

A Smart Cleansing Technique & Garbage Collection Using IOT

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Abstract - The issue of drinking water insecurity in coastal regions is caused by intricate hydrogeological formations. Safe water supply is more challenging in certain areas than others due to natural catastrophes and issues with transboundary rivers. In these coastal locations, attempts to provide appropriate and broad access to clean and reasonably priced drinking water are complicated by the possible danger of industrial contamination. Knowing that having access to clean water in one's immediate vicinity is a human right in order to have a healthy life highlight how vital it is to address water-related illnesses and stop pollution. It is necessary to closely monitor water characteristics including pH, turbidity, temperature, dissolved oxygen, and salinity in order to effectively manage these problems we have developed a sustainable and efficient IoT-based water quality measuring system in response to these demands. A sophisticated sensor interface device at the heart of the solution can identify water quality metrics and provide real-time data straight to an online system. An all-encompassing method of tracking water quality indicators is offered by integrating many sensors with Arduino. Data transfer and information presentation on an internet platform or web interface were ensured by establishing a serial communication link between the Arduino and the water TDS. To improve user accessibility, every water source includes a QR code that people can scan to instantly determine the safety of their water. In addition to giving citizens access to information on the quality of their drinking water, this cutting-edge technology gives governments a useful tool for tracking the water quality in certain regions. This adaptable technology may be utilized in industrial and agricultural settings in addition to homes. Authorities in regions with water quality problems will be able to take preventative action and put effective solutions in place thanks to the design, development, and deployment of these IoT-based solutions.

Keywords - Real Time System, IoT, Arduino Nano, pH Sensor, WI-FI Module, Salinity, Dallas Temperature Sensor, Esp Sensor, Water Quality, Humidity Sensor.

1 | INTRODUCTION

The correct administration of freshwater is imperative, particularly considering the developing needs in farming, industry, and different divisions. The quality of freshwater is evaluated based on its "chemical, physical, and natural" components. Checking water quality plays a significant part in recognizing issues such as contamination, harmful chemicals, and defilement. The conventional strategy, still broadly utilized, incorporates the collection of water tests, research facility examination, and proposals for essential water treatment. The modern approach to checking water contamination includes three fundamental stages. Checking water quality through the conventional forms of water inspecting, testing samples, and investigative examination isn't as it were costly, challenging, and time-consuming but too requires master input, making it less efficient. [23,14] With the movement of innovation, there's an opportunity to present robotization into water quality checking, advertising a more responsive and streamlined approach compared to manual strategies. Mechanical advancements have begun to clear the way for robotized frameworks that upgrade the observing of water quality, displaying a reasonable elective to conventional manual forms. Within the locales encompassing material, dying, and coloring units in Dhaka, Narayanganj, and Gazipur, the shallow aquifers confront serious contamination due to the unregulated release of untreated effluents into adjacent low-lying lands and streams. This contamination renders the aquifers unacceptable for different purposes. Businesses arranged along riverbanks utilize water from the waterway discharging both treated and untreated effluents.[23] Downstream communities depend on this water for water system, drinking, and other household exercises. The winning circumstance underscores the critical require for the advancement of moved forward strategies for real-time observing of water quality parameters. We have formulated a show to survey water sources, wherein the accumulated information is transferred and analyzed online utilizing remote communication. The framework, leveraging the extending reach of remote sensor systems all inclusive, holds considerable commercial value Moreover, it consolidates

a feature to alarm far off clients in case of deviations from pre-established standard values for water quality parameters. This paper seeks after a dual objective. Firstly, it presents a clear, cost-effective, and less complicated demonstrate for testing water quality. Furthermore, it includes information investigation to compare it with the Water Quality File (WQI). The assessment of water quality considers its physical, chemical, and natural traits. Endeavors have been contributed in formulating Water Quality Files (WQIs) to offer an comprehensive delineation of water quality based on different estimations. The Water Quality List (WQI) capacities as a metric for assessing water quality over diverse applications, making a difference anticipate its suitability for purposes like drinking, horticulture, or supporting sea-going life forms. Ordinarily, the WQI is gaged on a scale that ranges from 0 to 100.

2 | LITERATURE SURVEY

"Water Quality Monitoring in Rural Areas - The Cloud Economy Project", Nikhil Kedia 1st International Conference on Next Generation Computing Technologies (NGCT-2015), Dehradun, India, 1st edition, 2015. The whole process of water quality monitoring including sensors, Integrated design and information sharing were selected in this study to ensure the proper distribution of information by governments, network operators and residents. The location of the music cloud is also being investigated. Although we cannot automatically improve water quality at this time, efficient use of technology and adoption of cost-effective technologies can increase people's awareness of the problem. The work of Inesh Patoliya and Jayati Bhatt "Continuous Water Quality" Monitoring System " This study It was clarified that the water quality should be monitored continuously to ensure the safe supply of drinking water and for this purpose, a method called monitoring was proposed of water quality in the Internet of Things (IoT) This paper presents the architecture of a monitoring system based on the Internet of Things (IoT) water quality monitoring that continuously monitors water quality. The system contains an array of sensors that detect a variety of water quality parameters, including temperature, turbidity, conductivity, pH, and dissolved oxygen. The microcontroller processes the measured values of the sensors and sends the processed values to the main controller, Raspberry Pi, via the Zigbee protocol. Finally, the sensor data can be viewed using a cloud-based web browser. [21,22] Industry 4.0 as part of smart cities", by Michal Lom, Ondrej Pribyl and Miroslav Svitek. This study shows the convergence of Industry 4.0 and smart city projects. The term "smart city" has gained a lot of attention in recent years, especially after the 2008 global financial crisis. Creating urban models and maintaining people's quality of life are the main drivers for creating smart city projects. The concept of smart cities cannot be seen only as a technical field. Other factors such as law, psychology and economics must also be taken into account. According to the concepts of Industry 4.0, the Internet of Things (IoT) will be used to produce so-called intelligent products. Every little part of the product has its own intelligence. Additional knowledge is used from product manufacturing to further

processing, examining the entire life cycle (knowledge processes). Another important aspect of Industry 4.0 is the Internet of Services (IoS), which includes, among other things, smart and logical transport (smart mobility, smart logic) and the Internet of Energy (IoE), which determines how environmental resources should be assigned to use correctly. Public services (electricity, water, oil, etc.). Industry 4.0 can be seen as part of smart cities and IoT, IOS, IoP and IoE can be seen as elements that can create connections between smart city projects and Industry 4.0. Paper "QOI-Aware 'Internet of Things' Energy Management" by Zhanwei Sun, Chi Harold Li, Chatschik Bisdikian, Joel W. Branch, and Bo Yang wrote the Environment' This research aims to develop energy management that can occur in the high quality experience (QOI) in the sensitive context IOT, energy efficiency over time, is clear and compatible with the low-level methods used. In particular, the new concept of "person-aware" QOI takes into account the QOI requirements of an activity and the intelligent capabilities provided by sensors in the smart IOT environment. An innovative idea of the "critical coverage set" of a task to select the cells to perform the task over time. Electronic control decisions are made during operation as the best option for long-term traffic data and taking into account the duration of services. The concepts and methods presented in this paper are illustrated through a comprehensive case study of water level monitoring using a sensor network. Simulations are also performed to demonstrate the effectiveness of the proposed algorithm. "Adaptive Surface Analysis for Distribution Network Management of Water Systems," written by Sokratis Kartakis, Weiren Yu, Reza Akhavan, and Julie A. McCann. In this paper, we present a break detection and localization approach for cascading networks that integrates graph topology analysis, anomaly detection, and lightweight compression. We demonstrate that by using the differences in the arrival times of the measured vibration changes at the sensor location, we can accurately locate the water damage location by reducing the amount of communication between the music device and the backend server. Compared with the usual reporting situation, our findings can save up to 90% of communication. [1]

3 | RESEARCH METHODOLOGY

In this section different research methodologies is mentioned.

3.1 | REQUIREMENT ANALYSIS

The design and use of an Internet of Things (IoT) boat for the separation of bio and non-biodegradable waste from rivers using a vehicle system requires a detailed requirements analysis. Boats and structures should use durable, water-resistant materials that can be held down by conveyor belts and waste distribution units. It is important to choose a conveyor belt system that is resistant to water damage and can handle any type of waste. Using a multiple combination approach, we integrated biological and non-biological sensors to improve the accuracy of residue detection. Navigation and autonomous control and navigation of GPS systems and anti-lock braking systems

are critical to ensure safe operation. Information systems must be connected to the IoT for real-time data transmission and security measures. Along with energy efficient design, a reliable and stable power source, such as solar or batteries, is very important for ship power sources. Cloud integration for data storage and analysis, control panel and alarm system promote efficiency and monitoring. A focus on rigorous testing, compliance, public engagement and education is critical to successful delivery. Field testing and improvements based on feedback are essential to optimizing your boat and its performance in real conditions.

3.2 | TECHNICAL OVERVIEW

It is a stand-alone room management system designed to independently separate waste with conveyor belts and prevent excess waste from being thrown into the bin. An IR sensor is used to detect the fullness of each tank in a different position. Auxiliary conveyor belts are installed separately on each bin and are connected to the main conveyor system. [17,19] The main conveyor belt collects debris from each auxiliary zone. The main conveyor has several categories of waste: wet, dry, waste (such as plastic, cardboard, paper), etc. The use of the Internet of Things (IoT) project allows the calculation of several categories of waste. As a result, the amount of each type of waste is also recorded.

3.3 | PROPOSED SOLUTION

Many small transporters pushing into the main transporter. At the beginning of each auxiliary transporter is a litter box. Garbage is thrown by infrared sensors on the top of the bin. Debris can be detected with an infrared sensor, which essentially performs the same function as the human eye, using a camera sensor. The radiation emitted by the infrared transmitter and received by the infrared receiver decreases as the waste approaches the infrared sensor due to the increase in the amount of waste. Debris can be detected by the reduction in energy of the infrared receiver. [20,18] After that, the waste moves onto the auxiliary conveyor and reaches the main conveyor. There is also an infrared sensor at the end of the main conveyor to detect debris. Then the isolated area begins. The bins are located in a separate area where sensors allow waste to be separated into wet and dry categories. If the waste is biodegradable and non-biodegradable, it first falls into the corresponding bin from the circular platform turned by the servo motor, which is held at the bottom. When the waste falls into the appropriate container at the round base if defined as wet, and into the round bottom container if defined as dry. The integration of the Internet of Things is done to track and count waste. The Wi-Fi module chip is connected. The amount of waste belonging to wet and dry category is collected through IOT. [16]

3.4 | MODULES

MODULE 1 – HYDRO CLEANER

This module collects waste from rivers with the help of IR sensors and this module is based on Arduino Nano.

MODULE 2 – TRASH SEGREGATOR

This module segregates between biodegradable and non – Biodegradable wastes with the help of moisture sensor.

MODULE 3 – HYDRO QUALITY CHECK

This module checks the quality of water with the help of TDS sensor and shows the Real time data on a system.

3.5 | IMPLEMENTATION

At first, the infrared sensor decides in case the waste can be full or not. The IR sensor identifies whether the canister is full and informs the PIC16F877A chip. At that point, in understanding with the microcontroller's coded program, a servo engine turns the squander container in a 180° revolution after 1 seconds, permitting the squander to drop onto the sub transport. The sub conveyor starts to turn. The rubbish is presently landing on the most transport. After a small delay, the most transport starts to roll whereas the sub conveyor ends operation in understanding with the time delay indicated within the microcontroller program. Trash is spilling into the isolation container, which has dry, wet, and metallic sensors. The dampness sensor and metallic inductive nearness sensor are mounted and associated inside the segregation container. In arrange to identify garbage arrival, an IR sensor is additionally mounted at the conclusion of the most transport. The computer program causes the isolation container to turn 180 degrees. The servo engine is joined to one isolated collecting containers. Depending on the kind of trash and where it falls in connection to the particular squander collecting holder, the servo engine pivots either clockwise or counterclockwise. [15] It is conceivable to track the sum of each kind of squander, such as dry, damp, or metal squanders. The Wi-Fi chip has been arranged and connected. The user's portable phone will get data from the Web of Things (IoT) module that screens the rubbish. The collection of each kind of squander on the containers is shown by the smartphone app.

3.6 | WATER QUALITY ANALYSIS

The Water Quality Index is a standardized method for evaluating and displaying the overall quality of water bodies, such as lakes, rivers, and groundwater (WQI). By distilling complex water quality data into a single numerical number, it simplifies the understanding of water quality for human and environmental use. WQI is calculated using key water quality indicators, including turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), nitrate content, total dissolved solids (TDS), pH, and fecal coliform levels.

These characteristics provide important information about the health of the water and are assigned a weight based on their relative importance to the total water quality.

WQI is frequently estimated using the formula below:

$$WQI = \frac{\sum(Q_n \times W_n)}{\sum W_n} \quad (1)$$

Where:

Qn: The measured value in relation to standard values is used to generate the quality rating for the n-th parameter.

Wn: The n-th parameter is given a unit weight that represents its relative significance to the total quality. Every factor in the WQI computation is essential to figuring out the water quality:

a. pH

The concentration of hydrogen ions in water is determined using the formula:

$$\text{pH} = -\log [\text{H}^+] \quad (2)$$

The ideal range for aquatic life and safe ingestion is between 6.5 to 8.5, which indicates the water's acidity or alkalinity.

b. Dissolved Oxygen (DO)

It is a measurement in milligrams per litre, indicates how much oxygen is dissolved in water. Higher DO levels are indicative of healthy water, which is necessary for aquatic life, whereas lower levels point to organic contamination or a sick environment.

c. Biochemical Oxygen Demand (BOD)

It measures how much oxygen microbes require to break down organic materials. By lowering the amount of oxygen in the water, high BOD levels indicate significant organic pollution, which stresses aquatic life.

d. Nitrate

The concentration of nitrate, expressed in milligrams per liter, indicates the amount of nitrogen compounds present in sewage or fertilizers. Infants that consume contaminated water run the danger of developing "blue baby syndrome" and eutrophication due to elevated nitrate.

e. Total Dissolved Solids (TDS)

TDS is a measurement that shows the overall concentration of dissolved organic and inorganic materials in water. It is expressed in milligrams per liter. Water flavour, potability, and agricultural usefulness are all impacted by high TDS, which can occasionally be a sign of chemical contamination.

f. Turbidity

Turbidity measures the number of suspended particles in water and is expressed in NTU. In addition to harming aquatic plants and reducing light penetration, high turbidity can contain diseases, making disinfection challenging.

g. Fecal Coliform:

When the number of fecal coliform bacteria is 100 mL, it indicates that human or animal feces has contaminated the area. Elevated levels indicate contaminated water that can harbour cholera, dysentery, and typhoid.

It becomes crucial to quantify the influence of each component in a consistent manner when assessing water quality using the factors listed above. **The Quality Rating (Qi)** idea is used here to allow for constant comparison and to contribute to the overall Water Quality Index (WQI), each measured parameter is transformed into a quality rating that is used to evaluate the water quality in areas where waste tends to gather, such as lakes,

rivers, or ports. Real-time data is sent to a central Internet of Things system via the sensors that are put on the boat and measure things like pH, DO, BOD, Nitrate, TDS, Turbidity, Fecal Coliform, and more. To ascertain pollution levels, Qi values for every water

quality metric are computed using the data gathered.

$$Q_i = \frac{(\text{V}_{\text{actual}} - \text{V}_{\text{ideal}})}{(\text{V}_{\text{standard}} - \text{V}_{\text{ideal}})} \times 100$$

where:

Qi: The i-th parameter's quality rating, Vactual: sensor-measured value, Videal: The optimal value for that metric, such as pH, is 7, Vstandard: The highest amount allowed under environmental regulations.

3.7 | SYSTEM ARCHITECTURE

The system architecture of the IoT-based waste sorting boat is designed with several integrated components to achieve efficient and independent waste management in rivers. The strong structure of the boat, made of durable and waterproof materials, is the basis of its functionality. At its core is a motorized conveyor belt system, which is responsible for collecting and sorting the waste into the boat's containers. Biodegradable and non-biodegradable sensors that can use machine learning algorithms play a crucial role in identifying and separating waste types. A microcontroller or processor manages these sensors, the conveyor belt and other connected components, ensuring coordinated operation. The communication module enables real-time data transmission between the boat and the central monitoring station, which facilitates remote monitoring and management. [13] GPS and navigation system integration allows the boat to navigate waterways independently, while barrier systems increase safety. A power management system that includes an energy source such as solar panels or batteries optimizes energy use [12,14] Collected data is sent to a cloud-based platform for storage and analysis, which provides insight into tree sorting patterns. Drivers can monitor and control the boat through the user interface, and an alarm system notifies them of malfunctions or critical situations. Security features, including data encryption, ensure the integrity of communication between the boat and the central monitoring station. This comprehensive architecture combines various elements to create a powerful IoT-based solution for river cleaning and waste sorting.

In this section, we discuss the procedure for working with multiple components.

3.8 | Arduino Nano

The Arduino Nano is a small but powerful microcontroller board with an ATmega328P microcontroller at its core, which is used in the larger Arduino Uno. The compact design is ideal for projects with limited space. A USB connection allows the Nano to easily interface with a

computer for programming and power. [10,3] It operates at 5V and can be powered via USB or external power supply. Despite its small size, the Nano offers a variety of digital and analog I/O pins to handle a variety of connections to sensors, transducers, and other components. Nano supports serial, I2C and SPI communications, ensuring compatibility with a wide range of devices and components. It was programmed using the Arduino IDE, which simplifies the coding and deployment process. Arduino Nano is popular among hobbyists, students, and professionals for a wide range of electronic projects, including mechanical engineering and prototyping.

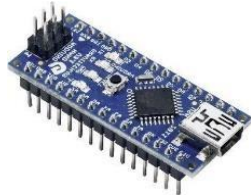


FIGURE 3.7.1 Arduino Nano

3.8.1 | Moisture Sensor

A moisture sensor is a device designed to measure the moisture content of the environment, especially soil and other materials. These sensors play an important role in agriculture, horticulture and environmental monitoring by providing real-time data on soil moisture levels. Sensors typically use conductive or capacitive technologies to measure the electrical conductivity and dielectric properties of soil, which vary with moisture content. As soil moisture increases, the conductivity, or strength, increases and the sensor can calculate moisture levels. This information will help you determine the best watering method and prevent you from overwatering or drowning your plants. The simplicity and ease of installation of humidity sensors is an important tool to maintain optimal humidity conditions in various environments, contributing to the conservation of the material and improving the health of the plants. [6]

$$\text{Moisture \%} = \left(\frac{V_{\text{dry}} - V_{\text{raw}}}{V_{\text{dry}} - V_{\text{wet}}} \right) \times 100$$

where:

- V_{raw} : sensor's current analog reading
- V_{dry} : sensor reading (usually high value) in dry circumstances
- V_{wet} : sensor reading (usually low value) under damp circumstances

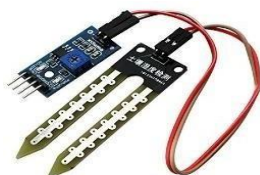


FIGURE 3.7.2 Moisture Sensor

3.8.2 | TDS Water Conductivity Sensor

Total Dissolved Solids (TDS) is a device designed to measure the conductivity of water and provide information

about the concentration of dissolved solids in water. This measurement plays an important role in the assessment of water quality because it contains minerals, salts and various organic and inorganic substances in dissolved form. Typically, testers using the conductivity scheme immerse the electrodes in water to measure the conductivity between the electrodes. Calibration is a critical process involving standard solutions containing known concentrations of TDS to convert conductivity values into meaningful TDS measurements. Sensors and outputs are expressed in parts per million (ppm) or milligrams per liter (mg/l). Widely used in industries such as agriculture, aquaculture, environmental monitoring, water treatment and laboratories, these sensors contribute to water quality control. Regular maintenance, including electrical cleaning, and following the manufacturer's repair instructions are essential to ensure accurate and reliable readings over time. It is important to note that TDS sensors generally measure dissolved solids but do not detect ions or chemicals in water. Further experimental methods are required for detailed analysis. [8,11]

$$\text{TDS (ppm)} = K \times \text{EC}$$

Where:

- EC: Electrical conductivity in $\mu\text{S/cm}$
- K: Calibration constant (typically around 0.5-1.0)



FIGURE 3.7.3 TDS Water Conductivity Sensor

3.8.3 | Dallas Temperature Sensor

Dallas temperature sensors, which refer to a family of digital temperature sensors manufactured by Maxim Integrated under the DS18B20 brand, are widely used in temperature measurement devices. These sensors use a single communication protocol, which allows multiple sensors to be connected to the same bus. [7,9] Known for their accuracy and ease of use, Dallas temperature sensors provide digital temperature readings without the need for analog-to-digital conversion circuitry. Each sensor has a 64-bit address, which is easily identifiable in various sensor configurations. These sensors are used in a variety of applications, including weather stations, industrial automation, and electronic devices that require temperature control. Due to its easy installation and stable performance, Dallas temperature sensors are widely used for temperature detection in a variety of field. They are appropriate for both indoor and outdoor settings since they can withstand a broad temperature range, usually between -55°C and $+125^{\circ}\text{C}$. Their waterproof versions are also perfect for usage in challenging or flooded environments. Their adaptability makes them more popular in consumer and business-grade projects.

$TC_{Celsius} = 16/T_{raw}$

where: T_{raw} : is a signed 16-bit integer value that was obtained from the scratchpad of the sensor.



FIGURE 3.7.4 Dallas Temperature Sensor

3.8.4 | ESP Microcontroller

ESP microcontrollers, such as ESP32 or ESP8266, are a powerful and affordable option for IoT projects. Built-in Wi-Fi provides a seamless connection, perfect for applications ranging from home automation to wireless networking. The ESP32, on the other hand, is designed for Internet of Things projects and comes with a dual-core processor, more GPIO pins, Bluetooth connectivity, and a touch sensor. Both microcontrollers provide full GPIO functionality for interaction with various components and support programming using the Arduino IDE. [5] Support for platforms such as Platform IO and low-power versions promotes flexible and energy-efficient development. Offering wireless connectivity and agility for a variety of applications, ESP microcomputers have become a staple of IoT communities and professionals due to their strong community and easy-to-access programming environment.



FIGURE 3.7.5 ESP Microcontroller

4 | RESULT & DISCUSSION

The Water Quality Index (WQI), which has values between 0 and 100, is a standardized metric for evaluating the general health of water bodies. Generally speaking, a WQI of 70 or more is preferable as it denotes clean water that is safe for aquatic life and human consumption. Values in the range of 51 to 70 indicate average quality, which is suitable for basic care. Non-ideal WQI ratings, on the other hand, fall below 50, indicating poor to extremely poor water quality that is unsafe for use without significant treatment or that poses major dangers to human health and the environment.

This research evaluated the WQI of five major Indian rivers: the Sabarmati (Ahmedabad), the Ganga (Kanpur), the Cooum (Chennai), the Mithi (Mumbai), and the Yamuna (Delhi) before and after intervention. Identifying the changes in water quality as a result of specific actions such as solid waste collection, sewage management, and Internet of Things-based monitoring was the goal.

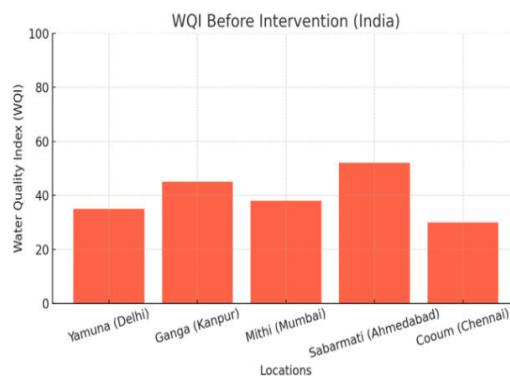


Fig 4.1 shows the Water Quality Index (WQI) of Major Indian Rivers Before Intervention

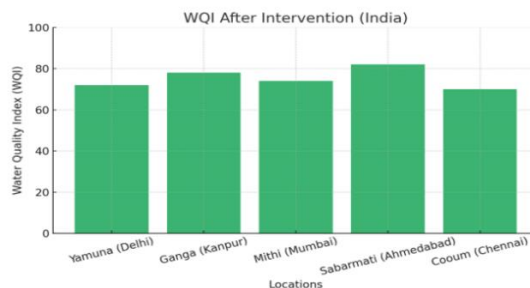


Fig 4.2 shows the Water Quality Index (WQI) of Major Indian Rivers After Intervention

4.3 | TDS SENSOR

In Figure 4.3 shows the TDS sensor, IoT-based ships use dissolved solids (TDS) sensors to measure the concentration of dissolved solids in water. It helps to monitor water quality by providing information on the amount of dissolved substances such as salts and minerals.



FIGURE 4.3 TDS Sensor

4.4 | Esp 32 cam model front

In Figure 4.4 shows the front of the ESP32 Cam model, By integrating the ESP32-CAM into an IoT system, users can monitor their ships and the environment in real time. This helps in remote control, navigation and decision making based on camera video information.



FIGURE 4.4 Esp 32 cam model front

4.5 | Thing Speak Server

In Figure 4.5 there are two fields that shows Two different charts Filed 1 shows the Temperature reading and Field shows the Electrical Conductivity readings. Thing Speak is an IoT analytics platform service that allows you to collect, view and analyses real-time data streams from the cloud. You can send data from your device to Thing Speak, which will monitor the data in real time and send alerts.

FIGURE 4.5 Think Speak Server Reading

Component Used	Components Description	Alternative Component	Significance of preferred Component
IR Sensor	Detects fullness of tanks containing waste at different positions	Ultrasonic Sensor, Camera with image processing (using OpenCV, ML)	Low Cost, Simple to use and code, and power usage is minimum as compare to its alternatives.
Moisture Sensor	Measure the moisture content of the environment, especially soil and other materials	Time-Domain Reflectometry (TDR), Electrical Conductivity (EC) Sensors	User-friendly, cost-effective, easy to install and require less technical knowledge, consumes less power which makes them perfect for solar and battery powered IoT devices.
TDS Sensor	Helps in monitoring water quality by providing information on the amount of dissolved substances such as salts and minerals.	Turbidity Sensor, Salinity Sensor	TDS sensors are superior to EC and salinity sensors because they measure the overall quality of the water, are affordable, require less calibration, and give clear, easy-to-understand ppm readings.
TDS Conductivity Sensor	Main aim of using it is to measure the conductivity of water and provide information about the concentration of dissolved solids in water	pH Sensor, EC (Electrical Conductivity) Sensor	pH and EC sensors only look at certain aspects of water quality, the TDS Conductivity Sensor measures total dissolved solids directly and provides a comprehensive reading.
Dallas Temperature Sensor	Dallas temperature sensors provide digital temperature readings without the need for analog-to-digital conversion circuitry.	LM35 Temperature Sensor, DHT11/DHT22 (Humidity and Temperature Sensor)	Dallas sensors are superior because LM35 requires an ADC and have a shorter range, whereas DHT11/22 sensors are less accurate, have a shorter range, and are difficult to link to numerous sensors.
Arduino Nano	The Arduino Nano is perfect for smart water or waste IoT projects because of its small size, low power consumption, support for multiple sensors, and ease of programming.	Arduino Pro Mini, Raspberry Pi Pico	The Raspberry Pi Pico is complicated, requires sophisticated setup, and has fewer analog connections than the Arduino Nano, which is superior since the latter lacks USB and requires an external programmer.
ESP32 Microcontroller	With built-in Wi-Fi and Bluetooth, low power consumption, various I/O ports, and robust dual-core processing, the ESP32 is a great choice for Internet of Things projects. It is suited for smart garbage and watercraft monitoring.	Particle Photon, BeagleBone Black	With greater features, power, and flexibility, the ESP32 outperforms the BeagleBone Black (too big, power-hungry, complicated) and Particle Photon (restricted I/O, cloud-dependent, poor processing).
ESP Cam Model Front	With its integrated Wi-Fi, camera module for visual monitoring, low power consumption, and small size, the ESP32-CAM is a great choice for Internet of Things projects.	Arducam Mini Module TeraRanger EVO 60M	With built-in Wi-Fi, Bluetooth, and camera capability, the ESP32 performs better than the Arducam Mini (limited processing, requires extra modules) and TeraRanger (just distance detection, no picture capturing).

Table 1. Comparative Analysis

5 | CONCLUSION

Automating water quality monitoring is critical to environmental protection, and the introduction of mobile and sensor systems will facilitate this process. The Wi-Fi module allows you to evaluate the water quality. This automated approach has not only proven to be cost-effective, but saves time and resources by eliminating the need for manual intervention. Its versatility and scalability make it a valuable asset in a variety of situations and play an important role in water quality monitoring. The autonomy of the system corresponds to the nature of the use of new technologies to increase efficiency and reliability and to protect the environment. [2,3]

6 | FUTURE SCOPE

This platform is an open and modular system that allows the future addition of (bio)electrochemical sensors, such as advanced pH detectors or dedicated trihalomethane sensors, which are important for the detection of common toxic chlorine byproducts. The advantages of the miniaturized use of high-resolution sensors in water distribution networks are clear. Expandable capabilities and integration of various sensors enable the system to effectively identify water sources of arsenic, highlighting its adaptability and advanced capabilities for comprehensive water quality monitoring. [1]

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