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Design and Development of a Water Pollutant Measurement System for the Textile Industry

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Abstract : Worldwide, the textile industry is one of the main reasons for water pollution. It has a significant environment impact since it uses a lot of water for processing and releases a lot of dirty water. If the quality of those discharged water exceeds the prescribed limit set by the authorities, it will cause a serious threat to the living organism. This demands a suitable monitoring system even from a remote location. Technology innovation could serve as the best solution to the above problem. The chemical qualities of the textile effluent are measured, and if they exceed the prescribed limit, an announcement will be made to take preventive steps. The quality parameters of the effluent are continually monitored and information is recorded in the cloud through different sensors. The information which is stored can be tracked by the component authority via the web page.

IndexTerms - **Textile, Pollutant, Chemical, Cloud, pH, Web page, Threshold**

I Introduction

Textiles are one of the world's most polluting industries. Textile waste takes up approximately 5% of all landfill space, according to studies. Moreover, nearly 20 percent of all freshwater pollution is caused by textile treatment and dyeing. To determine the number of metals found in soil and groundwater near textile and tannery plants, a study was conducted. Several metals such as chrome, iron, manganese, lead, copper, and cadmium were found in quantities greater than those recommended by the World Health Organization (WHO).

Clean water quality has generally decreased due to various factors, including industrial waste. The sixth sustainable development goal emphasizes clean water for all. Many industries are directly and indirectly responsible for water pollution. UNEP says hundreds of millions of tons of chemicals are discharged into the water. A large number of industries are involved in the conversion of raw materials into yarn into fabric, but textile processing is by far the most significant.

There are several water quality control systems in place across the country that are monitored monthly or annually by CPCB. It is important to ensure that the quality of water is maintained. Routine Monitoring is necessary. As part of the monitoring process for water quality, the requirements for pollution control are assessed and the effectiveness of pollution control is determined. Although the government has drawn up many protocols and rules on efficient effluent disposal, there are always violations of the business interests of the sector.

II Literature Survey

The application of a wireless sensor network (WSN) for water quality monitoring is composed of many sensor nodes with a networking capability that can be deployed for ad hoc or continuous monitoring purposes. The parameters involved in the water quality determination such as the pH level, Turbidity, and temperature are measured in real-time by the sensors that send the data to the base station or control/monitoring room. In this paper, the fundamental design and implementation of WSN featuring a high power transmission Zigbee-based technology together with the IEEE 802.15.4 compatible transceiver are proposed [1].The Autonomous Live Response Monitor (ALARM) toxicity Biosensor was used to create this device, which was designed to be placed in the stream for continuous monitoring. The goal is to develop a low-cost, wireless water monitoring system that can track water conditions in real-time. Salinity, dissolved oxygen, temperature, intensity level, pH, electrical conductance, total dissolved solids, and redox potential are among the physicochemical parameters measured by the system in freshwater[2].In recent years the fish responding behavior has been considered as one of the approaches for water quality monitoring. The system was created utilizing image processing and auto-recognition of fish gestures in water bodies using fuzzy inference. The image background model was first made up using the W4 approach, and then the backdrop was deduced to detect the fish profile. Once the Centre-of-gravity position of the fish profile is found [3]. The system is skilled to measure the physicochemical parameters of water quality, such as flow, temperature, pH, and conduction. Water contaminants in rivers, lakes, and other bodies of water are identified using these physiochemical criteria. The sensors are connected to a microcontroller-based data processing and evaluation node. In this scheme, ZigBee receiver and this system, ZigBee receiver, and transmitter modules are used for communicating among the measuring and notification nodes [4]. Three wireless sensor sub-systems make up the system. All communicate with each other wirelessly and send information to a gateway connected to a computer that hosts the GUI. Data delivery is not always guaranteed due to wireless data transmission. There are chances of loss of data[5].

WSN-based water quality monitoring system was developed. This system is based on a wireless sensor network that consists of a wireless water quality monitoring network and a remote data center. The wireless sensor network is built on the Zigbee network protocol. WSN simply the water quality, and sends the data to the internet with the help of GPRS[6]. To record water quality parameters from a variety of sources in the study area via a prototype embedded in real-time, they have developed a real-time prototype. This hardware solution transmits data to the cloud for real-time processing and storage. The developed software solution, which comprises a mobile app and a dashboard, can monitor the data remotely and control water flow. These preliminary results have indicated a high degree of potential for scaling up this concept [7]. An optimization model involving flow and transport equations is used as a constraint in the proposed methodology. For determining the best estimates of unknown source characteristics, we use a nonlinear programming algorithm. It incorporates measurements of pollutant concentrations gathered at observation sites. Even when the aquifer parameters are unknown, the proposed methodology successfully identifies the locations, determines the magnitudes, and specifies the duration of ground-water pollution sources [8].An innovative microcontroller-based system for water quality monitoring with a high degree of accuracy and the ability to measure several parameters of water such as temperature, turbidity, and pH are presented in this paper. As water sources are becoming tainted due to excessive pollution, those parameters must be detected to lead a healthy life. Simple devices that track out water parameters unerringly do not need to be modeled. Sensors that measure various parameters send the data to a microcontroller, and finally, the LCD display the results[9]. The purpose of this study was to develop a wastewater monitoring system using a wireless sensor network with a wasp mote main board as a microcontroller, plus a smart water sensor connected to a pH sensor, Conductivity sensor, Dissolved oxygen sensor, and water temperature sensor. To communicate with the server, we used a 3G module. The data from the sensors is collected in real-time and saved in a database before being visualized in a graphical format on the web-based dashboard [10]. The creation and use of a methodology for determining the ideal configuration of a detection system, taking explicit account of unsteady hydraulics, as well as the dilution and decay qualities of water quality constituents as distributed with the flow, are discussed in this study. The detection system's output is a network of monitoring stations tasked with capturing pollutant entry while maintaining a pre-determined level of service. The methodology is implemented in an EPANET-specific algorithm framework[11]. Network of smart sensors for in situ and continuous space-time monitoring of water surface bodies, particularly seawater, based on the ISO suite of standards. The system is intended to be a useful tool for assessing water quality and a reliable source of information for strategic decisions about major environmental issues. The suggested system's goal is to catch potential extreme occurrences and collect data over long periods [12]. The design and implementation of a low-cost system for real-time water quality monitoring in the IoT. The system, which consists of multiple sensors, is used to measure the water's physical and chemical characteristics. Temperature, pH, Turbidity, Conductivity, and dissolved oxygen can all be detected in the water. The core controller can process the measured values from the sensors. As a core controller, the raspberry pi B+ model can be used. Finally, using cloud computing, the sensor data may be seen on the internet [13]. The goal of this research is to use wireless sensor networks to control the quality of drinking water. To detect chemical, physical, and microbiological water characteristics, this architecture employs a new generation of wireless sensors. Then we create a new water anomaly detecting model. Our machine learning-based technology detects irregularities and harmful behaviors in real-time. A data aggregation strategy is used in our solution to reduce the amount of data and processing time[14]. IoT-enabled remote sensing kit for multiparameter water quality monitoring and contamination event detection. The proposed kit may gather real-time data monitor from domestic reservoirs, evaluate them and present it on a simple platform for monitoring. Temperature, pH, Conductivity, and Turbidity are all key indicators of water quality. It can also use the onboard processor to process data before sending it to the cloud to determine the water quality. They proposed that a remote sensing kit be smoothly incorporated into the metropolitan area's water management system [15].

III Proposed System

In this project, we are using pH, Turbidity sensor, and TDS sensor to check the quality of water. Turbidity is mainly used for detecting dust particles in the water. Based on the dust particles we can decide on water quality. pH sensor is to know whether water is acidic or basic. TDS sensor is to measure any harmful solutions present in water. The values are uploaded to the cloud server and a message will be sent if any sensor crosses the threshold value and also buzzer will activate.

In this, we tried to develop an automatic water quality monitoring system that can measure some important water parameters like pH, temperature, total dissolved solids, and total suspended solids. Our device can send data wirelessly to mobile through Bluetooth for real-time monitoring, can store the data, and can alarm the authority in critical conditions.

We proposed a low-cost automatic water quality monitoring system that provides real-time information about water parameters and transmits data. Figure 1 shows the block diagram of proposed system.

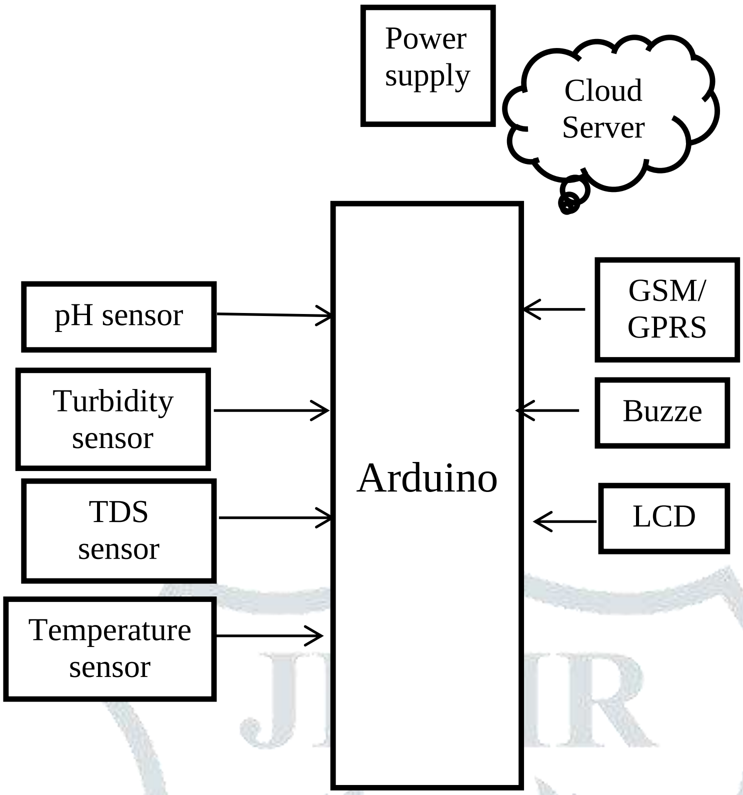

Figure 1 Block Diagram

IV EXPERIMENTAL RESULTS

Execution procedure:

- Collect the water sample in a beaker. And place all the sensors such as pH, TDS, and Turbidity as well as a temperature sensor in the sample water collected.
- All the components are connected as given in the connection diagram.
- Switch on the power supply.
- The parameter values will be displayed on the LCD screen.
- In the source code set some threshold value for all the parameters if any of the parameter values exceed the threshold value then it indicates that water is polluted.
- Then with the help of GSM, the user will receive the message that includes all values.
  7. The same data will be stored in the cloud server. It is used to monitor or read the values for every day from the server.
- The same steps will be repeated every day to monitor the water quality in the textile industry.

Figure 2 show TDS and Temperature values and Figure 3 indicates LCD Turbidity and pH values and Figure 4 Message received by user.

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Figure 2 TDS and Temperature values

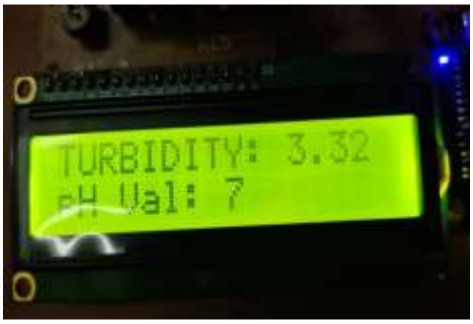

Figure 3 LCD Turbidity and pH values

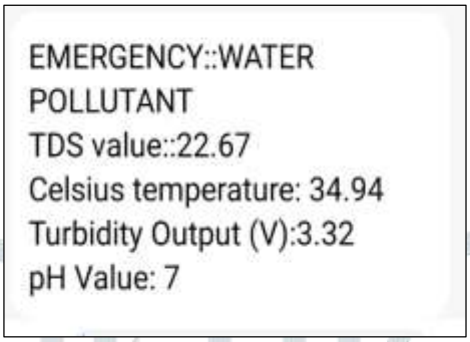

Figure 4 Message received by user

V CONCLUSION

In this project, we are implementing smart water quality monitoring using an embedded system developed. In this, we use three modules. They are:

Data Sensing Module:

It will detect data from the sensors that we used in the project in data sensing. It will take data in both analog and digital. By connecting the sensors to the Arduino, the data is taken and displayed on the LCD panel.

Server Module:

Server modules store the data that is obtained from the microcontroller in the cloud. A Mobile device or PC can be used to view the data. If there is an internet connection available to the microcontroller, it will connect to the server.

User Module:

The user module will use GSM/GPRS to communicate with sensors and a server containing the sensing data. This server module sends data to the server module, which stores and backups the data continuously and allow us to monitor the data using a laptop or Mobile device.

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