

## IOT based Toxic Gas Detector in Sewage

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### ABSTRACT

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Effluents around the IOT system and network that detects toxic gases has been developed as a measure to help sanitation staff who risk their life to ensure reduced health hazards due to toxic contaminants. This paper attempts to device an IOT technology that shall detect the mixture of gases ,sensing each type of gas to measure its level while keeping track of the real time dynamic changes ,it shall send an alert through a buzzer ,who are remotely located. In addition the device offers live streaming of level gases in ThingSpeak.

Keywords : Sewage, Detector, Gas Sensor ,LCD, Microcontroller (Arduino IDE), buzzer, WiFi Module, Cloud ThingSpeak

### I. INTRODUCTION

Internet of Things (IOT) is a worldwide network which provides the communication between human to human to things and things to things. IoT is an open network which comprises of highly intelligent things that organize automatically, sharing of information, data and resources.

Toxic gases present in drainage system is fatal to human beings. Situation may arise when harmful gases get emitted via drainage which causes danger to human life. The pathetic situation continues to exist in our state.

Sewage gases are usually the result of decomposition of organic waste products and mixtures of compost that result in assembly of noxious waste which releases lethal gases. Human waste which is unsafe

settled for months or years, the toxic increase and reduce the level of oxygen. To overcome this problem, a hardware is developed using Internet of Things and Arduino UNO. A device of IoT technology is attempt to detect the mixture of gases, sensing each type of gas to measure its level, if levels exceed beyond Threshold, it sends an alert.

The system deals with monitoring and controlling the environmental conditions like carbon monoxide, methane, hydrogen, LPG and flammable gases with sensors and send this data to the cloud server and draw the sensor data as pictorial statistics. The data upgraded from the enforced system is accessible within the web.

## II. LITERATURE REVIEW

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

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.

### 2. Detection, Monitoring and Control of Toxic Gas using Iot

Toxic gas detection and control system on the field is one of the most dangerous problems in the industries. The aim of this research is to detect the leakage of toxic gas and take preventive action to control the leakage. The leakage of gas is taken as the input. This input is further processed and the output is given to the alert system, exhaust fan and solenoid valve. The input sensor used to detect the gas leak is the MQ-7 gas sensor. The analog input from the sensor is given to the system as digital input through DAQ. Then, it is compared with the condition in the LabVIEW

environment and the corresponding output is obtained. This control signal is fed to the output device through DAQ which controls the gas leakage.

### 3. IoT Based Sewage Monitoring System

This paper aims to measure and analyze the real time levels of toxic gases. In order to ensure safety of the workers working under such severe conditions. This project attempts to device an IOT technology that shall detect the humidity, temperature levels and mixture of gases, sensing each type of gas to measure its level while keeping track of the real-time dynamic changes in the above factors. If levels exceed beyond threshold, it shall send an alert on the connected mobile devices of the authorized people who are remotely located in the job. If any blockage is encountered, it can be monitored with the help of live video streaming.

### 4.Toxic gas detection using IOT Sensors

The primary sources of hazardous gases include ignition of coal, oil for electricity and transport, as well as emissions from industries and refineries. Volatile organic compounds are common in air pollutants which includes different kind of chemicals cause's adverse health effects. In last few years sensors which has high sensitive to VOCs had been used; this paper summarizes the latest advances in sensors for detection of pernicious gases. In addition analytical information revised here shows the efficacy of the existing approaches in toxic gas prediction and an improvement in terms of data validation techniques to improvise the accuracy.

### 5. IoT device for sewage gas monitoring and alert system

This project aims at providing smart solutions to monitor poisonous sewage gases and works on a

system of live sewage level detection and monitoring. Whenever, a certain threshold is crossed, an alert is sent to the observer who is examining the conditions from a remote location. The information is then forwarded along with different gas ppm values indicating whether it is safe for the worker to clean or work in that environment or not. The remotely placed IoT monitoring equipment and IoT platform are integrated to create proposed system. This requires calibration of gas sensors for industrial purposes and determining the correct threshold levels for septic plants and facilities. The hardware is designed such that it shall send a prior alert to the sewage worker to ensure their safety, if damaging gaseous constituents increase in concentration over time. Various types of sensors are utilized to monitor parameters present in sewage like gas, temperature etc. When the threshold value is lesser than the sensed values, this system alerts the sewage worker/cleaner by sending SMS and call alerts by analyzing concentrations of different toxic gases and graphing out their results for real-time monitoring thereby aiding in protection from hazardous diseases and hence serves a social cause as well. In the proposed system, sample values for sensors have been recorded and plotted on ThingSpeak analysis tool. Carbon monoxide and methane sensors charted values up-to 2.3 and 60 ppm respectively, and this breached threshold and GSM module was utilized for sending alert to mobile number fed in the code.

## 6. Iot based air quality monitoring

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles. Effect of air pollution has many bad things and the others may cause problems to our health, for instance, asthma, cough, and lung disorders. In addition, the pollutant can cause global warming, acid rain, and disturbing plant growth. Basically, a human

cannot determine whether the air is good or not. Hence, it is necessary to have a tool that can measure the air quality. This research is purposed to design an air quality monitoring system by utilizing esp8266 module. As the result, users can monitor the air quality using smartphone connected through ESP8266 Wi-Fi. Therefore the air condition can be monitored every time. Currently, there is so much air pollution cases that actually can be changed if we are aware. In other words we can contribute as part of the solution instead part of the pollution.

## 7. IoT Application for Gas Leakages Monitoring

Gas leaks are a potential risk in homes and other areas that use gas, so monitoring equipment is needed to limit the risk of harm. This paper presents the design and construction of IoT-based gas leak detector and alarm. This is an intelligent device with a highly sensitive gas sensor and LCD display that displays the device's status as well as the gas value in the environment. The device is placed in a position where there is a possibility of gas leaks. If the device detects that gas exists in the environment beyond the limit, it will immediately turn on the light, warning the buzzer. At the same time, the device will automatically call the phone number to notify in time, in case the owner is not in the area where the gas leak occurs. Also, the device is connected to the Internet so the gas value in the environment will be posted to the internet for online monitoring. This project contributes to the application of IoT to life to help families feel more secure in the matter of using gas.

## 8. A Sensor-based Garbage Gas Detection System

Garbage poses threat to the environment and human health. Toxic gases may causes respiratory disorders and other health related problems. This research focuses on design and implementation of a sensor-

based system to sense the existence of garbage gases, namely Methane (CH<sub>4</sub>), Hydrogen Sulfide (H<sub>2</sub>S), and Ammonia (NH<sub>3</sub>). Our sensor device consists of an Arduino Uno, a Node MCU ESP8266, MQ-136, MQ-137, and TGS-2611 sensors. We implement two programs - an Arduino program at the sensor device and a PHP program that runs at the web server. In the experiments, the three sensors give higher values when the air is contaminated with garbage gas. The average sensor values from every sensor in the clean air and contaminated air experiments are 0.0904 ppm and 44.696 ppm for the MQ-137 sensor, 0.0624 ppm and 9.1884 ppm for the MQ-136 sensor, and 8.6236 ppm and 368.8128 ppm for the TGS-2611 sensor.

### III. Existing System

In drainage system will have various type of toxic gases which is harmful for surroundings. The intelligence of sensor and system is used to identify the blockage inside the drainage system and give the detail and other information. This system will also sense the various type of gases like Methane, Carbon monoxide, Sulphur dioxide etc. As the level gas exceeds the threshold value the system gives an alert using alarm system by which the health department will take the action accordingly. The module is implemented using Wireless Sensor Networking (WSN) technology each node will carry its own data along with the data of neighboring node. These entire data packet will be collect and store at the cloud and these data will be accessed in real time purpose for monitoring continuously.

### IV. Proposed system

Harmful gas leakage which work mainly using chemicals. Gas leakage can be easily detected and observed by using latest trends in Information Technology by applying Internet of Things. Arduino UNO board is used as central microcontroller which is connected with sensor. Gas sensor (MQ-2 and MQ-

6) which can continuously monitor the respective environmental parameters. The Arduino converts the analog values into digital values and the board functions with set of instruction through the Arduino IDE software. An alarm is produced instantly if the level of the gases goes above the normal level means indication through the internet specific receiver section. Data received by sensor is stored in cloud which can be used for further processing and it can be analyzed for improving safety regulations. This model can be future extended for providing better living environment for people in and around with a pollution controlled environment.

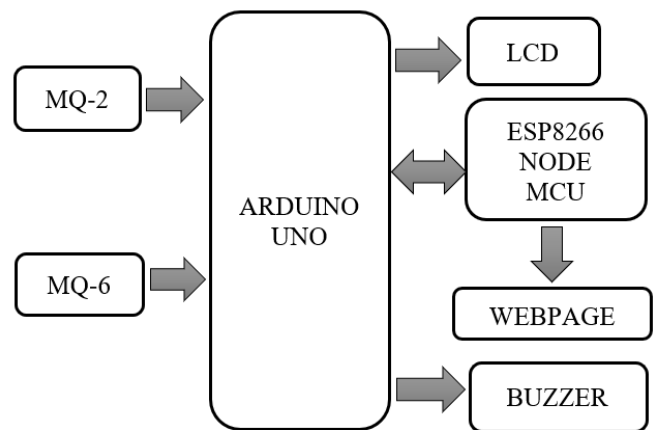


Figure 4.1. Block diagram of proposed system

### V. Basic concepts and Technologies used

#### Hardware Module:

In this proposed system, Gas Sensor and Arduino UNO are used for monitoring the toxic gases present in sewage. The proposed system deployed a set of sensor nodes, where each sensor node has sensors to sense the toxic gases. In this paper, Microcontroller and variety of sensors are considered as the major hardware components. The hardware components collect real time data of toxic values. The collected values are transmitted to cloud server using a WiFi module.

i. Arduino UNO:

A micro-controller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/ output peripherals. The important part is that a micro-controller contains the processor (which all computers have) and memory, and some input/output pins that you can control. (Often called GPIO - General Purpose Input Output Pins). This combines a micro-controller along with all of the extras to make it easy to build and debug projects. The Uno is a microcontroller board based on the ATmega328P. The Uno can be programmed with the Arduino Software (IDE). Select "Arduino/Genuine Uno" from the Tools > Board menu (according to the microcontroller board).

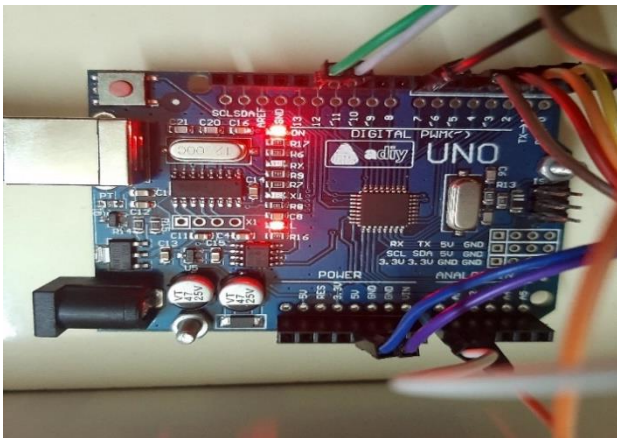


FIGURE 5.1 ARDUINO UNO

ii. Gas Sensor:

A gas sensor is a device which detect the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage.

Gas sensor (MQ-2):

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H<sub>2</sub>, LPG, CH<sub>4</sub>, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast

response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

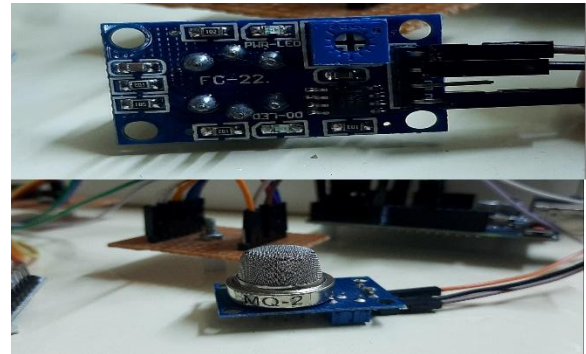


FIGURE 5.2.1 GAS SENSOR MQ-2

Gas sensor (MQ-6):

Sensitive material of MQ-6 gas sensor is SnO<sub>2</sub>, which with lower conductivity in clean air. When the target flammable gas exists, the sensor's conductivity gets higher along with the gas concentration rising. Users can convert the change of conductivity to correspond output signal of gas concentration through a simple circuit. MQ-6 gas sensor can detect kinds of flammable gases, especially has high sensitivity to LPG (propane). It is a kind of low -cost sensor for many applications.



Figure 5.2.2 GAS SENSOR(MQ-6)

iii. WiFi module ESP8266:

Node MCU is an open source LUA based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, Node MCU firmware comes with ESP8266 Development board/kit i.e., Node MCU Development board. Since Node MCU is open-source platform, the hardware



design is open to edit/modify/build. Node MCU is an open-source development board and firmware based in the widely used ESP8266 -12E Wi-Fi module. It allows to program to the ESP8266 Wi-Fi module with the simple and powerful LUA programming language or Arduino IDE. With just a few lines of code we can establish a Wi-Fi connection and define input/output pins according to your needs exactly like Arduino, turning ESP8266 into a web server and a lot more.



**FIGURE 5.3 WiFi module ESP8266**

iv. LCD:

Dot matrix LCD modules is used for display the parameters and fault condition. 16 characters 2 lines display is used. It has controller which interface data and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

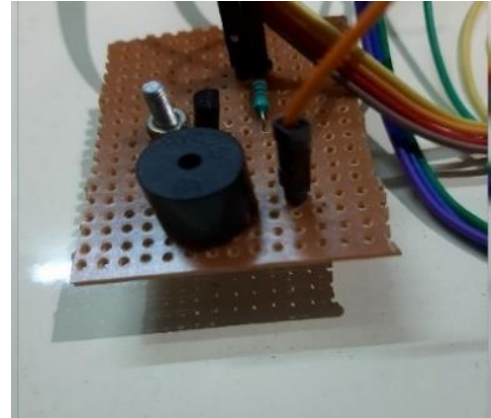


**Figure 5.4 LCD Display**

v. Buzzer:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Piezo buzzer is an electronic device

commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc.



**Figure 5.5 Buzzer**

**Software Module:**

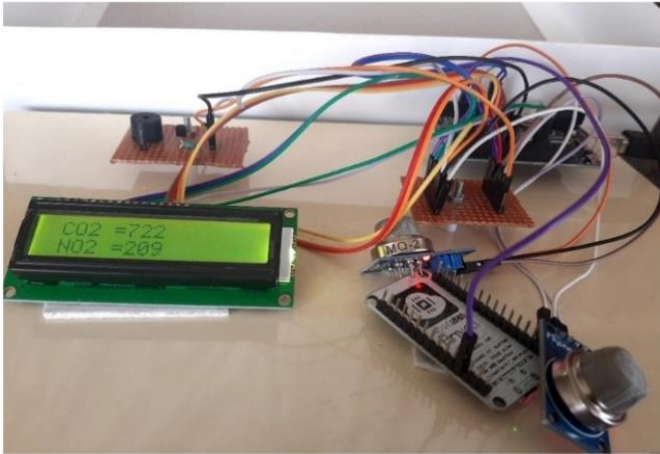
In Software module, Arduino IDE software is a text editor like a notepad with different features. It is used for writing code, compiling the code to check if any errors are there and uploading the code to the Arduino. It is open-source software, where the user can use the software as they want it to. They can also make their own modules/functions and add them to the software.

**VI. RESULTS AND ANALYSIS**

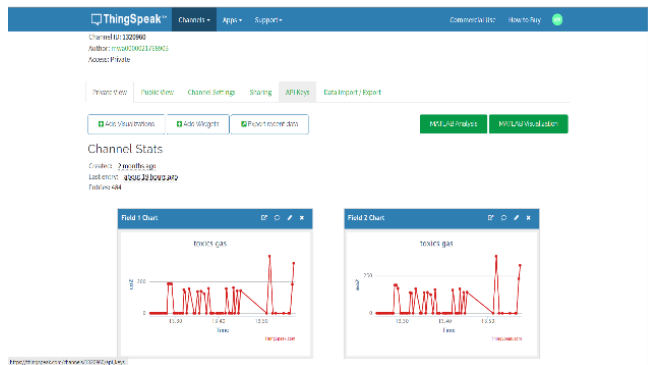
In this paper, it solves toxic gases present in drainage system is fatal to human begins. The harmful gases get emitted via drainage which causes danger to human life. The pathetic situation continues to exist in our state. Different sensors are used to get a value of toxic gas and the values are shown in LCD display. This play an important role in calculating the toxic gases contained. This hardware system interface with the WiFi module to store the data in cloud (Thingspeak).

The Sensors are initially turned on and the toxic values from the sensors get exceeds and processed to the Microcontroller and the values are higher than

abnormal value, an alarm (buzzer or siren) rings and alerts the sanitation staffs.



**Figure 6.1.** Hardware Implementation of Gas value detector



**Figure 6.2.** Detected Values are shown as Graph in Thingspeak

## VII. CONCLUSION AND FUTURE SCOPE

Gas Sensor MQ-2 and MQ-6 are interfaced with Arduino UNO to detect the toxic gas values present in the sewage system. Using Embedded C programming language in Arduino IDE software, the gas values are analyzed and detected. The analyzed values are displayed in the LCD board. After, all the data had been gathered, analyzed and processed, it is concluded that the “Toxics gas Detector Using Arduino are uploaded in webpage”. This will help a lot in terms of preventing any danger caused by gas

leakage and useful as part of safety to avoid the gas leak that can cause harmful result.

In future it enhanced with Wireless Sensor Network (WSN)-based harmful Gases sensing system using different gas sensors and sensed data is passed through IOT gateway to server. This project is also used for ensuring healthy atmosphere for the people who are mostly exposed to harmful gases. This prototype can be extended. Since in the project X-bee can be used which has limited range up to 100m so the distance can be increased by using X-bee Pro up-to km. Also, RPI can be used whose application is restricted in internet-based application only, so a hardware can be developed module which can work.

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