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Real Time Gas Leakage Detection Using Cloud

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ABSTRACT: The majority of the people in the India use Liquefied Petroleum Gas (LPG) as a fuel for cooking, but in India the technology applied in the field (security) is very less. LPG is a flammable gas, which has the potential to create a Hazard, therefore it is important that the properties and safe handling of LPG are understand and applied in the domestic/industrial situations. The gas leakage detection system can constantly monitor the gas leak with the help of the sensors. ZigBee is used to feed real time sensor data over the cloud. The sensor monitors, detects and raises an alarm whenever a gas leak or fire broke out condition is detected. This data is made available at real time feeds over the cloud. Thus making it possible to collect, store and analyze the large amount of data in several new forms and activate context based alarm. This novel information acquisition paradigm allows continuous and ubiquitous leakage information access from any connected device over the internet. This data helps in easily locating the root cause of the emergency condition. So, one can know the complete detail of the hazards.

KEYWORDS: LPG; sensor; ZigBee; data;cloud.

I. INTRODUCTION

Leakage detection and location is one of the paramount concerns of home owner all over the world. A timely evaluation and response to a leakage, allows proper management of the consequences and an effective risk minimization. With the continuing growth of the forces of social production and the gradual awakening of the people's consciousness of the importance of home safety, a series of measures have been put forth to ensure person's safety. In home, small negligence may cause heavy economic losses and serious environmental pollution. Therefore, many large companies, including Petro China and Sinopec, are pumping large amounts of funds to upgrade existing equipment in order to remove the hidden danger. However, there are still some shortcomings on real-time monitoring and on data transmission and accurate location of a leakage point when an accident happens. Mainly because: most of the current equipment's are based on wired networks, it is backward in technology and hard to be deployed; the technology of data acquisition in accidents is also backward and so it is hard to locate the leakage point. These problems can be solved with the help of Wireless Sensor Networks.

II. RELATED WORK

Gas leakage detection and auto on-off gas system:

In this system, mq-6 sensor and temperature sensor is used for gas leakage detection. Here mq-6 sensor works on basics combustion process, and output is given in variable voltage form, so when lpg gas is leakage voltage at the output pin of mq-6 is increased and they used ic2 as a comparator for compare the lpg leakage with respect to normal condition. Output is comparator is fed to microcontroller and corresponding coding lcd is displayed gas leakage and give another instruction to stepper motor driver to turn 90 degree to turn off the regulator of gas tank. Temperature sensor is continuously communicated with microcontroller and displayed temperature at lcd. If temperature is more than 50 degree then fire alarm is activated and displayed fire on LCD.

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GSM based Gas Leakage Detection System:

GSM based gas leakage detection System. In this project, gas leakage is detected by the gas sensor MQ-6. This detects the gas leakage and gives the signal to the microcontroller with the help of ADC. After that microcontroller receives the signal, send by gas sensor. It sends activation signal to other external devices attached to it Such as two stepper motor IC, buzzer, LCD (Liquid Crystal Display), GSM module and RF link. When signal is received by the external devices it performs some tasks such as buzzer activates, message display on liquid crystal display screen and GSM module activated, which send warning sms to the user. Stepper motor IC to drives the stepper motor attached it, as a result main power and gas supply turn off.

III. REQUIREMENT ANALYSIS

A. Embedded C

As assembly language programs are specific to a processor, assembly language didn't offer portability across systems. To overcome this disadvantage, several high level languages, including C, came up. Some other languages like PLM, Modula-2, Pascal, etc. also came but couldn't find wide acceptance. Amongst those, C got wide acceptance for not only embedded systems, but also for desktop applications. Even though C might have lost its sheen as mainstream language for general purpose applications, it still is having a strong-hold in embedded programming. Due to the wide acceptance of C in the embedded systems, various kinds of support tools like compilers & cross-compilers, ICE, etc. came up and all this facilitated development of embedded systems using C.

B. Gas Sensor

The electrical properties of the sensor would change with variations in gas concentration. Sensitive material of MQ-6 gas sensor is SnO₂, which with lower conductivity in clean air compared to MQ-3 and MQ-7. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. MQ-6 gas sensor [8] has high sensitivity to Propane, Butane and LPG, also response to Natural gas while other sensors are less sensitive to LPG.

C. ZigBee

ZigBee [2] is new wireless technology guided by IEEE 802.15.4 Personal Area Network standard. It is primarily designed for the wide range controlling applications and to replace the existing non-standard technologies while GSM has free bandwidth, there is less ease of data transmission. One of the main advantages of this ZIGBEE communication is that it provides a noise free communication than GSM, the amount of noise added in this type of communication is very less compared to the other wireless communications.

D. Arduino

8051 is just a single microcontroller while Arduino [3] is a development board which comes with various series of microcontrollers, mostly AVR'S. 8051 is a CISC microcontroller with limited features even on board ADC and DAC is not available so for even simple programme take lot of efforts. Arduino have ATMEGA328 microcontroller with RISC architecture and the board supports various features that lead easy usage. In case of burning the code over microcontroller Arduino supersede the 8051 as there is no need of separate programmer instead of that the USB provided will directly connect your PC with board and reduce time to create and burn HEX file.

E. Cloud

On cloud, analyze and store the data and communicate wirelessly for further analysis is possible. Anyone can access the leakage data from anywhere using any Internet enabled device like PC, tablet or smart phone, and analyze it.

IV. BLOCK DIAGRAM

To resolve the problems of existing work the new approach is extension work for GSM based gas leakage detection [4]. The propose work will solve the problems of sensor failure, less ease of data transmission. This work will majorly process gas leakage detection system using following parameters; they are gas sensor, microcontroller, buzzer, ZigBee (transmitter and receiver), power supply and cloud computing.

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- 1) Gas sensor detects the gas leakage and gives the signal to the microcontroller.
- 2) Microcontroller receives the signal, send by gas sensor. It sends activation signal to buzzer, LCD (Liquid Crystal Display), ZigBee.
- 3) Buzzer [8] gives sound indication.
- 4) Detected gas information is send from sensor to microcontroller.
- 5) When the gas is detected, microcontroller sends the information to the ZigBee transmitter.
- 6) ZigBee sends details of this node to the receiver, the receiver will send to the Laptop/Computer [8] to update the details.
- 7) This information will be fed on cloud through laptop/computer.
- 8) On cloud [7] data is collected, stored and analysed in a form and context based alarm will generate.

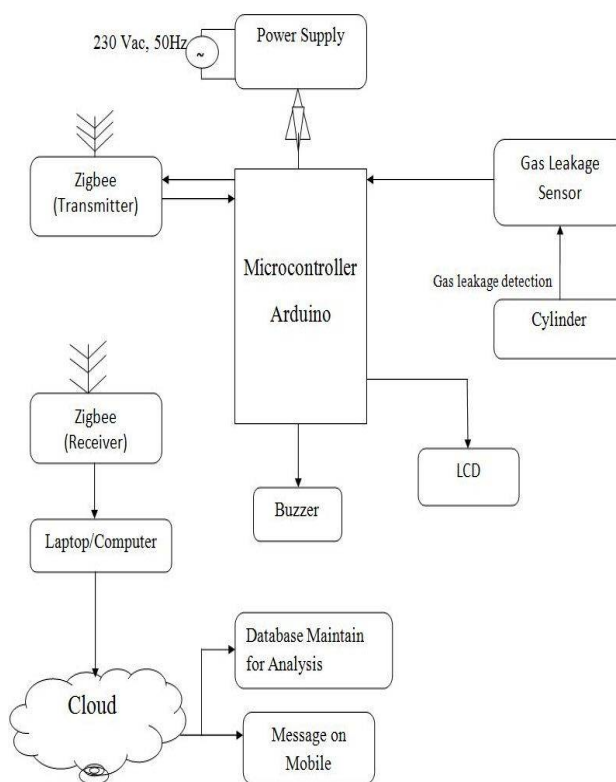


Fig 1: Block Diagram.

Fig 1 represents the various blocks as shown in the block diagram, each block plays an different role

V. FLOW DIAGRAM

In this level 0 of data flow diagram, the sensor detects the leaked gas in appropriate manner. The sensor sends and signals to the microcontroller. The activation signal is received by ZigBee, buzzer, motor and output devices, depending on that signal the motor turn off the regulator of gas.

In this level 1 of data flow diagram, the gas leakage detection module sends the details of leakage to the microcontroller and it generate the activation signal. The ZigBee transceiver updates the all details on laptop/computer.

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The cloud generates the context based alarms to the owner. The cloud creates a database for analyzing the data of leakage.

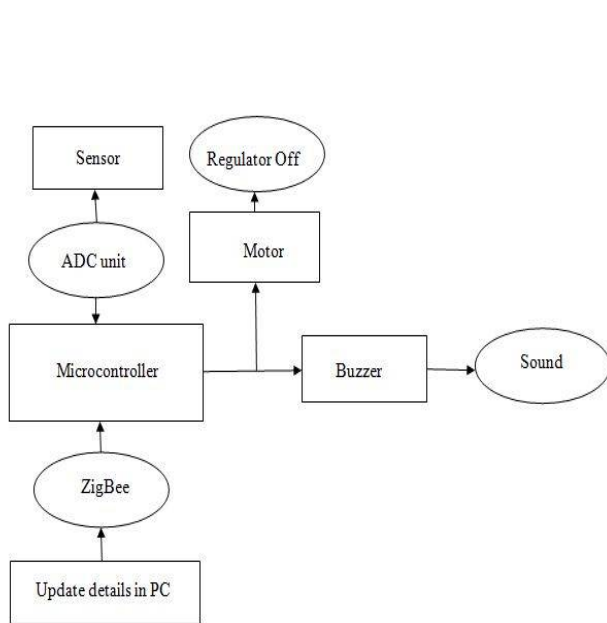


Fig 2: DFD level 0

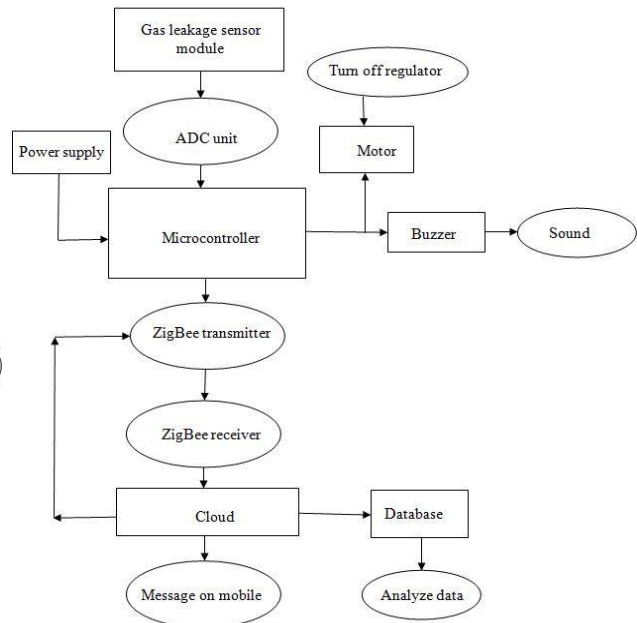


Fig 3: DFD Level 1

The figure 2 and 3 represents data flow diagram (level 0 & 1) for gas leakage detection module and analysis of data on cloud.

VI. RESULT AND DISCUSSION

STEP 1: For interfacing the Arduino with the computer, the PuTTY software is used which creates the terminal window in Windows 7 OS. After installing the software, a window appears where we can select the COM port and then select serial communication for interfacing the Arduino. The terminal shows the real time leakage readings read by gas sensor.

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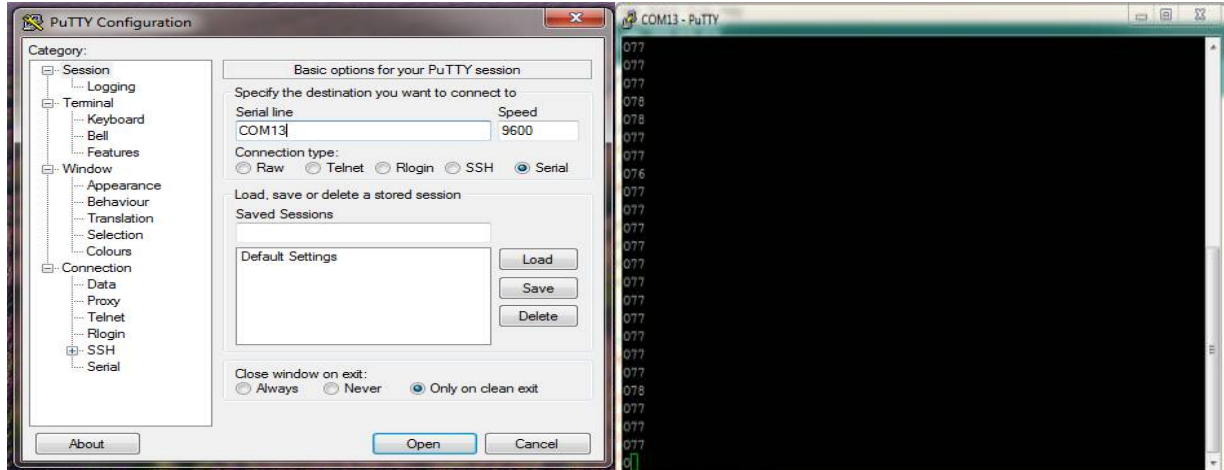


Fig 4

Fig 5

The figure 4 and 5 represents the connection with putty and terminal showing normal readings respectively.

STEP 2: Whenever the sensor detects gas beyond a limit the alarm raises to alert neighbours or user that there is leakage in the particular area.

The messages that are displayed in LCD as shown in figures below:



Fig 6



Fig 7



Fig 8: Gas Leakage readings

The figure 6 and 7 represents that the LCD displaying when system is on and when gas leakage is detected.

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Also figure 8 represents that the putty terminal showing readings when gas is detected.

STEP 3:



Fig 9: When sensor fails.

The figure 9 shows If sensor fails i.e. does not detect any gas then a message is displayed on LCD screen.

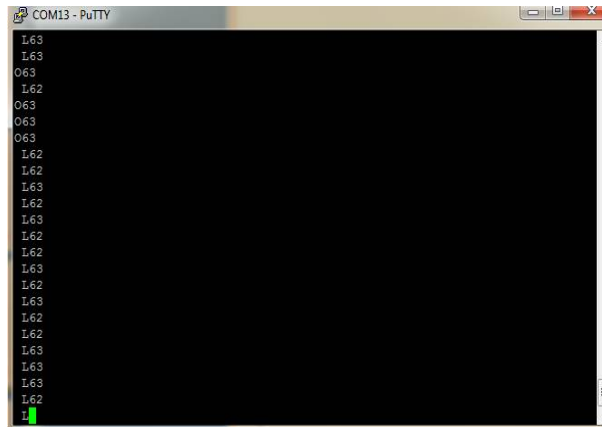


Fig 10

Above figure 10 represents that the putty terminal displaying readings when line break condition occurs.

STEP 4: The leakage readings are sent to ZigBee receiver on computer side through ZigBee transmitter on system side. The data is fed on cloud using Wamp server.

STEP 5: After analysis of data on cloud, a text message of leakage is send to owner.

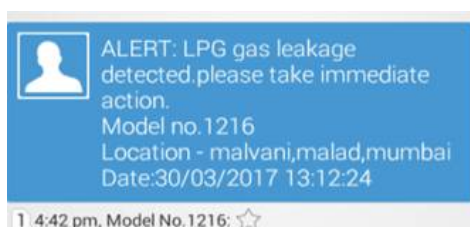


Fig 11: Gas leakage SMS has arrived.



Fig 12: Gas leakage SMS has arrived.

Above both the figure 11 and 12 shows that alert SMS has arrived on the mobile of home owner and fire brigade with model number, location, date and time.

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VII. CONCLUSION

This software approach can develop a real-time detecting and controlling of gas leakage system for highly sensitive industries using ZigBee, Arduino and Cloud. It comprises ZigBee modules, gas sensor, so it can be easily deployed. This proposed method can overcome the shortcomings of the current systems. With this, the rescue management improves and can save economy and lives very quickly.

VIII. FUTURE SCOPE

Wi-Fi module can be used for large scale areas like industries to monitor leak of gas in each room from the control room. This paper mainly aims to implement gas leakage detection technology with cloud. We can use temperature sensor, Multi Language Display, audio o/p to make it user friendly. However, this application can also be developed in future by integrating more number of equipments to measure various parameters, for instance, a humidity sensor or an optical sensor to determine the humidity.

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