VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JNANASANGAMA, BELAGAVI – 590014

A Project Report of Phase-1
on

"SMART SAFETY DEVICE FOR SEWAGE WORKERS"

Submitted in partial fulfillment for the award of *degree of*

Bachelor of Engineering

In

Computer Science and Engineering

Submitted By

FAIZA SHAREEF	4BP19CS015
NIGAH REHEM SHAIK	4BP19CS048
S A SAJJAD AHMED	4BP19CS052
SAAD ADAM BANDADY	4BP19CS053

Under the esteemed guidance of
Prof. UMAIRA
(DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
BEARYS INSTITUTE OF TECHNOLOGY
MANGALURU – 574153

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI - 590014
Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the project work of phase-1 entitled **"SMART SAFETY DEVICE FOR SEWAGE WORKERS"** carried out by **FAIZA SHAREEF (4BP19CS015), NIGAH REHEM SHAIK (4BP19CS048), S A SAJJAD AHMED (4BP19CS052), SAAD ADAM BANDADY (4BP19CS053)** a bonafide students of **Bearys Institute of Technology, Mangalore** in partial fulfillment for the award of degree of **Bachelor of Engineering in Computer Science and Engineering** of the **Visvesvaraya Technological University, Belagavi** during the year **2022-2023**. The project phase-1 report has been approved as it satisfies the academic requirements with respect to the project work phase-1 prescribed for the said Bachelor of Engineering degree.

PROF.UMAIRA
PROJECT GUIDE
(DEPT.OF CSE)

PROF.MOHAMMED SINAN
PROJECT COORDINATOR
(DEPT.OF CSE)

DR. AZIZ MUSTHAFA
HOD
(DEPT.OF CSE)

EXTERNAL EXAMIANATION

Name of the Examiners: **Signature with Date:**

1. _____   _____

2. _____   _____

BEARYS INSTITUTE OF TECHNOLOGY

(Affiliated To Visvesvaraya Technological University, Belagavi and Recognized by AICTE) INNOLI, MANGALURU – 574153, KARNATAKA

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI - 590014

Department of Computer Science and Engineering

DECLARATION

We students of 7th semester B.E in Computer Science and Engineering, Bearys Institute of Technology, Mangalore hereby declare that the project work phase-1 entitled **"SMART SAFETY DEVICE FOR SEWAGE WORKERS"** embodies the report of our project work phase-1 carried out independently under the guidance of **Prof. Umaira**. The work contained in the report has not been submitted in part or full to any other university or institution or professional body for the award of any degree.

By,

Place: Mangalore   **FAIZA SHAREEF**

Date: **NIGAH REHEM SHAIK**

                                                     S A SAJJAD AHMED

                                                     SAAD ADAM BANDADY

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FAIZA SHAREEF

NIGAH REHEM SHAIK

S A SAJJAD AHMED

SAAD ADAM BANDADY

ABSTRACT

Sanitation workers are those who work in any part of the sanitation system. These workers are frequently in close contact with various types of garbage, such as human excreta, household wastes, and other hazardous materials, while working without proper safety equipment or protection, exposing them to a wide range of health risks and diseases. Toxic gases in septic tanks and sewers, such as Ammonia NH3), carbon-monoxide (CO), and sulphur-dioxide (SO2), can cause workers to pass out or die. In this project, a wearable smart safety device for sewage workers is proposed which intends to safeguard their life by providing early notifications for the presence of toxic gases. Values from sensors were registered and plotted on the ThingSpeak that same result represent in worker profile website, These parameters in real time alerts the worker to stay safe and detects harmful gases before any harm. It also gives notification to other persons like supervisors.

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CHAPTER 1

INTRODUCTION

1.1 Overview

The Internet of Things (IoT) refers to the interconnected network of physical devices, vehicles, buildings, and other objects that are embedded with sensors, software, and network connectivity, allowing them to collect and exchange data. IoT systems have the potential to revolutionize various industries and improve our daily lives by enabling automation, efficiency, and convenience.

From chemical exposure and equipment mishaps to fatigue, heat stroke and fatal falls, there are numerous workplace dangers facing industry. Robust regulations and extensive training alongside conventional personal safety equipment (PPE) are vital, however, these practices do not inform workers when external environments suddenly turn dangerous. Likewise, supervisors and managers are entirely unaware when remote field workers are reaching their physical thresholds.

The introduction of IoT and smart, connected devices are now giving rise to an unprecedented level of visibility into workers' health and their environments. Intelligent gadgets (watches, helmets, vests…) continuously capture vital physical metrics like heart rate, skin temperature, movement, activity, and location. In parallel, environmental sensors record critical information about employees' working conditions and their exposure to external dangers.

Leveraging an advanced analytics platform, situational data can then be distilled into actionable insights visualized at a remote management console. Through enhanced visibility, IoT for worker safety solutions empower data-driven decision-making, thereby improving the safety and productivity of the cross-industry field workforce

CHAPTER 2

LITERATURE SURVEY

IRJET -IOT Based Smart Safety Monitoring System for Sewage   Workers with Two Way Communication

Most of the cities adopted the underground drainage system and it's the duty of Municipal Corporation to maintain cleanliness, health and safety of cities. If the drainage system is not properly managed then pure water gets contaminate with drainage water and infectious diseases may get spread. Drainage cleaning people are not aware of risk by sudden attack of poisonous gas since the gases are odorless if exposed for long time which may cause serious health problems. Due to the lack of using proper gas leakage detection system, a number of dangerous accidents occurred during the last few decades. To overcome all these problems effective monitoring system is needed in the drainage channels. The detected system is proposed with gas sensors like Carbon Monoxide, Hydrogen sulphide sensors and Methane, one Heart Beat sensor used to Calculate the pulse rate of Human. Carbon Monoxide, Hydrogen sulphide, Methane gases are highly toxic to human hence the proposed system will give alert through the LCD Display after reaching the threshold level of each gas sensors then people get alerts Heart Beat sensor will calculate the range of the Pulse rate then output at the abnormal range will give alert through notification through an IOT

Sewage system is an underground system of pipes commonly used to transport wastewater from homes and business either to a treatment facility, where the water is treated and released into natural water bodies like lakes and streams or in any river to permanently drain out from the area. Sewer manhole is one of the most important parts of the sewer system. Sewer manhole is a structure through which a person can gain access to the underground wastewater collection system. Manholes are not designed for someone to work in regularly, but workers may need to enter inside the manhole to complete their jobs such as cleaning, repair, inspection etc

Internet of Things has gained its wide popularity in recent days due to its various streams of applications which has paved way for smooth, safe and easier mode of living style for human beings. Though, several techniques are existing for the same, yet sewage cleaning is one major concern and a challenge always. This paper thus put forth a new proposed system which is microcontroller-based application of sewage workers health monitoring systems using IOT.

Smart Safety Monitoring System for Sewage Workers Using IOT

A large number of sanitation workers die every year due to erratic and lack of facilities available, and harmful toxic gases released while cleaning the sewage. Real time health monitoring systems for such workers will work in a sewage as a safety equipment. In our project, the device will monitor the pulse rate of the person using a Heartbeat sensor and the concentration of CH_4 with respect to atmospheric O_2 and provide alert to the worker and exterior unit when parameters deviate from the safe range. This outcome will promptly alert the worker to stay safe and detect the toxic gases before any harm.

Sewage system is an underground system of pipes commonly used to transport waste water from homes and business either to a treatment facility, where the water is treated and released into natural water bodies like lakes and streams or in any river to permanently drain out from the area. Sewer manhole is one of the most important parts of the sewer system. Sewer manhole is a structure through which a person can gain access to the underground wastewater collection system. Manholes are not designed for someone to work in regularly, but workers may need to enter inside the manhole to complete their jobs such as cleaning, repair, inspection etc. The lack of prior caring of sewage work is the witness for the deaths of thousands of sewage cleaners throughout the year from accidents and various diseases such as hepatitis and typhoid due to sudden or sustained exposure to hazardous gases like CO, hydrogen sulphide, methane. The smart drainage system will have: Sensors to detect blockage, flood and gases. The intelligence of sensors and system will identify the clogging inside the drainage system and will give the details of the location and other information for further actions. The system will also sense the presence of various harmful gases such as CH_4, SO_2, CO etc.

Internet of Things has gained its wide popularity in recent days due to its various streams of applications which has paved way for smooth, safe and easier mode of living style for human beings. Though, several techniques existing for the same, yet sewage cleaning is one major concern and a challenge always. The device finds major application in household sewage systems, municipal manholes and sewage, sewer, deep well, gutters and drains etc. However, the places where toxic gases or fumes are present should never be handled by human workers directly. The smart safety device is cost wise less and fast in accessing the WSN and transfer the information to both the concerned department and emergency department. The proposed device helps the worker at a basic level of knowledge to understand the gas level and his pulse rate.

Smart Safety Monitoring System for Sewage Workers

U. Vijay Kumar Asst. Professor, Dept. Of CSE KITS Warangal

This project mainly focuses on safety of sewage workers as a large number of sewage workers die every year due to lack of facilities and harmful toxic gases released while cleaning a sewage. This Real-time health monitoring System will be very useful and works as safety equipment. In this Project, the device will monitor heartbeat of the person, hydrogen sulphide concentration and other toxic gases concentration and alerts the worker and exterior unit when the parameters deviate from safe range by sending SMS and provides location of the worker through GPS.

Sewage water or domestic water is a type of waste water that is produced by a community of people. This water contains all the impurities and it is sent to a treatment plant for purifying the water and the purified water is sent to the river bodies. So, here when the water is released from the communities, they reach the underground tunnels, and there is a huge work that has to be done by the sewage workers. Thousands of people are being killed every year because of the poisonous gases emitting from the manholes. The main reason behind this is that the workers are sent into the manholes without any safety equipment. Real time health monitoring systems for such workers will be helpful to save their lives. Gases like Carbon Monoxide Methane gas, Hydrogen Sulphide gas are very toxic. So, our problem of interest is to develop a device that will detect the harmful gases, temperature inside the manhole and heartbeat of the worker so that if anything is not under the normal buzzer is activated and the worker is saved on time.

Arduino MEGA is the primary component which acts heart of the project. It allows you to read sensor data from sewage, such as ppm values obtained from MQ2 and MQ136 sensors. Arduino also reads values from heart sensor and Temperature sensor to detect pulse of the person and temperature respectively. These parameters are also updated to the server at the same time using the ThingSpeak IoT platform. The analytics tool in ThingSpeak is used to plot the graphical representation of these parameters. The device includes a GPS module for tracking the worker's position. When the values exceed the threshold values, the GSM module sends an SMS alert to the specified mobile number. The warning specifies the coordinates of the worker's location.

Therefore, to prevent these hazards, an IOT based safety for sewage workers was proposed and designed which monitors toxic gases levels and heart rate of the worker in sewage. GPS module is used to know location of the worker in sewage. If any of the parameters divert from threshold values then an alert is given to worker and also to exterior unit using SMS before any harm.

IRJEdT -SMART IoT DEVICE FOR SEWAGE GAS MONITORING AND ALERT SYSTEM

This paper aims to design a system to measure and analyze the real-time levels of toxic gases and alert the workers. This project 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 in the above factors. The measured gases level is uploaded to firebase. 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 sewage is about to overflow it can be informed to the officials through SMS message. An android application was developed and integrated with the designed system for monitoring purposes.

Sewage environment IoT device and IoT platform to monitor poisonous gas has been proposed as a solution to help the sewer workers who put their lives risk. Because of these poisonous gases, the death rate of sewer workers has increased in the 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 gases. 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.

The proposed system will help sewage workers to protect their lives from risk and harmful disease. According to recent news updates, many sewage workers lost their lives while doing their job by coming across the high concentration of such poisonous gases, which once inhaled led to serious health issues. This proposed system with advanced technology based on IoT will significantly impact the lives of sewage workers. Moreover, by introducing new functionalities like location services, tracking and modified alert system, this design can serve a great social cause.

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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.

Effluent around the IoT system and network that detect toxic gases has been developed as a measure to help sanitation staff who risk their life to ensure reduced health hazards due to these toxic contaminants, sanitation employees' death rates have increased over the past few years. After reaching hazardous levels, the lack of proper sewage decontaminating results in the deaths of sewage cleaning staff from injuries and Specific illnesses including influenza and dysentery caused by abrupt yet prolonged harmful gas exposure.

The goal of this paper is to provide a methodology to check harmful release of gaseous materials in areas included in the drainage system, in social housing and industrial facilities. Sewage also contributes to the natural process of producing poisonous gases. When inhaled for a significant period of time, these gases can be harmful, and if high doses are absorbed in the bloodstream, it may lead to serious illnesses in the work force. Drainage systems indicate the presence of gases, namely sulfur dioxide, methane, ammonia, nitrogen dioxide, carbon dioxide, and carbon monoxide. Therefore, these toxic gases are hazardous, and sometimes lead to their death, particularly for sewage workers and cleaners. Hence, an IoT-based monitoring system is being introduced to avoid exposure to such workplace hazards. Previous programs suggested manual sampling for the sewer gas analysis at defined time intervals. Many variables such as humidity, temperature and generation of live videos were not considered. Using the latest design, the drawbacks of the current system will be addressed. In addition to the gas sensors, the humidity and temperature sensors can aid in assessing the overall environment of the sewage. While assisting sewage employees to check blockage, there will be live video streaming from the camera attached to the raspberry PI.

CHAPTER 3

PROBLEM IDENTIFIED

3.1 Problem Statement

Now a day`s people are becoming more and more busier with their own life and are forgetting to clean their own surroundings. When the cleaning is not done, the waste either remains as stagnant in that area or the municipality cleans it. So, when the municipality cleans the area all the impurities are dumped into the tunnel. These impurities are cleaned by the sewage workers. The sewage workers have to clean the impurities releasing from the communities, impurities dumped by the municipality and the industrial waste. In the existing system the worker will be in danger zone, it will send only a vibration alert to the higher officials or to the control room by the vibrator module. So, the sewage workers lives are always at risk. In-order to save their lives, A Smart Safety Monitoring System is developed that detect the condition of the worker, harmful gases inside the manhole and the temperature of the manhole so that when the values exceed the threshold values, buzzer is activated automatically and messages are sent to the headquarters via SMS and GPS in the device tracks the location of the worker so that the rescue team reaches the manhole on time and their lives are saved.

3.2 Proposed System

The smart drainage system will have: Sensors to detect blockage, flood and gases. The intelligence of sensors and system will identify the clogging inside the drainage system and will give the details of the location and other information for further actions. The system will also sense the presence of various harmful gases such as Methane (CH_4), Sulphur dioxide (SO_2), Carbon monoxide (CO) etc. system will generate the alert using alarm system by which the health department will take proper action on it. The module is implemented using Wireless Sensor Networking (WSN) technology each node will carry its own data along with the data of neighboring node and will pass it to next node by hopping techniques. These entire data packet will be collectively sent by the gateway node and stored at the cloud all these data will be accessible in real-time scenario for continuous monitoring.

CHAPTER 4
OBJECTIVE AND METHODOLOGY

4.1 OBJECTIVE

The purpose of this project is to provide the following objectives for safety of sewage workers. The condition of the sewage acts as an input using Temperature sensor, ultra-sonic water level sensor, Gas sensor detectors. It measures and analyze the real-time levels of toxic gases in order to ensure safety of the workers working under such severe conditions.

• To provide safety for sewage workers

• To avoid deaths of sewage workers due to toxic gases.

• To develop cost friendly system.

• To find location of the worker in the sewage tunnel.

• To update the readings in real-time over ThingSpeak analysis tool.

• To alert the worker if any parameters exceed.

• As soon as parameters exceeds, SMS alert is sent via GSM module.

4.2 METHODOLOGY

Arduino MEGA is the primary component which acts heart of the project. It allows you to read sensor data from sewage, such as ppm values obtained from MQ2 and MQ136 sensors. Arduino also reads values from heart sensor and Temperature sensor to detect pulse of the person and temperature respectively. These parameters are also updated to the server at the same time using the ThingSpeak IoT platform. The analytics tool in ThingSpeak is used to plot the graphical representation of these parameters. The device includes a GPS module for tracking the worker's position. When the values exceed the threshold values, the GSM module sends an SMS alert to the specified mobile number. The warning specifies the coordinates of the worker's 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 gases.

4.2.1 ARDUINO BOARD AND IDE

Arduino is an open-source platform that uses hardware and software to create simple yet powerful devices. It consists of a microcontroller, which is a small computer that can be programmed to perform a variety of tasks, and a development environment, which is a software application used to

write and upload code to the microcontroller.

The Arduino Integrated Development Environment (IDE) is a software application that allows users to write and upload code to the microcontroller. It includes a text editor for writing code, a compiler for converting the code into a form that the microcontroller can understand, and a debugger for finding and fixing errors in the code. The Arduino IDE also includes a library of functions and resources that can be used to create a wide range of projects. The Arduino platform is popular among hobbyists, educators, and professionals for a variety of reasons. It is easy to use and requires no prior programming experience, making it a great tool for beginners.
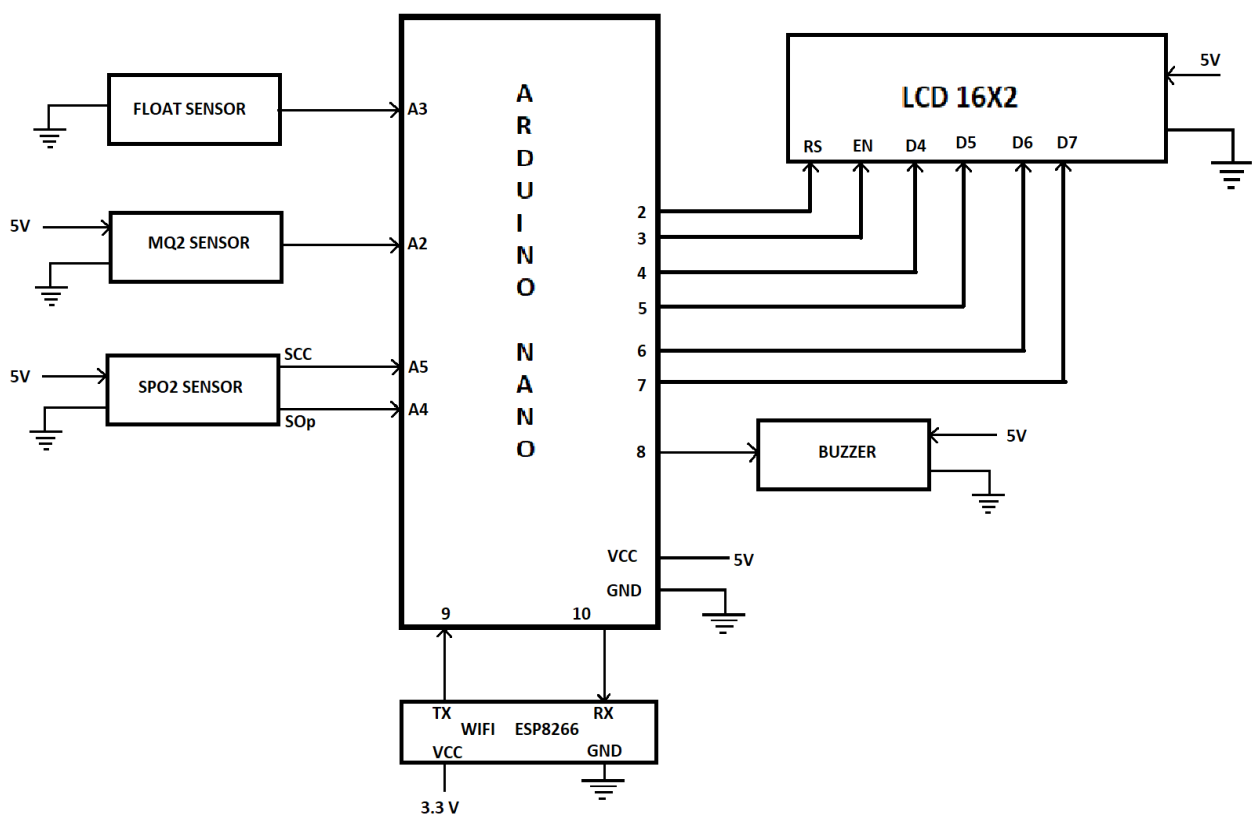
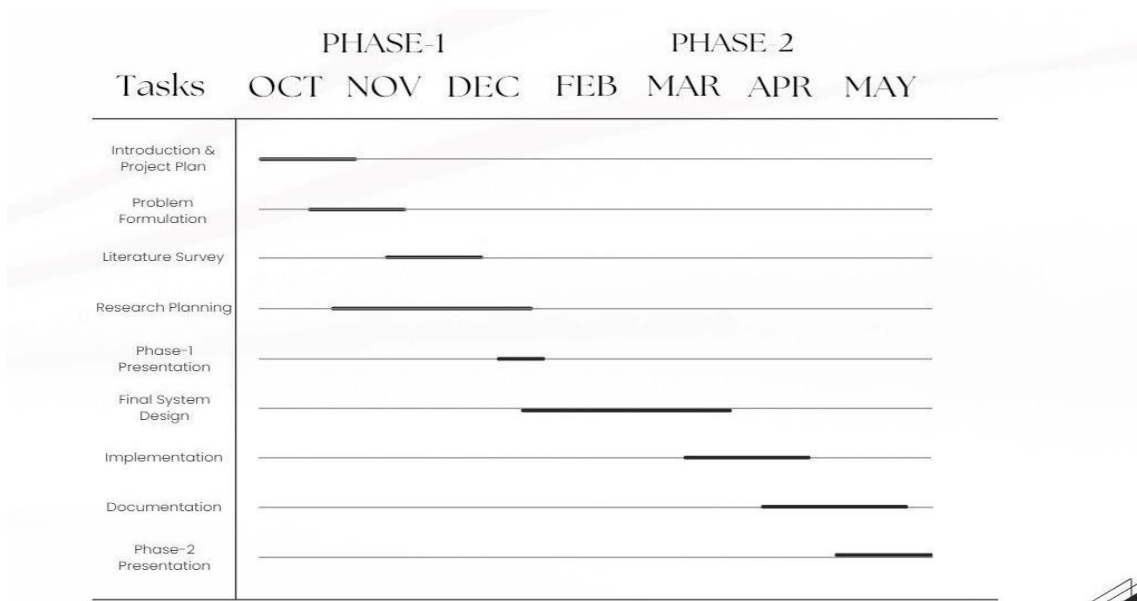## 4.3 Block Diagram

Fig 4.3 Block Diagram

4.4 GANTT CHART

Fig 4.4 Gantt chart

CHAPTER 5

REQUIREMENTS

5.1 Software requirements

- Arduino IDE

- ThingSpeak

5.2 Hardware requirements

- ARDUINO NANO

- WIFI MODULE

- BUZZER

- GAS SENSOR

- POWER SUPPLY

- PULSE SENSOR

CONCLUSION

If inhaled for an extended period of time, sewage gases can be toxic and can cause chronic illnesses and death if high concentrations are released into the body. Sulfur dioxide, hydrogen sulphide (H2S), methane (CH4), ammonia (NH3), carbon dioxide (CO2), and traces of carbon monoxide are all contained in sewage gases. These toxic gases are particularly dangerous for sanitation workers, and they can even cause death. Therefor to prevent these hazards, an IOT based safety for sewage workers was proposed and designed which monitors toxic gases levels and heart rate of the worker in sewage. GPS module is used to know location of the worker in sewage. If any of the parameters divert from threshold values then an alert is given to worker and also to exterior unit using ThingSpeak before any harm.

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