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Iot Based Drainage and Waste Management Monitoring and Alert System for Smart City

1. Aarthi M.
Assistant Professor, Department of Computer Science and Engineering, K. Ramakrishnan College of Technology, Trichy, Tamil Nadu.
Email: aarthim.cse@krct.ac.in
2. Bhuvaneshwaran A.
Assistant Professor, Department of Artificial Intelligence and Data Science, Kumaraguru College of Technology, Coimbatore, Tamil Nadu.
Email: bhuvanesh0312@gmail.com

Abstract
To ensure the safety of the residents, the drainage system must be managed properly. Drainage monitoring teams aren't present in every region. As a result, the drainage status is checked on a regular basis. Intermittent inspections can cause flooding, clog drainage systems, and pay compliments. Controls that can be used by hand have been disabled as well. We need expert assistance, but we have a limited number of articles to track. Because of their lack of experience, operators are also unaware of the state of this manhole, which can result in an accident. The implementation and design goals of an intelligent real-time monitoring system for wastewater and waste management are described in this document using the Internet of Things. In the modules, there are microcontrollers, gas sensors, liquid level indicators, and temperature sensors. the garbage can and sewer system. The device checks for blockages between the two manholes, detects the amount and depth of different gases that are toxic to the human body, and provides information through alarms. City Hall is located in the heart of the city.

1. Introduction

Drainage is the removal of surface and groundwater from flooded areas, either naturally or artificially. The drainage systems in the basin are the patterns formed by rivers, streams, and lakes. The terrain and slope of the land have an impact on whether the area is hard or smooth. Waste management (or waste disposal) refers to the activities and actions involved in disposing of waste from beginning to end. Waste collection, transportation, treatment, and disposal, as well as waste management process control and regulation, as well as waste-related laws, technical, and economic mechanisms, are all covered.

2. Literature survey

Phattaleeya Mabpa-IEEE-2017

Sewer blockages are one of the most common causes of sanitary sewer overflows (SSOs), which cause severe environmental damage and property loss. There is a way to detect and monitor pipeline blocks using acoustic analysis to determine whether the pipeline is blocked and how much it is blocked in this current work to minimise the risk of SSO problems. It's been put forward. As a sound source, a vibrating speaker is traditionally attached to the tube. A microphone on the other side of the pipe detects a blockage by reading the change in the

pipe's resonance frequency. The Fast Fourier Transform determines the measured signal's resonant frequency (FFT). To normalise the frequency response, compensation-based lines are used. Make acoustic analysis easier. The sound pressure level (SPL) drops when the resonant frequency drops and the pipe becomes clogged, according to experiments.

Muragesh SK and Santhosha Rao-2017

The Internet of Things (IoT) is made up of physical objects and communication devices that are connected to sensor networks and allow for automated connections and activities between the real world and information systems. The Internet of Things arose from computers' ability to access data on objects and devices without requiring manual intervention, but programming can overcome input limitations. When it comes to retrieving human data, cost, accuracy, and other factors all play a role. It is a situation. Sensor networks are a critical component of Internet of Things (IoT) systems. This feature is implemented and designed in underground engineering drafting and manhole monitoring systems (UDMS) used in IoT applications. Low cost, low maintenance, fast installation, multiple sensors, and long service life are the primary considerations for this project a long life at a low price Customer service is exceptional. A system for measuring water level, temperature, and atmospheric pressure in the catchment tank is included in the proposed model to ensure access to the cover.

Amar Upadhyay-IEEE-2017

This white paper describes how a cloud-based, wireless waste management system was successfully implemented in a smart city. Currently, the system is being put through its paces. The system reduces the average cost of keeping a clean and safe environment in the Recycle Bin by optimising the garbage collection plan and prevents hazards like fire and bacteria. The system, moreover, makes use of the existing telecom infrastructure, as well as the city's free ThingSpeak cloud server service. Because it's a wireless system. Because it is cost-effective, quick, and efficient to implement, this system is particularly relevant for developed countries like ours. It also aligns with a number of government plans, not only in terms of smart cities, but also in terms of the environment. Many countries' telecommunications policies are beginning to recognise the increasing importance of application development. To extend the life of your batteries, we suggest using a solar or piezo energy harvester. This would allow the wireless sensor node to function independently for longer periods of time, enhancing the proposed facility's overall reliability and efficiency.

Bruno Rente, Matthias Fabian-IEEE SENSORS JOURNAL-2019

Experimental evaluations are carried out in sewer environments with corrosion, humidity, and gaseous hydrogen sulphide, using Fiber Bragg Grating (FBG)-based surveillance systems. Surveillance systems are built specifically for onsite use, with rugged packaging and operational problems in mind. The system is in place. The device is battery-powered and includes hardware for device control, power management, data logging, and 4G connectivity research. The results show that the same probe can provide long-term performance over a period of six months of real-time monitoring data. When the collected data is compared to ambient temperature and precipitation data from the same location during the same time period, a strong correlation is found. Expected and measured data have a correlation. The results show that fiber-based sensor systems can be used for long-term monitoring in these harsh environments.

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SarathKodagoda-IEEE SENSORS JOURNAL-2020

Water firms use alternative measurements (such as relative air humidity) as model observations because there are no sensors to monitor the humidity status of the concrete sewer surface. As a result, corrosion predictions are often hindered, and prediction uncertainty is common. Previous research has suggested that a series of resistance-based sensors can be successfully developed and evaluated. Surface humidity conditions in concrete sewers are being estimated. The sensor will be placed in a city sewer pipeline in Sydney, Australia, and measurements will be taken on the spot. Following deployment, post-deployment testing and research revealed that the detection system can withstand harsh sewer conditions and is suitable for long-term sewer pipeline monitoring

Existing System

The aim is to keep track of the city's resources' quality in order to ensure proper management and rapid expansion. The Internet of Things can be used to realise the idea of a smart city with easy wireless connectivity. A sensor collects different kinds of data from the device . The final outcome of controller is emailed to the control room and displayed on the screen. Real-world and information system connections, as well as autonomous driving, are enabled by objects and communication devices connected to sensor networks. The Internet of Things is based on the fact that computers can access data on things and devices without the need for human intervention, but it produces artificial intelligence when it comes to feedback. To avoid human flaws, set limits. The goal is to get around the feedback. Sensor networks are a critical component of the Internet of Things. This functionality was realised and developed by the Underground Manhole Mapping and Surveillance System (UDMS), which is used in Internet of Things applications. Low cost, low maintenance, fast implementation, and multiple implementations are the primary considerations for this project creates a framework for monitoring and regulating mine water levels, temperatures, and pressures. Replace the manhole cover if it is possible. Check to see if the power cord is buried as well. An intelligent wastewater treatment system is described in this article. The Internet of Things Drainage Framework explains how the Internet of Things works. can detect and remove impediments in drainage systems A gas sensor, a level gauge, and an RFID-enabled microcontroller interface are all included in the gas collection module. An alarm is triggered when the liquid level sensor detects a blockage between the two manholes. An alarm is triggered when the liquid level sensor detects a blockage between the two manholes.

Proposed System

It's made up of an ultrasonic sensor, a gas sensor, and a surface sensor, and it's used to determine drainage depth, gas level, and temperature in a distant field. We want to use the Internet of Things to create low-cost, self-contained waste and wastewater management systems. The network is made up of the network coordinator and the cloud storage of the GPS sensor node. The graphical user interface for remote access has been updated.The ability to view data and interpret results has been improved. According to the proposed device architecture, the sensor node response samples physical parameters at a voltage level that the sensor can calculate. Then submit the data using the Blynk server. Smart systems can be used to provide real-time information tracking and data reporting to IoT devices in addition to proper sensor data analysis.Principles, counties, or competent authorities are all examples of competent authorities.

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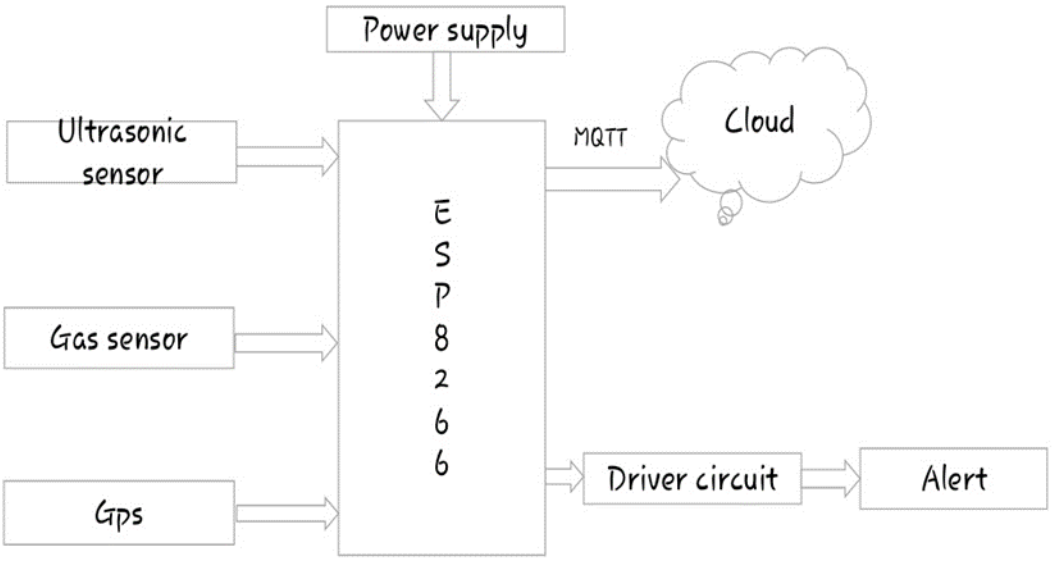
Block Diagram



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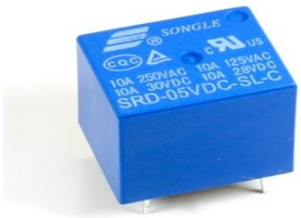
Hardware Description

Power Supply

The power supply is the most serious issue with electronic devices. Low-power devices, such as controllers, necessitate lowering the voltage to rectify the output and transform it to a constant DC. A power supply is the most fundamental requirement for electronic devices. A 5V stabilised DC power supply is used.

Driver circuit

An electric switch known as a relay is a type of electric switch. Many relays use electromagnets to mechanically drive the switching mechanism, but other operating principles are also employed. In circuits that control low-power signals or multiple circuits with a single signal, relays are used. The first relay, which repeats signals from one circuit to another, is used in long-distance telegraph circuits. transferring them to a third-parties Relays were widely used to perform logical operations in telephone exchanges and early computers.



ESP8266

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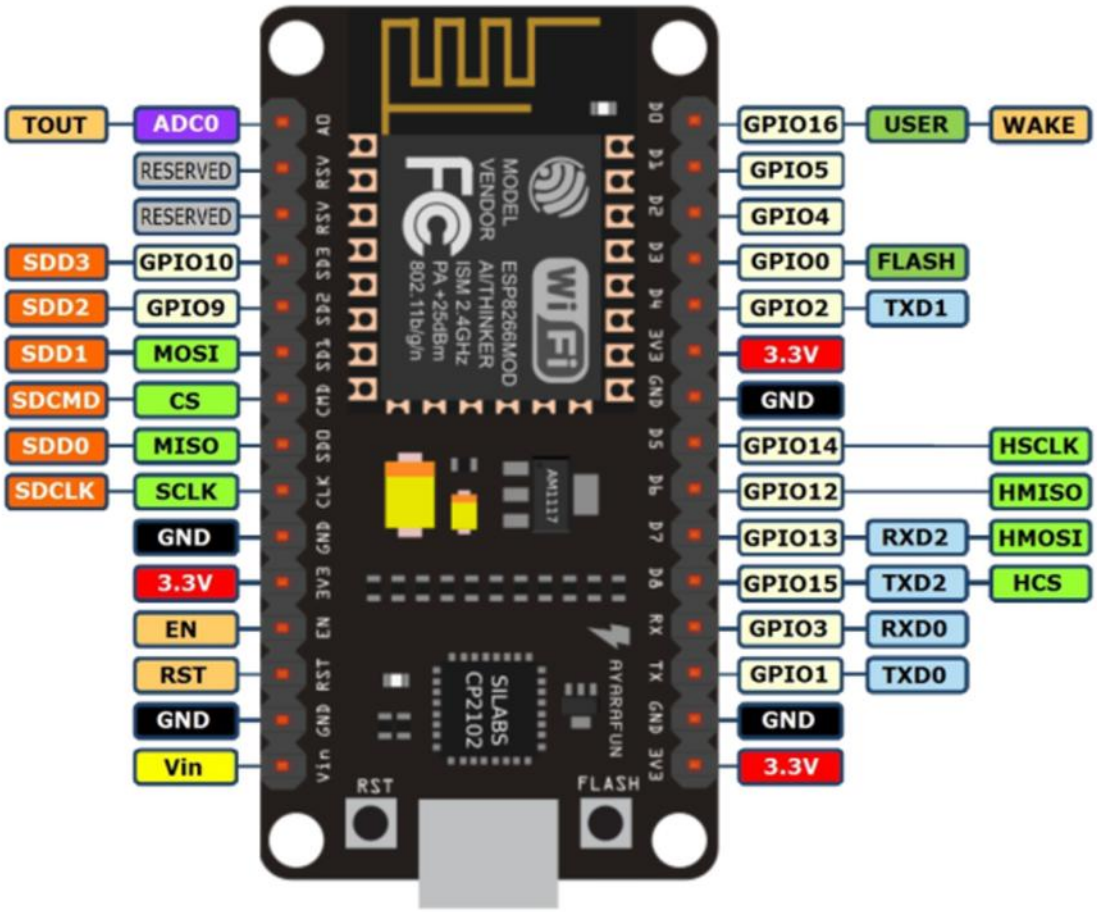
NodeMCU is an open source firmware and development kit for prototyping and building Internet of Things (IoT) products. These include firmware based on the ESP8266 Wi-Fi SoC from Espressif Systems and hardware based on the ESP-12 module. Lua is the scripting language used by the firmware. It is based on the ESP8266 Espressif non-OS SDK and is based on the eLua project. NodeMCU is a development and firmware board that is open source.The ESP8266-12E WiFi module is widely used. The ESP8266 WiFi module can be programmed using the LUA or Arduino IDE (a simple and powerful programming language). By creating a WiFi connection with just a few lines of code and defining input/output pins as required, you can turn your ESP8266 into the exact same web server as your Arduino. Ethernet modules are WiFi compatible. You've got a real deal now.Tool for the Internet of Things (IoT).



Ultrasonic Sensor

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An ultrasonic sensor is an electronic device that emits ultrasonic waves, measures the distance between it and the object, and converts the reflected sound into an electrical signal. Ultrasound travels at a much faster rate than audible sound.

Gas Sensor

A gas sensor is a device that detects the presence of gas or its concentration in the atmosphere. The sensor generates a corresponding potential difference by changing the resistance of the internal material of the sensor in response to the gas concentration, and this resistance can be measured as the output voltage.

Global Positioning System (GPS)

GPS receivers are programmed, managed, and monitored using GPS software. It's a wireless navigation device that uses data from orbiting satellites to provide location information for objects on Earth. GPS software is tailored to a particular operating system.

Software Description

Arduino

Arduino microcontrollers are single-board computers that are popular in both the hobby and professional markets because they are simple to use but powerful. Because Arduino is an open source project, the hardware is inexpensive and software development is free. This guide is for ME 2011 students who are new to Arduino, as well as students from all over the world. If you're a seasoned Arduino user, do some research online.A 5V Atmel ATmega328

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microcontroller is used on the Duemilanove board. It has 2 kilobytes of RAM, 32 kilobytes of flash memory for programme storage, and 1 kilobyte of EEPROM for parameter storage. It runs about 300,000 lines of C source code per second at a clock speed of 16MHz. There are 14 digital I/O pins and 6 analogue input pins on the assessment board. When the programme is run without being connected to the host computer,A USB connector is provided for communication with the host, as well as a DC power jack for connecting an external 6-20V power supply To connect to the I/O pins, the included header connector uses a 22g single wire connector or connector.

Blynk App

Blynk is an IOS and Android platform that allows you to control Arduino, Raspberry Pi, and other devices over the internet. This is digitaldashboard that lets you drag and drop widgets to create a graphical interface for your project. Everything is very simple to set up, and you can have it up and running in less than 5 minutes. Blinks aren't attached to any specific board or shield. Rather, it is supports the hardware you've chosen Blynk remains online and can use the Internet of Things if yourArduino or Raspberry Pi is linked to the internet through Wi-Fi, Ethernet, or this new ESP8266 chip. Blynk was created with the Internet of Things in mind. You can control your hardware remotely, view sensor data, store and view data, and do a lot of other cool stuffer

Module

Module-1Iot Environment

To make the city more environmentally friendly, the government will use IoT in almost any public service situation. Devices that support 1TSensor can assist you in tracking the city's environmental impact and collecting comprehensive data on sewage, air quality, and waste. These gadgets can also be used to keep an eye on forests, rivers, lakes, and oceans. The sensor detects and converts all physical parameters. converting analogue values to digital values To get real-time data from sensors, combine modules. This information is forwarded to the IoT gateway.

Module-2Network and Cloud storage

The network is in charge of analysing and calculating sensor data (in the form of raw data) and distributing the results to the cloud storage displayed on the IOT interface. An MQTT proxy that uses the MQTT protocol or an HTTP module that uses the HTTP protocol are the two ways to connect a hardware component to the cloud. MQTT may be a better option. MQTT is more reliable than HTTP because it is message-based rather than document-based.

Module-3IOT based interface

APIs are used in IoT integration, and applications use logical connectors to communicate with each IoT device. The API exposes data that enables these devices to send data to data interface applications. The app can also control the device and serve as a user interface.

Module-4Blynk IOT Platform

All communication between the smartphone and the hardware is handled by this app. You can either use the Blynk cloud or set up a local Blynk server. It's free and open source, and you can use it on your Raspberry Pi to handle hundreds of devices.

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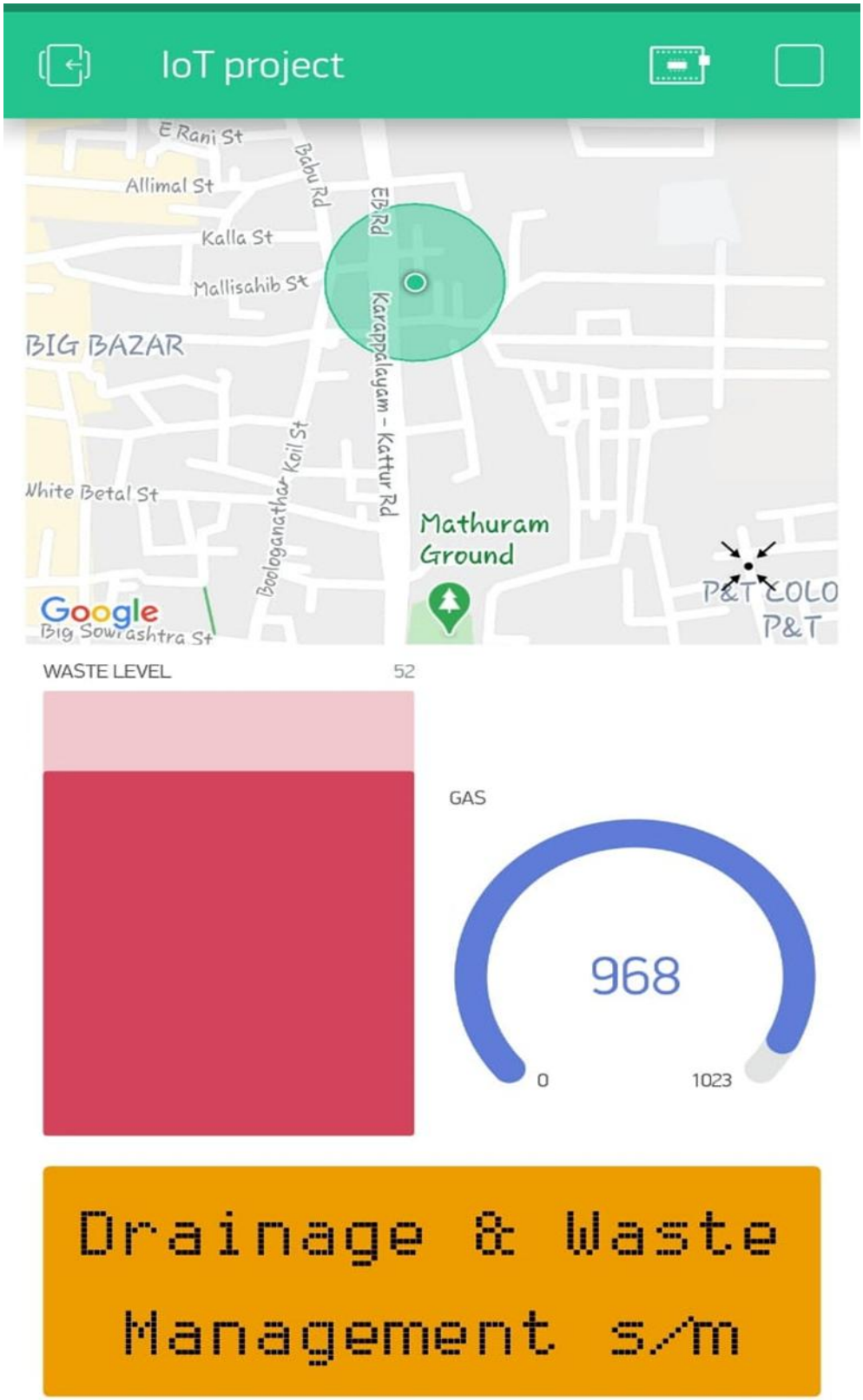
Output



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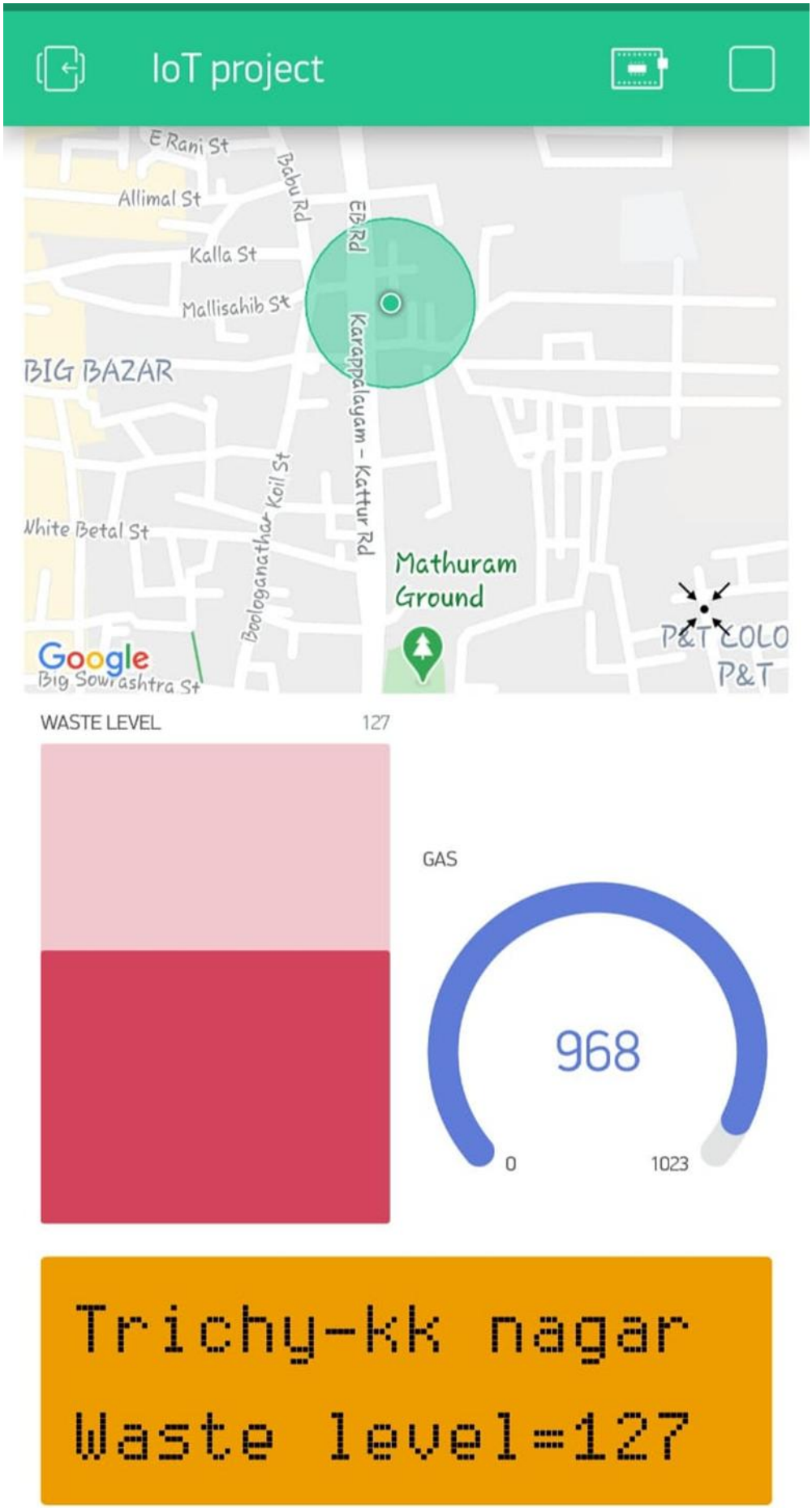

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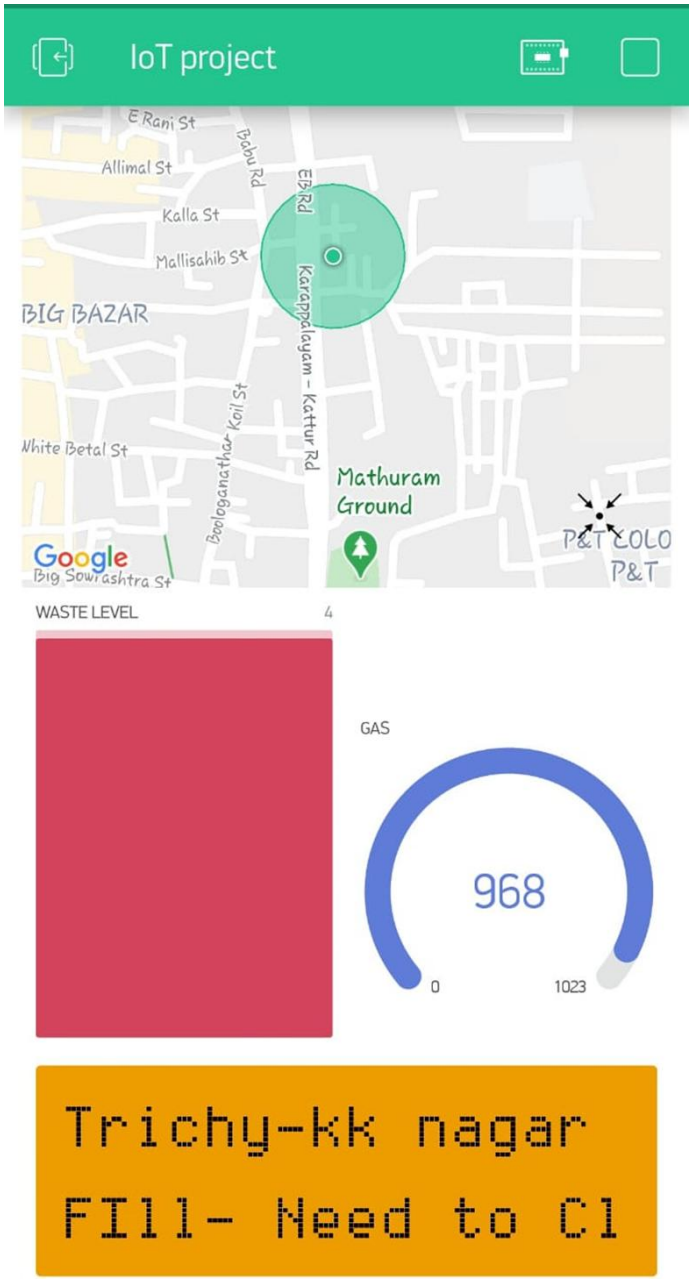

Conclusion

Surveillance in the dark is a difficult problem to solve. Various methods for monitoring and controlling underground drainage systems are proposed in this project. Real-time explanations of various applications such as underground drainage and manhole identification. Various parameters such as temperature, poisonous gas, flow rate, and water level are monitored and updated on the Internet using the Internet of Things. This enables the person in charge to take the appropriate actions. In this way, unnecessary trips to the manhole are avoided, and only necessary trips are made. Furthermore, real-time updates on the Internet aid in the consistency of drainage checks and the avoidance of risk. Sensor networks are seen as a fundamental enabler of the Internet of Things.

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