to measure the chemical and physical parameters of the water. This smart water quality system consists of a Raspberry pi controller interfaced with various sensors like CO2 sensor, pH sensor, turbidity sensors, temperature sensor and water level sensors. These sensors control the entire operation and monitoring is done by Cloudbased wireless communication devices

3. EXISTING SYSTEM

There are several Existing systems for water quality monitoring that are used different parts in the world. Laboratory-Based Water Quality Testing: This involves collecting water samples and analyzing them in a laboratory for a range of parameters such as chemical composition, microbiological contamination, and toxicity. In the existing system the pH Value and temperature we can measure at certain limit range. But in the proposed system we can integrate the system with IOT to find temperature, turbidity, pH value, Humidity to monitor the conditions Drinking water faces many challenges in the current situation due to growing population and pollutants from industries, agriculture waste etc., are mixed with drinking water. Traditional methods to test drinking water quality parameters like turbidity, pH, conductivity and temperature etc., may consume time because, samples are tested manually in the laboratory. Also, there has been the coding in Raspberry Pi. Raspberry units working with normal coding also created so much of the slow operation of the unit. Overall, the choice of water quality monitoring system depends on the specific needs and resources of the organization or agency responsible for monitoring water quality. A combination of different methods may be used to provide a comprehensive picture of water quality over time and across different locations.

4. PROPOSED SYSTEM

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. An app is installed in the android version to see the output. When the system gets started the 230v alternating current is converted into 5v dc which is given to the kit and Arduino and WIFI get on. The parameters of water are tested one by 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.

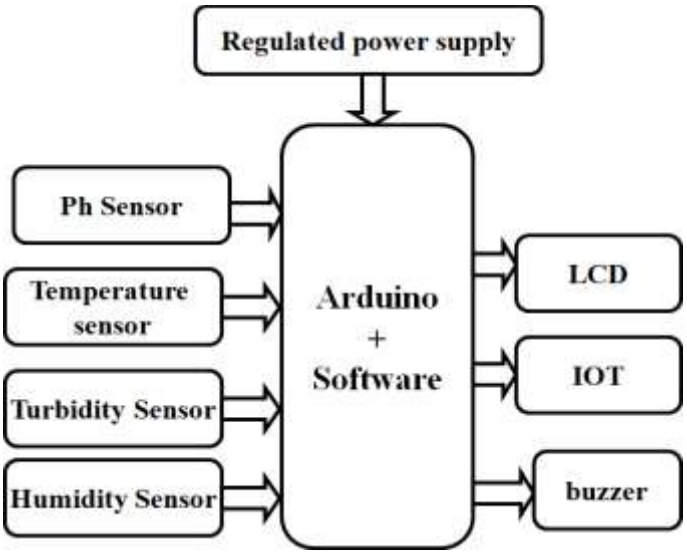

Figure 1: Proposed block diagram of water quality monitoring system.

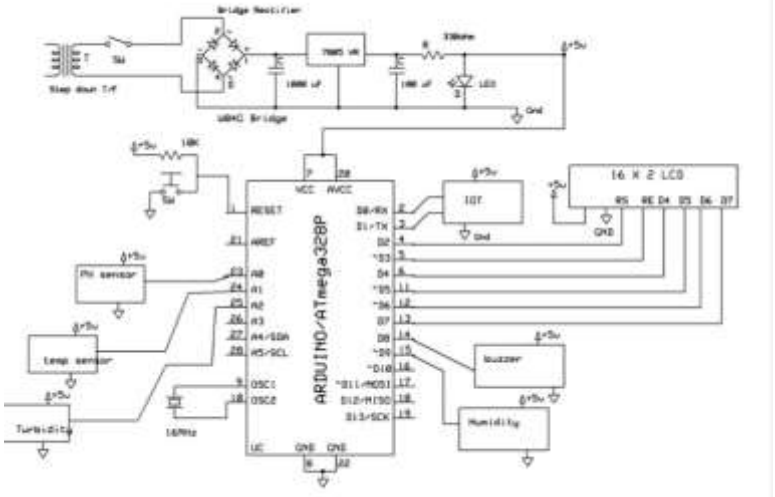

Figure 2 Schematic diagram

5. Results and Discussion

Here the circuit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The LED is the indication for 5v current so, if there is 5v current then automatically the LED glows. The generated 5v dc current passes to every hardware component in the circuit.

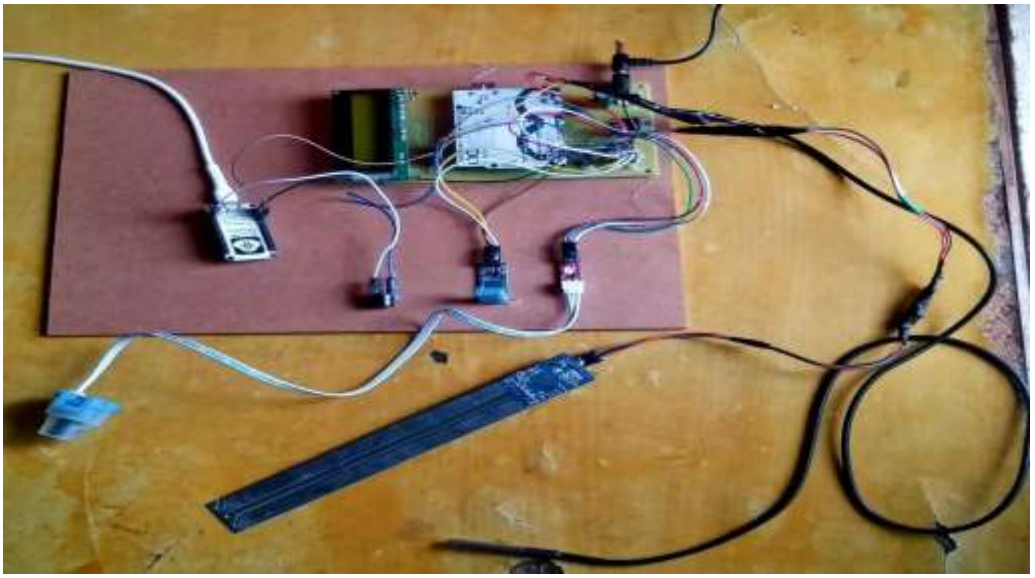

Figure 3. Overview of the Designed Kit

Figure 4. Display values in LCD

Whenever the power supply is given to the circuit, the previously recorded values will be displayed on the LCD screen. After placing the sensors in the water, the display will show the values measured by the Real-time sensors accurately.

The resultant values are displayed on the IoT Application. The values displayed on the IoT application are similar to the values displayed on the LCD display. It displays the PH and Turbidity and Temperature and Humidity Values.

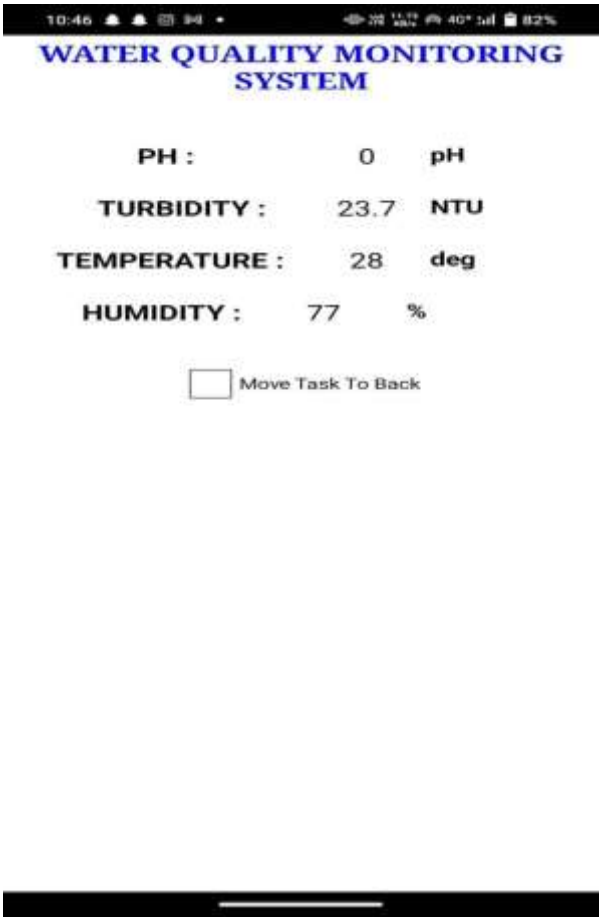

Figure 5. Values Displayed In IOT Application

6. CONCLUSION

Water quality monitoring using IoT is a promising technology that can help ensure the safety and sustainability of water resources. The advantages of IoT-based water quality monitoring systems include continuous monitoring, cost-effectiveness, easy installation, and efficient data management. As the demand for water resources increases, it is important to adopt innovative technologies such as IoT-based water quality monitoring systems to ensure the safety and sustainability of our water resources. The future of water quality does not look better as the development and industrialization of the developing countries have just begun. Although, if the precautions are applied soon and the systems placed at the right time then it can be prevented well in developing countries. If the designs explored in the paper were to be implemented in the future then the need for human intervention would be minimal and there will be more chances of getting good quality water in developing countries.

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