VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, VIRAGANOOR, MADURAI-625009

Project Report (GROUP PROJECT)

TITLE: ADVANCE DRAINAGE SYSTEM

Department of Electronics and Communication Engineering

2020-2024

OBJECTIVES OF THE PROJECT:

The objectives of the proposed project are to save the lives of the manual scavengers by

a. Detecting the block in lesser time and removing the block in the drainage system.

b. Monitoring the hazardous gas levels like methane and hydrogen sulphide thus preventing asphyxiation of manual scavengers.

c. Managing the drainage system using IoT

THE PROPOSED METHOD COMPRISES OF:

Ultrasonic Sensors, Methane and Hydrogen sulphide sensors, IoT and retractable high pressure jet pump as major components for block detection and removal in the sewage system. The technique and the reason for choosing the major components are as follows

1. Ultrasonic Sensors:

The proposed method uses ultrasonic sensors to detect the location of the block. Ultrasonic sensors are placed on the inner side of the lid of the manholes that detects the rise in the sewage level and helps in alerting the authorities if the threshold level is reached. Moreover, the logic combined with the ultrasonic sensors let us know the approximate location of the block. This helps the workers involved to spend less time inside the drain. Due to these problems like asphyxiation, exposure to the most virulent forms of viral and bacterial infections that affect their skin, eyes, limbs, respiratory and gastro-intestinal system could be averted

2.Methane and hydrogen sulphide sensors:

Sewer gases can be both toxic and non-toxic. Its major component is Methane [28], which can be extremely toxic in high concentrations. Hydrogen sulphide [15] can be poisonous even in small concentrations in the form of irritation of the eyes, shortness of breath and incessant cough. Prolonged exposure can even cause pulmonary enema, headache and dizziness [2]. Exposure to levels > 100ppm (parts per million) can be dangerous as it causes olfactory fatigue and the smell becomes undetectable. Exposure to higher concentrations (>300 ppm), results in rapid loss of consciousness and death. Even a single breath of a concentration higher than 1000 ppm can cause immediate collapse ('knock-down") and death [7]. Methane gas inhalation can cause asphyxia, loss of consciousness and pneumonitis [7]. Asphyxiation is caused by these hazardous gases and their levels need to be found out before the sanitary workers enter the sewage canal. Methane and hydrogen sulphide sensors are placed along with the ultrasonic sensors to get the values in ppm of the sewage canal

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MQ136 Hydrogen Sulfide Sensor

3. IoT:

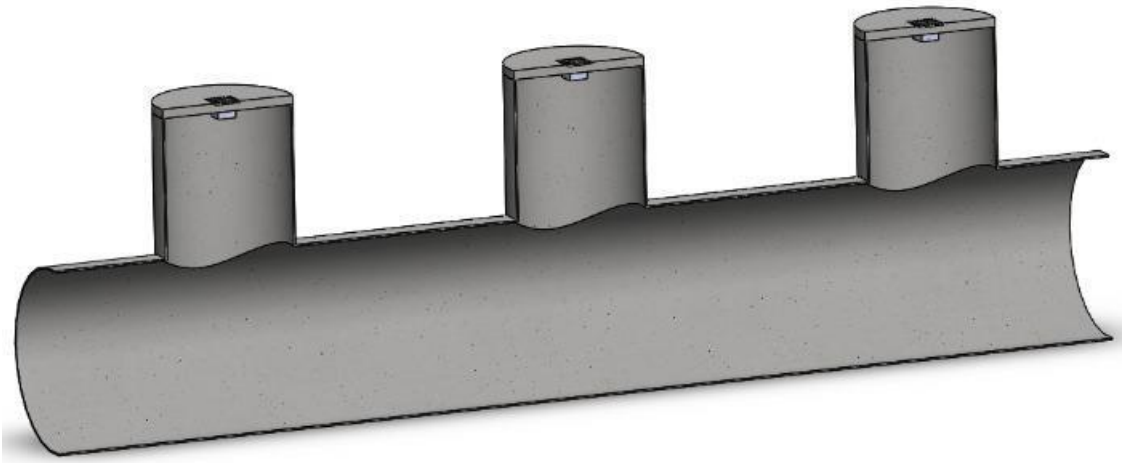
The values obtained from the drainage are continuously made to be updated in the cloud using IoT. When a threshold value is reached by a particular sensor it will alert the authorities by sending the sensor ID and value of the rise in the value. The continuous updates through IoT, will also assist the authorities in knowing the drainage pattern based on the hour, location, and area. This can make them forecast and efficiently manage during unforeseen situations in future.

4. Retractable high pressure jet pump (future scope):

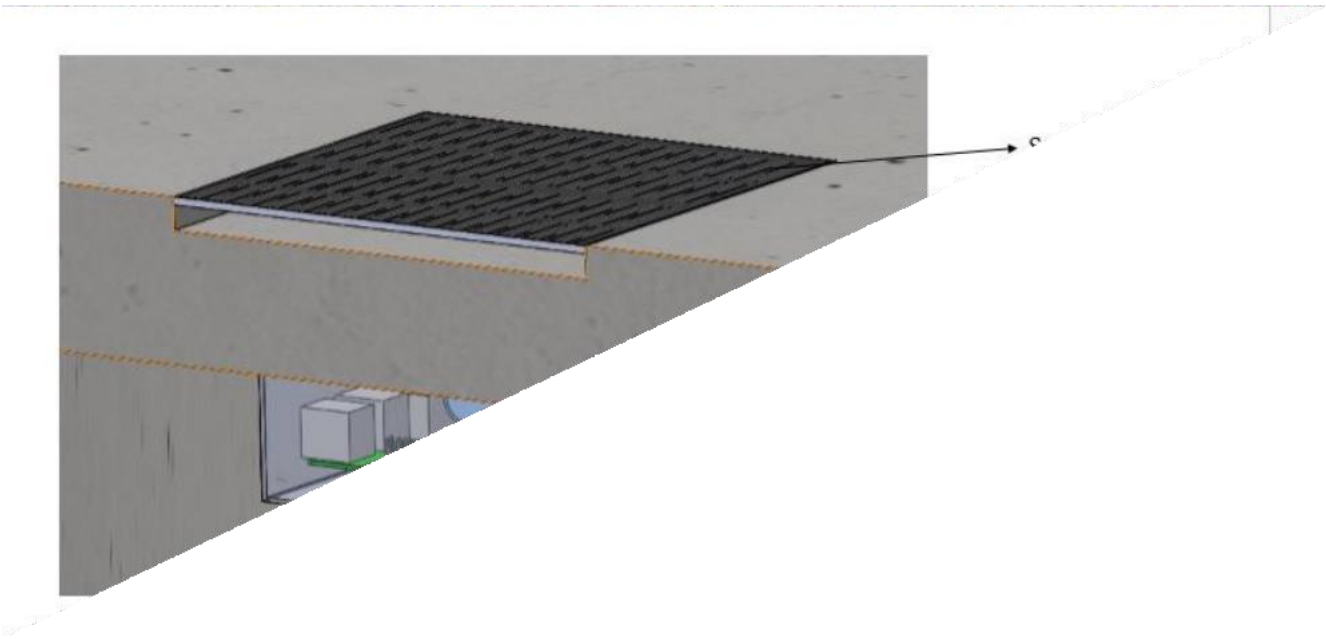
In order to avoid the sanitary workers entering into the sewage canal and face the consequences a retractable high pressure jet pump is proposed. This pump comprises of a control unit to maneuverer the movement of the pump both in and out and activate the turbine to flush out the blockade. Moreover, the control unit is also utilized to triggering the jet flow of water to flush off the sewage slush. A camera attached to the high-pressure pump assists in finding the location of the block when the retractable system is maneuverer to find the location of the block.

PRINCIPLE OR OPERATION:

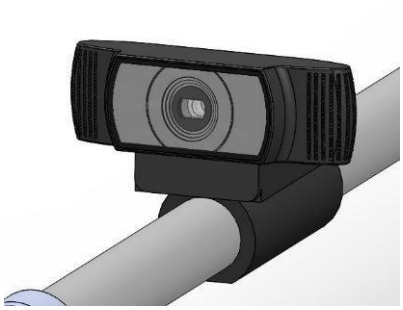
The proposed method uses ultrasonic sensors to detect the location of the block. Ultrasonic sensors are placed on the inner side of the lid of the manholes that detects the rise in the sewage level. The values of the rise in level of the sewage, and the level of methane and hydrogen sulphide gases in ppm are continuously updated using IoT. Once the rise in level of the drainage reaches a threshold level, an alert is given to the authorities concerned. Once the block is detected, the intensity of methane and hydrogen sulphide gases that causes asphyxiation is obtained through the respective sensors placed along with the ultrasonic sensors on the inner side of the lid. Acoustic sensors can be used to identify the exact location of the block. To remove the clog, we have proposed to construct an equipment that uses snake technique. The retractable equipment that can be controlled from outside is fitted with a camera to identify the location of the block. Once identified, a turbine is activated to dislodge and remove obstructions. Moreover, a jet of water is gushed with high intensity through a nozzle to remove the obstructions.



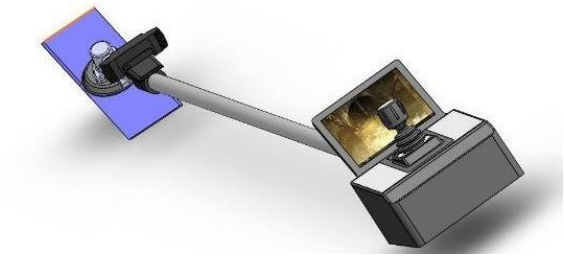
Sewer pipe



Zoom in view of proposed electronics system



Camera



Cutter design

Joystick control

BLOCK DIAGRAM:

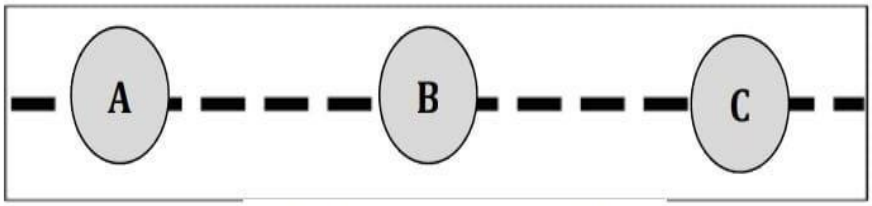
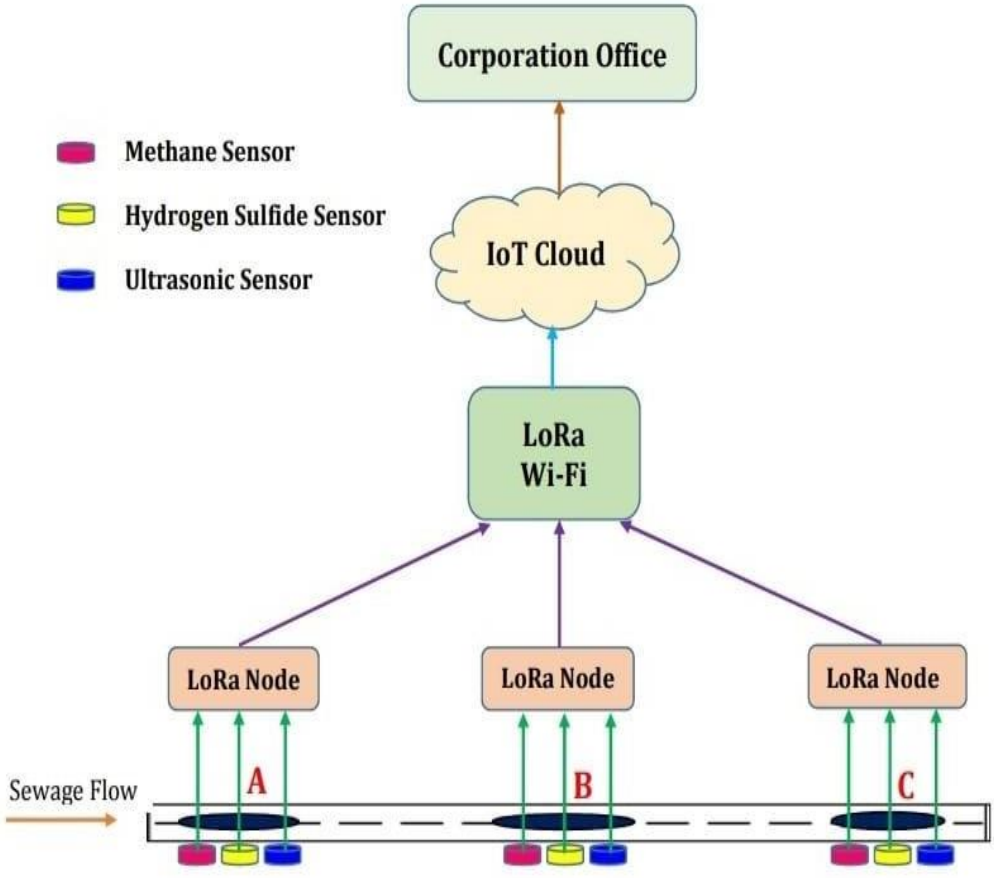
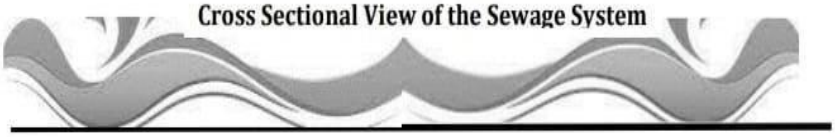


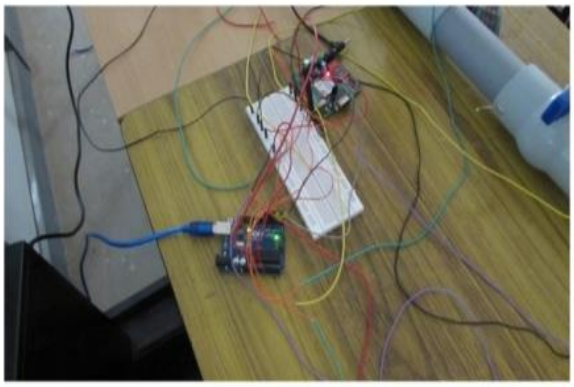
Fig. 1 Top View of the sewage system





PROTOTYPE:

Set up of the drainage system



Circuit used to send messages when a block is identified

Set up displaying the presence of sensors on top of the lid

SOURCE CODE:

```
#include <SoftwareSerial.h>
SoftwareSerial gsmSerial(9, 5); //RX, TX
#define trigPin1 A0
#define echoPin1 A1
#define trigPin2 A2
#define echoPin2 A3
#define trigPin3 A4
#define echoPin3 A5
int ALARM = 7;
long duration, distance, FIRSTSensor,SECONDSensor,THIRDSensor;
// Digital pin 8 will be called 'pin8'
int pin8 = 2;
// Analog pin 0 will be called 'sensor'
int sensor = 3;
// Set the initial sensorValue to 0
int sensorValue = 0;

void setup()
{
Serial.begin (9600);
pinMode(trigPin1, OUTPUT);
pinMode(echoPin1, INPUT);
pinMode(trigPin2, OUTPUT);
pinMode(echoPin2, INPUT);
pinMode(trigPin3, OUTPUT);
pinMode(echoPin3, INPUT);
pinMode(ALARM, OUTPUT);
digitalWrite(ALARM, LOW);
}

void loop()
{
SonarSensor(trigPin1, echoPin1);
FIRSTSensor = distance;
SonarSensor(trigPin2, echoPin2);
SECONDSensor = distance;
SonarSensor(trigPin3, echoPin3);
THIRDSensor = distance;



}

void SonarSensor(int trigPin,int echoPin)
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
```

```
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
Serial.print("S1:");Serial.println(FIRSTSensor); delayMicroseconds(10);
Serial.print("S2:");Serial.println(SECONDSensor);delayMicroseconds(10);
Serial.print("S3:");Serial.println(THIRDSensor); delayMicroseconds(10);
if(FIRSTSensor<=10 && SECONDSensor<=10 && THIRDSensor<=10)
{
  Serial.print("block at s3\n");
}
else if (FIRSTSensor<=10 && SECONDSensor<=10 && THIRDSensor>=10)
{
  Serial.print("block between s2 and s3\n");
}
else if(FIRSTSensor<=10 && SECONDSensor>=10 && THIRDSensor>=10)
{
  Serial.print("block between s1 and s2\n");
}
else
{
  Serial.print("no block\n");
}

setup1();
}

void setup1()
{
   gsmSerial.begin(9600); // Setting the baud rate of GSM Module
   Serial.begin(9600);    // Setting the baud rate of Serial Monitor (Arduino)
   delay(1000);
   Serial.println("Preparing to send SMS");
   Serial.println("Setting the GSM in text mode");
   gsmSerial.println("AT+CMGF=1\r");
   delay(20);
   Serial.println("Sending SMS to the desired phone number!");
   gsmSerial.println("AT+CMGS=\"+917871716122\"\r");
   // Replace x with mobile number
   delay(20);
   if(FIRSTSensor<=20 && SECONDSensor<=20 && THIRDSensor<=20)
      {
        gsmSerial.println("block at s3\n");
        gsmSerial.println("area : villapuram");
      }
   else if (FIRSTSensor<=20 && SECONDSensor<=20 && THIRDSensor>=20)
      {
        gsmSerial.println("block between s2 and s3\n");
        gsmSerial.println("area: villapuram");
      }
   else if(FIRSTSensor<=20 && SECONDSensor>=20 && THIRDSensor>=20)
      {
        gsmSerial.println("block between s1 and s2\n");
```

```
        gsmSerial.println("area : villapuram");
       }
    else
    {
        gsmSerial.println("no block");
    }   // SMS Text
    delay(20000);
    gsmSerial.println((char)26);               // ASCII code of CTRL+Z
    delay(20);
    setup2();
}

void setup2() {
  // Initialize the digital pin 8 as an output
  pinMode(pin8, OUTPUT);
  // Initialize serial communication at 9600 bits per second
  Serial.begin(9600);
  sensorValue = analogRead(sensor);
  // Print out the value you read
  Serial.println(sensorValue, DEC);
  gsmSerial.println(sensorValue, DEC);
  if(sensorValue>=5)
  {
    Serial.print("danger\n\n\n\n\n\n");
  }
  else{
    Serial.print("normal\n\n\n\n\n\n");
  }
  delay(200);

}
```

BLOCK DETECTION SYSTEM:

a. Inside the drainage system:

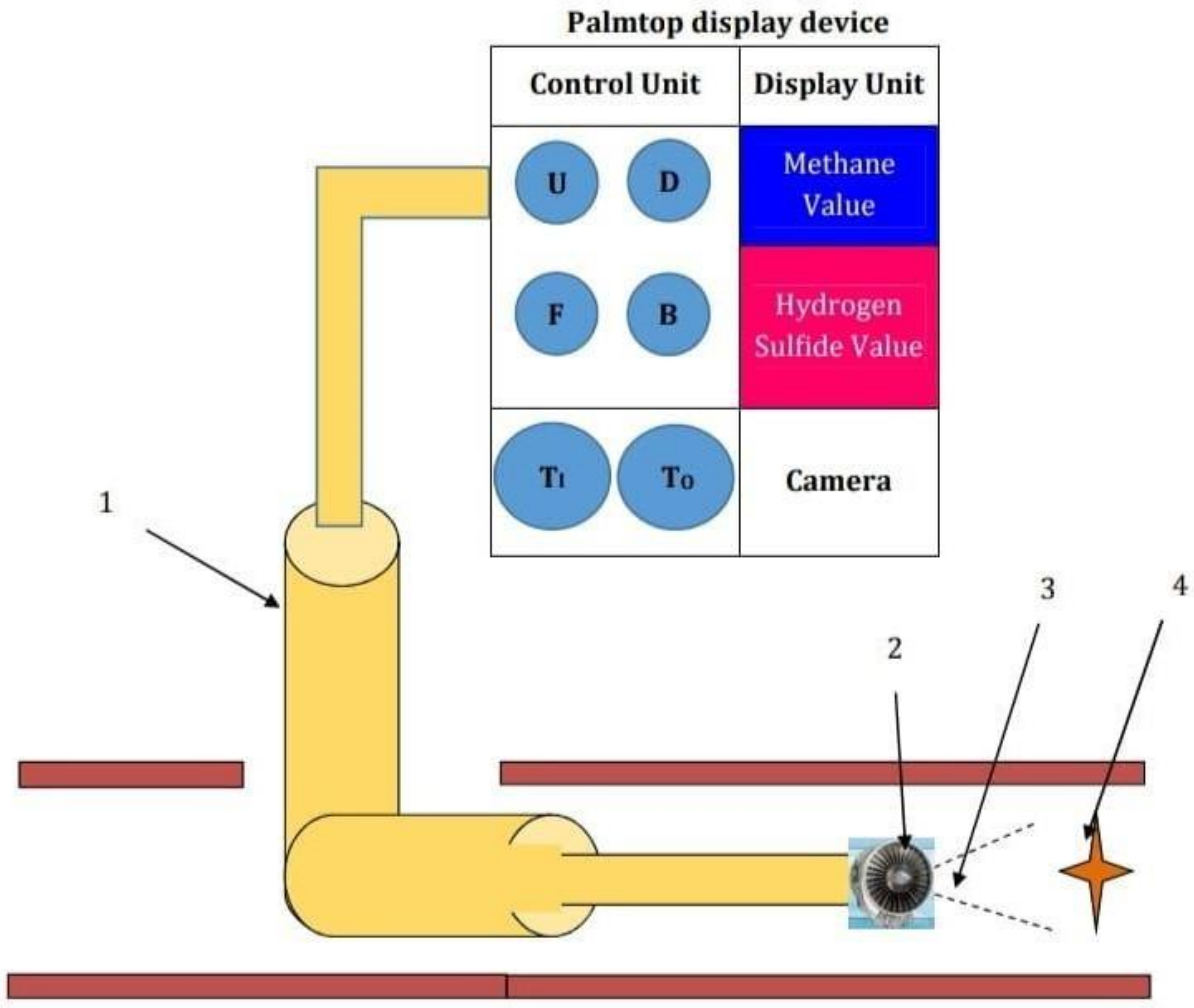
The proposed method uses ultrasonic sensors to detect the location of the block. Ultrasonic sensors, Methane sensors and Hydrogen sulphide sensors are placed on the inner side of the lid of the manholes that detects the rise in the sewage level, and intensity of methane and hydrogen sulphide gas respectively. Fig. 1 shows the block diagram of a drainage stretch consisting of three manholes A, B and C. It is observed that that the three different sensors are placed on the inner side of the lid. The sensors continuously update the respective values on to the cloud using IoT that guides to have a continuous monitoring of the values by the authorities. If a block occurs between B and C, the sewage level rises and the ultrasonic sensor in manhole B first detects the increase in level above threshold. It immediately sends a warning alert. Followed by this, ultrasonic sensor A next detects the rise and communicates the same to the office after finding the increase in level above its threshold. As the ultrasonic sensors A and B alone communicate, it is inferred that there exists a block in between manholes B and C. Once the communication is sent to the office, the workers know the location of the block and so can spend lesser time to clear off the block.

b. Outside the drainage system:

The values of the sensors are collected by the LoRa Nodes that are then sent to the LoRa Wi-Fi device that is placed at a centralized location to collect the details from many LoRa Nodes. The Lora Wi-Fi device can collect the values of Lora Nodes that are 2 Kms within its range. The LoRa Wi-Fi device updates all the values continuously on to the cloud. The authorities monitor these values and efficiently manage the drainage system.

BLOCK REMOVAL SYSTEM:

A retractable pipe system is proposed to be designed as shown in Figure. The device will have a display unit and a control unit. The control unit takes care of the control of the movement of the retractable system whether to move the inner pipe up, down, front or back.



1. Retractable system
2. Turbine
3. Nozzle for high jet of water
4. Block

A camera assisted by a light is fitted in the retractable pipe to exactly identify the location of the block. A display of the video is seen in the display unit. Once the block is found out, a turbine is activated in combination with a high jet of water to clear the blocks. This high-pressure jetting of water that is proposed to be used is to clean sewers, utilizing the extreme cutting action of water jets to dislodge and move obstructions. A display of the values of the intensity of hazardous gases like methane and hydrogen sulphide is also done. By knowing these values, the workers / authorities can have a knowledge of danger residing in the drainage canal.

CONCLUSION:

To monitor the amount of hazardous gases like methane and hydrogen sulphide in the drainage system. To detect and inform the rise in level of the sewage before spillage. To locate and remove the block present in the drainage system. To inform and update the gas levels and sewage levels to the authorities concerned using IoT.