**Faculty of Electrical and Electronic Engineering Technology**

# Development of Sewage Monitoring and Maintenance Alert using IoT

**AKMAL SAIFUDDIN BIN ABU BAKAR (B081910378)**

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**Development of Sewage Monitoring and Maintenance Alert using IoT**

**AKMAL SAIFUDDIN BIN ABU BAKAR**

**A project report submitted**
**in partial fulfillment of the requirements for the degree of**
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**DECLARATION**

I declare that this project report entitled "Development of Sewage Monitoring and Maintenance Alert using IoT" is the result of my own research except as cited in the references. The project report has not been accepted for any degree andis not concurrently submitted in candidature of any other degree.

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## ABSTRACT

Overflowing water on roads is one of a biggest problem in both industrialised and developing countries. Sewage is commonly referred to as sewerage. The feedback to the criticisms is not completed or entered into the report in a timely manner. This issue of trash overflow could be avoided by early recognition of an increase in allure level, according to a cautious manner. A sensor to sense the level, a boss to command, and an ideas network to register the ailments on obstruction and the persistent increase in the level of waste make up the system architecture. To record the dossier, a computerised data in system is planned to be used. The system prefers to simply listen to the level and sends out alert signals in the form of sickness to the appropriate locations by email and SMS in the event of an overflow.

**ABSTRAK**

Limpahan air di jalan raya adalah salah satu masalah terbesar di kedua-dua negara perindustrian dan membangun. Kumbahan biasanya dirujuk sebagai pembetungan. Maklum balas kepada kritikan tidak disiapkan atau dimasukkan ke dalam laporan tepat pada masanya. Isu limpahan sampah ini boleh dielakkan dengan pengecaman awal peningkatan tahap daya tarikan, mengikut cara yang berhati-hati. Penderia untuk mengesan tahap, bos untuk memerintah, dan rangkaian idea untuk mendaftarkan penyakit pada halangan dan peningkatan berterusan dalam tahap sisa membentuk seni bina sistem. Untuk merekodkan dossier, data berkomputer dalam sistem dirancang untuk digunakan. Sistem lebih suka mendengar sahaja tahap dan menghantar isyarat amaran dalam bentuk sakit ke lokasi yang sesuai melalui e-mel dan SMS sekiranya berlaku limpahan.

# CHAPTER 1: INTRODUCTION

## 1.1 Background

Sewage, often known as household wastewater, is a sort of seepage caused by a group of people. It is distinguished by its capacity, physical state, and the presence of synthetic and toxic ingredients. It is composed of generally muted silver-coloured water from sinks, tubs, and showers, as well as inky water used to flush toilets, which is connected to the human waste with which it flushes soaps and detergents. Sewage flows from a construction's probing district into a drain, which then transports it to an onsite waste disposal facility. There are numerous types of drains, depending on the drain design (clean drain or linked drain). The reality is that most waste water caused anywhere remnants prepared, resulting in severe water contamination, particularly in low-income country. According to UNDP and UN-Habitat estimates, 90 percent of all wastewater produced is released into the atmosphere untreated. In many developing countries, the book of domestic and modern wastewater is regularly completed without or only rarely after fundamental situation.[1]

Sewage is a versatile chemical substance with a variety of distinct synthetic characteristics. Extreme ammonium, nitrate, planet seen at sunrise, extreme created power (due to extreme annulled chunk), extreme alkalinity, and pH usually grazing between 7 and 8 are all included. The allure organic oxygen demand (BOD) or the synthetic oxygen demand are used to calculate the natural resources of garbage (COD). Pathogenic animals that transmit disease to humans and mammals can be found in sewage. They once again control natural resources, which is a source of embarrassment and will undoubtedly drive people away. Water runs over the ground during rainstorms and contaminates water sources in metropolises where seepage and hygiene are poor. This contributes significantly to the spread of diseases including typhoid and cholera, as well as increasing the risk of condensing wiggle pollution from soil adulteration. Flooding has the potential to move people and raise new concerns about strength. This filthy water is home to a variety of weaponry projectiles as well as harmful bacteria that produce much air innate affliction. The stench of this stagnant trash on the streets is unpleasant. Uneven maintenance of the hidden seepage order, incorrect responses, and behaviour toward the issue's discontents are just a few of the key factors for the problem. No proper action is being taken to address the issues of garbage overflow and no decent hearing is being done on the concerns of city peasants.

Drainage environments must be carefully monitored in order to ensure proper operation. Not all areas have enough seepage listening groups, which results in uneven hearing of the seepage condition, which has a large influence on the clogging of the seepage, which indicates siltation and almost causes inundation. Manual listening is far more ineffective. It requires a large number of hardworking bodies, one of whom is merely intellectual enough to record a limited report with low veracity. These flaws contribute to the sluggish control of seepage issues.[2]

To address the aforementioned issue, a waste level perpetuation structure based on IoT technology is proposed, with place bureaucracy using a drawing ride sensor to discover and an IoT piece to write. A drawing swim level sensor is listening to the maximum and minimum set levels for the insidious seepage arrangement. This level sensor continuously monitors the trash level and sends information to the concerned city area, business, and other commanding regions via MAILS or SMS. As soon as the level reaches  the maximum set, the illnesses will be auto initiated superior to the overflow . As long as the level reaches  the minimum set, the illnesses would be recorded often on each device. An ARDUINO data processing machine boss is in charge of the entire strategy.[3]

## 1.2 Problem Statement

The sewage system is one of the important element of a city that should be keep clean and safe for a healthy and clean city . It can contribute to the spread of infectious illnesses and an unhealthy environment if it is not properly cleaned and maintained. The management station is responsible for keeping the city clean.

To begin with, drainage equipment isn't always cutting-edge. As a result, establishing the specific location of a blockage is extremely difficult whenever one occurs.

Moreover, it appears that detecting and repairing the blockage from earlier initiatives will take a long time.

Finally, sanitation workers are still dying as a result of inhaling toxic gases and water from the drainage system. Leaks and bursts are unavoidable occurrences as well. Leaks and bursts are also inevitable incidents that, if ignored for an extended period of time, might lead to significant loss.

## 1.3 Project Objective



1. Create an application that can detect obstructions in real time with using mobile applications for sanitations workers and consumers.
2. To find a cost-effective and adaptable condition monitoring and infrastructure management system for the city via sensors and mobile applications.
3. Create a project that can detect water flow in real time using appropriate sensors for the safety of plumbing workers performing sewage repair.

## 1.4 Scope of Project

In order to achieve the project objectives, the scope will cover on the following areas:

1. Create a project using ESP 32 Module.
2. Use Blynk applications for the IoT to monitoring flooding risks alerts, blockages.
3. Using water flow sensor for detecting the flow and water levels in the sewage.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 Introduction

A literature review is an academic paper text that includes substantive results as well as a theoretical and methodological contribution to a related study. There are previously developed to use IoT to develop sewage monitoring and maintenance alerts.

## 2.2 Sewage Monitoring

Sewage systems are essential for any city, large or small. Proper sewage monitoring is key to ensuring that the city's wastewater is properly treated and released into waterways without causing any harm to the environment or human health. Monitoring the water quality is essential to ensure the health of the community and avoid potential health risks to residents. As access to clean water has become a growing concern in many parts of the world, effective sewage monitoring systems have become more important than ever before. The local government of a city is responsible for ensuring that its sewage system is working properly. For this reason, it is important that the local authorities maintain a close watch on the system to ensure that the waste is being treated and disposed of properly. Local governments typically employ the services of an environmental consulting firm to supervise and monitor the system on a regular basis. In addition to hiring consultants to supervise the system, the local authorities must hire a competent technician to monitor and evaluate the system on a regular basis.



A featured component of the Water Monitoring Study was conducting water quality characterizations of the study areas using data collected previously from a range of monitoring programmes and research The characterizations included an assessment of current water quality and some other indicators of ecosystem functions; an evaluation of long-term trends in conditions over time to aid in the identification of difficulties; and an evaluation of loadings to these waterbodies from pollutant routes and expected future loadings as an outcome of planned water quality improvement actions. A Real-Time Online Sewage Monitoring System is a packaged system that includes measuring sensors, a control panel, and a communication unit to monitor sewage quality parameters such as COD, TSS, temperature, and so on, as well as flow rate.

The sensors can be tailored to the needs of the client. Clients can monitor the parameters in real time from their PCs and smartphones via the cloud-server, and if the wastewater quality exceeds the pre-set values, clients will receive an alert immediately, allowing them to halt the operation of wastewater treatment plants or the discharge of effluents until the problem is resolved. This system will aid in the realisation of appropriate sewage management for the clients.[4]

## 2.3. Maintenance Alert

Sewage maintenance is the process of maintaining the quality of water in a sewage system. This process includes regular inspection and cleaning of the system to remove any debris or buildup that could cause blockages or overflows. Sewage maintenance is important to prevent problems with the quality of water in the system. It is also important to keep the system running smoothly and efficiently. Sewage maintenance is typically done by a professional company that specializes in this type of work. The company will have the necessary equipment and training to do the job properly.

Preventive, routine, and emergency maintenance are all required for a sewage system. To avoid system breakdowns and emergency operations due to clogged sewer lines , overflowing manholes , sewage backing up into a dwelling, or structural failure of the system, preventive or routine maintenance should be undertaken. Preventive maintenance is less expensive and guarantees that sewer system operations are reliable. Emergency repairs, which would be exceedingly rare if proper maintenance is conducted, must also be provided. In addition, proper inspection and preventive maintenance are essential.



## 2.4. Related Works to Development Sewage Monitoring and Alert Maintenance

### 2.4.1. IoT Based Smart Sewage Monitoring System using GSM and Wi-Fi Module by Priya Tiwari, School of Electrical, Electronics and Communication Engineering Galgotias University, Greater Noida, India.

The goal of this project is to develop a low-cost, configurable system for detecting clogs and stinky or nasty gases. The sewer tank has ultrasonic sensors attached to measure the water level often. The ultrasonic transmitter transducer is activated by code on the Arduino. When the energy is switched on, it incorporates IoT technologies. The Arduino board receives power from the junction board, which also powers the ultrasonic sensor, MQ2 gas sensor, LM35 temperature sensor, and SIM800L. The level of the sewage water rises if there is an obstruction in the tank. Clog will therefore be identified. Bad scent was caused by sewage water. This offensive scent is extremely dangerous and can cause various illnesses, including diarrhea. The MQ-2 gas sensor, which has an Arduino interface, is used to detect smelly gas. The LM35 temperature sensor is utilized to gauge the temperature within the manhole. An open IoT server analytics application called "Thingspeak" interacts with the data transmitted from the Wi-Fi module in the cloud. Four fields are generated in Thingspeak for the four sensors that will be used in the channel. Each field chart displays the sensor's graphical value. A low number indicates typical water flow inside the tank, but a peak on the graph denotes an obstruction or clog. Gas detection is carried out similarly. And in the third graph, the temperature is displayed. Continuous values that were obtained at regular intervals are included in the data.

The author, who is directing this research, envisions future blockage clearance from the sewage system. It can be improved by implementing cutting-edge technologies. To clear the clog, chemicals used in sewage pipelines may be employed. Furthermore, robots can be used to eliminate the impediment.[5]



*Figure 1 the proposed prototype*

### 2.4.2. Drainage Monitoring using IoT by Aditya Patel, Parth Dave, Aatish Patel, UG Student, A.D. Patel Institute of Technology, Karamsad, Gujarat -India.

The report's recommended system offer with an interconnected network of sensing devices that will provide with real-time environmental data that can be compared to gas concentrations and temperature up to a degree that is not harmful to the human body and provides workable conditions. These threshold levels are classified as either feasible or harmful, also provide safety precautions to cleaners, our proposed system will have a record of water level with any two adjacent sensors can be a blockage or leakage, both of which are hazardous, and crossing threshold height of drainage a notification will be sent to government authorities responsible for maintaining sewage lines and dealing with potential overflow, and we can have a database for battery of sensors, similar to gases.



In their application, the primary page, which includes login options, will be displayed at the beginning. There are two different categories of participants for this prototype: users and administrators. Additionally, if you are an existing user, you can tap on sign up, which will take you to the registration page where you must enter the information required for registration. Additionally, you may log in using your credentials if you have already registered. If you successfully signed up as a user, you will be given access to a real-time map where you may tap on hotspots to access sensor data that shows the presence of sewer gases like methane, carbon monoxide, and others as well as the surrounding water level and temperature. Additionally, if you are an administrator, you will have a variety of duties at your disposal, such as user maintenance, which involves maintaining user data and tasks.

You will be able to see the percentage of each sensor's battery life left in the battery report, which will aid in maintaining the sensors. If the task manager discovers any defects in the sewage lines, they will notify the appropriate authorities and let them know where, when, and what task needs to be completed while keeping a record of it.

After protecting underground drainages against hazardous gases and other contaminants in the future. They may then shift our attention to a different issue, sewage overflows, by redirecting waste from the busiest sewage line to others that can handle the excess sewage waste. They plan to work on water usage in the future, as well as robotically automating the entire sewage cleaning system and monitoring wastes before they are released into the sea to determine if they harm marine flora and wildlife. If someone violates the dumping regulations, we can discover and punish them with little manual assistance.[6]


*Figure 2 the Javascript application displayed*



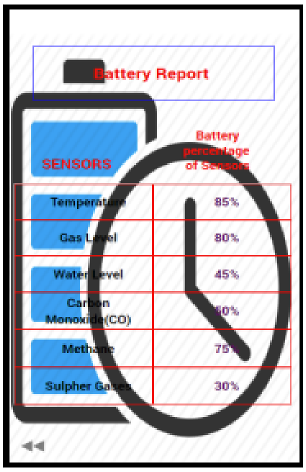


*Figure 3 Javascript application displayed battery report*

### 2.4.3. A Cost-Effective IoT Model for a Smart Sewerage Management System Using Sensors by Jahid Hasan Rony, Nazmul Karim, MD. Abdur Rouf, Md. Monirul Islam, Jia Uddin 2 and Momotaz Begum.

The proposed system consists of a data collection unit, a processing and communication unit, and a monitoring unit. The data collection unit collects raw data from the environment using sensors and feeds it to the processing unit. The processing and communication unit next turns the raw data into logical data before initiating network communication and storing the data in a cloud database. The communication system supports both GSM and Wi-Fi technology to reduce network disruption. At the last monitoring unit, the system retrieves cloud data and shows a graphical view of the critical data for real-time monitoring.

The proposed smart sewage systems' hardware structure is made up of a metal body, sensors, a motor section, and a controlling unit. The hardware configuration of the suggested system is shown in Figure 4. To determine the water level and transmit the information to the micro-controller, several water sensors are required. The main microcontroller used in this project is the "ESP32," a low-cost, energy-efficient microcontroller with integrated Wi-Fi and dual-mode Bluetooth. There are Wi-Fi networks everywhere. Wi-Fi is therefore largely used in this study as the means of data exchange, as well as to connect to and store data in a cloud database. However, employing LoRa is preferred for long-distance and large-scale implementation.

A GSM module is used to send SMS notifications to the water authority through a mobile device. The GSM mobile technology used by this module creates a data link to a distant network. The "ThingSpeak" service is used for cloud data analysis and storage. Two 12V DC motors and two waste-removal conveyor belts make up the motor portion. The conveyor belt is moved by these DC motors, removing the floating sewage from the drain and placing it on the top conveyor. Figure 5 displays the 3D-designed hardware configuration of the suggested system.[7]

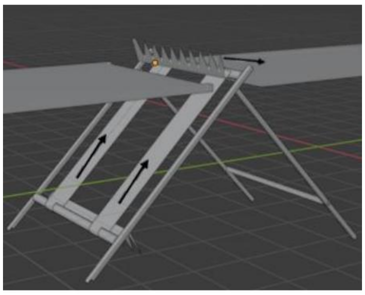

*Figure 4 the hardware configuration 3D design by using AutoCAD*

As shown in Figure 6, where (a) depicts the front of the circuit board and (b) depicts the back, a specially created control unit was created to fit all the electric components in a small, condensed space. Additionally, a detachable connector is used to link all of the connections. The module can therefore be changed quickly as a result. A 12V DC input is available for the controller. Direct 12V input is provided to the motor driver, and a built-in voltage control IC then converts 12V to 5V for supply to the sensors and microcontroller. The main power source and backup source is a 12v lithium polymer (LIPO) battery with a 25c discharge rate, which is coupled to the charging device. An AC-to-DC converter that can convert the provided AC to 12 volts DC can also be utilised with solar power or a standard AC source.



Their project's future scope is to generate green energy using solar cells. A large-scale trial in various cities is possible. Furthermore, Wi-Fi and LoRa are used for network connection, while other choices such as cellular connectivity or ZigBee may be used.[7]

*Figure 5 the system prototype running*

#### 2.4.4. Smart Sewage Alert System for Workers in Real-Time Applications Using Iot by M. Lizzy Nesa Bagyam, B. Raja Nithya, D. Rubikumar, S.Sangeetha, J.Santhosh.

The envisioned system includes a level and gas sensor, as well as a WEMOS D1 controller. A sensor node with two gas sensors and a level sensor is used in this method to communicate the necessary sensed information about the dangerous gases and water levels in the drainage system. The WEMOS D1 detects the specified conditions and sends an automatic SMS through GSM, as well as updating it in real time via IoT. A sensor node that transmits the relevant detected data about the dangerous gases and water levels of a drainage system. It has two gas sensors and a level sensor. The toxicity of CO and methane is detected by the MQ-7 and MQ-4 sensors. Here, an ultrasonic sensor serves as a level sensor to continuously measure the amount of waste water in the sewer. The communication modules will be used to send this data to the cloud (server). With the use of a level sensor, the controller monitors the water level; if it rises, it is visible from the base station and corrected by the workers. Drainage workers can take measures while accessing manholes by using the gas sensors to monitor the toxicity of various hazardous gases. If the toxicity rises beyond the threshold value, an alert message will be delivered to the base station. This project can be improvised to eliminate gases created within the drainage system whose toxicity exceeds the safe level.[8]

*Figure 6 the hardware setup for smart sewage monitoring system*

### 2.4.5. IoT based Sewage Monitoring and Alert System using Raspberry P1 by Jyothi Chillapalli*, Yogesh H. Jadhav.

In the current design, they prefer to employ a variety of gas sensors, such as the MQ4 (methane sensor) and MQ7 (carbon monoxide sensor), as well as humidity and temperature sensors, to monitor the amount of dangerous compounds in trash (DHT 11). For the management of the existing system, one receiver end is offered at many nodal sites that are entirely separate from one another. The system sends a lot of data from the sewage to the control panel. The ThingSpeak IoT database stores these data as graphs. ThingHTTP is connected to the Pushover Application through the React application, which is used to create thresholds. If the values are higher than the average survival rates, the Pushover application will receive messages. If the operators want to comprehend fluctuations in the volume of sewer gas, humidity and temperature. The graphs on the ThingSpeak IoT platform allow for analysis of temperature and other variables over time. Additionally, the Raspberry Pi camera offers the capability of live video streaming to detect obstructions, assisting sewage personnel in bringing the necessary equipment.



In this project model, the Raspberry Pi, Sensors, and Raspberry Pi camera are essential elements. The Raspberry Pi gives users access to sensor data from the methane (MQ-4) and carbon monoxide (MQ-7) sensors as well as the humidity and temperature sensors (DHT11).

In practice, these values were used to calculate the ppm values in real time which are then consistently. The graphical depictions of these gases' ppm values are plotted using the ThingSpeak Tool. After activating the ThingHTTP application, which then sends the alert messages to the registered devices' Pushover application, the React application is used to deliver the warning to the user's smartphone when the readings surpass the threshold values. To prevent mishaps and protect the sewer personnel from illnesses brought on by these dangerous gases, the authority reports and monitors the sensor's ppm data rates.

The Raspberry Pi's IP address was initially set up. The MQ-4 gas sensor for methane, the MQ-7 gas sensor for carbon monoxide, and the DHT11 digital humidity and temperature gas sensors were calibrated. The VNC terminal was used to write the sensor code. Pi was later linked to the ThingSpeak Platform. Fields like CH4 PPM, CO PPM, temperature, and humidity percent were added to a channel. Each sensor had a ThingHTTP Request made for it that contained the message content. The requirements for ThingHTTP to be activated were contained in four Reacts that were developed in a similar manner.[9]

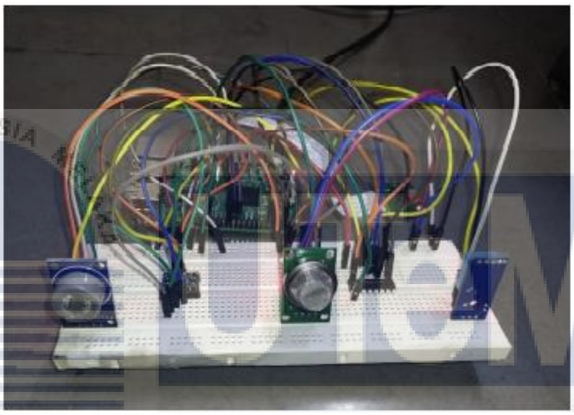

*Figure 7 Real-time implementation system*



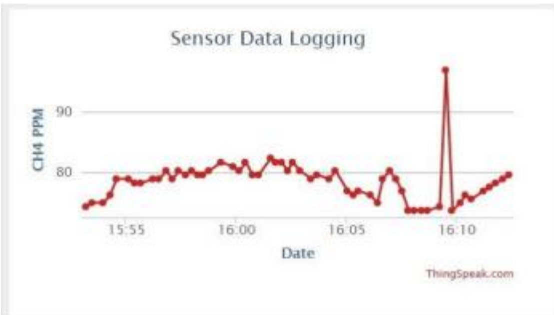


*Figure 8 Examples of graphs display in ThingSpeak app*

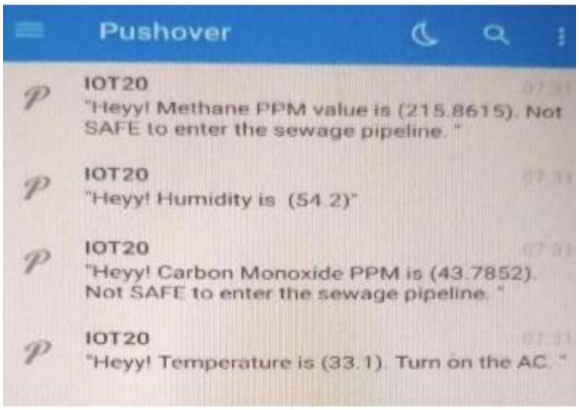


*Figure 9 message received on Pushover application*