Asian Journal of Applied Science and Technology (AJAST)
Volume 1, Issue 3, Pages 249-251, April 2017

Sewage Poisonous Gas Monitoring Using FPGA

R.Maniarasi[1] and J.Vidhya[2]

[1]*UG Scholar, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamilnadu India.*
[2]*Associate Professor, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamilnadu, India.*

Article Received: 12 April 2017 *Article Accepted: 23 April 2017* *Article Published: 29 April 2017*

ABSTRACT

In fast moving world, people are keener on developing and solving technological problems, they don't consider about the minor issues which could drown human lives. One of such inconspicuous social is poisonous gas which leads to many sewer workers risking their lives. Hence in this paper, the effective solution has been provided for sewage poisonous gas monitoring. It uses various type of sensors to monitor parameters present in sewage like gas, temperature, ultra-sonic sensor etc. Analog values from sensors are converted into digital values using analog digital convertor and these values are given to signal conditioning circuits and are monitored using field programmable devices. When the threshold value is lesser than the sensed values, it will give us alert in form of buzzer, seven segment display, led. This type of indication will help sewer employee to protect their lives from risk and harmful disease.

Keywords: Sensor, Analog to digital convertor, Signal conditioning and Poisonous gas.

1. INTRODUCTION

There are various kind of pollution in the world which leads to global warming, climatic changes, natural calamities etc. Some of pollution which are commonly known are air pollution, water pollution, soil pollution, chemical industrial pollution. These issues are taken into consideration and alternate solution has been provided with the use of latest technologies available in the outsource. Pollution has been raised 20% in 2016 when compared to past years. Therefore special attention has been given to reduce the air pollution by implementing alternate scheme in various places in India. Causes of these pollution lead to drastic changes in weather condition, temperature variation, delay in monsoon rainfall, many hazardous diseases. Some of air pollution like smoke release from industries, vehicles, burning of plastics, carbon-monoxide gas from air conditioner, and leakage of sewer gas will have an impact starting from skin disease to death. There are numerous recognizing device used to monitor air pollution like AVR, ARM, microcontroller etc. The main features of using field programmable gate array (FPGA), it is interoperating device, reprogrammable, and provides high speed, high efficiency, low power dissipation etc. In this paper, sewage poisonous gas monitoring using FPGA has been proposed as an alternate solution for sewer workers who dare their lives at jeopardy.

The death rate of sewer workers has been increased in the recent years due to panting of poisonous gases. The raise for this issue is lack of basic consciousness and improper knowledge of the workers during their working period. There are some simple test used to avoid the density of poisonous gas which are created due to pressure in closed atmosphere [1]. In order to evaluate the gases which are present in environment, sensor has been used to analyze the amount of hazardous gas and control using atmega processor to provide an alert message [2]. Causes and safety measures which prevents human lives from death for manual scavenger has been proposed. Risks which evolved during working places and necessary equipment were provided for labour force [3]. Sewage treatment has been monitored using wireless mesh node to overcome the problem present in wired network. The data are transferred from wireless sensor node to data collector using ZigBee wireless mesh communication network. Monitoring center is designed based on FPGA [4]. The presence of combustible gases present in the sewage can be used for producing electricity and even use to rotate turbine of generator [5]. In this paper, the effective solution for sewer poisonous gases monitoring has been provided with usage of sensors. FPGA is used to receive the sensed values given manually. When the level of sensors get crossed through the predefined values, alert message will be displayed.

The remainder of paper is organized as follow. Section 2 describes the system model which consists of block diagram, methodologies, software used has been discussed. Results are discussed in section 3 and conclusion are drawn in section 5.

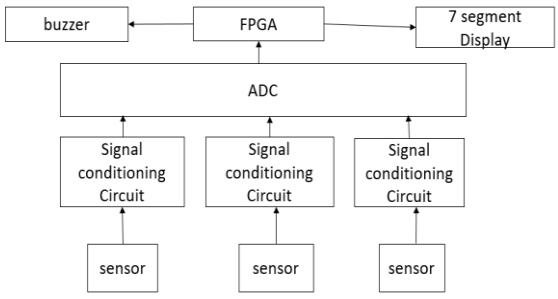

Fig.1. Block Diagram

2. SYSTEM DEVELOPMENT

A. Block Diagram

The block diagram of sewage poisonous gas monitoring using FPGA is shown in fig 1. The sensors has been interfaced to FPGA [6]. The three inputs are compared with their threshold values which has been predefined in coding. The input for the sensor are given manually considering the gas level present in

sewage and the output is simulated using modalism software [7].

B. Methodologies

In this paper, we use technology which help to manage the sewage plant like monitoring the gases which are present in it, water level, temperatures of underground drainage system [8].

Gas Sensor

To measure the poisonous gas present a gas sensor MQ – 2 is used to sense the gases like methane, propane, carbon monoxide, hydrogen sulphide. If the poisonous gas present, it will diffuse into the sensor and settle on the electrochemical sensor, the sensor is either oxidized or reduced according to the chemical properties of the gas [9]. The methane gas is oxidized and hence the sensor produces some raise in temperature. Safe methane concentration for workers should be 0.1%. Methane is considered as an asphyxiant at extremely high concentrations and can displace oxygen in the blood. Exposure to 100 ppm of hydrogen sulphide causes coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue), altered breathing, and drowsiness after 10 minutes of extended exposing leads to death [11]. Exposure to 2,000 ppm of liquid petroleum gas (LPG) is hazardous to health, as it will blow up at any time. Meanwhile 800ppm of carbon monoxide will cause death in hours [12]. The input for gas sensor module is given manual and if it cross the threshold level buzzer will be turned 'on' state.

Ultrasonic Sensor

To measure the water level present in the sewage holes, ultrasonic sensors are used. The sensor can be fixed at top lid of manhole cap facing inwards. When trigger is applied with high pulse, the transmitter will emits the echo signal and the timer starts. When the echo signal bounces back to receivers, timer stops and the time taken to reach the receiver is calculated and it will be distance where the level of water present in manholes. The operating frequency of ultrasonic sensor is 40Hz. The input for ultrasonic modules is given has four bit and it will be indicated in logical led.

Temperature Sensor

To monitor continues variation of temperature level in the sewage due to presence of high pressure of gases gets accumulated in the closed containers, temperature sensor lm 35 can be used sense these variation and hence display it in the seven segment display.

Flow Chart

The sewage poisonous gas monitoring system works on various blocks. The flow chart is reveal the flow process of this project. Fig 2 illustrates about the process that happens during monitoring. If the signal values received are set above the threshold value a displays. Alert the corresponding module.

C. FPGA

In FPGA, coding has been dumped with a predefined values for each parameter. When it cross the values of threshold alert message will be given to sewers [10]. The use of FPGA is because it's an interoperating device, is easily reprogrammable, high speed, high efficiency and low power dissipation.

D. XILINX

This tool is used for designing and implementation of this project. It is a software tool produced for synthesis of VHDL design. It enables the developer to compile their designs, perform timing analysis, examine RTL diagrams, provide various reaction for various stimuli and configure the destination device with the programmer. It is a software design environment for FPGA products from Xilinx and tightly coupled to architecture of such chips and cannot be used with other vendors. Model sim simulator is used has a system level testing tool for VHDL codes.

E. VHDL Programming language

VHDL is used as a design-entry language for FPGA and application-specific integrated circuits in electronic design automation of digital circuits. It's a hardware description language.

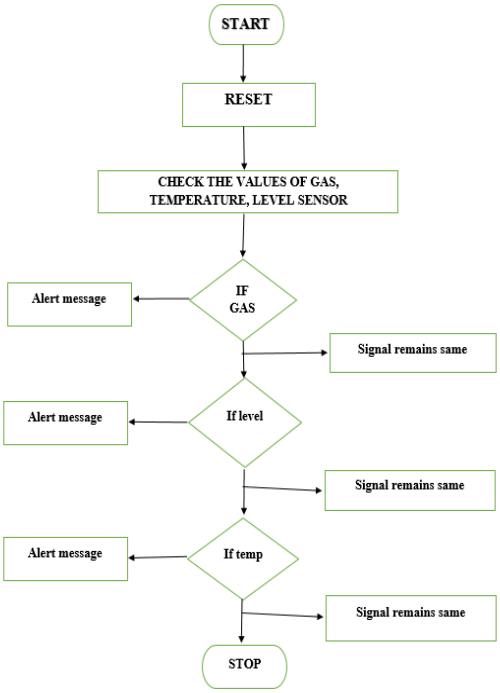

Fig.2. Flow chart for data transmission

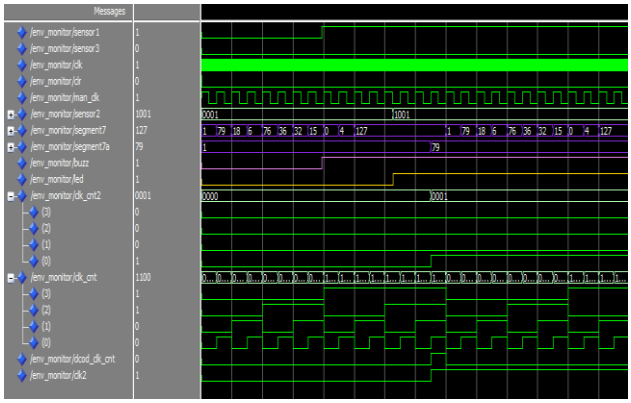

Fig.3. Simulation Output for Sewage Poisonous Gas Monitoring

3. RESULTS

The proposed model is implemented using MODELSIM software and the observations snapshots are shown in fig 3. It is observed that fig 3 which consists of three different sensor input, clear, clock, alert modules for three sensor (buzzer, led, seven segment display), count clock is used to monitor the values on the count basis. When gas sensor input is given above the threshold values set, buzzer signal will be raised. If the ultrasonic sensor values is given in four bits, output values will be indicated in binary form of blinking led. The temperature values will be continuous displayed in seven segment display by counter clock.

4. FUTURE WORK

This system can also be enhanced in future by developing the simulation into hardware model. The data transmission can be sent wireless by interfacing wi-fi to it. Various other sensors can also be interfaced with it like flow sensor, smoke sensor for monitoring environmental issues.

5. CONCLUSION

The sewage poisonous gas monitoring using FPGA system application which was implemented help to monitor poisonous gas present in the sewage. Here we used FPGA technology whose capacity is very high compared to other devices such as AVR, Embedded Ethernet and ARM 7 etc. Thus the poisonous gas identified and methane can be used to produce electricity or even rotate turbine of a generator. Hence the conclusion of this simulation project is by using sensor as an input, FPGA of monitoring the poisonous gas is done easily and successfully.

REFERENCES

[1] K.S. KamaleshKumar, M. Lokesh, V. Prabhakaran, G. Anandhakumar "Analyzing Manual Scavenging Death Rate over a Critical Circumstances and Methods to Ensure Safety" *JCHPS*, Issue 5: October 2016.

[2] Thangalakshmi.S, Kathiravan.A.R., "Poisonous gas detector with electrochemical nose" *IJAREEIE*, vol .5, issue 4, April 2016.

[3] *Booklet issued from Occupational Safety and Health Branch, Labour Department*, October 2007.

[4] Liting Cao, **"**Wireless Mesh Monitoring System for Sewage Treatment Plant"**,** *ISECS*, 2009.

[5] Amit Verma, Rahul Singh, Ranjeet Singh Yadav, Neeraj Kumar, Priti Srivastava, "Investigations on Potentials of Energy from Sewage Gas and Their Use as Stand Alone System" *IEEE*, March 30, 2012.

[6] J. Kathirvelan, "Electro-chemical gas sensor for multi-gas detection application", *in proc: Indian Journal of Science and Technology*, Vol. 4 No. 11 (Nov 2011).

[7] Linhongjia Xiong and Richard G. Compton, "Amperometric Gas detection: A Review", *in proc: International Journal of Electrochemical Science, Int. J. Electrochem. Sci.,* 9 (2014) 7152 – 7181.

[8] Krishnan Murugappan, Debbie S. Silvester, "Sensors for Highly Toxic Gases: Methylamine and Hydrogen Chloride Detection at Low Concentrations in an Ionic Liquid on Pt Screen Printed Electrode", *in proc: MDPI*, 22 October 2015.

[9] Li Jinghone, Zou Xiaouhui, Wang Lu *Control and Decision Conference*, 2012 "The design and implementation of fire smoke detection system based on FPGA".

[10] J. Rose, A.E. Gamal, and A. Sangiovanni-Vincentelli, "Architecture of Field Programmable Gate Arrays," Proc. *IEEE*, vol. 81, no. 7.

[11] Rajeshpant, Mayankuniyal, Prashant Ratodi, Bhawesh Mehta Tarun Kumar, Zaki-ur-rehman, Gurpreetsingh, "Manual Scavenging and technological solution to eradicate it", *Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, 11 (3), 2014, 08-15.

[12] Rajendiran V.R, Chennai, "How to protect from sewage accident", *Sunday special, daily thanthi*, 2016.