Life-Saving System from Harmful Gases in Sewage Tank

Mrs. Ashwini Katkar
Assistant Professor
Department Of EXTC V.C.E.T
Vasai, India

Shreya Teli
Department of EXTC V.C.E.T
Vasai, India

Snehal Sutar
Department of EXTC V.C.E.T
Vasai, India

Pankaj Gupta
Department of EXTC V.C.E.T
Vasai, India

***Abstract*— Most urban zones have developed an underground sewage framework and it's the obligation of the common body to see to the tidiness of the tanks considering the way that as the hour of these tanks being unclean forms makes it a critical issue. Because of the absence of utilizing appropriate gas spillage recognition framework, a number of dangerous accidents occurred during the last few decades. The proposed paper focuses on designing a life-saving framework that will end up being financially affordable and furthermore shielding the sewer workers from the threats of sewage gases. The smart glove in the proposed approach incorporates the gas sensor and wellbeing checking heart sensor where the values obtained are processed. Various types of sensors are utilized to monitor parameters in sewage like gas, obstacle, etc. When a threshold value is lesser than the sensed values this system alerts the sewage worker in the tank through the Blynk app, this helps the wellbeing of society.**

Keywords—Smart glove, Internet of things, Blynk app, Sewage gases, life-saving.

I. INTRODUCTION

In recent years human scavenging is an important issue and these are developed due to many reasons out of which we are focusing on sewage systems. The Indian sewage system is not a pretty scene and what is making it worse is that almost 80000 unskilled workers are sent to sewage tanks without proper gear and equipment[10]. So, this is taking an immense toll on human workers who are sewer laborers.

The lack of prior caring for sewage work is the witness for the deaths of thousands of sewer workers from accidental deaths and diseases like hepatitis, skin disease and typhoid due to gases. Many ways are being searched to curb this problem but the result has led to difficult solutions which include high cost, low availability, etc. The main objective of this project is to develop a system affordable glove which comes in handy for the sewer laborers. The technology on which the system is based is IoT.

IoT is becoming the basis of many smart systems, it's a network where all the data is sent from humans and their surroundings which has sensors for collecting the data to network without human-computer interactions[9]. The major challenges of IoT are network issues, difficult to identify if the device is affected. In the project, we propose a life-saving system from harmful gases in the sewage tank which will provide an integrated system wherein continuous monitoring for the sewage worker's health and harmful gases present in the vicinity of the tank. Here a person is wearing the equipment consisting of the gases sensors for harmful detection, ultrasonic for object detection and heart sensors which will continuously monitor the person's heart rate and all the notifications regarding the worker's health and the gases is displayed in the app and alerted to the sewer laborer through buzzer.

II. RELATED WORK

Most gas poisoning incidents occur in the sewage tank thereby claiming lives. The prominent gases present are methane gas, carbon monoxide and hydrogen sulfide[7]. Many contractors and corporations ignore the safety procedures so as get the job done more quickly. So, a study was done to see how lives are affected by it. If the sewer workers were exposed to smell it was found that close to 50% of the workers develop symptoms like Sub-acute symptoms including sore throat, cough, chest tightness, breathlessness[4].

The most common way is by hand-to-mouth contact during eating, drinking, and smoking, or by wiping the face

with contaminated hands or gloves or by licking splashes from the skin [8]. Incidents of gas poisoning in drainage work often result in deaths because in such accidents, co-workers often instinctively enter the drainage immediately in an effort to help the collapsed victim and thus also succumb to the gas poisoning.

Rescue should only be performed by trained personnel with appropriate equipment and support from other rescuers. So, the main concern here is to build something which is cost-effective and which detects most of the harmful gases thereby making a smart system that is affordable to the contractors, proprietors and all the civic bodies which uses this system.

Due to the rise in manual scavenging, the need to develop a device to prevent accidents has become the need of the hour. The existing methods available are not much portable or affordable. The basic problem that arises is the implementation because the model designed should work without much hassle to the sewer laborer. One of the existing models consists of all the gas sensors and it provides an indication with Led. GSM module is used to transfer information. The problem which arises is the probability of network issues[2].

The gsm module has the network depending on the base station. There can be the possibility of no network which can cause problems. Also, the device available is not wearable[1]. The other model consists of the device which monitors heart rate and sends the information to the database and the authority monitoring will see to it[5]. The most common framework used is IOT wherein the alert system is activated and messages are sent to the authorized person[3]. Slight delay in the delivery of messages can cause a serious problem. In totality, the crux of the problem for designing the smart system for the detection of harmful gases is implementation, network issues, and affordability.

III. PROPOSED SYSTEM

We will develop the smart system with the help of IoT, wherein there will be integration of hardware and software[6]. The system to be developed is affordable, reliable and is able to give the results. The device consists of many elements mainly gas sensors (mq4, mq7), heart sensor, led, LCD, display, buzzer, bypass switch. The overall system can be split into four stages: evaluation of ppm, and evaluation of bpm, sending the data to monitor, comparing the data to the reference data and then sending an alert message. We take two values into consideration – parts per million (ppm) and beats per minute (bpm). Each value is uploaded to the database which is compared with reference data.

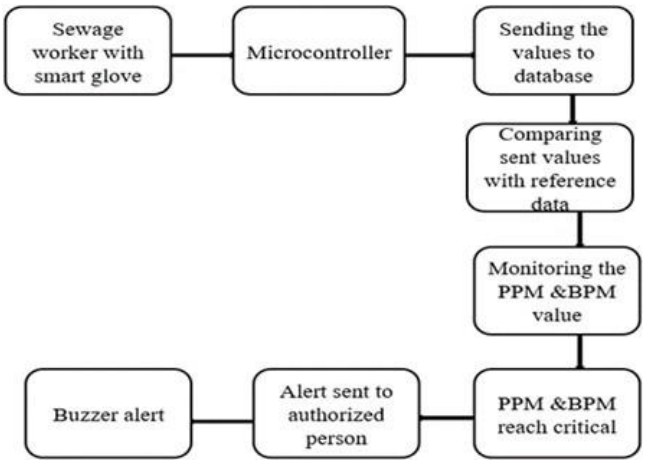

Fig. 1 Life Saving System Flow Chart

The reference data contains the normal data of the hazardous gas and the normal rate of the bpm when the user is in action. The sample data are given below, which are dependent on the age of each person.

The flow process of the life-saving system starts firstly with the sewage worker wearing the smart system. We have designed it in the form of a glove. Here the worker provides age as input through the app before entering the sewage tank. This step is important since the heart rate monitoring is done according to age.

For every age group, there is a critical heart range calculated for the harmful sewage gases in the sewage tank which mainly consist of carbon monoxide, methane, and hydrogen sulfide. The smart glove is connected to the internet and it sends the value of the gas sensors, heart rate continuously so that it can be compared with the reference value present in the server. If there is alert then the worker is alerted through the buzzer and led. For each gas alert, the buzzer has different tones.

Network issues can also be resolved. In the system, there are two modes with WIFI and without WIFI. One can switch between the modes using the bypass switch. This system is able to work thus providing the notification to the user. LCD displays are used to provide the information to the worker.

IV. IMPLEMENTATION

A. Design

The smart system is to be incorporated into a smart glove. So the prime factor for developing the glove is mounting all the components of the system. Since the glove is the integration of hardware and software. We will be designing the PCB layout in such a way that it can be imbibed with the glove structure. First PCB designing is done. The PCB is a long rectangular structure of 10X10. The positioning is done

from right to left. Ultrasonic is the first component placed and just below it, the heart sensor is placed above the radial artery located on the thumb side of the wrist. Gas sensors are placed after the above two components on the PCB. LCD for display is placed on the left side, led beside it and so is the buzzer.

B. Microcontroller

It is the core of the system. We have used Arduino Nano which processes the data from the sensors and provides the display on LCD. The mapping of the controller is done as follows.

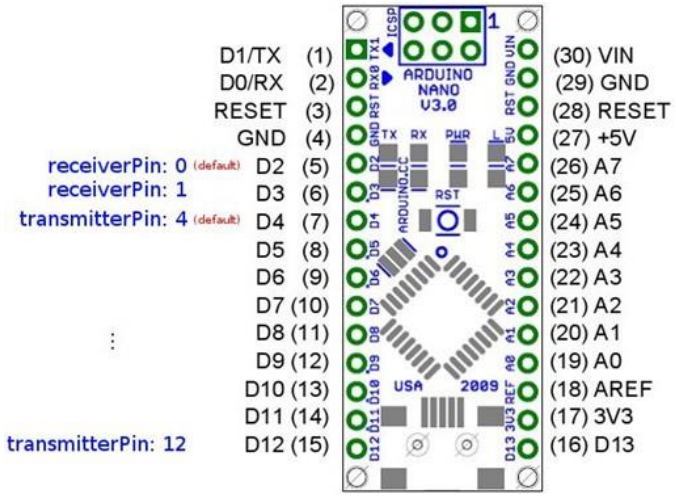

Fig. 2 Pin Diagram

Pin A0-A7 is used to measure Analog voltage in the range 0-5V A0 is used for Heartbeat monitoring. A1 is connected to the MQ-4 gas sensor. A2 is connected to the MQ-7 gas sensor. A3 and A4 are used for led indication for MQ-4 sensor and MQ-7 sensor. A5 is used as a switch for bypass. Pin D0-D13 is used to measure digital voltage. Pin D0-D1 is used as a transmitter and receiver. Pin D2-D3 is connected to the WIFI transmitter and receiver. Pin D4-D5 is used for the trigger and echo pin of the ultrasonic sensor. Pin D6-D11 is connected to LCD. Pin D12 is used for Buzzer and pin D13 is used as an indication of heartbeat testing.

C. Heartbeat Sensor

Heartbeat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heartbeat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to the microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse or by placing it on the artery nerve on the left hand.

D. Ultrasonic Sensor

The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. ultrasonic level sensors measure the distance to the target by measuring between the emission and reception. Distance is calculated using the formula.

$$L = 1/2 \times T \times C \square\square\square$$

L is the distance

T is the time between the emission and reception C is ultrasonic speed.

The value is multiplied by 1/2 because 'T' is the time for go-and-return distance. The time calculated is always less than 50microseconds. The features of ultrasonic are unique which sets it apart. Detection is not affected by the accumulation of dust and is stable even for targets such as mesh trays.

V. RESULT AND DISCUSSION

During the making of this smart system the ultrasonic because the time required is in microseconds as compared to other devices. All the errors were rectified .We were able to obtain all the values on LCD and when the WIFI mode is on the notification is obtained on the Blynk app.The buzzer and Led are also used for notification. Ideally, the value of the harmful gases is in higher concentration but for demonstration, we have set at the normal values.

Fig. 3 LCD display

Demonstration for the gases is done by using perfume for methane gas and burning of match stick for carbon monoxide. The heart sensing is done according to the age. For different age groups, there is a critical heart range for different gases.

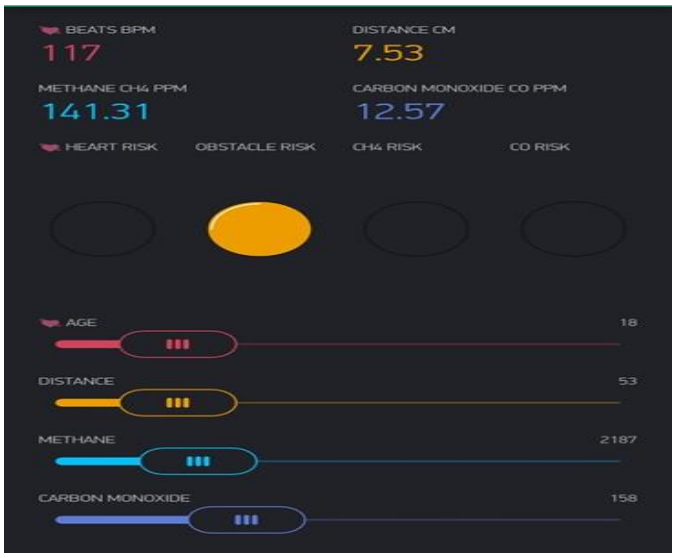

Fig. 4 Output

As the above figure shows the yellow color ,this is the notification considering the presence of obstacle .So all the panels present can we used to set different values following according to the conditions .Age of the person is alterable.so every time the sewer labourer is different the health can be monitored accordingly.

VI. CONCLUSION

After using the technologies mentioned we have got the results, wherein tracking of heart rate is done continuously by the heart sensor. Arduino nano processes the data which automatically alerts the worker. The system can be converted into a fully internet-connected network with better connectivity. This project will save human life at a faster rate because this project is easy to use.Here even if the connection is lost one can get the notification via the alarm system.

The glove costing is inexpensive compared to the products available in the market. It can be customized according to the user. This will encourage the contractors and corporations to imbibe this system in the sewage cleaning procedure. The design is done in a manner that the smart system is compact and wearable. Sewage workers can work without hassle. The main contribution the study has made is the establishment of safety rules required for sewage cleaning. The inclusion of parameters regarding the health of workers is a bonus factor. Overall the smart system works in an effective way thereby saving lives which leads to a fruitful future.

ACKNOWLEDGMENT

It is our great privilege to express our sincere gratitude to our project guide, (Prof. Ashwini Katkar) for their guidance, motivation, whole-hearted cooperation and encouragement throughout the duration of our project. We deeply express our sincere thanks to our project coordinator (Prof. Amrita Ruparee) for encouraging and for allowing us to present the project on the topic “Life-Saving System from Harmful Gases in sewage tank”.

REFERENCES

[1] Ambeth Kumar VD, Elangovan D, Gokul G, Praveen Samuel J, Ashok Kumar VD. Wireless sensing system for the welfare of sewer laborers. Health Technol Lett. 2018;5(4):107–112. Published 2018 Jul 13. Date of issue:10.1049/htl.2017.0017

[2] Vijayalakshmi, R. (2017). IoT Based Smart Detection System for Harmful Gases in Underground Sewages. International Journal for Research in Applied Science and Engineering Technology. V. 604-614. 10.22214/ijraset.2017.11095

[3] Srinivas, Chalasani & Kumar, Ch.M. (2017). Toxic gas detection and monitoring utilizing the internet of things. International Journal of Civil Engineering and Technology. 8. 614-622.

[4] Hariharan, Uma. (2016). A fatal case of septic tank gas poisoning: Critical care challenges. Journal of Anesthesia and Critical care: Open access.

[5] Lohitesh, K. & Behera, A.K. & Alexander, Allen & Vuppu, Suneetha. (2013). Detection and removal of hydrogen sulfide gas from food sewage water collected from Vellore. Der Pharmacia Lettre. 5. 163-169.

[6] Ravichandran, Dr. (2016). Internet of Things in the Drainage Management System.

[7] Ghosh, Dr & Das, Indranil & Adak, Deepanjana & Mukherjee, Nillohit & Bhattacharyya, Raghunath & Saha, Hiranmay. (2016). Development of selective and sensitive gas sensors for manhole gas detection. 1-5. 10.1109/ICSensT.2016.7796220.

[8] “Prevention of Gas Poisoning in Drainage Work”, published by the Labour Department.

[9] https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.pololu.com/file/0J313/MQ7.pdf&ved=2ahUKEwjikoih9YLoAhUGH7c

[10] AHVIXB44QFjAFegQIDhAK&usg=AOvVaw2nU7JmmXWJ1Xn Rp-zS8cX7

[11] https://www.indiatoday.in/india/story/7-suffocated-to-death-while- cleaning-hotel-sewer-in-gujarat-s-vadodara-1549381-2019-06-15