

Design of Smart Sensors for Real-Time Water Quality Monitoring Using IOT Technology

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Abstract- To ensure the safe supply of the drinking water the quality needs to be monitored in real time. Here, we present a design and development of a low cost device for real time monitoring of the water quality in IOT (internet of things). The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, conductivity of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino uno model can be used as a core controller, wifi module to send the collected data to the server and a LCD screen to display the values. The sensor data are stored in cloud and can be accessed by the water department to monitor the water quality. The device can be used for two purposes domestic and industrial.

Index terms: IOT, Arduinouno, sensors, water quality monitoring

I. INTRODUCTION

At present scenario, impurities in water are a major problem which occurs due to release of harmful chemicals such as arsenic, fluoride and copper. The formation of algae on the surface of lakes and rivers because of bacterial and viral pathogens may cause diseases among human beings on consuming the water. Some industries discharge chemicals into water, due to which industries have become the major factor of water pollution. Thus preventing water pollution is one of the primary tasks.

Hence monitoring water quality in real time requires development of better techniques. Water quality is a measure of physical, chemical, biological characteristics of water. To improve water quality, new measures can be implemented based on the results which are obtained by monitoring the quality of water. This helps us to determine whether the quality of water meets the standard requirements.

Internet of things (IOT) [1] environment is used in our proposed work to develop a water quality monitoring system. IOT illustrates the concept of networking devices which can gather and sense the data from surrounding environment which can be shared for different purposes using the internet. Wireless sensor networks are sensors to monitor the physical conditions such as temperature, pressure, sound and to pass this data through the network to a main location. Arduino Uno is the micro-controller which receives the data from the sensors such as pH, temperature, turbidity and conductivity which are dipped in the water sample. The analog to digital conversion is performed by the Arduino Uno and the values are displayed using LCD screen. The displayed data is then sent to the cloud server for storage.

The advantages of our system are it reduces the time required for testing water quality as no laboratory analytical techniques are involved. The device is portable, handy and since the previous results are stored in cloud it can be fetched easily and compared with the standard values

II. LITERATURE SURVEY

I. EXISTING SYSTEM

The existing system did not provide a level of public health protection in real time and it involved laboratory based methods where water specimens had to be collected physically and results were obtained by using analytical methods.

The existing system in paper[3] by MohdAmriMdYunus, Associate Member, IEEE, Subhas Chandra Mukhopadhyay, proposes the method where water samples are collected from different water bodies at geographically distant locations and they are examined using electromagnetic sensors. Independent component analysis(ICA) method is used to obtain results. In ICA method, the experiments need to be reiterated many times to obtain adequate amount of data to decide about water contamination and hence produced long delayed results.

Nitrate and Sulfate Estimations in Water Sources Using a Planar Electromagnetic Sensor Array and Artificial Neural Network Method by AlifSyarafi Mohamad Nor, *Student Member, IEEE*, Mahdi Faramarzi, MohdAmriMdYunus, *Member, IEEE*, and Sallehuddin Ibrahim Nitrate and sulphate estimation were detected using electromagnetic sensors by using wavelet decomposition

technique to obtain output parameters[4].The results were then given as input to Artificial Neural Network and another paper proposed by An Ning at el[5] for water monitoring system is composed of substation and main station but the drawback of these paper are that it involved physical collection of water specimens at remote locations which was followed by laboratory methods. UAV[6] an unmanned aerial vehicle by Paulo Rodrigues, Francisco Marques, Eduardo Pinto, Ricardo Pombeiro,Andre is a water light system capable of vertical takeoff and landing on water for water source monitoring. It consists of six rotors to ensure that UAV to keep flying whenever required and it has a downward facing cameras to capture images for further analysis. UAV is capable of giving efficient results but not economically feasible.

II. PROPOSED SYSTEM

To support operations at water utilities, online water monitoring system is needed comparing with existing laboratory based methods where water samples are collected manually and brought to labs where further analytical process takes place and do not provide a level of public health protection in real time. By focusing on the above issues we have developed a low cost device for real time monitoring of the water which can be used at the site or location of consumers to monitor water quality. We describe the design of water quality monitoring system with the help of information sensed by the sensors , so as to keep the water resource within a standard described for usage and to be able to take necessary actions to restore the health of the degraded water body. Using different sensors, this system can collect various parameters from water, such as temperature, pH, salinity and turbidity.

The Arduino Uno board is used as micro-controller which converts analog data received from sensors to digital data and wifi-module is used to send data fetched from the sensor to the cloud and LCD screen is used to display the values.The device can be used for two purposes domestic and industrial. For domestic household use, sensors can be dipped in the water to check the contamination level in the water. The various parameters collected from the sensors will be displayed on the LCD screen. We can use the same device for industrial purpose to monitor whether the industrial waste water is polluting the water bodies. To switch between domestic and industrial mode we have introduced an electronic button. On pressing this button the sensors will fetch the values and will be stored in the cloud. This information which is stored in the cloud is retrieved by the department which monitors the water quality and compares it with standard values of data sheet which is obtained by the laboratory research. If the values do not fall in the specified range of standard values, a report in the pdf format is generated and sent to the respective factory owner with the help of email.If necessary action is not taken we upload the details of the factory in social media in order to create awareness. The Fig.1 shows the overall architecture of the proposed system.

The features of our proposed system are as follows

- It minimizes the time required for testing the quality of water since no laboratory analytical techniques are involved to estimate the quality of water.
- It can be used for domestic usage as well as for industrial purposes.
- Test results are recorded in cloud so that any previous data of testing can be fetched easily and it can be used for comparison of present values with the standard values .
- A handy device which is easily portable.
- If necessary action is not taken in the given time the factory details will be uploaded on a social media website so that it will create awareness among people.

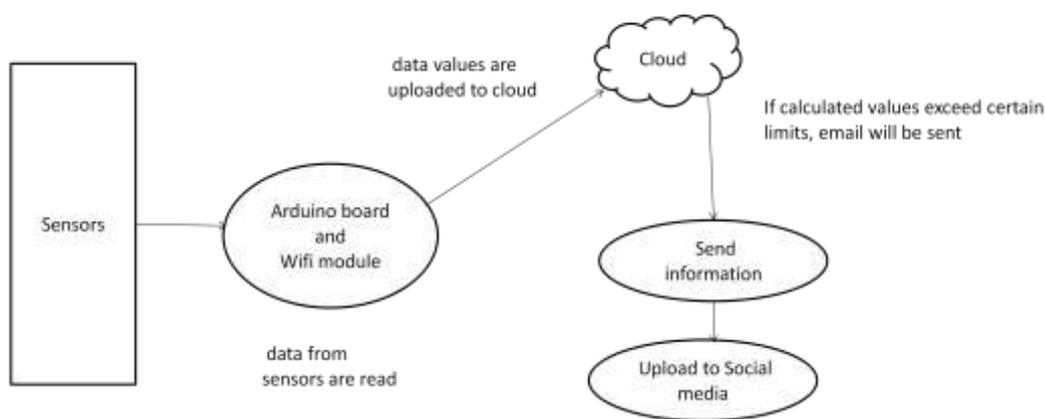


Figure 1: The Proposed System of water monitoring system

III. DESIGN AND IMPLEMENTATION

The device consists of various sensors such as ph,turbidity,salinity and temperature sensors. It also consists of aArduino uno with a wifi module. In our design Arduino is used as a core controller. The design system applies a specialized IOT module for accessing sensor data (simulated) from core controller to the cloud. The sensor data can be viewed on the cloud using a special IP address. Values from the sensors are taken to the Arduino. In Arduino the calculations are carried out. The calculated values are

uploaded to cloud. The values are then fetched from the cloud. If calculated values exceed certain standard present in the dataset that is with the department a notification will be sent to the respective factory owners. Details of water quality will be uploaded to social media if it is not rectified.

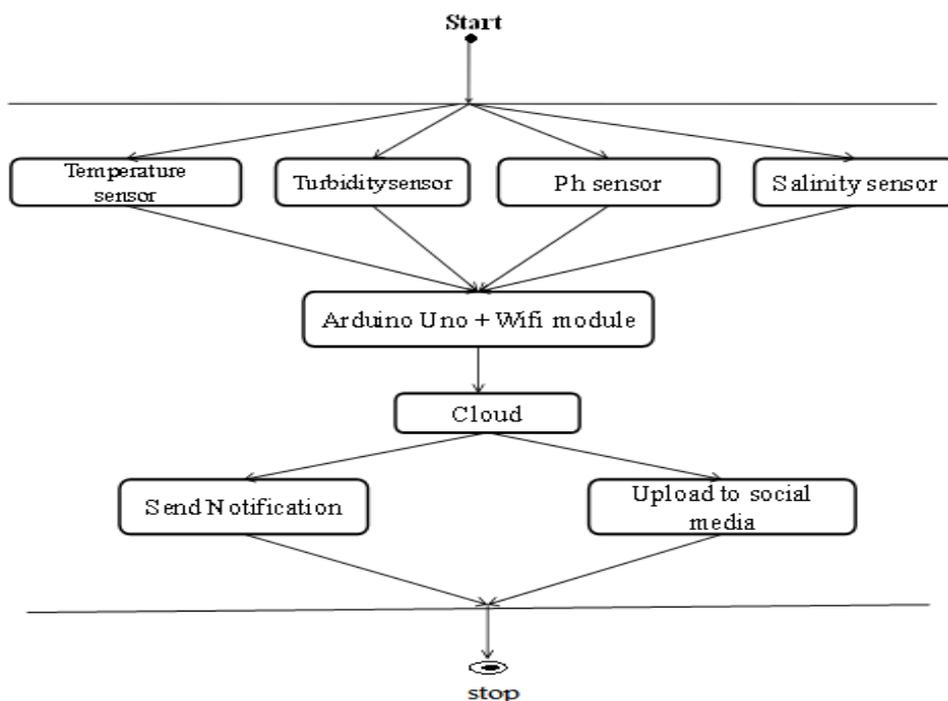


Figure 2: Activity Diagram

IV. CONCLUSION

This paper presents a cost effective portable device for real time water quality monitoring using IOT. This device consists of Arduino Uno, wifi module and a LCD screen. This handy device is beneficial for day to day purposes as well as for industries. The water department will retrieve and analyze the sensor values stored in the cloud and these can be used at any point of time hence it is time efficient and department can take necessary actions by sending the report which consists of details about the water quality to the factory owners.

V. FUTURE ENHANCEMENT

The device size can be further reduced and made into a compact device. One more phase can be added to the IOT system like purity department so that if any further actions need to be taken regarding the quality of water, the department can improve the quality of water by taking appropriate measures to purify it.

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