SMART MONITORING SYSTEM FOR MANHOLES USING IOT

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Abstract- **This project aims at providing a solution to monitor poisonous sewage gasses and works on a system of live drainage water level monitoring. The remotely placed IOT monitoring equipment and IOT platform are integrated to create the proposed system. This requires calibration of gas sensors for industrial purposes and determining the correct threshold level for septic plants and facilities. The hardware design sends a prior alert to the sewage worker to ensure in case the damaging gaseous constituents increase in concentration over time. Various types of sensors are utilized to monitor parameters present in sewage like gas, temperature, water level, humidity etc. The detected system is proposed with gas sensors like Carbon Monoxide ,Ammonia and Hydrogen Sulfide. The gasses are highly toxic to humans hence the proposed system is designed to give alerts via notification, once the threshold level of each gas sensor is reached or exceeded. The control room and the workers receive alerts related to gasses and the level of water in the sewage.**

Keywords- **Carbon Monoxide, Hydrogen Sulphide, Ammonia, Internet of Things, LCD Display , Arduino IDE , Blynk.**

I. INTRODUCTION

Use of IoT to monitor poisonous gas has been proposed as a solution to help the sewer workers who put their lives at jeopardy, and ensure minimal health risk. Because of these poisonous gasses, the death rate of sewer workers has increased in recent years. The lack of treatment of sewage after crossing dangerous levels leads to the deaths of thousands of sewage cleaners throughout the year from accidents and various diseases such as hepatitis and typhoid that occur due to sudden or sustained exposure to hazardous gasses. Septic tanks are devices which are found commonly in different types of localities, ranging from residential areas to largely developed industrial areas to provide solutions for treatment of sewage wastes. Sewage gasses generally arise from the natural decomposition of sewage and their mixtures formed by slurries which leads to the production of toxic wastes that release hazardous gasses. These gasses can be lethal if inhaled in high concen used to analyze the amount of hazardous gas and send an alert. The gas sensors periodically sense the hazardous gasses like hydrogen sulfide, methane and carbon monoxide emitted from sewage and are updated when it surpasses the normal grade.The project aims at designing a prototype for monitoring a sewage plant or septic tank in real time for keeping check on concentration levels of gases.As compared to pre existing systems, which lacked real time monitoring and online updating of status of gas concentrations in the air, this system provides as solution to the dynamically changing sewer environment.This happens because flow of sewage water varies substantially with time and depends on a number of factors, like water pump condition, gas retention and damage to facility.This system checks on these factors as minute by minute analysis is accessible from remote locations, thanks to online monitoring. This enables accurate understanding of CH4,CO and other sewer gasses and their emission from sewers and aids in quantifying and dynamically altering municipal planning, a feature that was missing in previous proposals.

II. LITERATURE SURVEY

A sensor node containing two gas sensors and a level sensor that transfers the appropriate sensed information about the harmful gasses and water levels of the drainage system. The system checks for the specific conditions and it sends automatic SMS through GSM and updates it in real-time through IoT[1], The model gives the concentration of explosive gasses individually within a minute and displays in LCD. Harmful gasses like carbon monoxide detection, Methane gas detection, and Hydrogen Sulphide gas detection these glasses are very toxic to the human, Heart Beat sensor will be fixed on the worker's hand watch and a message will be sent to outside workers and Municipal Officers with the help of IOT[2], the system detects concentration determination of hazardous gasses and data is uploaded using Thingspeak server{3}. Therefore,our system senses the temperature and humidity and checks the concentration of toxic gasses like H2S, NH3, CO, etc. It also checks the level of sewage and tracks the location of a worker's traditions or for a prolonged period of time.In order to evaluate the gasses which are present in the sewage environment, sensors have been . When the threshold value of gas concentration in ppm is crossed, the buzzer will be activated and this data is sent to the Blynk IOT application so the user can access it.

III.PROPOSED SYSTEM
A. **Problem Statement**
This proposed system provides a smart solution to monitor poisonous sewage gasses and work on a system of sewage level detection and monitoring.The system will also sense the presence of harmful gasses like CO,H2S,NH3,etc.ESP 32 allows reading sensor data from sewage such as ppm values obtained from MQ 135 AND MQ 136 sensors.It also reads values from water level sensor and Temperature and Humidity sensor respectively.These parameters are also updated to the server at the same time using Blynk IOT platform .The device includes a GPS module for tracking a worker's position.
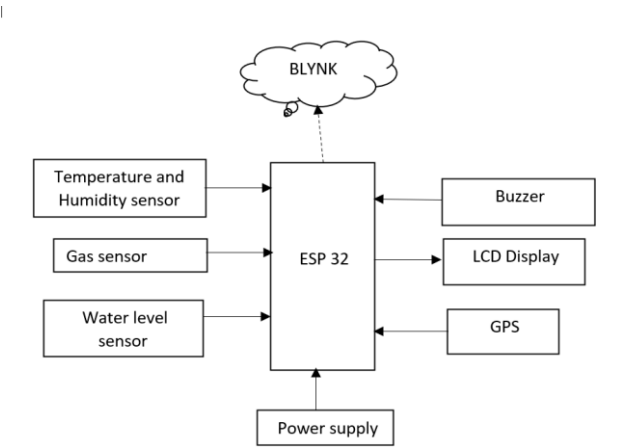
B. **BLOCK DIAGRAM**

Figure: 1 Block Diagram

IV.HARDWARE DESCRIPTION

1.ESP 32 Development Board:

Figure 2 :

Table 1 : Comparison between processor

Parameters	Raspberry Pi Pico	ESP 32 Node MCU
Processor	Dual core ARM Cortex M0+CPU	Single/Dual core LX7, 38 pin microprocessor
RAM memory	264 KB	520 MB
Clock speed	133 MHZ	80/160/240 MHZ
I/O Interface	2 * UTAR ,2* SPI , USB 1.1	38 Pin GPIO , 4 * SPI , 3* UTAR
Operating Voltage	1.8 - 5.5 V	2.2 - 3.6 V

2.DHT22:

Figure 3 :

Table 2 : Difference between sensor

Parameters	DHT11	DHT22
Operating Voltage	3 to 5V	3 to 5V
Max Operating Current	2.5mA max	2.5mA max
Temperature Range	0 to 50°C	-40 to 80°C
Humidity Range	20-80%/5%	0-100%/2-5%
Sampling Rate	1 Hz	0.5Hz
Advantage	Low cost	More Accurate

3.MQ 135 - MQ 136 SENSOR

Figure 4: GAS Sensor

Table 3: Difference between sensors

Parameters	MQ 135	MQ 136
Operating voltage	5 V	5 V
Analog Output	0V - 5V	0V - 5V

Digital Output	0V-5V (TTL Logic)	$\geq$ 0.5V(in 50 ppm H2S)
Operating Temperature	-10°C – 45°C	-20°C – 70°C
Measure & Detect	CO,NH3,NOx, Smoke,C6H6	H2S
Concentration scope	10-300 ppm NH3 ,10-1000 ppm C6H6	1-100 ppm H2S

5.GPS Module:

Figure 5

The Global Positioning System(GPS) provides position and time information. This system is freely accessible to everyone. A GPS receiver calculates its position by precisely timing the signals transferred by GPS satellites. It operates with ESP32 with 3.3 V as well as 5V. The module labors GPS data in NMEA0183 format. Each of the communication strings starts with '$ ' and also the communication identifier.
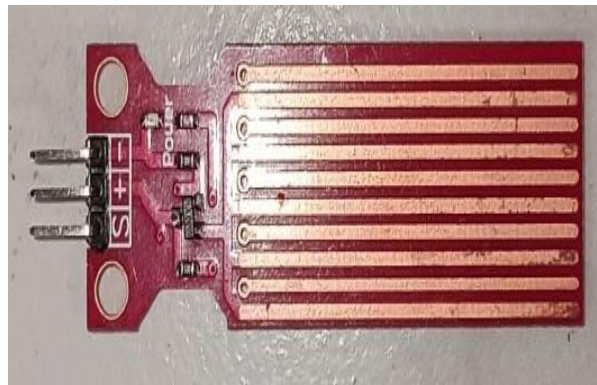
6.WATER LEVEL SENSOR:

Figure 6

Type of Sensor	Media	Advantages	Disadvantages
Float Sensor	Liquids	● Precise measurement ● Unaffected by foam and viscosity ● Inexpensive,no maintenance required	● Sensitive to waves ● Low measuring range(<1m) ● Not suitable for corrosive products
Capaci	Liquids,	● Easy to	

tive sensor	Granular products, Powders	install ● Can withstand very high temperatures and pressures ● Heavy duty ● Insensitive to viscous and adhesive products	

   This water level sensor is used to determine the water level.These output analog values can be directly read via ADC and can also be connected directly to Arduino's analog input pins. It operates at 3.3 V and consumes less than 20 mA.
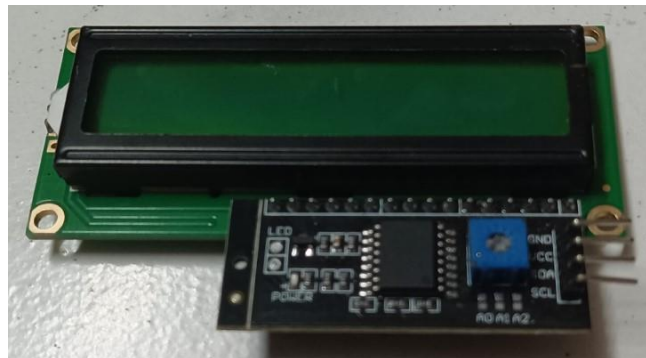 7..LCD DISPLAY:

Figure 7

 LCD is used to display data and messages. It contains 16 columns and 2 rows to display 32 characters. It operates at 4.7V to 5.3V and consumes 1mA.

V.SOFTWARE IMPLEMENTATION
1.Arduino IDE-
ArduinoIDE IDE stands for (Integrated Development Environment) : it is an official software introduced by Arduino.cc, that is mainly used for editing, compiling and uploading the code in the Arduino Device. It is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++.Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
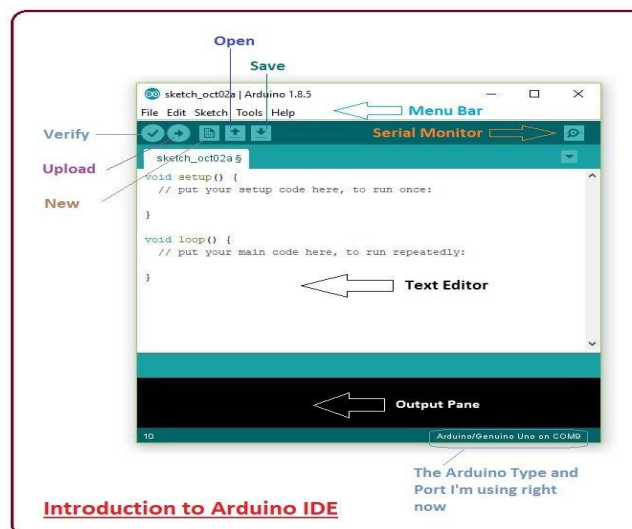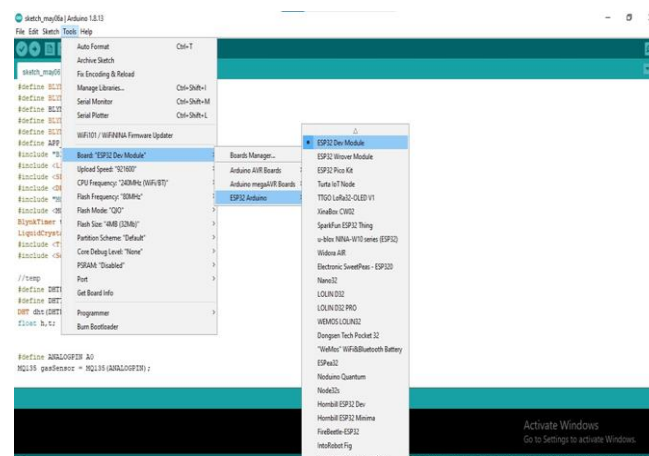

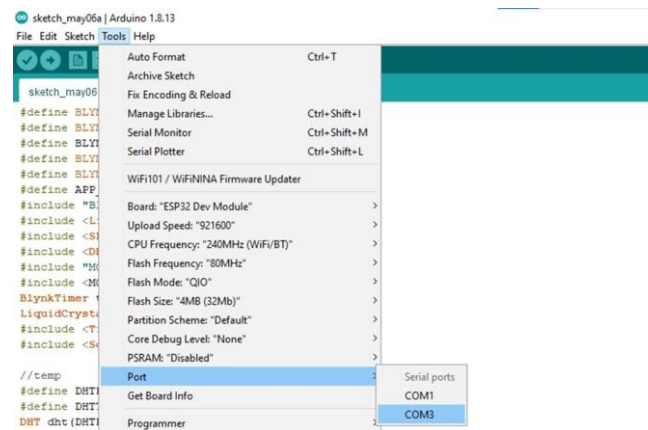**Step 1 – Create a new project**
 Select file → New
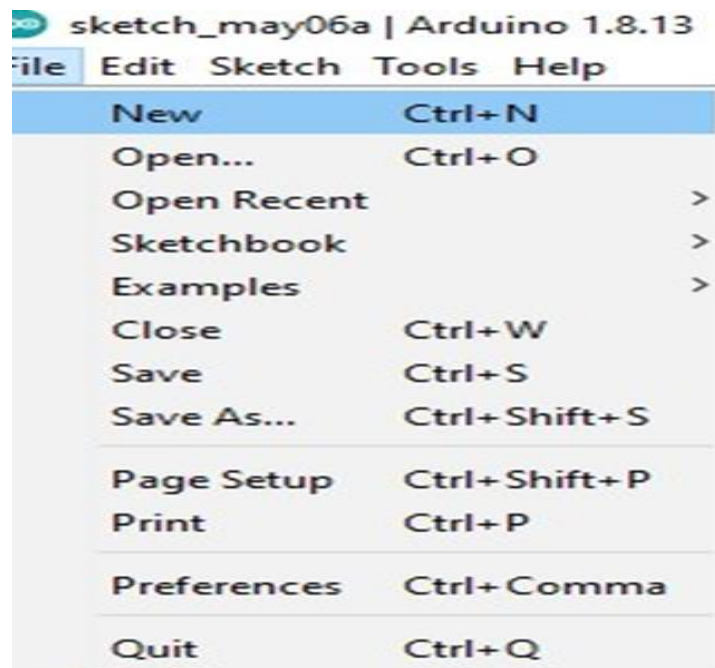
Step 2 – Select your board
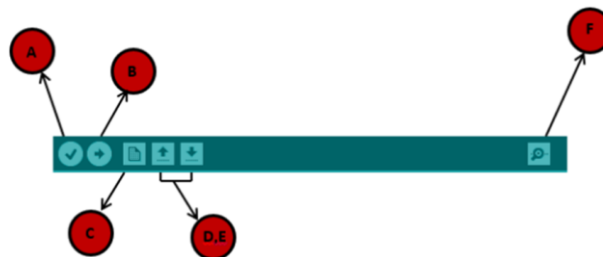
Go to Tools →Board and your board

Step 3-Select your serial port
This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports).

Step 4 − Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

A − Used to check if there is any compilation error.
B − Used to upload a program to the board.
C − Shortcut used to create a new sketch.
D − Used to directly open one of the example sketches.
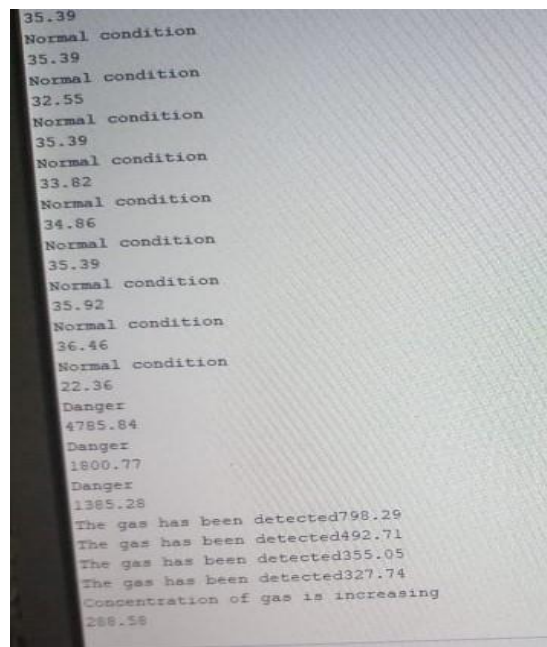**E** − Used to save your sketch.
F − Serial monitor used to receive serial data from the board and send the serial data to the board.
Now, simply click the "Upload" button. If the upload is successful, the message "Done uploading" will appear in the status bar.
Step 5- Check output
Then click on the serial monitor and the output is visible to us.

2.Blynk IOT Application-

Blynk is an IOT platform for iOS and Android Smartphones that is used to control Arduino,Raspberry-Pi, Node MCU via the internet . There are the following steps to create a new project in mobile App.
A.Create a project of DHT 22 sensor
Step 1 : Templates - > New - > Name - >DHT 22 - > Hardware - > ESP32 Connection - > Wi-Fi.
Step 2 : New data stream - >Virtual Pin - > Name -> Humidity - >V pin - >V1 data type - > double - > max value 100 ,

Step 3 : Web Dashboard - > widget box - > 1 . setting - > Template - > Title - > Temperature - > Datastream - > Temperature VT - > 2. setting - > Template - > Title - > Humidity - > Datastream - > Hum VH.

Step 4 : Search - > New device - >From Template - > New Device - > Template (DHT 22)

Step 5 : Copy out code - > Paste to your program.

Step 6 : ESP32 Dev module.

Step 7 : ON Mobile App - > Select template DHT 22 - > Click on setup Dashboard - >widget box - >Draw 2 Gauge for temperature and humidity - > Give name temp & select variable as temp - > Give name hum & select variable as hum .

B.Create a project of Gas sensor

Step 1 : Templates - > New - > Name -> MQ135 , MQ136 Gas leakage - > Hardware - > ESP32 Connection - > Wi-Fi.

Step 2 : New data stream - >Virtual Pin - > Gas value Vpin - > V0 - >Datatype - > Integer Max Value - > 200.

Step 3 : Event - > New - > Name - > Gas _ alert -> Type - >Warning - >Description - > Gas leakage detected - > Notification- >Timeline- >Enable notification.

Defect recipient : Email to - > Device Owner

Push notification - > Device Owner

Notification limit period - > 1 min.

Step 4 : Search - > New device - >From Template - > New Device - > Template (Gas leakage)

Step 5 : Copy out code - > Paste to your program.

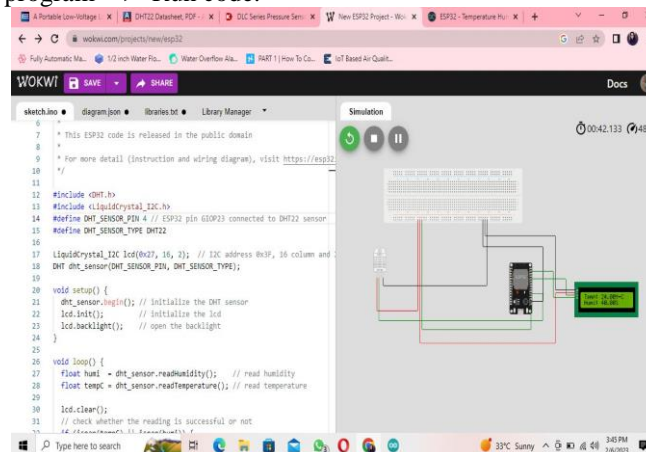Step 6 : ESP32 Dev module.

C.Create a project for GPS

Step1:

D.Create a project for Water level sensor module

3. DHT 22 Simulation

Step 1 : New - > Project Name - >Select component - > DHT 22 , ESP32 , LCD I2C module , breadboard .

Step 2 : Add labrary - > Save the program - > Run code.

VI.METHODOLOGY:

In this we used the ESP32 as a microcontroller Here we have used some Sensors,like Temperature and humidity Sensor,Water level sensor,gas sensor. The Temperature and Humidity sensor used to detect the humidity and temperature. Gas sensors are used to detect any hazardous gasses like carbon monoxide,hydrogen sulfide,ammonia,etc. The GPS module is used to map the location which is attached with the ESP32.So our problem of interest is to develop a prototype that will detect the harmful gasses, temperature and humidity inside the manhole and water level of the sewage will be detected.The main aim of our prototype is used to display these parameters are also updated to the server at the same time using Blynk IOT platform.The analytics tool in Blynk is used to plot graphical representation of these parameters. The device includes a GPS module for tracking the workers position.The warning specifies the coordinates of the workers location.The data can be viewed by the consumer as well as an external unit to prevent any accidents that could occur when working in sewage and to save workers from health problems caused by harmful gasses.

VII. RESULT

In the mobile app ,DHT 22 sensor measures the temperature and humidity in the manhole , MQ 136 measures the H2S gas detection value in ppm.and it also display the different level of gasses in the air gas sensor will be activated at (0 to1000 ppm) and after (1100 to3000 ppm) normal condition greater than the (3000 to 5000 ppm) gas concentration will be increasing , when the gas value is greater than the 5000 ppm , it is near to the danger stage for the MQ 135 gas sensor will be activated at the (0 to 100 ppm) and it is working in (110 to 300 ppm) range if the value is greater than the (300 to 800 ppm) it will display the message near to risk condition for sewage worker.A water level sensor is used to display the water level in the manhole to calculate the height of the manhole . At low level it displays the value (0 to 150), moderate for (160 to 250), and high level displays (260 to 500). Also GPS modules trace the workers location provided to the control room and emergency department .

1)Hydrogen sulfide concentration in air

Table no-4

Exposure(ppm)	Effect/Observation
0.0005-0.01	Odor threshold
0.01-0.6	Increased eye symptoms, Increases in nausea, Increased headache, mental symptoms, diseases of nervous system and sense organs
2.0	Bronchoconstriction in asthmatic individuals
5.0	Increased eye complaints,Mild respiratory, cardiovascular, musculoskeletal, and metabolic changes
3.6-21	Eye irritation
20	Fatigue, loss of appetite, headache, irritability, poor memory, dizziness Irritation of mucous membranes
100	Olfactory paralysis
>560	Respiratory distress
700	Death

2)Carbon monoxide concentration in air

Table no-5

| Exposure(ppm)	Effect/Observation
25	TLV exposure limit for 8 hours (TWA)
200	Possible mild frontal headaches in 2-3 hrs
400	Frontal headaches and nausea after 1-2 hrs

| 800 | Headache, dizziness and nausea in 45 min. Collapse and possibly death in 2 hours |
1600	Headache, dizziness, death in 1 hour
3200	Death in 30 min
6400	10-15 min death
12800	1-3 min death

3)Ammonia/Benzene concentration in air-

Table no-6

Exposure(ppm)	Effect/Observation
25	Odour detect
50	No adverse effect
100	No adverse effect for average workers
400	Immediate nose and throat irritation
700	Eye irritation
1700	Fatal after 30 mins
2000-5000	Fatal after 15 mins
5000-10000	Fatal with mins

https://www.ehs.iastate.edu/forms/sewergases.pdf
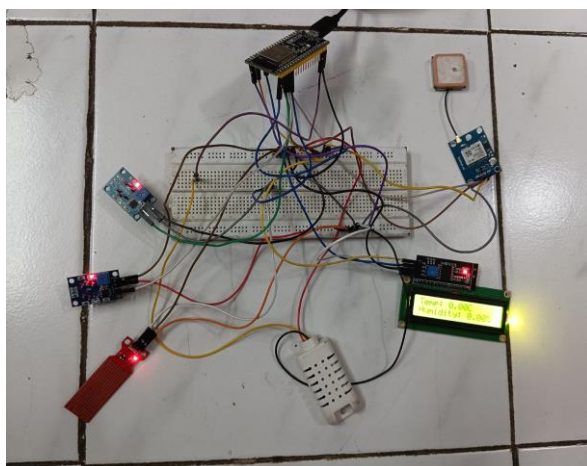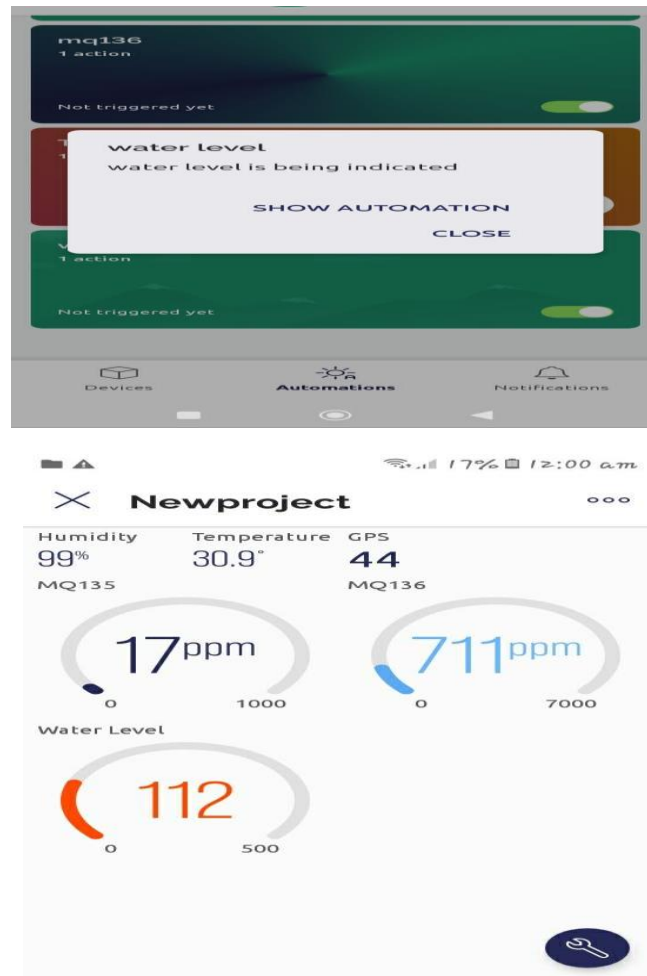
VIII. CONCLUSION

Main aim of our project is detect the highly toxic gasses in the manhole such as a hydrogen sulfide ,ammonia , carbon dioxide and also check the water level in the manhole and all data will message alert on the Blynk mobile app inform to the when worker clean the manhole.

IX. ACKNOWLEDGMENT

The project team is thankful to the guide, faculty evaluators, lab assistants in the department of E & TC for the technical and infrastructural support.

X. FUTURE SCOPE

This proposed device would protect sanitation workers from diseases that are harmful to them.This device,which uses modern technologies and is built on the Internet of Things, would have a huge effect on the lives of sewage workers.We can detect other harmful gasses such as ammonia(NH3), nitrogen oxide,and others by adding more sensors to the design. As a result, the Department of Health and Sanitation will benefit from this initiative.

REFERENCES:
1. Shubhada Malpe, Pranjali Gurad, Ankita Jambhorkar, Amit Pathare, IOT Based Sewers Safety Monitoring and Alert System, International Research Journal of Modernization in Engineering Technology and Science, Volume:04/Issue:05/May-2022
2. A.Vellingiri, K.Dharni, M.Arunadevi, R.L. Arvind Lal,IOT Based Smart Safety Monitoring System For Sewage Workers With Two Way Communication,International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072 © 2020, IRJET | Impact Factor value: 7.529 | ISO 9001:2008 Certified Journal | Page 3214
3. Revanth M.S,Sanjay S,Yaswanth Reddy Puta, DR B.S. Sreeja,Smart IOT Device For Sewage Gas Monitoring and Alert System,International Research Journal of Education And Technology,ISSN 2581 7795
4. Vijay Kumar Uppari, Teja Dugyala, Sanjana Thakkalapally, Sri Rupa Gangadhar and Venkatarama Sai Teja Dasarathi ,Smart Safety Monitoring System for Sewage Workers,EasyChair Preprint No,5680
5. Mr.C.Praveen Kumar, R.Manimaran, E.Logesh, N.Kishore,Safety System For Manhole And Sewage Worker Using IOT ,JAC : A Journal Of Composition Theory,ISSN :0731-6755