IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 8, Issue 5, May 2020

Surveillance of Hazardous Gases in Sewage Plant using Intelligent Electronic Nose and IoT

Poorna Shree.T[1], Rohini.C.M[2], Yogapriya.M[3], Dr.R.Sudarmani[4]

B.E / ECE, Department of ECE, School of Engineering,Avinashilingam Institute for Home Science and Higher Education for Women,Coimbatore[1,2,3]

Associate Professor, Department of ECE,
School of Engineering, Avinashilingam Institute for Home Science and Higher Education for Women,Coimbatore[4]

Abstract: Nowadays, in variety of applications such as industrial, automation industry, agriculture processes increasingly involve the production of highly dangerous substances, particularly hazardous gas which can create a potential hazardous to the humans. If we inhale the hazardous gas it can cause serious health impacts, unconsciousness and even death. Hence proper precaution measures should be taken for accurately detecting the hazardous gas to avoid the endangering of human lives. In this paper, an Intelligent Electronic Nose is developed for continuous monitoring of hazardous gas in sewerage plant. Sewer manhole is one of the most important part of sewer system. A continuous monitoring of the hazardous gases emitted by this system is an essential one. The measured gas level reaches the threshold level, an immediate rectifying activity has to be taken to prevent the human deaths. Hence, a WSN based embedded system is designed with various gas sensors which monitors and send an early warning signal to the concern person through a mobile app.

Keywords: Electronic nose, Hazardous gas, WSN,Gas sensors

I.INTRODUCTION

Sewer manhole is one of the most important part of the sewer system. Sewer manhole is a structure through which a person can access to the underground wastewater collection system. Manholes are not designed for someone to work in an easy manner, but workers need to get into the manhole to complete their jobs. The lack of prior caring of sewage work is the witness for the deaths of thousands of sewage cleaners throughout the year due to various diseases such as hepatitis, typhoid etc, and also sudden or sustained exposure to hazardous gases like carbon monoxide, hydrogen sulphide, and methane. A better knowledge related to hazards in the sewage system is essential for the prevention of human lives from the poisoning of gases.

The continuous monitoring of the level hazardous gases and the level of sewage effluents is a needy one to make the necessary corrective measures to prevent the unnecessary loss. In contrary, the existing systems available are not easily accessible and also not affordable. To avoid those incidents, a wireless sensor networks based embedded system is designed with various gas sensors for the purpose of an early warning system which helps to save the lives of many people who are working in sewer system. This system is affordable to implement as a well-defined monitoring system. The classification of gas is done by two algorithms. They are linear regression and k-nearest neighbour. In the proposed IoT based system a mobile app is developed to provide an early warning to the people those who are involved in the maintenance of sewage system also people in the municipal corporation office.

II. LITERATURE REVIEW

R.Vijayalakshmi et al.,[2017],proposed an underground drainage system in order to maintain the cleanliness, healthy and safety of cities. In order to maintain the cleanliness of the drainage system, an effective monitoring system is needed in the drainage channel. The monitoring system senses the gases and classifies the gas. The monitoring system gives an alert when the toxic gas reaches the threshold level. This method help to monitor various gases and to avoid the future accident[1].

M. Abdelkhaleket al.,[2019],proposed a system characterize the chemical components in a faster manner and the response time is reduced. In this study, they developed a compact e-nose dedicated to identify the volatile and non-volatile odour, so they use humanoid robot. This paper developed a humanoid robot which behaves like a human in sensing food such as volatile and non-volatile odour.E-nose has four MOS gas sensor and K-nearest neighbour classification algorithm. Experimental result shows success rate up to 98% to differentiate between four fruit juices like apple, orange, pineapple, greenade and to identify the rotten egg from good egg and butane gas in less than 60 seconds[2].

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 8, Issue 5, May 2020

Pei-Feng Qi et al.,[2017],proposed an electronic nose to classify the Chinese liquors by classic dynamic sampling method.CDS(Classic Dynamic Sampling) method and BBS(Bio-inspired Breathing sampling) method are adopted here. The sampling of BBS is faster than CDS. The BBS method result indicates higher accuracy[3].

Atiqur Rehman et al.,[2018],described the feature-rank-code-based classifier method which have been proposed recently in order to reduce the complexity of electronic nose. This system is used to detect the various gases in industries.It has three different data set. Two is taken from laboratory setup and one is from university of California atiravine machine learning respository[4].

Atiqur Rehman et al.,[2019],proposed a chemical sensor is used to identify different odours.The problem ariseswhen these sensors incorporate drift by passage of time, this drift measurement of odours fail to respond accurately. To overcome the drift in challenge, the re-calibration technique, had been adopted which provides this better prediction accuracy [5].

III. METHODOLOGY

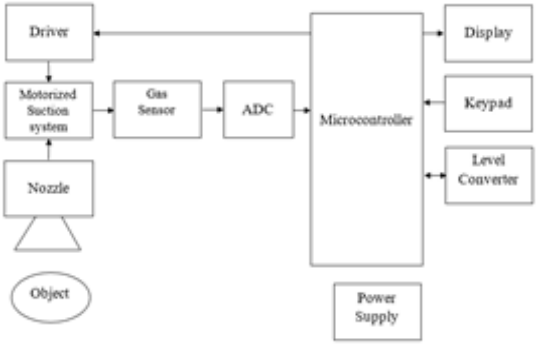

Fig.1

The power supply unit has 5V and 12V supply which feeds power to the units according to their voltage levels. The purpose of the keypad is to activate the microcontroller whenever the keypad is pressed, it will activate the embedded system which in turns triggers the driver. Through this driver the sucking system gets activated. Then the sucking system will inhales the surrounding air with help of Nozzle. This air or gas inhaled by the sucking system is given to the gas sensor. The gas sensor senses the smell and identifies what kind of gas it is. The sensed analog signals are converted to digital through inbuilt ADC and sent to the microcontroller. The sensed gas is displayed in the LCD and also the process is displayed out by the LabVIEW through a computer. For this we need a level converter, in this work RS232 is the level converter which is used to setup a connection between an microcontroller and a computer. By this the output of the gas sensor can be viewed in the LabVIEW through the computer.

A. Power supply

Thepower supply unit consists of Transformer, Rectifier, Filter, and Regulator. The 230V ac supply is converted into 12V ac supply through the transformer which inturn converted into dc powerthrough bridge diode.The constant 5v supply is given to microcontroller. For this purpose 78xx regulator is used in the circuit.

B. Microcontroller System

PIC16F877 is used in this proposed system. It is under (PIC) family of microcontroller.PIC is a Harvard architecture microcontrollers and it is made by Microchip Technology. It is derived from the PIC1640 and it is developed by General Instrument's Microelectronics Division.

C. LCD Display

A liquid crystal display is a type of flat-panel display. Liquid crystals use a backlight or reflector to display the characters. The display consists of two rows and 16 columns.

D. Level Converter

In this work RS232 is the level converter which is used to setup a connection between an embedded system and a computer. By this the output of the controller can be viewed in the computer.

E. ADC

Analog to Digital Converter (ADC) is a device that converts analog signals to digital signals. This is an essential unit when the processing is carried out over physical quantities, which are normally analog in nature. Most of the PIC Microcontrollers have inbuilt ADC.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 8, Issue 5, May 2020

F. Motorized suction system

The suction system which sucks the surrounding air with the help of motor fixed with it. This unit is triggered by the driver circuit.

G. Keypad

A switch is in the form of a push button which has typically “on/off” switch.Switches may be normally open or normally closed. A normally open switch doesn't make contact unless it is held down.

H. Gas Sensor

The Gas sensor used here is the MQ-Series multi gas sensor. It can detect gas concentrations anywhere between 200 and 10,000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog range. The supply is given to the gas sensor. The coil inside the gas sensor is heated and senses the gas. The output of the sensed gas is given to ADC converter to covert analog signal to digital signal.

I. Driver

The relay driver circuit is enabled for certain time duration. The enable pulse is depend on the delay programming of microcontroller.The darling circuit consists of two transistors and it is connected in cascade network. If the input is given to the base of the first transistor, then the first transistor is turned on and it produces an emitter current.The produced current triggers the another transistor. The circuit is closed through coil and second transistor is energized and it controls the switch to change from normally open to close (NOC) to normally closed to open (NOP) connection.

IV. RESULTS AND DISCUSSION

In this project an intelligent electronic nose has been developed to protect the life of workers. It is implemented to improve the protection and safety of the workers. This system continuously monitors the toxic gas levels. This system is flexible and cost effective and monitors the toxic gases. This system is found to be compact, user friendly and less complex which can be readily used in order to perform the detection operation. This approach believes that using gas sensor network devices the environmental balance can be achieved by saving the humans from hazardous gas. The gases is sensed by the gas sensor and its threshold values are displayed in the LCD, once it reaches the threshold value , it displays the type of gas present in the sewage system.

Fig. 2

It will interface serially with the computer to view the threshold value of the gas and based on the value it also displays the name of the gas in the LabVIEW. It also displays the type gas in the sewage plant.

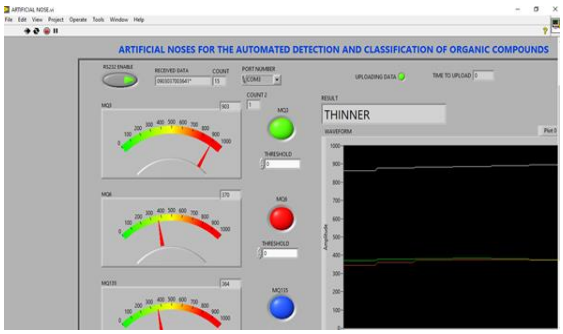

Fig. 3

VI. CONCLUSION

The proposed system is based on microcontroller and MQ- series sensors which can readily be used in order to perform the detection operation. The problem of toxic gases in sewage plant has become a major social problem in current time and requires urgent attention for this problem. The project will help the workers in protecting their lives. This approach believes that using gas sensor network devices the environmental balance can be achieved by saving the humans from hazardous gas. This method is easy to implement and eco friendly. It can save human life from hazardous gas.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 8, Issue 5, May 2020

REFERENCES

[1]. R. Vijayalakshmi, Dr. D. Sengeni, "IoT Based Smart Detection System for Harmful Gases in Underground Sewages", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887, Volume 5 Issue XI, November 2017

[2]. M. Abdelkhalek , S. Alfayad, F. Benouezdou, M. B. Fayek, L. Chassagne , "Compact and Embedded Electronic Nose for Volatile and Non-VolatileOdor Classification for Robot Applications", Digital Object Identifier 10.1109/access.2019.2928875,volume 7, 2019

[3]. Pei-Feng Qi, Qing-Hao Meng, Ya-Qi Jing, Ying-Jie Liu, and Ming Zeng" A Bio-Inspired Breathing Sampling Electronic Nose for Rapid Detection of Chinese Liquors", IEEE sensors journal, vol. 17, no. 15, august 1, 2017

[4]. AtiqurRehman , Amine Bermak, "Recursive DBPSO for Computationally Efficient Electronic Nose System", IEEE sensors journal, vol.no 18, 1, january 1, 2018.

[5]. Atiqur Rehman and Amine Bermak, "Heuristic Random Forests for Drift Compensation in Electronic Nose Applications", IEEE sensors journal, vol.no.4 ,19, February 15, 2019 1443

[6]. Cheng-Chun Wu, Shih-Wen Chiu, and Kea-Tiong Tang, " An Electronic Nose System for Rapid Detection of Ketamine Smoke", IEEE sensors vol. 3, no. 8, August 2019

[7]. Ying-Jie Liu, Qing-Hao Meng and Xiao-Nei Zhang, "Data Processing for Multiple Electronic Noses Using Sensor Response Visualization", IEEE sensors journal, vol. 18, no. 22, November 15, 2018

[8]. MustahsinAdib, Ralph Eckstein, Gerardo Hernandez-Sosa, Martin Sommer, UliLemmer, "SnO2 Nanowire-Based Aerosol Jet Printed Electronic Nose as Fire Detector",IEEE sensors journal, vol. no.18, January 15, 2018

[9]. Cheng kong ,Shishun zhao1xiaohui weng, Chang liu5, Renchu guan , Zhiyongchang, "Weighted Summation: Feature Extraction of Farm Pigsty Data forElectronicNose",DigitalObjectIdentifier10.1109/access.2019.2929526,http://creativecommons.org/licenses/by/4.0/ volume 7, 2019

[10]. Hena Ray, Nabarun Bhattacharyya, Alokesh Ghosh, Arunangshu Ghosh, BipanTudu, and Rajib Bandyopadhyay, "Age Analysis of Jasmine Concrete Using Electronic Nose",IEEE sensors journal, vol. 17, no. 12, June 15, 2017

[11]. HaoSun, FengchunTian, ZhifangLiang, Tong Sun, Bin Yu, Simon X. Yang, Qinghua He, Longlong Zhang, Xiangmin Liu, "Sensor Array Optimization of Electronic Nose for Detection of Bacteria in Wound Infection",IEEE transactions on industrial electronics, vol.no. 64, 9, September 2017

[12]. Xin Yin, Lei Zhang, Fengchun Tian, David Zhang, "Temperature Modulated Gas Sensing E-Nose System for Low-Cost and Fast Detection", IEEE sensors journal, vol.no. 16, 2, January 15, 2016

[13]. Srinonchat , "Development of Electronic Nose and Program for Monitoring Air Pollutions and Alarm in Industrial Area", International Journal of Computer and Electrical Engineering, Vol.No 5,1, February 2013

[14]. ChristianKrutzler,AlexanderUnger,HaraldMarhold,ThomasFricke,ThorstenConrad,AndreasSchütze, "Influence of MOS Gas-Sensor Production Tolerances on Pattern Recognition Techniques in Electronic Noses", IEEE transactions on instrumentation and measurement, vol.no. 61, January1, 2012

[15]. Ahmet Özmen and ErcanDo˘gan, "Design of a PortableENoseInstrumentforGasClassifications",IEEEtransactionsoninstrumentation and measurement, vol. 58, no. 10, October 2009 3609