

Harmful Gases Detection Based on Zigbee and GSM Technology

S.Deepika

PG Scholar,

Department of ECE,

**Priyadarshini Institute of Technology,
Ramachandrapuram, Tirupati, A.P, India.**

M.Swetha, M.Tech

Assistant Professor,

Department of ECE,

**Priyadarshini Institute of Technology,
Ramachandrapuram, Tirupati, A.P, India.**

ABSTRACT:

An odor is composed of molecules, each of which has a specific size and shape. Each of these molecules has a correspondingly sized and shaped receptor in the human nose. When a specific receptor receives a molecule, it sends a signal to the brain and the brain identifies the smell associated with that particular molecule. Electronic noses based on the biological model work in a similar manner, albeit substituting sensors for the receptors, and transmitting the signal to a control circuit, rather than to the brain. Electronic noses are one example of a growing research area called biometrics, or which involves human-made applications patterned on natural phenomena. Electronic noses were originally used for quality control applications in the food, beverage and cosmetics industries. Current applications include detection of odors specific to diseases for medical diagnosis, and detection of pollutants and gas leaks for environmental protection. This project uses two sensors like carbon monoxide sensor and LPG gas sensors. These sensors are mounted on a PCB and visual indicator with audible buzzer is provided for alert signal. When the sensor is activated, it sends the signal to receiver section using zigbee and sends the sms using GSM modem. This project is much useful for mines detection and surveillance applications.

I. INTRODUCTION:

A smell is made out of atoms, each of which has a particular size and shape. Each of these atoms has a correspondingly measured and formed receptor in the human nose. At the point when a particular receptor gets a particle, it sends a sign to the mind and the cerebrum recognizes the odor connected with that specific atom.

Electronic noses taking into account the organic model work in a comparable way, yet substituting sensors for the receptors, and transmitting the sign to a control circuit, instead of to the mind. Electronic noses are one case of a developing examination region called biometrics, or which includes human-made applications designed on normal wonders. Expelling people from cold situations is frequently attractive. Case in point, in the oil and gas industry, amid review, support, or repair of offices in a refinery, individuals might be presented to extremely high temperatures 50°C for an amplified period, to poisonous gasses including methane and H_2S , and to unforeseen disastrous disappointments. One approach to expel human introduction from these sorts of circumstances is to instrument an oil refinery with a remote sensor system, which appends a remote sensor on each gage and esteem. Shockingly, this methodology is costly and work concentrated, not to mention remote sensors are disappointment inclined. Henceforth, support of the system and dependably gathering information from the system are to a great degree testing.

We, in this manner, resort to an alternate approach that plans to expand how the human administrators interface with the physical world. A portable stage is a balanced simple to a physical human it can travel through tele-operation while detecting its surroundings with a variety of sensors. In any case, further requirements are connected while bringing physical frameworks into an oil and gas environment. All gadgets conveyed must meet the predetermined models set by the business. A nitty gritty clarification of these norms connected to a versatile refinery examination. The primary point of the task is to outline a framework for damage full gasses recognition in enterprises.

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This undertaking utilizes two sensors like carbon monoxide sensor and LPG gas sensors. These sensors are mounted on a PCB and visual pointer with capable of being heard ringer is accommodated ready sign. At the point when the sensor is enacted it sends the sign to recipient segment utilizing Zigbee and sends the SMS utilizing GSM modem. This venture is much helpful for mines discovery and reconnaissance applications. Modern wellbeing is one of the fundamental parts of industry uncommonly refining industry. To maintain a strategic distance from any sorts of undesirable wonders all refining industry tails some essential safety measure and marvels. Correspondence is the primary key variable for any industry today to screen diverse parameters and take important activities appropriately to stay away from any sorts of dangers.

II. PROBLEM STATEMENT EXISTING SYSTEM

In long time past days people were frequently used to recognize the unsafe gasses that are spilled in enterprises like oil and gas refineries. Be that as it may, this technique was not worked legitimately.

Now and again human may not distinguish the gasses accurately. Around then substantial harm will happen. It is a fundamental disservice in this technique. After that mechanical advances are came to beat this weakness. In enterprises now, a day's robots are assuming key part. These robots are caring for the spillage of gasses in businesses with the assistance of Wi-Fi and sensors. However, it's having a little time delay in finding the spillage of gasses starting with one place then onto the next spot while moving. Mean while Wi-Fi innovation requests overwhelming cost contrast with residual advancements. This is the principle issue in existing innovation.

Disadvantages in existing system:

The current framework has few disservices. They are taking after as appeared in underneath:

1. The man power will be wasted.
2. A complete day of work stopped.
3. High cost

PROPOSED SYSTEM

The proposed framework comprise electronic noses. Here the electronic noses are sensors. These sensors sense the issue. After discovery of the issue they will send message to the specific people versatile and at low affectability of the issue. On the off chance that the issue is understood inside the time there is no caution. On the off chance that the reach is high then it goes to the caution. It includes the advancements like GSM, Zigbee, ARM and Sensors. Here we are utilizing ARM7 LPC2148. Remaining modules will be imparted to this miniaturized scale controller. In this proposed framework we can recognize spillage of Co₂ (carbon Die oxide) and LPG (Liquid Petroleum gas) in mechanical territories and They are utilized as a part of gas spillage distinguishing types of gear in family and industry, are reasonable for identifying of LPG, is-butane, propane, LNG, keep away from the commotion of liquor and cooking exhaust and tobacco smoke. In this proposed framework, we can get Message (SMS) to the approved people portable or framework after discovery of any spillage of gas or Co₂ by Sensors.

This message can send by utilizing the GSM innovation. Here Zigbee transmitter is situated at the hardware unit in the business in the mean time Zigbee beneficiary is associated with the approved people framework. On the off chance, that sensor detects the gas then promptly zigbee transmitter transmits the sign to the collector, which is at the framework. Around then approved individual can get SMS by means of GSM in the interim he can likewise get the message to the framework which is as of now enrolled. In the event that the discovery of gas has constrained extent around then it sends the message as it were. On the off chance that the gas discovery reach is more than Alarm will be on which is situated on the ARM. With the goal that we can recognize the spillage of the gas effortlessly

ADVANTAGES

This proposed framework defeats the disservices in the current framework. The favorable circumstances are as taking after as:

1. High Safety
2. Easy to find out LPG and CO2 leakage detection
3. The man power will be saved
4. Reducing time delay
5. Cost is low
6. Highly Efficient.

III. BLOCK DIAGRAM TRANSMITTER SECTION

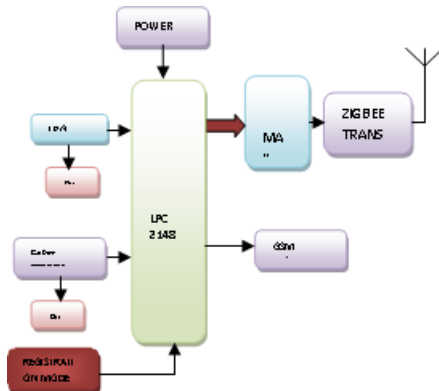


Fig 1: Transmitter section

RECEIVER SECTION

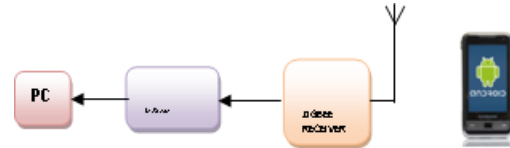


Fig 2: Receiver section

IV. HARDWARE DESCRIPTION ARM- LPC2148TDMI

ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British company ARM Holdings. A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical processors in average computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery-powered devices including smart phones, laptops, tablet and notepad computers), and other Embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and supercomputers.

ARM Family:

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB,

make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems. The LPC2148 microcontrollers are focused around a 16-bit or 32-bit ARM7TDMI-S CPU with constant imitating and implanted follow help, which consolidate microcontroller with inserted high velocity streak memory extending from 32 kb to 512 kb. A 128-bit wide memory interface and one of a kind quickening agent building design empower 32-bit code execution at the most extreme clock rate. For discriminating code size applications, the option 16-bit Thumb mode decreases code by more than 30 percent with negligible execution punishment. Because of their little size and low power utilization, LPC2148 are perfect for applications where scaling down is a key prerequisite, for example, access control and purpose of-offer. Serial interchanges interfaces running from a USB 2.0 Full-speed gadget, various UARTS, SPI, SSP to I2c-transport and on-chip SRAM of 8 kilo Bytes up to 40 Kilo Bytes, make these gadgets extremely appropriate for correspondence entryways and convention converters, delicate modems, voice distinguishment and low end imaging, giving both extensive cradle size and high transforming force. Different 32-bit clocks, single or double 10-bit ADC(s), 10-bit DAC, PWM channels and 45 quick GPIO lines with up to nine edge or level touchy outside intrude on pins make these microcontrollers suitable for mechanical control and restorative frameworks.

FEATURES:

- Processor: LPC2148
- 2xserial ports (one for ISP and other for Serial Communication)
- 12.00 MHz precious stone
- On board Reset Circuit with a switch.

- Dual Power supply (either through USB or utilizing outer force connector).
- Power on LED supply.
- Three ready for controllers 1.8v, 3.3v and 5v with up to 800ma current
- Extension headers for µc ports.
- Graphic LDC showcases interfacing port.
- USB Ports.
- CAN controller interfacing.
- MMC/SD card interfacing.
- 8 Bit LED interfacing.
- EEPROM Interfacing
- Onboard UART

Arm Construction:

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

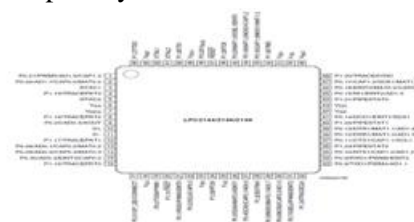


Fig 3: LPC2148 Pin Diagram

V. ZIGBEE TECHNOLOGY:

The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. As an answer to this dilemma, many companies forged an alliance to create a standard which would be accepted worldwide.

It was this Zigbee Alliance that created Zigbee. Bluetooth and Wi-Fi should not be confused with Zigbee. Both Bluetooth and Wi-Fi have been developed for communication of large amount of data with complex structure like the media files, software etc.



Fig 4: ZigBee Module

Zigbee is a low power spin off of Wi-Fi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. The specification was accepted and ratified by the Zigbee alliance in December 2004. Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard. The alliance is responsible for publishing and maintaining the Zigbee specification and has updated it time and again after making it public for the first time in 2005. Many years ago, when Bluetooth technology was introduced, it was thought that Bluetooth would make Wi-Fi redundant. But the two coexist quite well today, so do many other Wireless standards like Wireless HART and ISA100.11a. Then why would we need another WPAN standard like Zigbee? The answer is, the application focus of Zigbee Alliance - low cost and low power for energy efficient and cost effective intelligent devices. Moreover, Zigbee and Bluetooth have different application focus.

Zigbee Networks

Zigbee devices can form networks with Mesh, Star and Generic Mesh topologies among themselves. The network can be expanded as a cluster of smaller networks. A Zigbee network can have three types of nodes: Zigbee Coordinator (ZBC), Zigbee router

(ZBR) and Zigbee End Device (ZBE) each having some unique property.

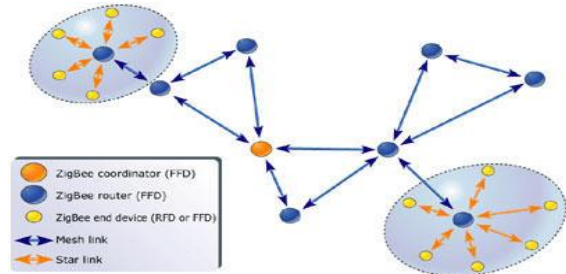


Fig 5: Structure of Zigbee Network

Zigbee understand through a typical usage scenario in a home automation system. There can be only one ZBC in a network, the one that initiates the network in the first place and stores the information about the network. This would be the main control panel or remote control in the living room of each storey. All the devices in the network communicate with this ZBC. In a network, data traffic can be periodic, intermittent or repetitive. When data is periodic, the application determines the rate of transfer. Intermittent data needs optimum power savings and hence the data rate is stimulus dependent.

Technical specifications of zigbee:

- Frequency band 2.400 — 2.483 GHz
- Number of channels 16
- Data rate 250 kbps
- Supply voltage 1.8 – 3.6 V
- Flash memory 128 kB
- RAM 8 kB
- EEPROM 4 Kb Operating
- Temperature -40 — +85 °C

VI. GSM TECHNOLOGY

It is a globally accepted standard for digital cellular communication. GSM is the name of standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900MHZ.



Fig6: GSM Modem

Presently GSM supports more than one billion mobile subscribers in more than 210 countries throughout the world. The GSM commercial modem is an approved modem for embedded applications. It provides a 5v TTL compatible serial interface to host data terminal equipment. Call control is provided by using the Hayer AT command set. By sending a code from a transmitter GSM equipped mobile to other mobile which is a receiving GSM equipped mobile.

CARBON MONOXIDE SENSOR:

A carbon monoxide detector or CO detector is a device that detects the presence of the carbon monoxide (CO) gas in order to prevent carbon monoxide poisoning. In the late 1990s Underwriters Laboratories (UL) changed their definition of a single station CO detector with a sound device in it to a carbon monoxide (CO) alarm. This applies to all CO safety alarms that meet UL 2034; however for passive indicators and system devices that meet UL 2075, UL refers to these as carbon monoxide detectors. CO is a colorless, tasteless and odorless compound produced by incomplete combustion of carbon containing materials. It is often referred to as the "silent killer" because it is virtually undetectable without using detection technology and most do not realize they are being poisoned. Elevated levels of CO can be dangerous to humans depending on the amount present and length of exposure. Smaller concentrations can be harmful over longer periods of time while increasing concentrations require diminishing exposure times to be harmful. CO detectors are designed to measure CO levels over time and sound an alarm before dangerous levels of CO accumulate in an environment, giving people adequate warning to safely ventilate the area or evacuate. Some system-connected detectors also alert a monitoring

service that can dispatch emergency services if necessary. While CO detectors do not serve as smoke detectors and vice versa, dual smoke/CO detectors are also sold. Smoke detectors detect the smoke generated by flaming or smoldering fires, whereas CO detectors detect and warn people about dangerous CO buildup caused, for example, by a malfunctioning fuel-burning device. In the home, some common sources of CO include open flames, space heaters, water heaters, blocked chimneys or running a car inside a garage.



Fig 7: co- mq -9 sensor

LPG GAS SENSOR:

This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC. This sensor comes in a package similar to our MQ-3 alcohol sensor, and can be used with the breakout board below.



Fig 8: LPG- mq -sensor

**VII. SOFTWARE TOOLS
INTRODUCTION TO KEIL SOFTWARE**

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the

microcontroller for further processing. Keil compiler also supports C language code.

PROLOAD:

Proload is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. As this programmer kit requires power supply to be operated, this power supply is given from the power supply circuit designed above. It should be noted that this programmer kit contains a power supply section in the board itself but in order to switch on that power supply, a source is required. Thus this is accomplished from the power supply board with an output of 12volts or from an adapter connected to 230 V AC.

EXPERIMENTAL RESULTS



Fig 7.1: Original Hardware Kit

The above figure 7.1 shows the overview of the project.



Fig 7.2: Mobile Number Registration Mode



Fig 7.3: System Initializing

When GSM is connected to the controller, system initializing will start at that time as shown in figure 7.3. It takes few minutes for initializing.

Figure 7.2 express the registration mode of the mobile number. In this mode mobile number registered in the network.



Fig7.4 LPG gas Detection

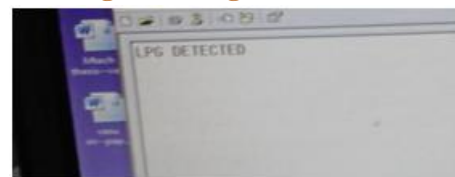


Fig 7.5: Output on System

The above figure 7.4 shows the LPG gas detection when we are using LPG sensor and it sense it and send to microcontroller. The microcontroller displays the LPG detection message on LCD display. The same message will be displayed on system which is connected to the kit as shown in fig 7.5.



Fig 7.6 Mobile Number SMS of LPG Detection

After detection of gas leakage GSM will send message to the particular persons mobile and at low sensitivity of the problem as shown in fig 7.5.

CONCLUSION AND FUTURE SCOPE

CONCLUSION:

This project is microcontroller based project. A Gas sensor is used to detect dangerous gas leakage in industries or near any gas. The sensor can also sense LPG and Co2 as well. Here the electronic noses are sensors. These sensors sense the problem. After detection of the problem they will send message to the particular persons mobile and at low sensitivity of the problem. If the problem is solved within the time there is no alarm. If the range is high then it goes to the alarm. This unit can be easily incorporated in to an alarm unit, to sound on alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time.

FUTURE SCOPE:

With the help of ZigBee and GSM we can identify the leakage of gases in industry easily. As the entire system is automated, it requires very less human interactions by using IOT devices. With the help of Internet of Things [IOT] we can easily monitor the "leakage density" i.e. how much amount of gas leaked in certain time at the particular place in in industries. Mean while we can monitor the leakage gas spreading time. We can enhance this project by adding extra feature to the system by sending SMS to the Emergency numbers like fire and ambulance.

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