



MEDICAL WASTE IN SEWAGE MONITORING AND MAINTENANCE SYSTEM USING IOT

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ABSTRACT

IoT-based sewage monitoring system Real-time measurement and evaluation of hazardous gas levels and medical waste is the goal here. to ensure the security of those working in such dangerous environments. The creation of an Internet of Things (IoT) system that can measure the levels of humidity, temperature, gas mixes, and humidity while simultaneously monitoring the dynamic changes in the aforementioned parameters. If the levels rise above the threshold, the sewage worker will receive a vibration alarm as part of the procedure, and the alert will also be issued to authorized staff who are located remotely and using mobile devices connected to their jobs. Whenever a problem arises, it can be followed up on utilizing notification through the mobile application. The Message Queuing Telemetry Transport protocol is sometimes known as MQTT. This is utilized to send data from our suggested system's sensor to the cloud. Adafruit IO is just one of several excellent services available for data logging or connecting to your microcontroller online. A microcontroller with a Wi-Fi module is called the ESP32. The ESP32 microcontroller is interfaced with sensors such as humidity and gas sensors to measure level and do cloud-based tracking. A fuzzy logic membership function or a built control method improved using a genetic algorithm. Genetic Algorithm optimizations in both decimal and integer form were performed to supply the Genetic Algorithm with a strong sensor threshold value and the current sensor scenario value, which maximizes sensor accuracy and triggers an alarm. Because of the sewage waste, the environment is filthy and a number of diseases are disseminated through the human cycle. Fuzzy logic statements are effective when employed in sewage monitoring. he fuzzy logic is dependent on specific conditions (either true or false). The Central Decision Logic is in charge of keeping track of the method procedure and executing the appropriate algorithm calls (evolving and adaptation mechanisms) (CDL). The evolving mechanisms are calculated based on the conditions for cluster addition, deletion, division, and fusion. The process through which the clusters' centers and fuzzy covariance matrices adapt. The EFUMO approach that has been provided serves as the foundation for the monitoring system. It is in charge of picking up on new information and modifying the fuzzy model that is used to locate sensors and store data transmission in the cloud in order to provide an alarm signal.

Keywords: CDL, ESP32, MQTT, and Fuzzy.

1. INTRODUCTION

Sewage is frequently overflowing, and Waste ends up on the streets as a result of municipal workers neglecting to check a lot of bins at the right times. As a result, For the general public, the environment is messy and polluted, with a horrible odor by proposing the new waste management method, authorities will receive a notification when the bin is about to overflow, allowing

them to quickly empty it and maintain public hygiene. Arranging waste collection in the manner outlined below is the most effective method for managing it. The Wireless Sensor Network (WSN) immediately transmits information to local authorities and the command center upon detection of the status. This system uses low-power, spatially dispersed devices and sensors to try to organize the information it collects in a central location and monitor and record the Environment's physical state.

The best results are obtained by connecting the sensors in various configurations. Transceivers are used for the communication process between sensors. Internet communication has moved from interaction between users to interaction between devices in recent years.

IOT is accelerating the growth of the transportation and home automation sectors. Despite this, very few articles have been published in this field. organizing a cutting-edge review of IoT. An active high-speed internet connection because the majority of the process is done online. Technology can simply be formed as a link between the humans and computers and the technology known as the Internet of Things which connects the systems and devices to collect the data. Embedded sensors are sensors which are built into the machines to collect the data. The Internet of Things are the band-new technology whose rapidly developed for enhancing people's lives.

2. LITERATURE SURVEY

"Smart sensors and arm-based drainage monitoring system" ARM7 is this project's primary component. The ARM7 processor can determine the blockage's sewage water level. By way of an alert message or buzzer sound, the gas sensor that is attached provides an early warning of any leaks.

"IoT-based smart sewage monitoring system using: gsm and wi-fi module" The testing and deployment of a smart sewage system powered by the Internet of Things at the Galgotias University campus is demonstrated in this project. For the purpose of producing the required output, the IoT module in this architecture makes use of a regulator circuit, sensor driver circuit, microcontroller, and serial communication devices.

"IoT-based sewage monitoring system" Toxic gas concentrations will be tracked and researched as part of this programme in real time. to make sure that staff are safe while working in such demanding conditions. This project intends to develop an Internet of Things (IoT) system to detect dynamic changes in humidity, temperature, and gas mixtures in real time while sensing each type of gas to quantify its amount.

"A cost-effective IOT model for a smart sewage management system using sensor" Using water sensors, a GSM module, and a microprocessor, this project suggests a design for an intelligent

sewerage management system that enables real-time monitoring without significantly altering the existing infrastructure. The microcontroller gathers rubbish in accordance with the scenario after receiving information about the sewerage situation, recording the value in the cloud.

“IoT-based underground drainage monitoring system”

Workers in the sewage industry are more likely to die from exposure to gaseous poisons like hydrogen sulfide, sulfur dioxide, carbon monoxide, methane, ammonia, and nitrogen oxide. The creation of a network system that facilitates the monitoring of sewage's poisonous gases is the primary objective of this project. Through the app, information with various gas ppm values is displayed on the smartphone whenever the gas level exceeds the threshold value. Additionally, it indicates whether manual scavengers can operate there safely.

“Smart sewage alert system for workers real-time application”

Using an ultrasonic sensor to continuously gauge the water level in sewage will be covered in this project. The toxicity of CO and methane gases can also be determined in order to avoid putting human life in danger.

“IoT-based sewage monitoring and alert system using raspberry pi”

This article's main emphasis was on the worker's ability to ventilate, smoking habits, and job responsibilities. The variations in health conditions observed among sewer workers were highlighted by the differences in ambient air pollution between new and older sewage plants. The survey introduces POLLUTION, a device that uses an Arduino to track air pollution.

“Smart drainage monitoring and controlling system using IoT”

As a result, since wireless sensor networks have lately been integrated into a number of applications and systems with a wide range of requirements and features, it is becoming more difficult to discuss typical requirements for hardware issues and software support.

“IoT-based manhole detection and monitoring system”

The monitoring system's framework is made up of ubiquitous distribution sensing devices and a context-aware information system for data collection and analysis. The 97% transmission reliability of sensor data using the suggested integrated network design is promising. The prototype was put to the test in order to collect real data rather than employing a test bed scenario.

“IoT-based smart safety monitoring system for sewage workers with two-way communication”

A processing section of the device receives input, processes it, and produces output. A structure through which a person can enter the underground wastewater collection system is called a sewer manhole. Manholes are not meant to be used for work on a regular basis, but workers may need to enter them to complete tasks like cleaning, repairing, or inspecting.

3. EXISTING SYSTEM

The currently used Smart Trash Monitoring System makes use of a Raspberry Pi and RFID (Radio Frequency Identification). Each dustbin in the city will receive a distinct ID to make it easy to distinguish which one is full, and a low-cost embedded device is used to track the level of the rubbish bins in these dustbins. There are many trash cans located across the city and on the campus. When the device reaches the limit, the level and the specified special ID will be transmitted. An ultrasonic sensor is a device that measures a distance to an object using sound waves. In order to determine how far away an object is, it emits sound waves at a predetermined frequency and waits for them to return to the same location. It is used to compute the difference between the permitted and actual trash levels. Then, utilizing data from ultrasonic sensors as input, ARDUINO calculates the garbage level. Any authorized user may access this processed data, which will be utilized for this transmission, by logging into the system. Garbage level ARDUINO

is sent to the cloud via a router.

4. METHODOLOGY

The MQTT protocol is used to transport data between systems and to send sensor data from our proposed system to the cloud. The ESP32 is a microcontroller that is utilized in the Wi-Fi module and is interfaced with sensors including humidity, temperature, and gas sensors to measure level and perform cloud-based tracking. ADC module is part of a fuzzy controller that provides sensor values with optimal accuracy so that an alert can be given right away. CDL is responsible for keeping track of the method's performance and developing the necessary algorithm for the calls (evolving and adaptation mechanisms). The changing mechanisms determine the prerequisites for adding, removing, splitting, and merging with the clusters.

If the level exceeds the threshold, the sewage worker will receive a vibration notice as part of the procedure, and the alert will also be delivered to authorized staff who are remotely located on the job's connected mobile devices. Whenever a problem arises, it can be tracked using alerts from the mobile application.

DISADVANTAGES

1. It can only be used in smart public spaces because the system will use electricity.
2. The cleaning department's current system must be altered.
3. The end of the clean-up department ought to have access to computers and the internet.

5. PROPOSED SYSTEM

ESP32 controller is used to reading the sensor value, which consists of an ADC module. of municipal infrastructure and unquestionably has an impact in our everyday hygiene. Real-time measurement and analysis of harmful gas levels is the objective of this work. To safeguard the workers safe while they are embedded c code is used to frame the condition to find the value that exceeds from threshold level. ESP32 controller consists of Wi-Fi and controller, so give the internet through the wi-fi communication. The SSID (Service Set Identifier) and pass are given in code to connect the controller to the router. The adafruit.io is an open-source cloud. Which is used to create a dashboard for viewing the sensor values and the feeds of the sensor give a history of value, so we can get data logging through the adafruit cloud. The management of sewage is a crucial component of working in such hazardous situations. The mobile hotspot is shared with our proposed hardware to connect with the cloud. The dashboard consists of four value progress GUI, in which threshold value is also derived to identify. Easily Mobile applications also give notifications of any dangers present while cleaning sewage.

6. FEATURES

Passive buzzer features are:

1. Internal passive shocks without a source; therefore, if a DC signal cannot be used, tweet. To drive it, a square wave of 2K to 5K is required.
2. You can achieve the "more than a meter hair Soul" effect by controlling the sound's frequency.
3. A control and LED mouth can be used again in some limited circumstances.

Active buzzer features are:

1. As long as it will be referred to as energized, an buzzer with a concussion internal source.
2. SCM, in contrast to the passive buzzer, allows for a high- and low-sounding program.

7. SYSTEM DESIGN

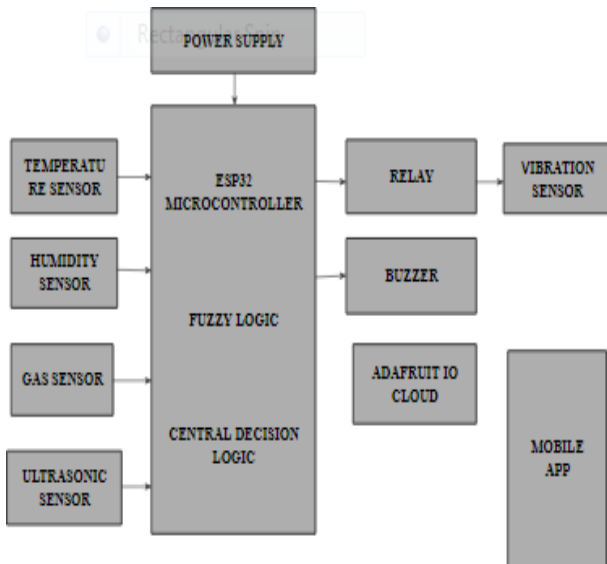


Fig.1

8. MODULES

Read sensor values like level and gas by Ultrasonic and gas Sensor

1. In these modules, the level of the drainage and gas concentration is read by using various sensors like ultrasonic sensors, and MQ3 sensors.
2. Temperature sensors and humidity sensors are also used to find the temperature and humidity level in drainage.
3. They are given analog output so that the ADC is built with a controller used to read the value of the sensor.

Esp. Controller, Fuzzy Controller, CDL, AndAdafruit. Io

1. Esp32 controller is used to reading the sensor value, Fuzzy controller gives optimized accuracy.
2. Sensor value to take give alert immediately which consists of ADC module and CDL module which is in charge of keeping an eye on the procedure itself, aswell as making the necessary calls to the algorithms.

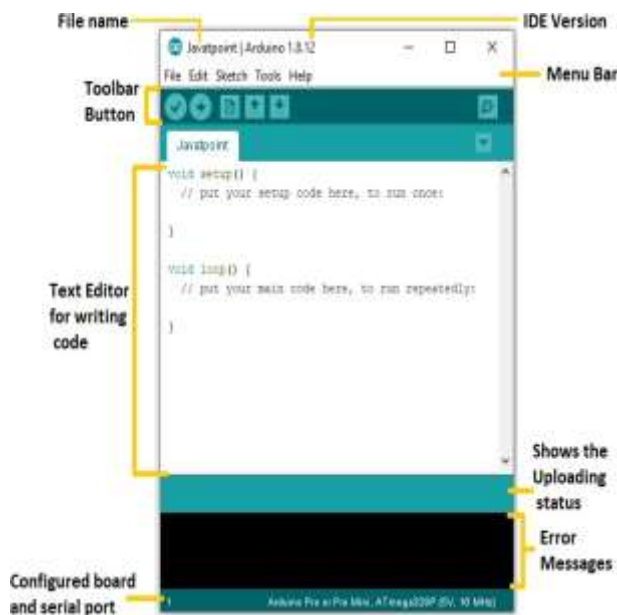


Fig.2

(evolutionary and adaptive mechanisms); the Adaptive Systems, which are determine as the conditions for cluster addition, deletion, division, and fusion; which consists ADC module.

3. Embedded code used to frame the condition to find the value that exceeds the threshold level. 3.ESP32 controller consists of Wi-Fi and controller, so give the internet through the wi-fi communication. The Service Set Identifier (SSID) and pass are given in the code to connect the controller to the router.
4. The adafruit.io is an open-source cloud. Which is used to create a dashboard for viewing the sensor values and the feeds of the sensor give the history of value, so we can get the data logging through the adafruit cloud.

Mobile Application and Vibration Motor

1. The vibration motor is used to give the alert about rt any dangerous gas present in the drainage.
2. Mobile applications like MQTT dash are used to minimize the usage of personal computers to access the cloud.
3. MQTT dash gives an attractive Graphical User Interface.

9. SYSTEM ARCHITECTURE

Once the System was started, it read the sensor values like temperature, humidity, CO2, and Ultrasonic sensor value in distance. The value is constantly compared to the thresholdvalue of gas is found, the vibrationmotor and buzzer are activated to send an alert to thefield. The mobile hotspot shared with our proposed hardware to connect with the cloud. Dashboard consists of four value progress GUI, inwhich threshold value is also derived to identify easily. Mobile application also gives the notification of any dangers present while cleaning sewage.

10. ARDUINO IDE

The Arduino IDE is a piece of open-source software that is used to write and upload code to Arduino boards. Windows, Mac OS X, and Linux are just a few of the operating systems that the Idea application is compatible with. It supports C and C++ as programming languages. The phrase "integrated development environment" is pronounced "IDE" in this situation. Writing code or a programme in the Arduino IDE is referred to as "sketching" in this context. We must connect the Genuino and Arduino boards to the IDE in order to upload the sketch that was created in the software for the Arduino IDE. With the ".ino" extension, the sketch is saved.

A. ALGORITHM METHOD

A Genetic Algorithm improvement of the developed control algorithm or the membership functions of fuzzy logic which are used to provide thegenetic algorithm with the strong sensor of the threshold value and the current sensor value for each scenario, which results in optimal accuracy and prompts an alert, Both decimal and whole numberHereditary Calculation improvements were completed.On unseen events, it was demonstrated that the integeroptimization outperformed the decimal one while consuming significantly less computational power.

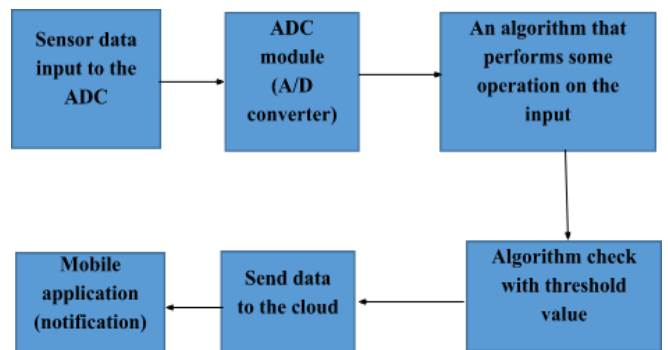


Fig.3

B. MQTT (MQ TELEMETRY TRANSPORT)

MQ Telemetry Transportation (MQTT), Network clients with constrained resources can easily distribute telemetry data in environments with constrained bandwidth thanks to the lightweight open messaging protocol. The publish/subscribe communication pattern is utilized by the machine-to-machine (M2M) communication protocol.

Benefits of MQTT

1. Because it is a light protocol, it transmits data quickly and efficiently.
2. Because there are fewer data packets, there is less use of the network.
3. Data distribution that is effective.
4. Implementation of remote control and sensing successfully.
5. Delivery of messages quickly and effectively
6. Consumes little power, which is beneficial to the connected devices.
7. Optimizes the bandwidth of the network to detect theft and determine whether a danger exists.
8. Sensors used to monitor health parameters for the patients leaving a hospital. Sensors used to warn people of danger.

C. ADAFRUIT IO

Adafruit.io is a platform developed by ADAFRUIT IO that allows you to view, respond to, and interact with the data in your project. Additionally, your data is kept private and secure by Adafruit (data feeds are by default private). This information will never be shared or sold by Adafruit.

D. IFTTT

IFTTT is both a mobile app and a website. The following slogan was used when the service first went live in 2010: Utilize the Internet to your advantage. It has undergone significant transformations in recent years. At the moment, you are able to connect all of your services to IFTTT in order to automate the triggering and completion of tasks. Applets are combinations of all your services that can be connected in a variety of ways.



Fig.4

Applets essentially automate your daily tasks, whether you're handling smart home technology or websites and apps. For instance, you could use IFTTT to have the Philips Hue smart lighting system turn on a light whenever you are mentioned in a Facebook photo. IFTTT can also be used to email visitors who make comments on your WordPress site.

E. CREATE AN IFTTT APPLET

1. Log in to the website of IFTTT.

2. Click New Applet on your username.
3. In the "If This, That" logo at the middle of the page, select the +This option. Because of this, you will be able to search for the "trigger" that tells your Applet when to run.
4. After that, you can look for a service and choose one. We will use Twitter for this illustration. Connecting to it and authorizing access to your account are required.
5. After that, you'll get a choice for triggers after that you can choose one. We'll use "New tweet from search" for this illustration. You might want to gather all tweets that include the hashtag for a forthcoming tech conference.

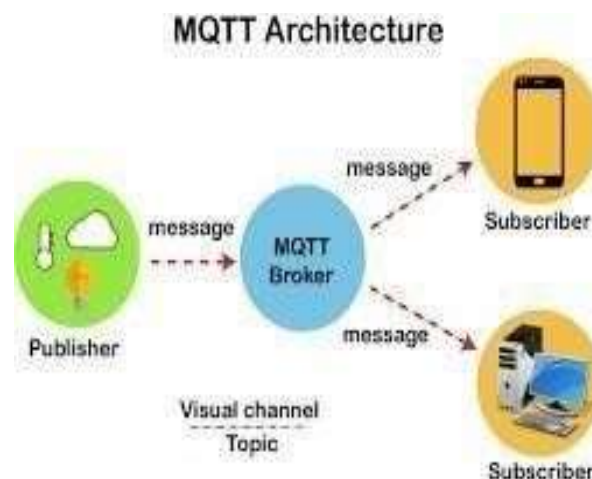


Fig.5

Now, Select the +That option from the "If This Then That" logo in the page's center. Here, you will specify the next action you want to take.

1. Then, choose the service as the action. You can opt for the weekly email digest, for instance. All of the tweets with hashes tags will be bundled up by this.
2. After reviewing your applet, click Finish.
3. Now it will believe. Select My Applets at the top of your IFTTT dashboard
4. To view your Applet. Adjust the "ingredients" (also known as details) by clicking the gear icon on the Applet's card, then click Save if you want to change or reconfigure it.

F. ADAFRUIT PROCEDURE TO CREATE AN ACCOUNT AND DASHBOARD TO MONITOR SENSOR PARAMETER

Sign in Adafruit account by using your registered id and password

Email id: gayathrikani157@gmail.com

Password: *****

After signing in to your account, the window shows the profile name "sewage monitoring" and we can add new devices in these windows. Now we create a dashboard to show sensor values interface with the microcontroller.

Steps to be followed,

1. Click the dashboard from the menu bar on the adafruit webpage.
2. This window shows a welcome dashboard. Now add a new dashboard in the window
3. Give the dashboard name and description. Create new blocks for shows the value of a sensor
4. Click on the block you would like to add to your dashboard. You can always come back, and switch the block type later if you change your mind.

5. The type of read-only block known as a gauge displays a predetermined range of values.
6. Choose a single feed you would like to connect to this gauge. You can also create a new feed within a group.
7. Connect new feed
8. Enter the feed name like temperature.
9. This represents your proposed system parameters.
10. Assign the feeds of blocks you added to the dashboard.

In this final step, you can give your block a title and see a preview of how it will look. Customize the look and feel of your block with the remaining settings.

When you are ready, click the "Create Block" button to send it to your dashboard.



Fig.6

The dashboard which shows the different feeds value. Collection from the sensor through microcontroller.

11. CONCLUSION

Using the cloud, costs are reduced in this data collection from each sewer. It will be simple to communicate and store the location of the full bins. Maintenance costs are low because there is no IOT module. Each node saves money when the controller is used. In order to make predictions about the future, data are periodically stored in the cloud.

The internet, which is extremely effective and can be used in place of the cloud, can be used to construct future intelligent sewage monitoring systems. Each node's coverage can be increased. Alternate technologies can reduce the cost of each node. First, a predetermined range of values has been used to specify the range of ultrasonic sensors' values. On the parent node, where data is collected and frequently updated, the cloud system aids in data transmission to the cloud database to the sensors which demonstrate regardless for whether the dustbins are topped off. When it reaches capacity, the truck driver is informed of the bins' locations for collection.

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