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INDUSTRY EFFLUENT WATER MONITORING SYSTEM

Shivam Chavan
Aniket Darade
Ritik Singh
Gourang Marathe
Dr. Gajanan Thokal

Abstract

The Arduino UNO/ Node MCU may be used to build an effective and efficient effluent water management system. Effluent water management is a crucial component of maintaining a healthy environment. The numerous procedures involved in treating effluent water are controlled and monitored by this system's Arduino UNO/ Node MCU microcontroller. The technology employs sensors to determine the rate of water flow in the tank, and using this information, water may be sent to a treatment facility. A pH sensor and a temperature sensor are also included in the system to assess the water's acidity and temperature, respectively. On an LCD panel, the system's data is presented, giving the user access to real-time data. The suggested system is a practical option for controlling effluent water since it is affordable, simple to build, and to use. The system includes of an Arduino UNO/ Node MCU microcontroller, a pH sensor, a temperature sensor, and a dissolved oxygen sensor. The sensors collect data on the many characteristics of the water sample and transmit it to an Arduino UNO or Node MCU microcontroller for analysis. The processed data is then sent to the cloud server via IoT protocols like ThingSpeak, which are displayed on an LCD display, using the Arduino UNO/ Node MCU microcontroller.

I. INTRODUCTION

The collection, treatment, and disposal of wastewater produced by industrial, commercial, and home sources are the essential elements of wastewater treatment. Untreated effluent water discharge can have detrimental effects on ecosystems, the spread of disease, and public health. It can also contaminate water supplies and harm ecosystems. Therefore, effective effluent water management is crucial for preserving water resources, promoting public health, and protecting the environment. Systems for managing effluent water are created to clean up pollutants and toxins from wastewater before releasing it into the environment. These systems filter wastewater to get rid of suspended particles, organic matter, and other contaminants using a variety of physical, chemical, and biological methods [1]. The repurposed cleaned effluent water can subsequently be utilized in industrial operations, for irrigation, or it can be released into surface or groundwater sources. The complexity and size of effluent water management systems can vary based on the quantity and quality of wastewater produced, as well as on local laws and environmental factors [18]. They could consist of sanitization, sludge management, and smell control procedures in addition to primary, secondary, and tertiary treatment operations.The field of effluent water management is dynamic and always changing due to regulatory changes, environmental concerns, and technological improvements. Therefore, continued research and development are required to enhance the effluent water management systems' efficacy and efficiency while reducing their negative environmental effects. This paper aims to explore the current state of effluent water management systems, the challenges faced in their implementation, and the opportunities for future research and innovation in this field.

A. Node MCU:

Node MCU is based on the ESP8266 WiFi System-On-Chip from Express if Systems, a publicly traded global semiconductor firm founded in 2008. An open-source development board called Node MCU is built on the ESP8266 Wi-Fi module. As a low-cost Wi-Fi chip, the ESP8266 is appropriate for Internet of Things applications [15]. The Node MCU board is intended to make it easier to prototype and construct IoT devices. It contains many GPIO pins for attaching sensors, actuators, and other devices, as well as a USB port for programming and charging the board. Both the Arduino IDE and the ESP8266 Arduino core are capable of being used to program the Node MCU board. Micro Python and other programming languages are also supported. The Node MCU board has gained popularity as a low-cost and simple-to-use platform for DIY Internet of Things projects, including sensor networks, home automation, and more.

B. Internet Of Things (IoT):

The term "Internet of Things" (IoT) refers to a fast-expanding field that includes a wide range of internet-connected gadgets and technology. These gadgets might range from industrial gear and medical equipment to smart thermostats and home security systems. The Internet of Things is transforming how we work and live and has the power to completely alter various sectors [17]. The IoT makes it possible to gather enormous volumes of data, which is one of its main advantages. These data can be analyzed to yield information that will help in decision-making and increase effectiveness. IoT sensors, for instance, can be used in manufacturing to monitor production lines and spot places where adjustments can be made to cut waste and boost productivity. The IoT also makes remote monitoring and control possible, which is another perk. This implies that gadgets can be tracked and In instances where it is difficult or dangerous for people to be present, the system can be managed from anywhere in the world. IoT sensors, for instance, can be used to monitor pipelines and spot leaks in real-time in the oil and gas sector, enabling speedy response and rehabilitation [13]. Additionally, the IoT is changing how we connect with our homes and cities. Homeowners can change the settings of smart home appliances like thermostats, lighting controls, and security cameras remotely using their smartphones. Utilizing real-time traffic signal adjustments and traffic pattern monitoring, smart city technologies can enhance traffic flow. The IoT's potential effects on privacy and security, however, are also a source of worry. Because there are so many internet-connected gadgets, there is a chance of cyberattacks that might jeopardize private information or even physical security. Concerns exist around the IoT devices' gathering and usage of personal data as well. The healthcare industry is one of the most exciting applications for IoT. IoT devices can be used to remotely monitor patients, enabling more individualized and effective care. Wearable technology, for instance, can be used to track vital signs and notify medical personnel of any changes that need attention. This can lower healthcare expenses and decrease readmissions to the hospital. With smart agricultural equipment that can monitor soil moisture levels, temperature, and other parameters to improve crop production, the IoT is also altering agriculture. IoT sensors can also be used to monitor animal health and spot possible problems before they worsen. In conclusion, the Internet of Things is a quickly expanding industry that is changing how we work and live. The IoT has a lot of potential since it can gather a ton of data, allow for remote monitoring and control, and increase productivity across a wide range of businesses. As the IoT expands, there are additional security and privacy issues that need to be addressed. Despite these challenges, the IoT is expected to continue to grow rapidly in the coming years, driving innovation and transformation across a wide range of industries.

II. DESCRIPTION

This project's main objective is to create an IOT-integrated system for checking the effluent water quality by installing a monitoring device that maintains a close eye on it. This will keep the water in storage or the water sample under monitoring in the event of excessive contamination. If something is out of range or polluting the water, a warning indicator will be sent to the user. Another feature of the system is the ability to record sensor readings and export daily and monthly data to a database that programs can use to show it. To view the results, users can access the website.

Flowcharts:

Figure 1. pH Sensor Flowchart

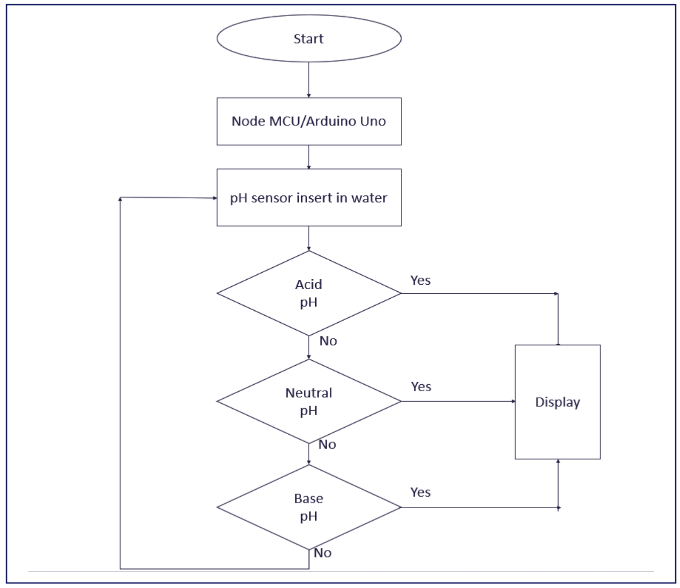


Figure 2. Temperature Sensor Flowchart

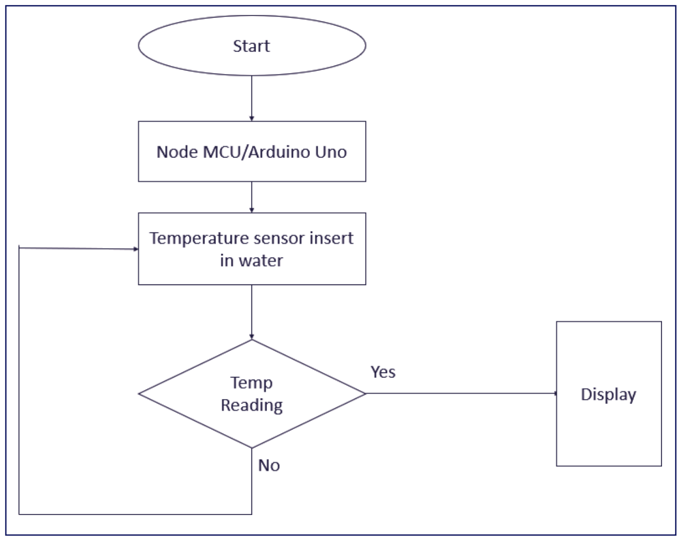


Figure 3. Water Flow Sensor Flowchart

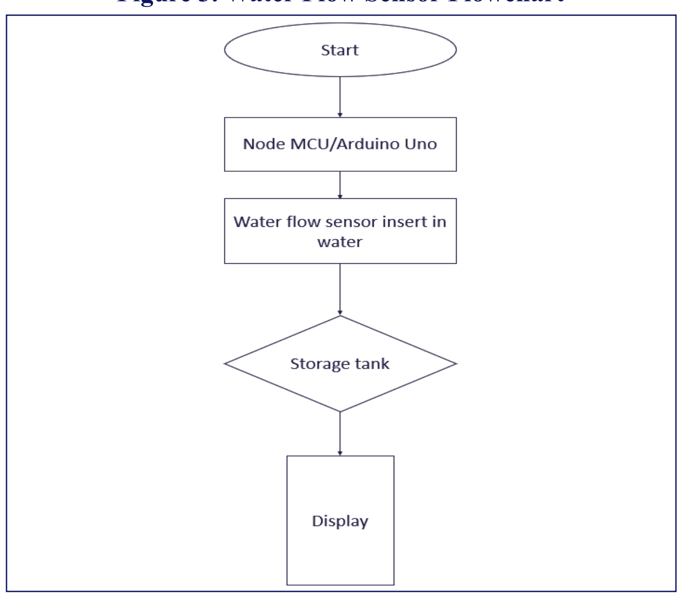


Figure 4. TdS Sensor flowchart

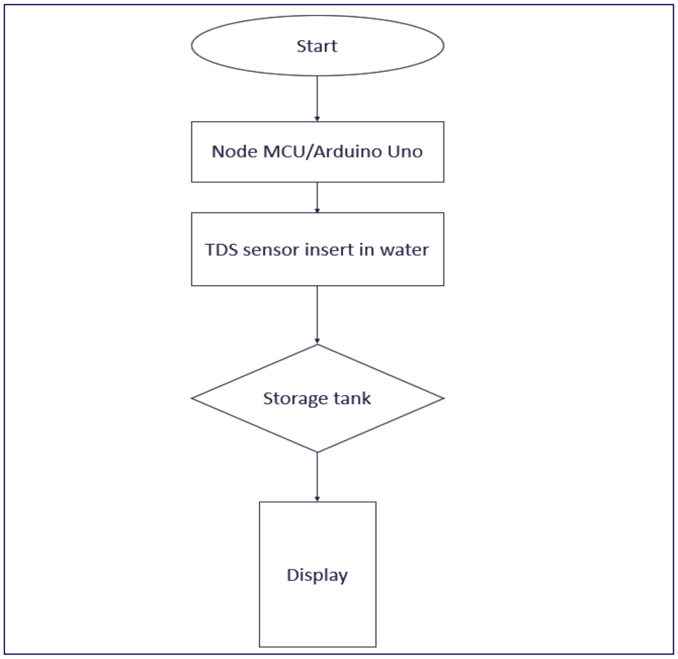
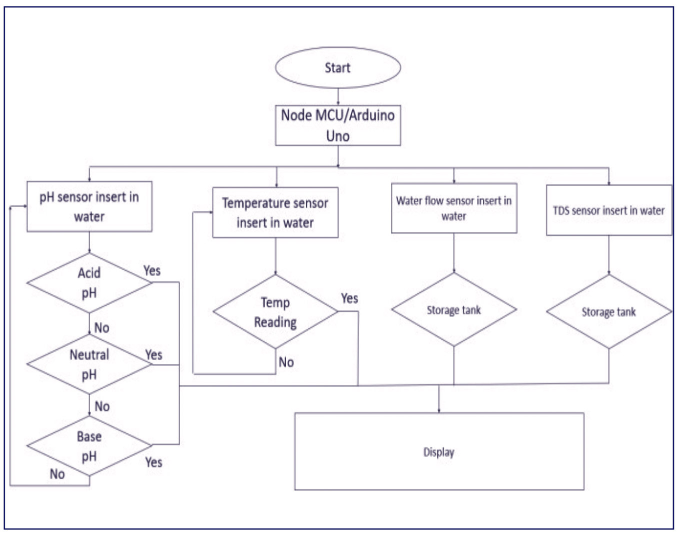


Figure 5. Combined Sensors Flowchart



III. DESIGN

Figure 6. Flow Sensor Connection.

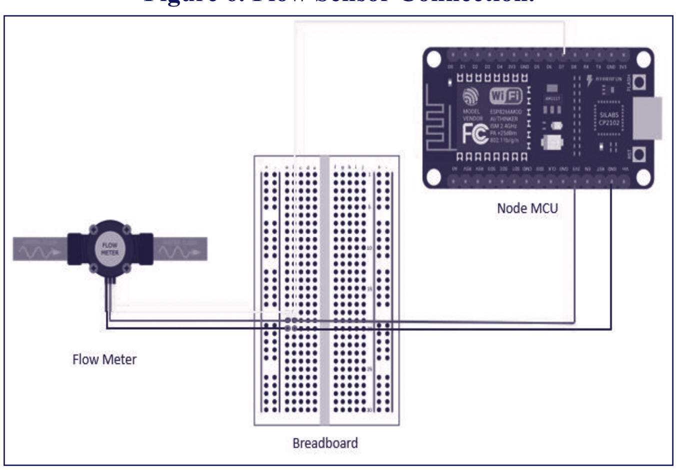


Figure 7. Ph Sensor Connection

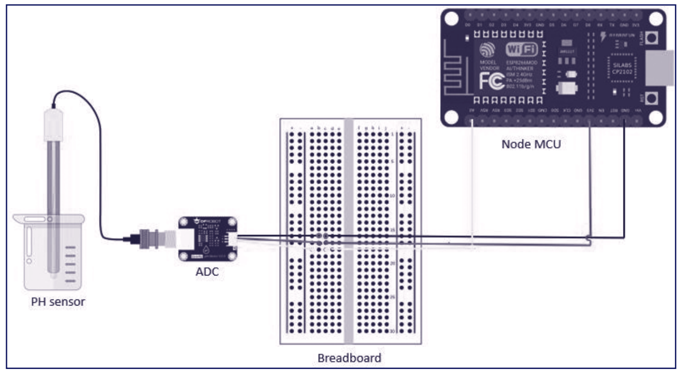


Figure 8. TDS Sensor Connection

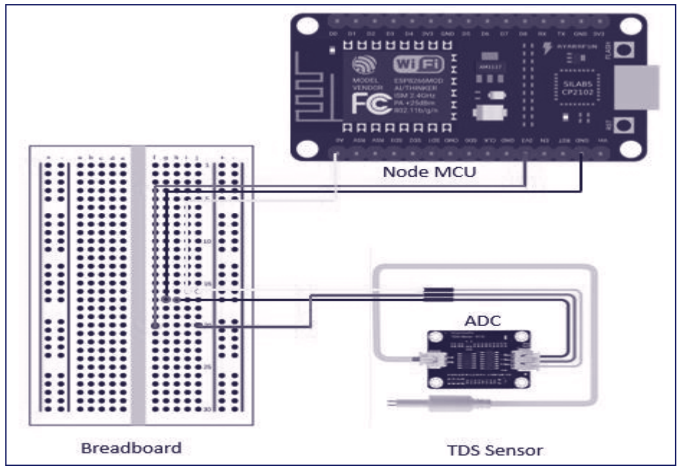


Figure 9. Temperature Sensor Connection

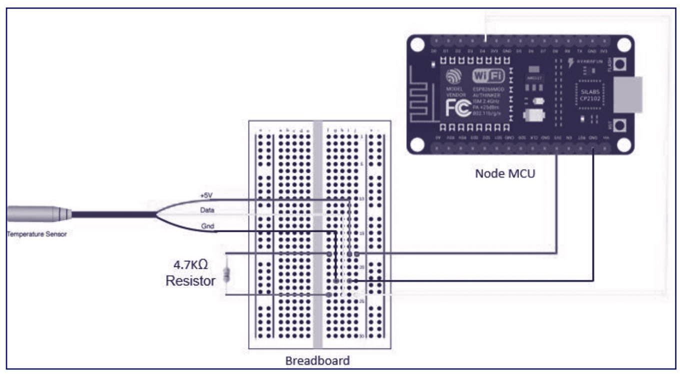


Figure 10. Combined Connections for all the sensors

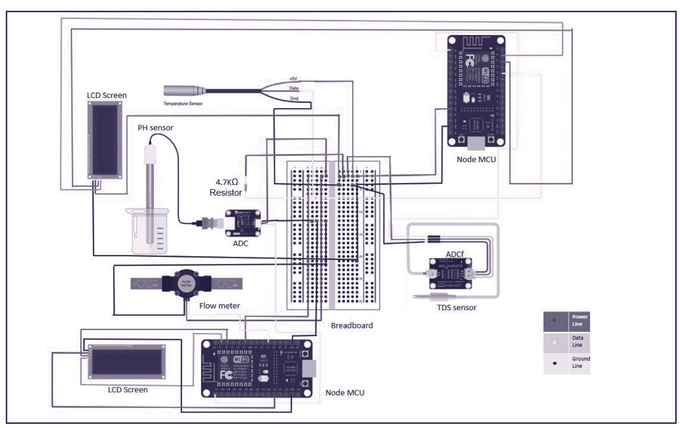
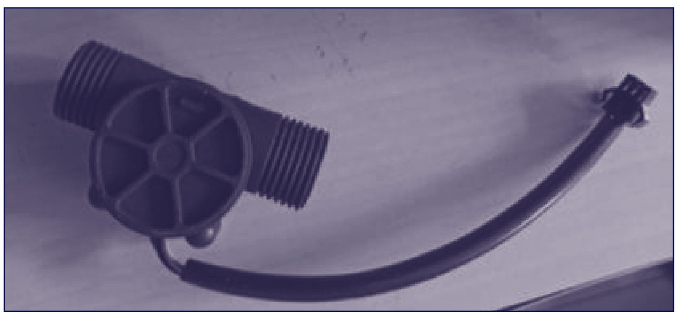


Figure 11. TDS Sensor

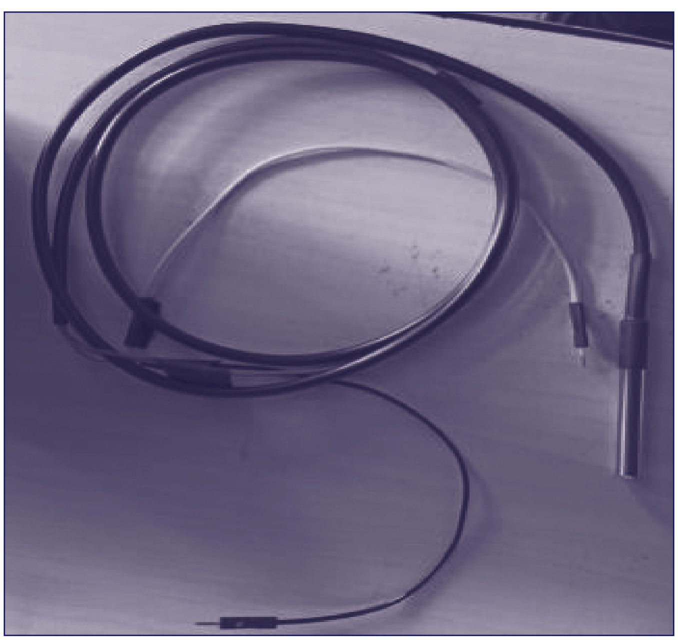
To measure the total dissolved solids (TDS) in a liquid, a TDS sensor is used. TDS stands for total dissolved solids, which includes the amount of minerals, salts, metals, and other chemical components present in a liquid.

Figure 12. Flow Sensor



A gadget called a water flow sensor is used to gauge how much water is moving through a pipe or channel. The sensor operates by detecting variations in the water's velocity as it travels through it [21].

Figure 13. Temperature Sensor

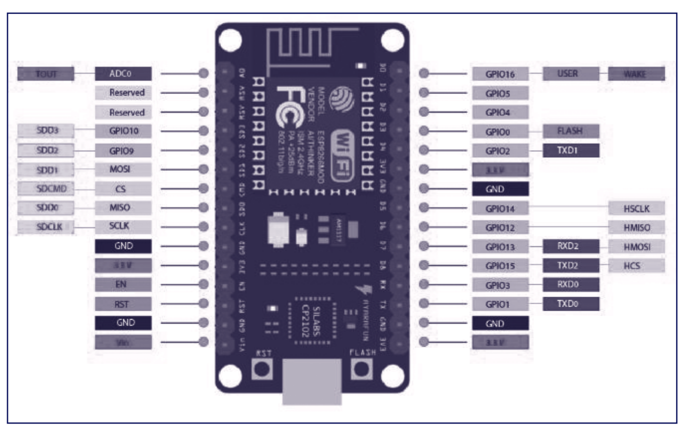


In applications including weather stations, industrial automation, and home automation systems, the DSB18B20 sensor is frequently utilized for temperature monitoring and control. A dependable and adaptable sensor, the DSB18B20 temperature sensor is frequently utilized in a variety of electronic projects [20].

Figure 14. pH Sensor

A pH sensor is an electronic device that gauges a liquid or solution's acidity or alkalinity. The pH scale runs from 0 to 14, with 7 representing neutrality, values lower than 7 indicating acidity, and values higher than 7 indicating alkaline or basic conditions. Numerous sectors, including those that clean water, make food and beverages, manufacture medications, and monitor the environment, employ pH sensors.

Figure 15. Node MCU



A development board called Node MCU is based on the ESP8266 Wi-Fi module. It is intended to facilitate quick prototyping of Wi-Fi enabled devices and is adaptable to a variety of sensors, actuators, and other gadgets. The board has a microcontroller, flash memory, and Wi-Fi connectivity in addition to a variety of input/output (I/O) ports for connecting to other devices.

Figure 16. Hardware Implementation

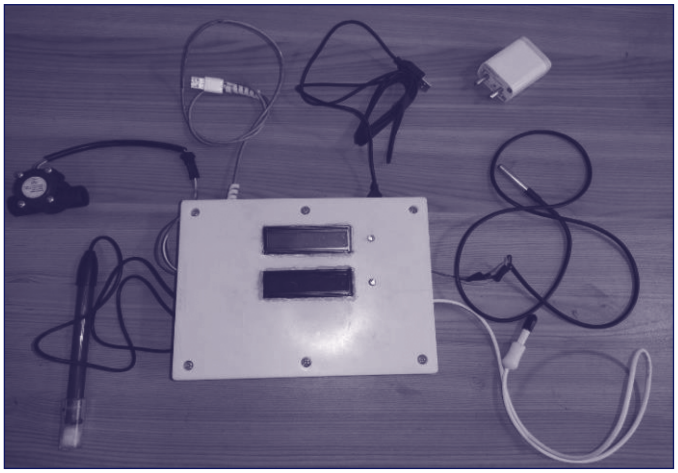
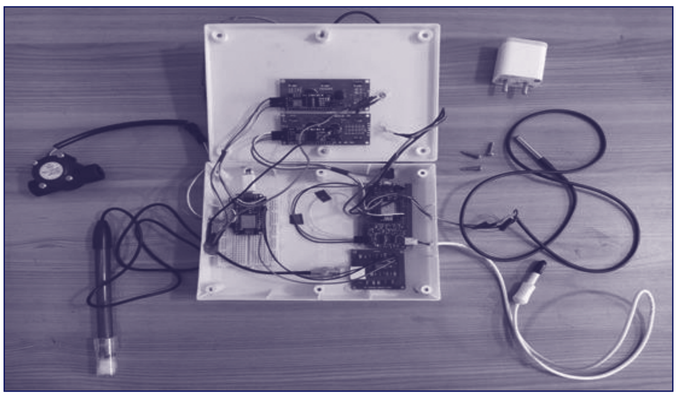


Figure 17. Inside View of Components



IV. RESULTS

The following results are anticipated to be attained following system development: In order to ensure an efficient and prompt reaction, the water quality monitoring system notices changes in the properties of the water and notifies the relevant user.

1) Cutting back on time and expenses in all their forms, including those associated with squandering contaminated water, repairing water damage, and conducting water tests.

2) Periodic measurement data collection, position coordinates, and packet data uploading to a database.

3) After sensing the data from different sensor devices, which are positioned in a specific area of interest or in a water sample, the sensed data will be displayed on the LCD display and automatically transmitted to the web server. Once a proper connection has been made with the server device, users can access the website or use an application to view the results.

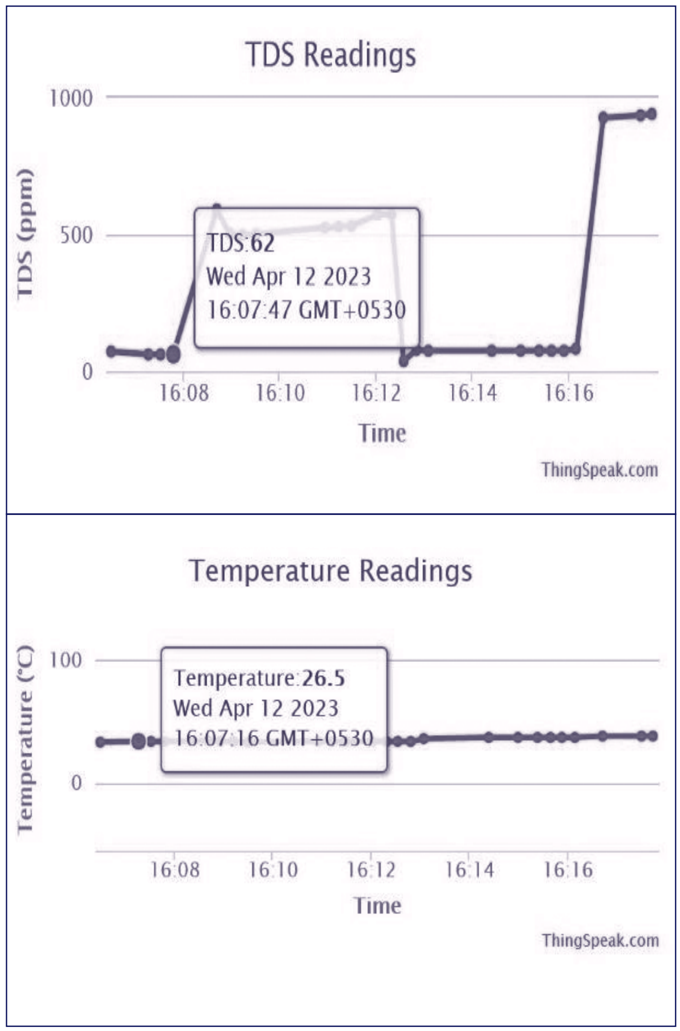
Sr No .	Temperature Sensor Readings (ºC)	pH Sensor Reading s (pH)	TDS Sensor Reading s (ppm)	Flow Sensor Reading s (L/min)
1	26.5	7.51	62	0
2	26.5	4.10	539	17.2
3	29.5	6.61	73	10.4
4	30.5	7.03	931	0

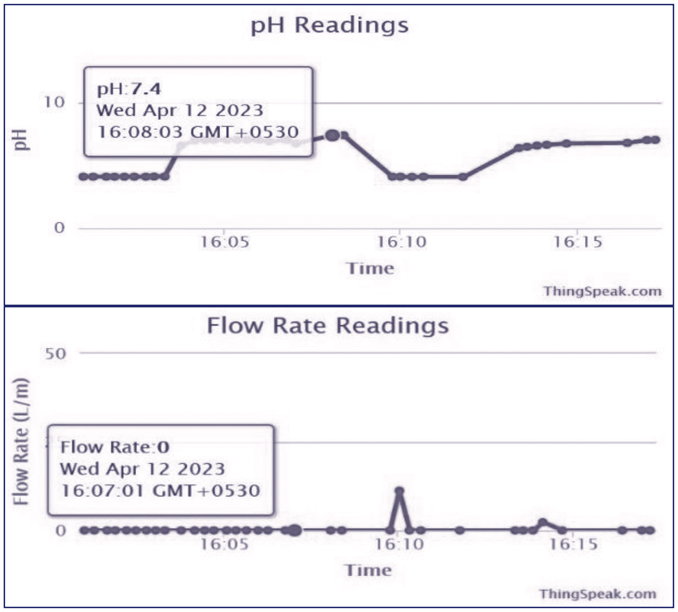
Beaker 1:

Sensor Readings for Beaker 1 displayed on LCD-

ThingSpeak Charts-

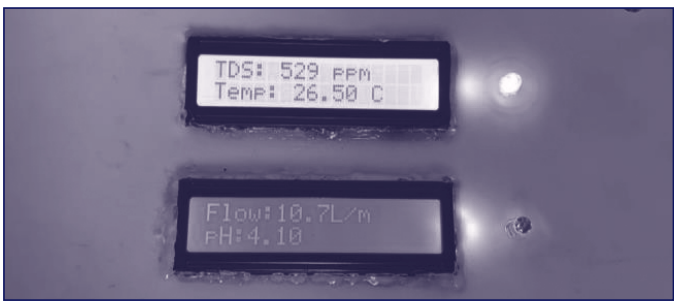
Figure 18. Thing Speak Charts for Beaker 1





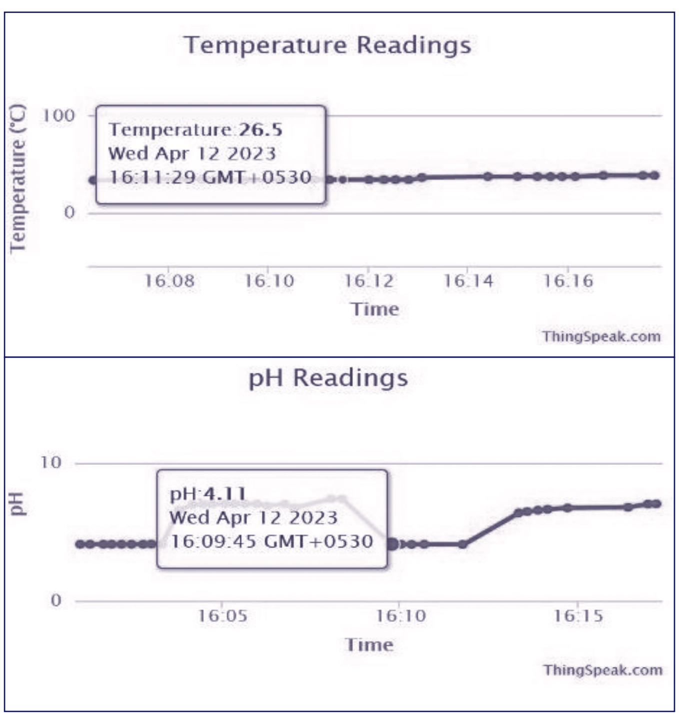
Beaker 2: Sensor Readings for Beaker 2 displayed on LCD-

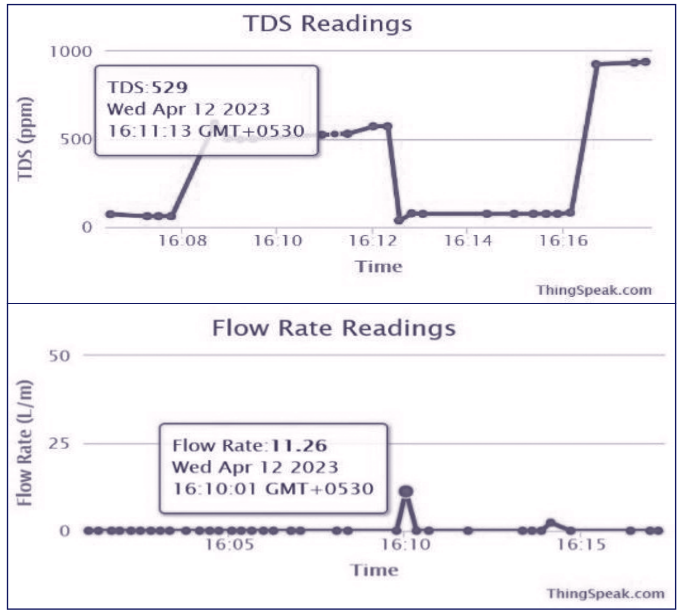
Figure19. Sensor Readings for Beaker 2 displayed on LCD



ThingSpeak Charts-

Figure 20. ThingSpeak Charts for Beaker 2



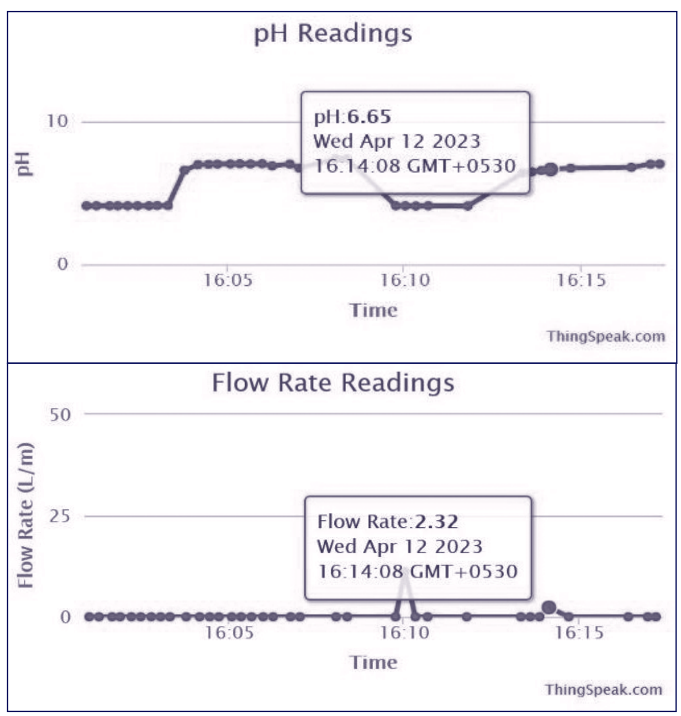


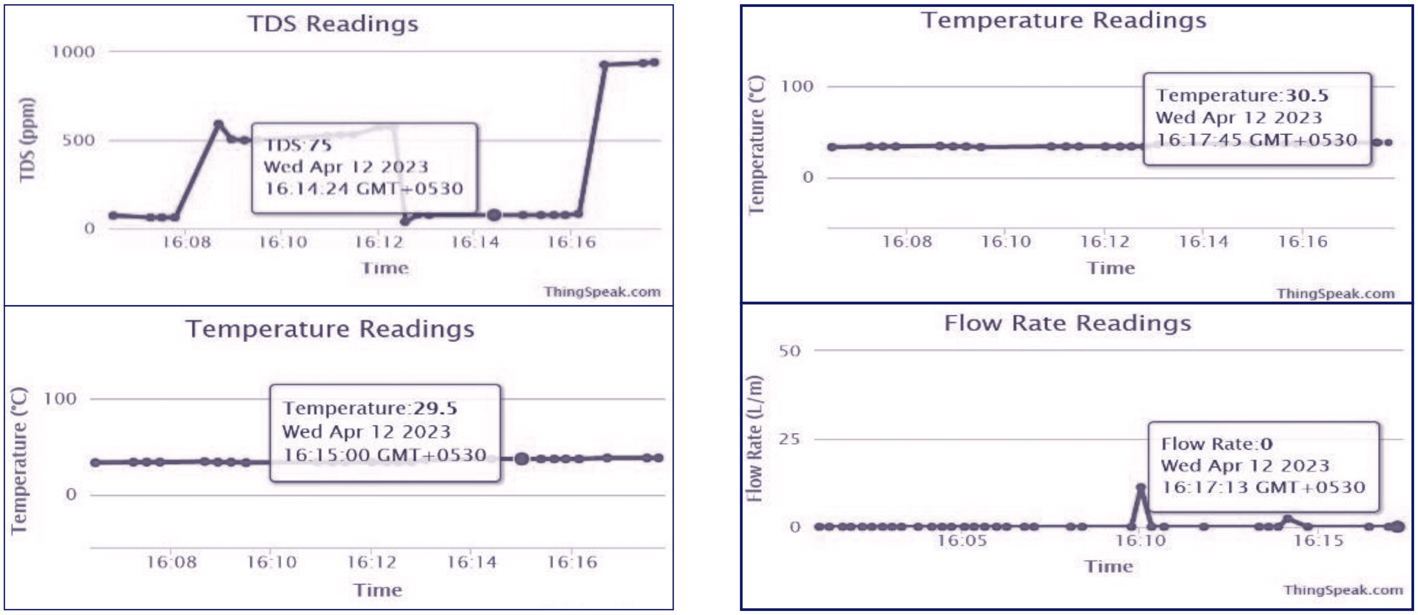
Beaker 3: Sensor Readings for Beaker 3 displayed on LCD-

Figure 21. Sensor Readings for Beaker 3 displayed on LCD

ThingSpeak Chart-

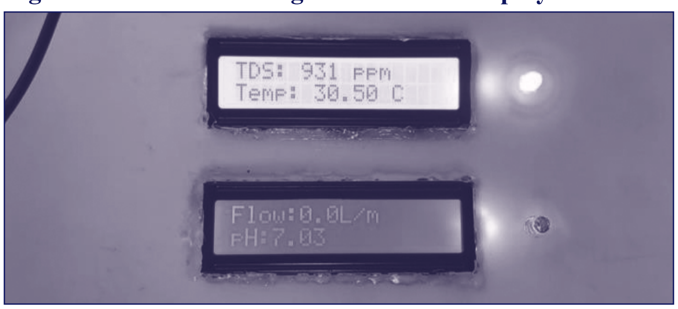
Figure 22. ThingSpeak Charts for Beaker 3





Beaker 4: Sensor Readings for Beaker 4 displayed on LCD

Figure 23. Sensor Readings for Beaker 4 displayed on LCD



ThingSpeak Charts

Figure 24. ThingSpeak Charts for Beaker 4

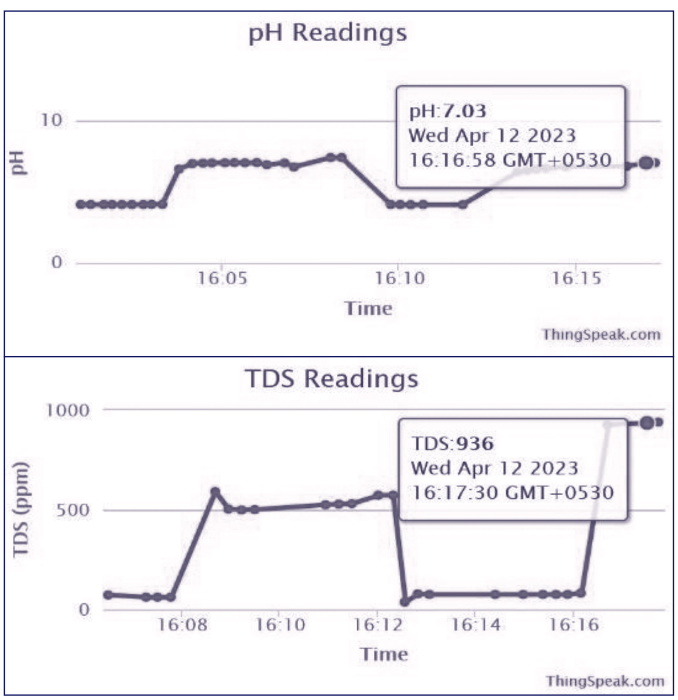
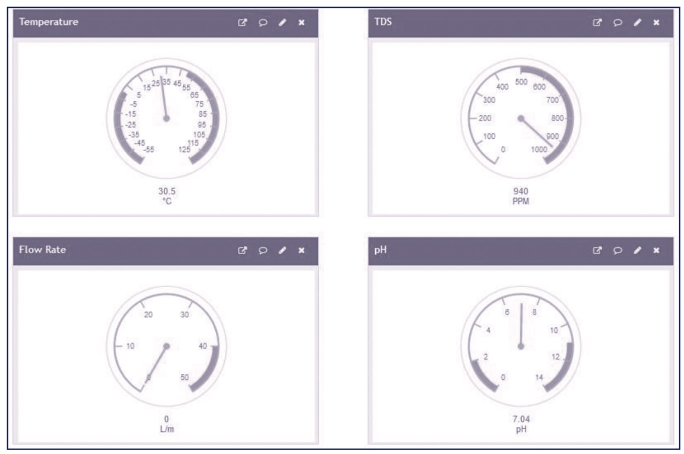


Figure 25. ThingSpeak Gauge Readings for all sensors



ThingShow Mobile Application data:

Figure 26. ThingShow Mobile Application Charts

Figure 27. Exported Datasheet from ThingSpeak

	A	B	C	D	E	F
75	2023-04-12 10:40:40 UTC	77			0	4.10
76	2023-04-12 10:40:56 UTC	78	26.5	525		
77	2023-04-12 10:41:13 UTC	79	26.5	529		
78	2023-04-12 10:41:29 UTC	80	26.5	531		
79	2023-04-12 10:41:47 UTC	81			0	4.09
80	2023-04-12 10:42:02 UTC	82	26.5	573		
81	2023-04-12 10:42:19 UTC	83	26.5	573		
82	2023-04-12 10:42:34 UTC	84	26.5	37		
83	2023-04-12 10:42:50 UTC	85	26.5	78		
84	2023-04-12 10:43:05 UTC	86	28.5	75		
85	2023-04-12 10:43:20 UTC	87			0	6.39
86	2023-04-12 10:43:36 UTC	88			0	6.49
87	2023-04-12 10:43:52 UTC	89			0	6.58
88	2023-04-12 10:44:08 UTC	90			2.32	6.65
89	2023-04-12 10:44:24 UTC	91	29.5	75		
90	2023-04-12 10:44:42 UTC	92			0	6.75
91	2023-04-12 10:45:00 UTC	93	29.5	75		
92	2023-04-12 10:45:23 UTC	94	29.5	75		
93	2023-04-12 10:45:39 UTC	95	29.5	75		
94	2023-04-12 10:45:54 UTC	96	29.5	75		
95	2023-04-12 10:46:10 UTC	97	29.5	82		
96	2023-04-12 10:46:25 UTC	98			0	6.80
97	2023-04-12 10:46:43 UTC	99	30.5	927		
98	2023-04-12 10:46:58 UTC	100			0	7.03
99	2023-04-12 10:47:13 UTC	101			0	7.04
100	2023-04-12 10:47:30 UTC	102	30.5	936		
101	2023-04-12 10:47:45 UTC	103	30.5	940		

Column A: Date and Time

Column C: Temperature in degree Celsius Column D: TDS in ppm

Column E: Flow rate in L/min Column F: Ph

V. CONCLUSION AND FUTURE SCOPE

This chapter includes a summary of the final result and the future work of the project.

A. **Conclusion**

In order to ensure that the water we use in our daily lives is of high quality, nature and society, including citizens, businesses, and factories, must overcome several difficulties. Consequently, we developed a concept for an integrated IoT system for monitoring water quality as part of this project. The on-demand water quality checker and as a standalone Internet of Things device are the two main usage scenarios for which this technology is intended. In the first case, a specific water sample might be tested using the gadget. The tool will evaluate specific factors and provide values for quality parameters. In the second case, the device is set up in a moving location and continuously checks the water quality. The concept of the device was developed with the idea that it should function in the setting of industries and businesses since they require the most continual water monitoring and are more susceptible to pollution. This technique makes it simple to detect water pollution, which aids in its management. The method also saves all the time and money loss that may be caused by lab tests or delays, as well as the ignorance of water that is unsafe for human consumption. It also enables the sensors to offer data online to users.

B. **Future Scope**

The Design and Development of Effluent/Water Monitoring The system project has a lot of potential for growth because it meets the urgent demand for efficient water resource management and pollution prevention. Potential paths for development in the future include:

1) Artificial intelligence: By incorporating machine learning and AI algorithms, predictive analytics may be created, allowing for the early identification of potential problems such equipment failure or changes in water quality indices. This would make it possible to take preventative measures, decreasing downtime and increasing system effectiveness.

2) Sensor Development: By advancing sensor technology, the monitoring system might become more dependable and accurate thanks to sensors that are more accurate and affordable.

3) Integration with Water Treatment Systems: Integrating the monitoring system with water treatment systems can enable automatic control of treatment processes based on real-time data, optimizing the efficiency of the system and reducing costs.

4) Expansion of Applications: The monitoring system can be adapted to other applications, such as domestic houses, aquarium, water parks, agriculture, public drinking water taps, etc.

In conclusion, the Design and Development of Effluent/Water Monitoring System has vast potential for future scope, providing solutions for critical environmental challenges. The integration of IoT, AI, mobile applications, and sensor technology can enhance the efficiency, accuracy, and accessibility of the system, enabling proactive measures to be taken, reducing costs, and improving the quality of water resources.

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VII. *WEBSITES*

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20. *Temperature sensor datasheet https://components101.com/sites/ default/files/component_ datasheet/DS18B20%20datasheet.pdf*
21. *Flow sensor datasheet- https://www.mantech.co.za/datasheets/products/YF-S201C-190128A.pdf*
22. *Arduino official website:-https://www.arduino.cc/en/software*
23. *Thing Speak official website- https://thingspeak.com/.*

AUTHORS

Shivam Chavan, Aniket Darade, Ritik Singh, Gourang Marathe, BE, Department of Mechanical Engineering, Pillai College of Engineering, Dr. K. M. Vasudevan Pillai Campus, Plot No. 10, Sector 16, New Panvel (East), Navi Mumbai, - 410 206 (MS)
Email: Shivamchavan05@gmail.com / aniketdrd1@gmail.com / ritiksingh6230@gmail.com / Marathegourang05@gmail.com

Dr. Gajanan Thokal, Project Guide, Department of Mechanical Engineering, Pillai College of Engineering, Dr. K. M. Vasudevan Pillai Campus, Plot No. 10, Sector 16, New Panvel (East), Navi Mumbai, - 410 206 (MS)
Email: gthokal@mes.ac.in