Waste Water Quality Monitoring System Implemented With IOT

Jayapoorani .S, Rinshu, Kumari Nitu, Jha Ritu Jha
Professor, Excel Engineering College, Tamil Nadu, India.
Students, Excel Engineering College, Tamil Nadu, India.

Abstract—this paper presents a novel approach for real-time monitoring of wastewater using Internet of Things (IoT) technology. The proposed system is composed of a gateway device, multiple sensor nodes, and a cloud-based platform. The gateway device is connected to an array of sensors, which are used to measure water quality parameters such as pH, temperature, dissolved oxygen, and turbidity. The acquired data is then transmitted to the cloud platform, where it is analyzed and stored for further analysis. The proposed system can provide real-time information about water quality and is expected to help water management authorities in making informed decisions about water quality.

Keyword—IOT, sensor, pic microcontroller.

I.INTRODUCTION

Water is undoubtedly one of the most vital environmental elements necessary to sustain our existence. Due to the exponential growth in population and improper management of water resources, there has been an acute shortage of water in different places around the globe. Besides, water pollution has adversely affected the lives of several organisms and is one of the foremost reasons for rise in mortality rate and outbreak of diseases worldwide. Monitoring the quality of water and its proper management is crucial for any industrial and economic application. The global shortage of water demands a sustainable solution to optimize its usage. The Internet of Things provides a robust and cost-effective solution for real-time monitoring of various parameters of water.

Thus, assessing the quality of water and its proper management is of paramount importance. In the order to cope up with the huge demand for water, we need high-quality technology which can monitor the quality of water as well as ensure its availability. Such a system should be capable of monitoring different parameters of water like TDS, turbidity etc. as well as measure the level and flow of water in different reservoirs for proper management. The traditional system for water quality monitoring and management relied heavily on manual work with no real-time monitoring available. This resulted in efficiency compromise and is not suitable to scale up well with the digital age.

This paper establishes an IoT based system for monitoring various parameters related to water quality and management of water resources. Our embedded system consists of various sensors for measuring the flow and level of water along for accessing the quality of the water. The information obtained from these sensors is processed by the pic microcontroller,

II.LITERATURE SURVEY

The implementation of a robust and cost-effective water monitoring system demands a good level of research and development. Many researchers have proposed different models in order to implement such a system.

Kamarul Hafiz Kamal din and Widad Ismail [1] have used RFID and wireless sensor networks to perform real time monitoring of a lake. The 920MHz Digi-mesh protocol is used for its unique property of surpassing the signal attenuation. Mohammad Salah Uddin Chowdhury et al. [2] have proposed a system for monitoring the quality of water in a river with the aid of an embedded system consisting of wireless sensor network and IoT. Deep learning models have been used to assess the quality of water and SMS alert is sent in case the value of a sensor has crossed the threshold. Soundarya Pappu et al. [3] have used a pH and a TDS sensor to determine the quality of water with the Arduino microcontroller and the Raspberry Pi3. K-means clustering algorithm is used to predict the quality of water based on the sensed values. Thinagaran Perumal, Md Nasir Sulaiman and Leong.C.Y [4] have implemented a system to monitor water level with IoT. The water level is measured using a sensor and is fed to a web-based dashboard. Twitter is used for sending necessary alerts to the users. Nikhil Kumar Koditala and Purnendu Shekar Pandey [5] have devised a model for regulating the temperature of water by predicting the temperature of the surrounding environment using machine learning. Besides, the quality of water is analyzed by sensors measuring pH and turbidity. The data is stored in Azure Event Hub and Power BI is used for displaying the values obtained from the sensors. Juan Huan et al. [6] have used STM32L151C8. Microcontroller for real-time monitoring of temperature, dissolved oxygen and pH of a water sample. A cloud-platform is designed using Java for real-time monitoring. Abbas Hussien Miry and Gregor Alexander Aramice [7] have used Thing Speak for monitoring and analysis of the TDS and Turbidity of water. When the values of these parameters are not within a normal range, a warning message is notified to the user through IFTTT. Yiheng Chen and Dawei Han [8] have depicted how a water management system can be implemented through IoT in urban areas for developing a smart city. They have measured different parameters of water like dissolved oxygen, turbidity, pH and conductivity and have also employed a camera system to get a video of the surface of water. Sathish Pasika and Sai Teja Gandla [9] have devised an IoT system based on the Thing Speak application for water quality monitoring. An Arduino Mega and NodeMCU microcontrollers are used to process the readings from the sensors and upload them to the Thing Speak server. Tongxin Shu et al. [10] have developed an energy efficient system for automatic water quality monitoring. They have applied a data-driven adaptive sampling algorithm (DDASA) in order to the efficiency of power consumption while acquiring the turbidity and dissolved oxygen of water. Kamarul Hafiz Kamaludin and Widad Ismail [11] have used RFID and wireless sensor networks to perform real time monitoring of a lake. The 920MHz Digi-mesh protocol is used for its unique property of surpassing the signal attenuation.

III.METHODOLOGY

To design the proposed water quality monitoring system various water monitoring sensors and water quality parameters were investigated. The initial step is to determine the various parameters which would be monitored for the assessment of the water quality and whether the water quality is within the specified rules and regulations of the World Health Organization (WHO). It was determined that water parameters such as nitrate levels, free chlorine concentration and dissolved oxygen cannot be monitored easily and/or required frequent maintenance and calibration to sustain accurate readings over long periods of time. Hence this proposed project would not be feasible for long-term real time water quality monitoring *GAS SENSOR*-A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring.

The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

1. *Temperature sensors* are simple devices that sense the degree of cold or heat and transform it into a simple unit. It is widely used to measure temperature in hard environments like in chemical solutions, mines, or soil etc.

As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy).

2. Humidity s**ensors** are used to measure and monitor the amount of water present in the surrounding air**.** These sensors are widely used in industries such as semiconductor, biomedical, textiles, food processing, pharmaceuticals, meteorology, microelectronics, agriculture, structural health monitoring, and environment monitoring.

3. The installed specifications of the Sensor Unit (SU-6808) include: (1) Operating Humidity Range: 30∼90% R.H; (ii) Operating Temp. Range: 0∼60°C; (iii) Output: DC 1∼3V (at 30∼90% RH; (IV) Name of Type: SYH-2; (v) Input Voltage: DC±15V, 1A.

4. Analog pH Sensor The pH of a solution is measured using an Analog pH meter, which reflects the acidity or alkalinity. pH sensor the specifications of the pH sensor used: • Measurement range: 0 -14 pH • Temperature During use: 0 -80 ° C • Response time : <1 minute • Accuracy of readings: up to 0.01 (with calibration) • Interference : <0.5 mV. Water is one of the most important natural resources for human life.

5. Water Level Sensor:

• Measuring Range: 0-4m
• Accuracy: 0.2% of measured value
• Output Signal: 4-20mA
• Supply Voltage: 12V DC
• Working Temperature: -30°C~+75°C
• Response Time: 1s
• Sensor Material: Stainless Steel
• Cable Length: 5m
• Waterproof Rating: IP68’

6. Bio Sensor:

● Accuracy: The accuracy of a biosensor determines how accurately it can measure the concentration of a particular substance.

- Sensitivity: The sensitivity of a biosensor indicates how sensitive it is to the presence of a substance.
- Response Time: Response time is the amount of time it takes for a biosensor to respond to a change in the concentration of a substance.
- Selectivity: Selectivity is the ability of a biosensor to distinguish between substances in a sample.
- Linearity: Linearity is the ability of a biosensor to accurately measure the concentration of a substance over a wide range of concentrations.
- Cost: The cost of a biosensor depends on the complexity of the device and materials used.

7. GSM Module The proposed system uses SIM 800L to send data to the cloud via GPRS connection in case of the Wi-Fi connection is lost, as well as to send SMS warning alarms to the user. The Node cu Esp8266 module is programmed to check the Wi-Fi connection.

Figure 1: Node Mcu Esp8266

8. The PIC microcontroller **PIC16f877a** is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient advantages is one of the use, the coding or programming of this controller is also.

It can be write-erase as many times as possible because it uses FLASH memory technology**.** It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have much application in digital electronics circuits. PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low, and its handling is also easy. It is flexible and can be used in areas where microcontrollers have never been used before as in microprocessor applications and timer functions etc.

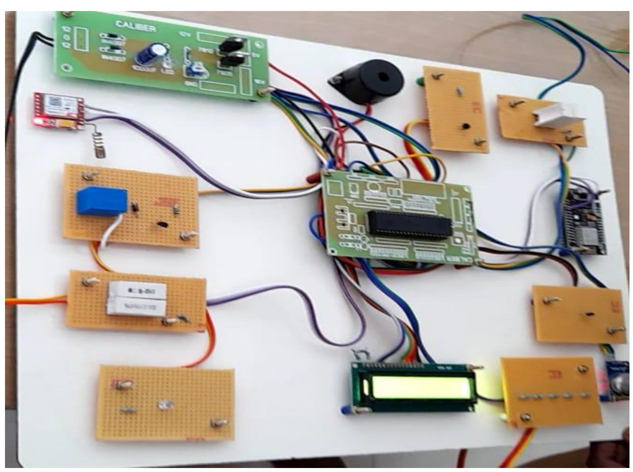

Figure 2: Implementing of west water quality monitoring system.

Figure 3: Sensor showing value.

9. **IoT Cloud-** Integration of the Internet of Things (IoT) and cloud computing has the potential to maximize the use of both. Because IoT systems are mostly made up of interconnected widespread and constrained devices, they can take advantage of essentially unlimited cloud entity resources, such as storage and compute capabilities, to store and process their sensed data. IoT could improve cloud computing by broadening its reach to include real-world applications. To put this concept into practice, and to provide an interaction layer between IoT and cloud computing those accounts for a wide range of network communication protocols as well as security and data management challenges, a cloud software platform is required. We were aware of certain IoT cloud services, such as: Blink, Thing speak, Google Cloud Platform, Eco site IoT Platform, Ayla IoT Platform. Just a few examples. These have two major drawbacks: cost and complexity. We built a simple IoT dashboard that can accept various IoT device connections, display a list of active devices, and chart the data. Also, the processed data collected from the sensors were stored in a database. It will also be used for data analysis, data visualization, and data prediction. We tested this by registering a free hosting account and creating Php pages to receive data from an IoT module via Wi-Fi or GSM module and store it in a database. New Devices can be added with their details and location of implantation. Daily and weekly reports feature have been added for all stored data, including sensor reading reports, fault reports, and the time of their occurrence. It is also possible to remotely control all IoT devices via the web server by sending the command to the database and then receiving the command via an IoT device from the database, this is performed by programming the IoT module using the PIC microcontroller program.

IV.EXISTING METHOD:

Now a day's water is polluted due to many reasons. In this current system, the equipment cost is high, and it takes a lot of time to process. Traditional methods have the drawbacks such as long waiting time for results high cost, low measurement precision, and complicated methodology. So, with the implementation in the technology, we use different methods and techniques to check the quality of water. There is a disadvantage in the existing system that the system has high complexity and low performance.

V.PROPOSEDSYSTEM

The proposed system for wastewater monitoring using PIC controller, PH sensor, gas sensor, temperature sensor, humidity sensor, bio sensor, LCD, and IoT will use the PIC controller as the main controller of the system. The sensors will be connected to the PIC controller which will read the data from the sensors and send it to the LCD for display. The LCD will display the readings from the sensors in real-time. The PIC controller will also send the data from the sensors to the IoT, which will be used for remote monitoring of the wastewater. This system will allow for accurate, real-time monitoring of the wastewater and will alert the user should any of the parameters exceed their safe limits.

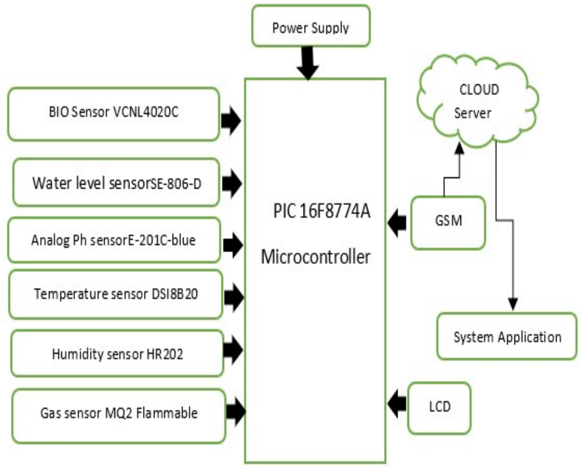

Figure 4: Block Diagram of propose system

VI.RESULTS AND DISCUSSION

The system implemented with the IoT is ideal for real time wastewater monitoring. This is shown in the form of the graphs that are generated by Thing Speak. The temperature sensor LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy).

The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. PH sensor the specifications of the pH sensor used: Measurement range: 0 -14 pH Temperature during use: 0 -80 ° C Response time: <1 minutes Accuracy of readings: up to 0.01 (with calibration) Interference: <0.5 mV. Water is one of the most important natural resources for human life. Water Level Sensor: Measuring Range: 0-4m. Accuracy: 0.2% of measured value Output Signal: 4-20Ma Supply Voltage: 12V DC Working Temperature: -30°C~+75°C Response Time: 1s Sensor Material: Stainless Steel Cable Length: 5m Waterproof Rating: IP68. The accuracy of a biosensor determines how accurately it can measure the concentration of a particular substance. Response time is the amount of time it takes for a biosensor to respond to a change in the concentration of a substance.

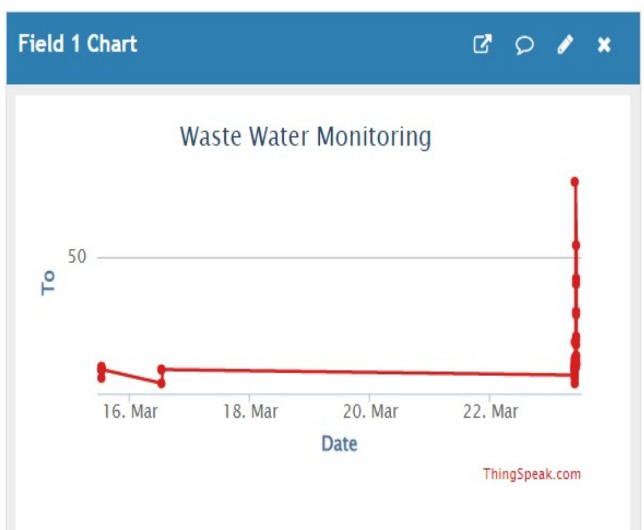

Figure 5 : Graph showing variation of toxic gas with date

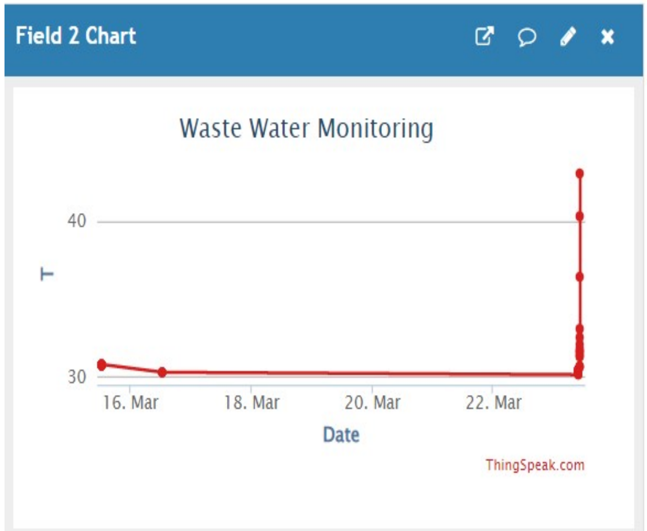

Figure 6: Graph showing variation of temperature with date

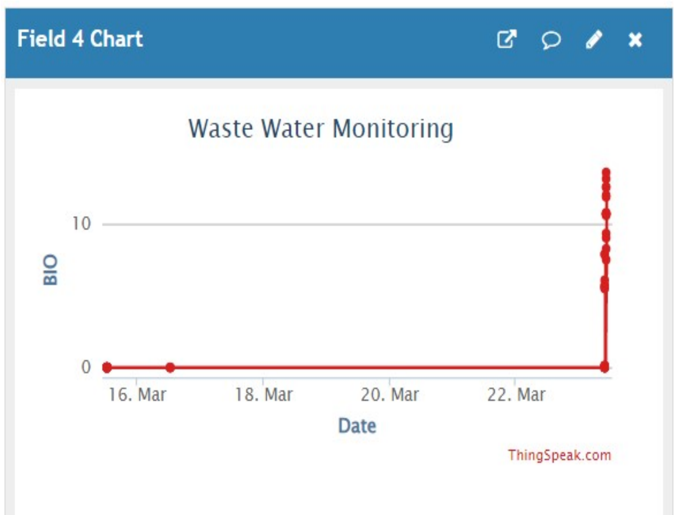

Figure 7: Graph showing variation of BIO level with date.

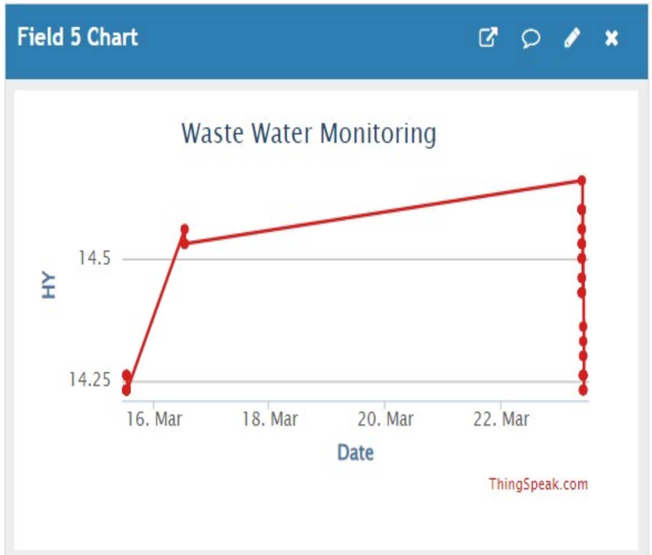

Figure 8: Graph showing variation of Humidity sensor level with date.

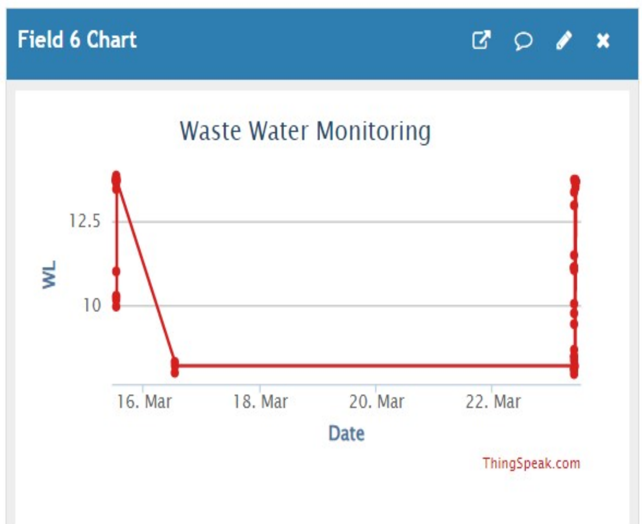

Figure 9: Graph showing variation of water level with date.

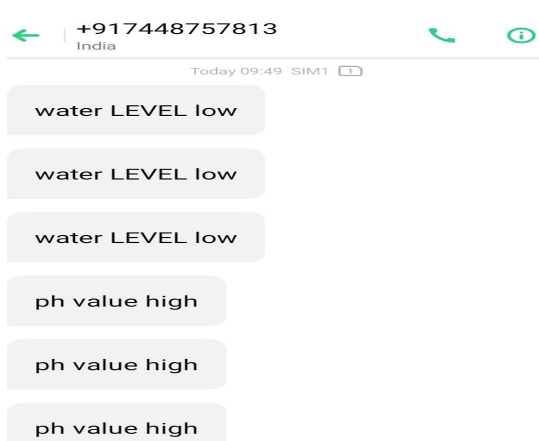

Figure 10: SMS notifications.

VII.CONCLUSION

The use of IoT in wastewater monitoring has revolutionized the way wastewater is monitored and managed. It has enabled the collection of real-time data that can be used to optimize wastewater treatment processes, reduce water pollution, and improve water quality. IoT-enabled wastewater monitoring systems can also help to identify and address any potential problems before they become a major issue. With the help of IoT, it is now possible to accurately monitor and measure parameters such as water temperature, pH, turbidity, and salinity, among others. With the help of IoT, it is now possible for municipalities and other wastewater management entities to accurately monitor and manage their wastewater and make sure that it meets the standards set by the authorities.

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