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A survey on water quality monitoring system using IoT and Blockchain

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ABSTRACT

From the last few years' water pollution has become an increasing problem across the world. Water is a one of the primary resource for all living organism. The objective of this system is to provide real-time monitoring of the water quality. For this we use some physical and chemical parameters like pH, turbidity, salinity and temperature etc., to find the quality of water. To collect values from these parameters an IoT model is used. Then these values are sent into the cloud. To avoid the alteration of these collected data in cloud, Blockchain technology is used. Using internet, the CPCB water department can access these data through an application developed.

Keywords: *IoT, Blockchain, Aurdino UNO, node MCU, Temperature senor, pH sensor, salinity sensor, Turbidity sensor, CPCB (Central Pollution Control Board).*

I. INTRODUCTION

There is a saying that, the essential requirement for all human beings is not technology or any application rather than cleanliness of water is required. But these days condition of water is deteriorating gradually. Water quality is affected by both point and non-point sources of pollution, which include sewage discharge from industries, run-off from agricultural fields and urban run-off's. Climate change is also one of the biggest issues of our generation. No other organisms have destroyed the biological balance as badly as humans have in the last decade. It is time that we start inventing innovative solutions that can help us to raise awareness among people about how we are destroying our planet. A smart water based IoT system using Blockchain can help us bring changes to the law and helps us to preserve the rivers.

This paper will measure the value of Temperature, pH, Turbidity, and Conductivity of the water and finds whether the water is suitable for normal use.

II. RELATED WORK

[1] A low-cost system for real time monitoring and assessment of potable water quality at consumer sites
Paper presented by T. P. Lambrou, C, G. Panayiotou and C. C. Anastasiou. This paper says how water can be monitored in real time. From this we got an idea of how the water quality can be monitored in real time, also how using internet the results of the tested water could be viewed and further actions could be taken up.

[2] A Portable Sensor with Disposable Electrodes for Water Bacterial Quality Assessment.
Paper presented by Marco Grossi, Roberto Lazzarini, Massimo Lanzoni, Anna Pompei, Diego Matteuzzi, and Bruno Ricco. Based on obstacle measurements, this paper presents a portable sensor implemented as an electronic embedded system featuring disposable measurement cells, which is suitable of measuring bacterial concentration in water samples.
From the above paper we got to know that different sensors available in the market could be used to test different parameters of the water quality. Our testing of water quality involves parameters like temperature, pH, conductivity and turbidity.

[3] Water Quality Analyser Using IOT
Paper presented by Manoharan. S. This presents the water quality measuring system 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.Based on the

measured data, corporation officials will track the pollution level that occurs 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.

[4] Towards a water quality monitoring system based on wireless sensor networks, Dziri Jalal and Tahar Ezzedine
This paper gives the initial steps to develop a drinking water quality monitoring system. This system is based on a wireless sensors network to detect and locate any changes in water quality in real time, quantify its importance, evaluate its consequences and determine the most appropriate actions to be taken to limit its effects. Anomalies detection algorithm is used to detect the contamination and malicious acts in the drinking water distribution system.

[5] Internet of Things (IoT) Enabled Water Monitoring System, Thinagaran Perumal, Md Nasir Sulaiman, Leong.C.Y
In this, the author proposed that an IoT based water monitoring system that measures water level in real-time. The model is based on idea that the water level can be very important parameter when it comes to the flood occurrences especially in disaster prone areas. A water level sensor is employed to notice the specified parameter, and if the water level reaches the parameter, the signals are going to be put in real time to social network like Twitter.

[6] Water Quality Monitoring and Waste Management using IoT, Maneesha V Ramesh, and Nibi K V
This project is designed and developed an IoT based system that can sense the environmental parameters and effectively deliver information on the level of contamination and the quality of the water. Sensors to detect the hydrocarbons, chemical and metal content in the soil can be integrated into a soil probe for monitoring the soil contamination. And sensors for detecting pH, conductivity, dissolved oxygen, turbidity, etc. are can be used for monitoring the water quality in the site of interest.

[7] Smart Water Quality Monitoring System, A.N.Prasad, K. A. Mamun et al
The high use of fertilizers and also other chemicals in different sectors such as mining, farm or agriculture and construction have contributed reduction of water quality globally. Water is an essential resource that is needed for human survival. Articulated supplies and as well as the rivers and shoreline that surround our towns and cities. Fiji Islands are located in the vast Pacific Ocean which requires a frequent data collecting network for the water quality monitoring and IoT and remote sensing can improve the existing measurement. It presents a smart water quality monitoring system for Fiji, using IoT and remote sensing technology.

[8] Reconfigurable Smart Water Quality Monitoring System in IoT Environment
Here a reconfigurable smart sensor interface device for water quality monitoring system in an IoT environment is proposed. The smart WQM system consists of Field Programmable Gate Array (FPGA) board, sensor, ZigBee based wireless communication module and personal computer (PC). The FPGA board is the core component of the proposed system and it is programmed in very high speed integrated circuit hardware description language (VHDL) and C programming language using Quartus II software and Qsys tool. The proposed WQM system collects the values of five parameters of water data such as water pH, water level, turbidity, carbon dioxide (CO2) water temperature.

III. EXISTING SYSTEM

Based on the survey, the application is implemented for water quality monitoring system in a specific environment
There is a government department called CPCB, this department is concerned about the water purity/quality check. The factories which usually use water for manufacturing process have to reduce the pollution of the water to certain level before they leave it through outlet. But for that industry has to spend some money on it so most of the companies don't bother about that and let the polluted water to go out of the factory with the outlet. Normally this will results in water related diseases.
CPCB officers will have the list of all factories that use the water for the production process. Officers of CPCB department have the duty to visit each one of those industries to check the water purity level before it is left to the factory outlet. So what they do is they will take the water sample from the outlet, they will come back to the lab and then they will carry the testing process to check the purity of water. So in order to check the purity of water usually there are some sensors are used, such as pH, turbidity, Conductivity and temperature sensors.
Now the purpose of all those sensors is to basically check the quality of water. Those 4 sensors are dipped into the water (which is the sample collected by the CPCB officer). And by taking the values from all these sensors, calculation is involved. The values collected from the sensors are manually examined by lab technicians, then they are going to intimate to the factory owners saying that whatever the quality of the water that you are leaving out of the factory is not up to the mark through a notice to the factory owners.
Now what if the factory doesn't care about the notice, then again CPCB department officers visits place and again collect the water sample to do the same process. If then also water is not purified again they will get a notice from the department. But at the third time serious action will be taken under the guidance of courts like lockout of the factory.

IV. DRAWBACK OF EXISTING SYSTEM

- It is labor intensive and high cost.
- The lack of real time water quality information to enable critical decision for public health protection
- Manual work is more
- Corruption may occur
- Industries may change sample of discharge water
- Actions cannot be taken against industries by corruption
- Lack of time
- The values may change and mediators are more
- The industries may cheat while quality of water

V. OVERVIEW OF THE PROPOSED SCHEME

The proposed system is used for monitoring water by using many sensors for parameter of water such as pH, Turbidity, Conductivity and salinity sensors are connected to Arduino UNO as a controller to read all the data from the sensors process to send the information to the blockchain by Wi-Fi module called node MCU. Hash value for each data is stored in blockchain which provides more security. A government department called CPCB is

running an application on the other side which will analyze the data from the blockchain, if the water from the factory outlet is not up to the mark then notice is sent to factory owner's email id for this SMTP protocol is used. An industry has around 15 days of deadline to purify the water. If the industry does not purify the water, information of industries is placed in social media and notice will be sent automatically. Actions against industry are taken without any discrimination. So this will help in the automated way of managing the water quality.

VI. IoT and BLOCKCHAIN

IoT is an improvising area with novel paradigms such as transparency in connecting heterogeneous networks and network devices, handling heterogeneous data types and scalable infrastructure. Although it provides the ubiquities for communication in various applications, it has to handle digital appliances, sensory devices, network elements and various communication standards. After the introduction of the IoT many problems were solved in the modern world. IoT can be used in all sensors for the public services. Sensors-enabled devices help to monitor the environment impacts and collects details.

A blockchain is a distributed transaction ledger protocol. A blockchain is composed of blocks and each block represents the set of transaction. The blockchain is immutable and uses public key cryptography to create content. This is possible because each block contains a hash that can be used to verify the integrity of the containing transactions. The blockchain does not rely upon central authority. Rather, Copies of the blockchain are distributed on each participating node in the network.

VII. ADVANTAGES OF PROPOSED SYSTEM

- Labors not required
- Low cost
- Time consuming is less
- Values cannot be changed
- Less corruption
- Not mediators

VIII. ARCHITECTURE DIAGRAM

System architecture gives an overall idea of how the software utilizes various services. The data's from the sensors are sent to the cloud and CPCB will access the data, monitor the quality of water and take respective actions.
The sensors are placed at outlet valve of industries, the sensors data are send cloud, the sensor data are computed by core controller Arduino the data's are viewed and monitored by CPCB department and take further action with respective to the data of water quality of respective factory.

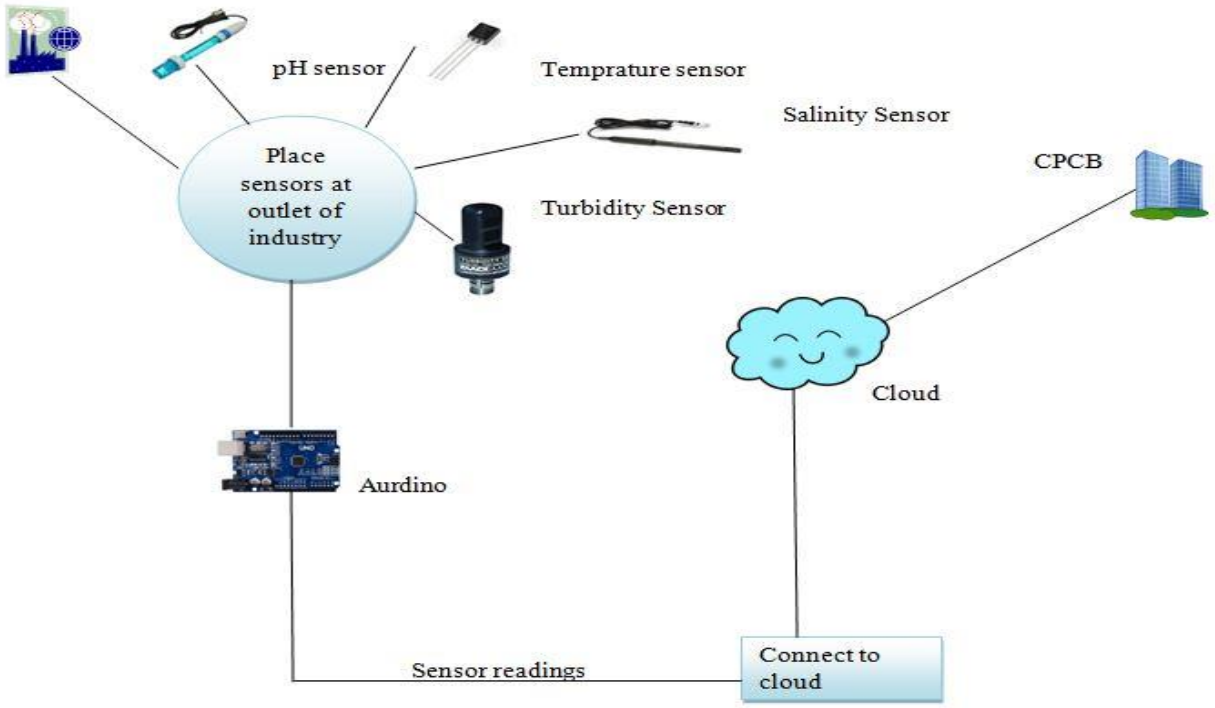

figure 1: Architecture diagram

IX. METHODOLOGY

In this project methodology model takes the fundamental process activities of analysis, design, testing and maintenance and represents them as separate phases. Here we have used the waterfall model as a project develo0pment methodology.
To do specific system models, system architecture and detailed design of the project, to implementation process using WINFORM .NET and c# for developing the modules in windows platform. In the water quality monitoring system hardware, it contains Arduino UNO, node MCU and sensors like pH, temperature, salinity and turbidity sensors are used. Each sensor are connected to Arduino UNO as a controller to read all the data from the sensors process to send the information to the blockchain by Wi-Fi module called node MCU. Then the values from the blockchain are verified by members from CPCB board and further action will be taken if water quality is not up to the mark.

X. DATAFLOW DIAGRAM

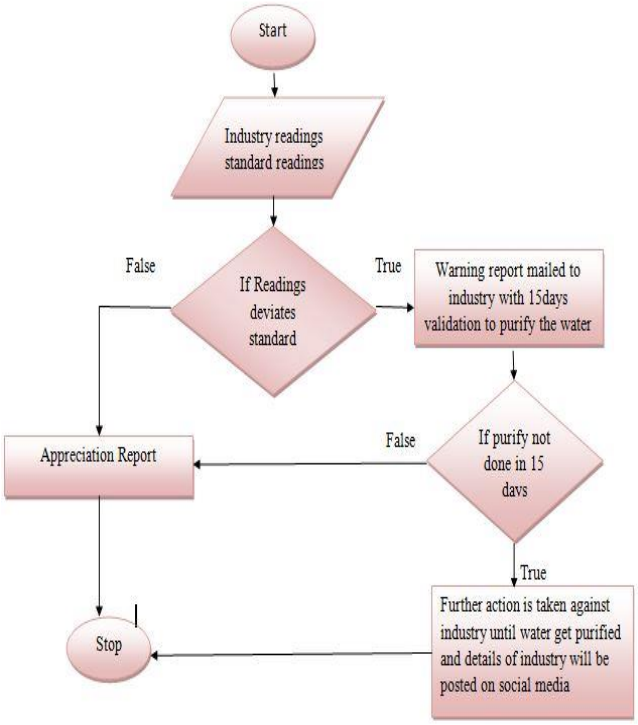

Figure2: Flow diagram of water quality monitoring system.

Fig 2 shows the flow diagram, start means the sensors connected to the Arduino will begin to collect the readings, the values are compared with the standard readings the if the values differed then an warning report is mailed to industry owner with 15 days validation to purify the water and if values are not differed then an appreciation report will be sent. And also if water not purified within 15 days further action will be taken against industry until water get purified and details of industry will be posted on social media to create awareness among people.

XI. SEQUENCE DIAGRAM

1. Tester sequence diagram

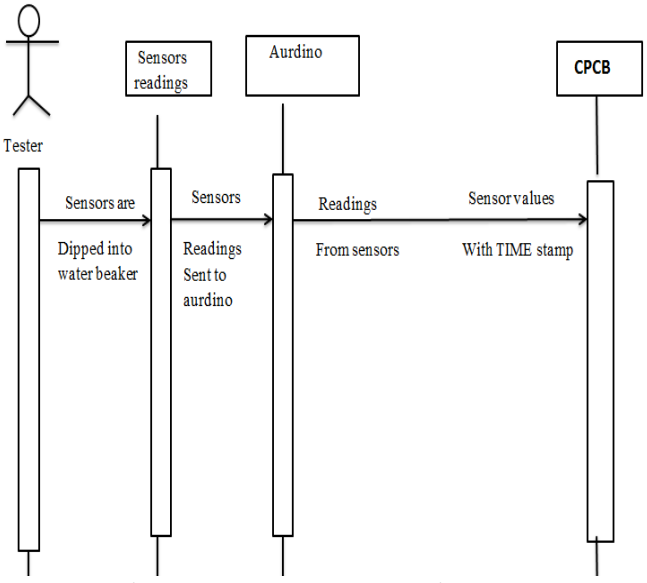

Figure 3: Tester Sequence Diagram

2. CPCB manager sequence diagram

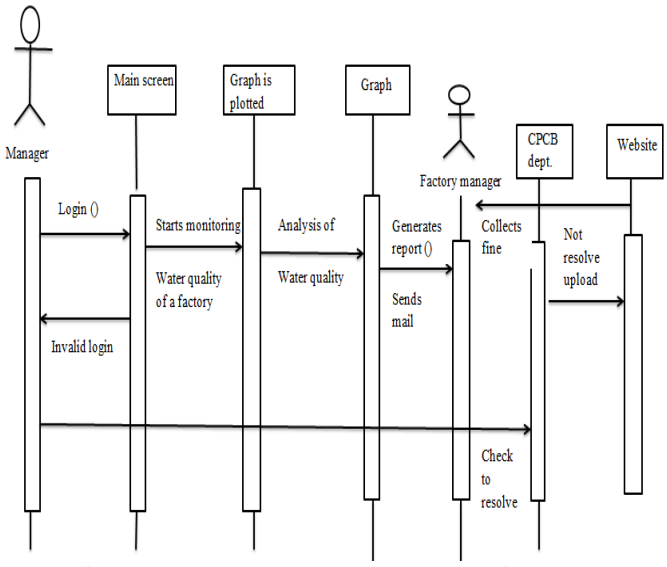

Figure 4: CPCB Manager Sequence Diagram

XII. RESULT ANALYSIS

The graph is a graphical representation of the parameters of the water that we are testing. If certain parameter in the water is not or suitable for the environment then button given becomes red indicating that the water needs to be purified for that parameter There are 4 parameters that we are checking on to decide the quality of the water the pH, temperature, turbidity and salinity. If any 3 out of 4 parameters blinks red then the water department sends a notification for that particular factory of which the water has been tested.

A PDF report is generated with the details of the factory the time and the date. The report contains values of each parameter and what that kind of water is suitable for. It also contains the importance of pH temperature turbidity and salinity in water. The parameter button blinks red based on these values:

1. For Temperature in Celsius: if the sensor reads 0 {9 º C poor, 10 {14 º C fair, 15 {25 º C good, 26 {36 º C fair,>37 º C poor
2. For pH: if sensor reads < 5.5 poor, 5.5 {6.5 average, 6.5 to 8.0 good, 8.1 to 8.5 average, >8 .6 poor.
3. For turbidity in nephrons electric turbidity units: if sensor reads < 10 good, 11 - 29 fair, > 30 poor.
4. For salinity in micro Siemens : if the sensor reads: 0 to 100 Excellent (30 = rainfall),500 Fair >750 Poor (840 = sewage eluent),1600 Upper limit for drink-ing,5000 Upper limit for crops,8000 Upper limit for livestock,50 000 Seawater

XIII. SCOPE

To develop an ancient online monitoring of water quality for better results, low cost, easy handling, less manual work and to reduce the time involved in lab testing. And to provide a better security for water related data stored in the cloud.

XIV. MOTIVATION

Nowadays drinking water is the most precious and valuable for all the human beings, it's the basic need for all the live-stocks hence drinking water utilities facing new challenges in real-time operation. Thesechallenges have occurred because of limited

water resources, growing population, ageing infrastructure etc. Hence there is a need of better methodologies for monitoring the water quality.

XV. CONCLUSION

Our main intention was to reduce the time required for testing of water in laboratories, and we have been able to achieve it but with lesser accuracy. It reduces the laboratory equipment that would be required for the traditional way of testing the water for its quality. The major point is we have been able to record all the details obtained in our testing in cloud. The data in the blockchain cloud is stored with different hash values. The results can be viewed and fetched whenever required. The quality of water can be done online easily using this system.

XVI. FUTURE WORK

The above presented project was successful in what it had to achieve. We have tried to implement testing of water with respect to few parameters. But in future, increase the parameters by adding multiple sensors and also by interfacing relay we can control the supply of water.

REFERENCES

[1] A low-cost system for real time monitoring and assessment of potable water quality at consumer sites, T. P. Lambrou, C, G. Panayiotou and C. C. Anastasiou, IEEE 2012

[2] A Portable Sensor with Disposable Electrodes for Water Bacterial Quality Assessment, Marco Grossi, Roberto Lazzarini, Massimo Lanzoni, Anna Pompei, Diego Matteuzzi, and Bruno Ricco, IEEE 2012

[3] Water quality analyser using IoT, Manoharan. S, IEEE 2019

[4] Towards a water quality monitoring system based on wireless sensor networks, Dziri Jalal and Tahar Ezzedine, IEEE 2017

[5] Internet of Things (IoT) Enabled Water Monitoring System, Thinagaran Perumal, Md Nasir Sulaiman, Leong.C.Yin International Conference on Intelligent Computing and Control Systems (ICICCS), 2015, IEEE.

[6] Water Quality Monitoring and Waste Management using IoT, Maneesha V Ramesh, and Nibi K V in International Conference on Electrical Engineering and Information Communication Technology (ICEEICT), 2017, IEEE.

[7] A.N.Prasad, K. A. Mamun et al. “Smart Water Quality Monitoring System”. H. Haqva School of Engineering and Physics University of the South Pacific Laucala, Fiji Islands

[8] Cho Zin Myint, Lenin Gopal and Yan Lin Aung, “Reconfigurable Smart Water Quality Monitoring System in IoT Environment”.Department of Electrical and Computer Engineering Curtin University Sarawak Campus, CDT

