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Online Monitoring of Green House Gas Leakage in Industries

Suganya.R[1], Suseendhar.P[2]

[1]PG Scholar, Department of EEE, Angel College of Engineering and Technology, Tirupur, Tamil Nadu, India.

[2]Assistant Professor, Department of EEE, Angel College of Engineering and Technology, Tirupur, Tamil Nadu, India.

Abstract

In recent years, there are so many industries emitting the green house gases (GHG) which affect the human beings. The most harmful gases among all of them are CO_2, methane gas, NO_2, etc. So it is necessary to monitor these gases that leaks from industries through online. This system is developed to monitor the green house gas leakage such as CO_2, NO_2, humidity and temperature from industries by its corresponding sensors interfaced with the ARM7 controller. LM35 temperature sensor is used. LED is used to indicate the emission level. LCD is used to display the constituents of gases and temperature. Relay is used to shut down the power supply for industries. GSM is used to communicate with the server to convey the emission level. Virtual terminal is connected with the controller in the simulation output. The system is user friendly.

Keywords: Green House Gas, LM35 temperature sensor, LED, LCD, GSM, ARM7 controller.

1. Introduction

This paper describes the simulation output of the system which can be used in industries to reduce the emission level by the indication given by the system. A much higher concentration of the green house effect gases has considerably increased in the recent times. The greenhouse gases are known to be the major cause of global warming, as they trap heat in the earth's atmosphere. Gas leak detection is the process of identifying potentially hazardous gas leaks by means of various sensors. These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected. The sensors used in the system will continuously monitor the emission of gases from the industry. The criterion level which the industry can emit is specified by the controller. If the emission exceeds its criterion level, a LED which is connected with the controller will glow to indicate the industries to reduce its emission level. Later also if the industry does not reduce its level, the controller will shut off the power supply using relay. After the industry reduces its emission level, the motor will starts to run. In simulation, LED is used to indicate the industry if it exceeds its emission level. In hardware system, buzzer will be used. A LCD is connected to the controller which displays the concentration of green house gases and the level of temperature and humidity which is emitted from the industry. To indicate this concept in simulation, motor is used as the industrial machine.

2. Overview of the system

This paper gives the simulation output of the monitoring system. The gas sensors, temperature and humidity sensor are connected to the ARM controller. The controller will process the values and it is displayed in LCD display. If there is abnormal temperature, using relay, the power supply will be shut on or off to the industries. The buzzer is used to indicate alarm to the industries on its emission level. LED is used to indicate the abnormal temperature.

3. Existing system

In the existing system, a remote online carbon dioxide (CO2) concentration monitoring system is developed, based on the technologies of wireless sensor networks, in allusion to the gas leakage monitoring requirement for CO2 capture and storage. The remote online CO2 monitoring system consists of monitoring equipment, a data centre server, and the clients. The monitoring equipment is composed of a central processing unit (CPU), air environment sensors array, global positioning system (GPS) receiver module, secure digital

memory card (SD) storage module, liquid crystal display (LCD) module, and general packet radio service (GPRS)wireless transmission module. The sensors array of CO2, temperature, humidity, and light intensity are used to collect data and the GPS receiver module is adopted to collect location and time information. The online monitoring WebGIS clients are developed using a PHP programming language, which runs on the Apache web server. MySQL is utilized as the database.

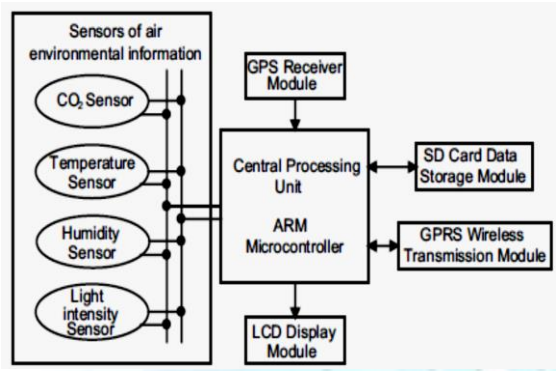

Figure 3.1 Hardware infrastructure diagram of geological CO2 leakage monitor.

Apart from the sound effects, the monitoring system is simple in structure, easy to operate, convenient to carry, remote monitoring, automatic storage, real-time display and continuous wireless transmission, which provide remote real-time monitoring means for further study of quantitative analysis and dynamic simulation of the process of CO2 geological storage, leakage, diffusion and migration under complex air environment.

4. Proposed System

The proposed system is used to monitor the green house gas leakage in industries. The various gas sensors inside the system will have a certain emission level as its criterion. If the gases from industries exceed its emission level, then the system will indicates with an alarm to reduce its emission level. If the emission is not reduced after the indication of alarm then the power supply will be shut down to the industry using relay.

The figure 4.1 is the overall block diagram of the project. The nitrogen dioxide (NO2) and carbon dioxide (CO2) gases will be detected by its corresponding sensors. The temperature sensor is used to sense the environment temperature near the industry. Humidity sensor is used to sense the moisture level in the industry. LCD display is used to display the temperature, humidity, NO2 and CO2 levels. The power supply to the industries will be shut down using relay. A GSM digitizes and compresses data, then sends it down through a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

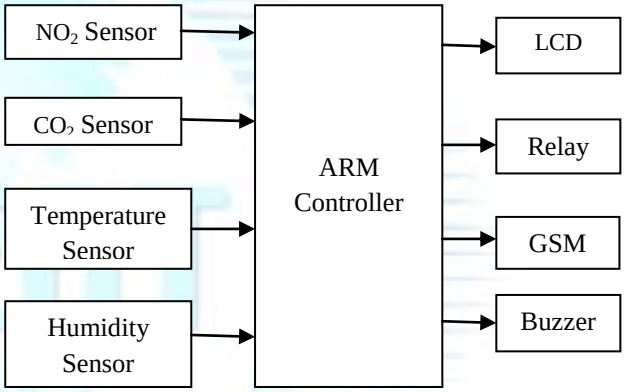

Figure 4.1 Hardware structure of the system

4.1 ARM Controller

The ARM controller is responsible for all the operations. With their compact 64 and 144 pin packages, low power consumption, various 32-bit timers, combination of 4-channel 10-bit ADC and 2/4 advanced CAN channels or 8-channel 10-bit ADC and 2/4 advanced CAN channels, and up to 9 external interrupt pins these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of-sale.

4.2 Gas Sensors

Gas sensors work by having some kind of electrical transducer that converts the presence of gas into a measurable signal.

A carbon dioxide sensor or CO2 sensor is an instrument for the measurement of carbon dioxide gas. The most common principles for CO2 sensors are infrared gas sensors (NDIR) and chemical gas

sensors. Nitrogen dioxide is a yellowish-brown gas with a characteristic pungent, acrid odour. Nitrogen dioxide is soluble in water at which time it reacts to form nitric acid. NO2 can be found in industries where the burning of diesel fuel takes place.

4.3 Humidity Sensor

Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort. Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications.

4.4 Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

4.5 GSM

GSM (Global System for Mobile Communications), is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. In this system, GSM is used to communicate with the server which indicates the temperature, humidity, CO_2 and NO_2 levels.

4.6 Relay

Relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. The relay used in the system will shut on/off the power supply to industries based on the abnormal levels.

4.7 LCD

The Liquid Crystal Display (LCD) is used to display the level of emitted CO2 and NO2 gases, temperature and humidity in the industry environment. It is interfaced with the ARM controller.

4.8 Result

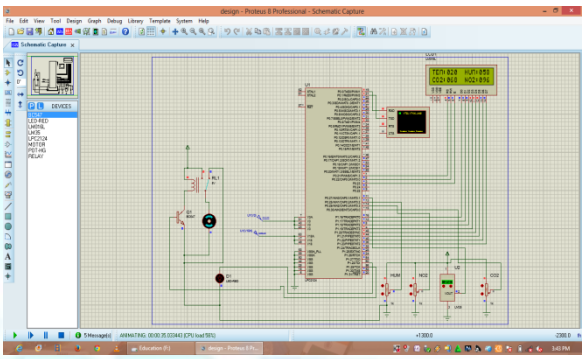

Figure 4.2 Simulation output

In Figure 4.2 and Figure 4.3, LCD is connected to the controller which displays the concentration of CO2, NO2 gases, the temperature and humidity that comes out from the industry. When the smoke exceeds its criterion level that we specified, LCD will display as abnormal temperature. Instead of buzzer, LED is used to indicate the industry. When LED is on, the motor will be stopped. After the smoke concentration gets reduced, the LED will be off and the motor will starts to run.

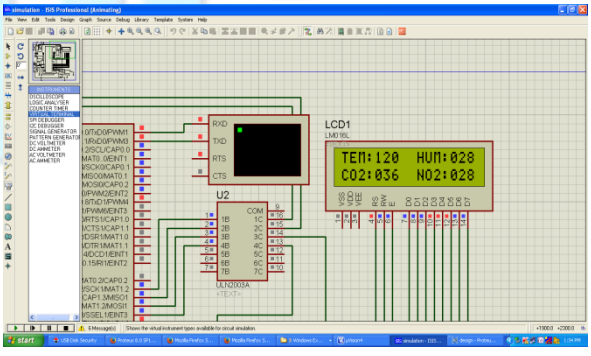

Figure 4.3 LCD showing the concentration of smoke

The Figure 4.4 shows the sensor interfacing with ARM controller. The sensors such as humidity, NO2, CO2 and temperature are connected in this design. LM35 temperature sensor is used.

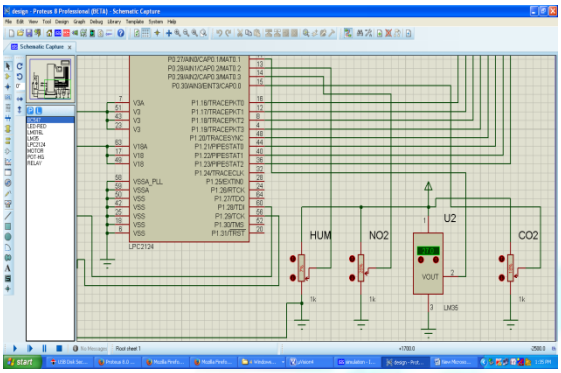

Figure 4.4 Sensor interfacing

4.9 Conclusion

The proposed system which is designed shows the simulation output of sensing the CO2 gas, NO2 gas, temperature and humidity in the industry environment. LED is used instead of buzzer. When the criterion level exceeds the controller will induce the LED to glow. If it glows, the motor will be stopped. Later if the emission gets reduced the LED will gets off and the motor starts. By using Proteus and Keil software we saw the simulation output. Embedded C language is used for programming the concept. In future, hardware implementation can be done. By having criteria for the level of gases emitted from the industries, the ARM controller will indicate an alarm through buzzer to reduce the emission.

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Author's Profile

Ms. R.Suganya received her B.Tech degree in Information Technology from Dr.N.G.P Institute of Technology, Coimbatore in 2012. She is pursuing M.E. Embedded Systems in Angel College of Engineering and Technology, Tirupur. Her area of interest includes Embedded automation, Real time operating systems, and Networking.

Mr.P.Suseendhar has completed his under graduate degree in Electronics and Communication Engineering from Karpagam College of Engineering in 2008. He has completed his Master of Engineering in Embedded Systems from Bannari Amman Institute of Technology. He is working as an assistant professor in Angel College of Engineering and Technology, Tirupur since 2012. His area of interest includes Embedded Systems, Digital Image Processing, Microprocessors and Microcontrollers, and Data Communication and Networking. He is a life member in ISTE.