Smart Safety Monitoring System for Sewage Workers

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ABSTRACT

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 heart beat 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. Values from sensors were registered and plotted on the ThingSpeak analysis tool in this proposed framework, and a GSM module was used to send a warning to a mobile number that was entered into the code. These parameters in real time alerts the worker to stay safe and detects harmful gases before any harm.

Keywords—Arduino MEGA ,MQ2, MQ136, Global System for Communication, Global Positioning System ,ThinkSpeak Server.

INTRODUCTION

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.

RELATED WORK

In sewage monitoring system, the device is carried with worker into the manhole and all the conditions like concentration of gases, temperature inside the manhole and heartbeat of the worker is

monitored and updated into the server. The sensor collects information from the surroundings and passes the information to the microcontroller. This smart safety device is described as an embedded system capable of processing sensor data and transmitting it to a server.

Different systems have been proposed earlier by scientists researching the environment situations because large amount of polluted water and other chemicals are received from the communities and industries into the manholes. Using Internet Of Things, large amount data from different places can be gathered, situation of the workers are monitored, and are rescued on time.

PROBLEM IDENTIFICATION

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. 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 head quarters 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.

PROJECT OBJECTIVES

The purpose of this project is to provide the following objectives for safety of sewage workers.

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

HARDWARE DESIGN

For detecting the presence of dangerous gases in sewage, we use a mq2 gas sensor and a mq136 gas sensor in the proposed device. The sensor generates values that are sent from the sewage to the control system. To make these sensor values usable for use, they must be calibrated by specifying a resistor value. The worker in the sewage is located using a GPS module. Depending on the set of predefined condition, the output is transmitted via GSM module to the server.
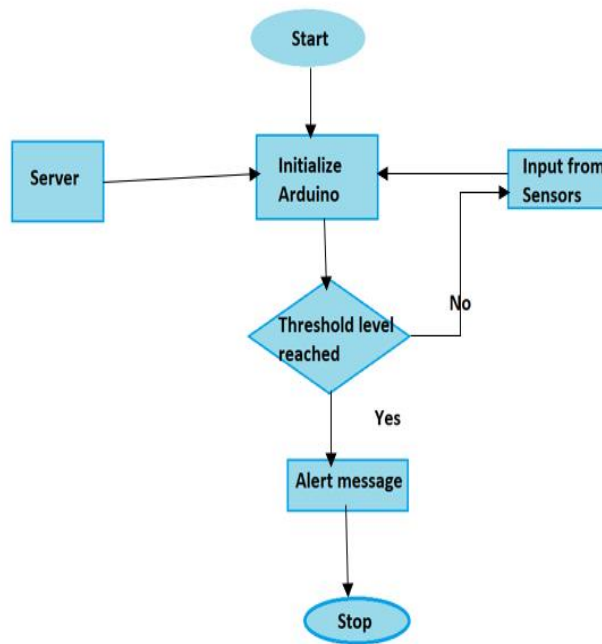
In this project,we have used ThingSpeak IoT platform.

Fig 1.Flowchart for system design.

B. SENSORS OF THE SYSTEM

Temperature Sensor:

The temperature sensor LM35 is an integrated circuit with precession. The value of its output voltage is determined by the temperature of its surroundings. -67 degrees Fahrenheit to 302 degrees Fahrenheit is the temperature range. The voltage increases by 0.01V for every degree Celsius rise in temperature.

MQ2 Sensor:

It can detect gasses like propane, LPG and Methane. Power the module with 5V, the power LED on the module glow and when no gas is detected, the output LED will be in off state, which indicates that the digital output pin is 0V.

MQ136 Sensor:

It is used for Hydrogen sulphide (H2S) gas alarm. In clean air, SnO2 is the sensitive material of the Mq136 gas sensor, and it has a low conductivity. In the presence of H2S, the gas concentration as well as the conductivity of the sensor increases.

Sensor for Pulse:

The Pulse Sensor amped is a heart-rate sensor for Arduino that can be used right away. It incorporates an optical heart rate sensor with noise reduction circuitry to make it operate quicker and provide accurate pulse readings.
The pulse sensor must be clipped to the finger tip and plugged into the Arduino to read the heartbeat.

Module GSM:

GPRS module is another name for it. The Global System for Mobile Module is abbreviated as GPRS. It is used to communicate between a GSM phone and a mobile device. The GSM 800I module's operating voltage ranges from 3.4 to 4.4 volts. With Auto-baud detection, this module supports baud rates ranging from 1200bps to 115200bps.

GPS module:

GPS stands for Global Positioning System. It specifies the object's position. The NEO-6M chip's operating voltage ranges from 2.7 to 3.6 volts. An HK24c32 two-wire serial EEPROM is included in the module. It's 4KB in size and uses I2C to communicate with the chip. It also has a super-capacitor that is powered by a rechargeable button battery.

Arduino Mega:

There are 54 digital input/output pins, 16 analogue inputs, 4 UARTs, a USB link, a power jack, a 16 MHz crystal oscillator, an ICSP header, and a reset button on the Arduino Mega. It comes with everything you'll need to run a microcontroller. To start it, you need to power it up with battery or it should be connected to computer with a USB.

WI-FI Module:

The ESP8266 Wi-Fi Module is a self-contained SOC with an integrated TCP/IP protocol stack that can provide access to your Wi-Fi network to any microcontroller. It has 4MB Flash memory. It has the ability to host an application while also offloading all Wi-Fi networking functions from another app. It is equipped with a 32-bit processor that operates at a maximum clock speed of 160 MHz while consuming very little power.

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 ThinkSpeak IoT platform. The analytics tool in ThinkSpeak 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.
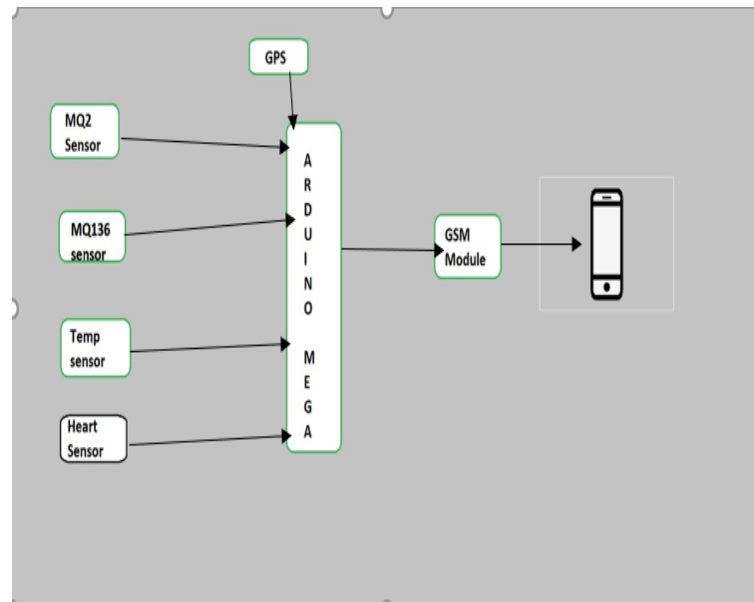

Fig2.Block Diagram for the system
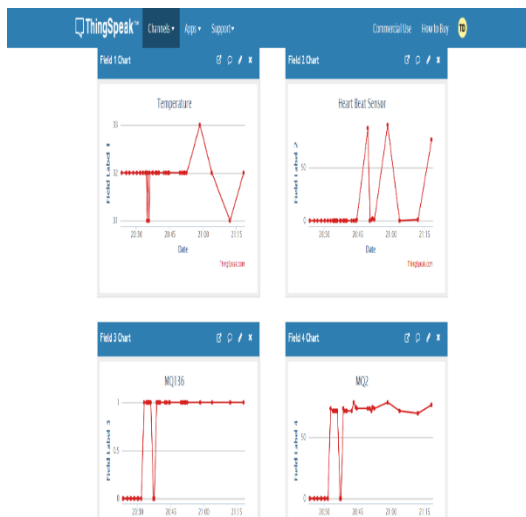
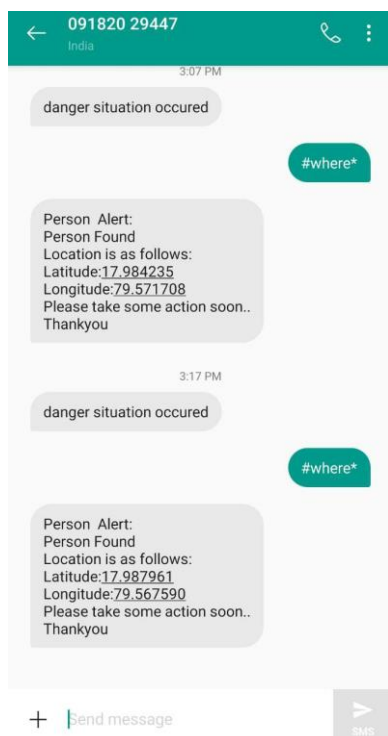## RESULTS

Fig 3 Thinkspeak output

Fig 4 Message received when parameters exceeds.

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 (H_2S), methane (CH_4), ammonia (NH_3), carbon dioxide (CO_2), 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. 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.

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 gases such as ammonia(NH_3), 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.

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