Arduino Based Gas Leakage Detecting System

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Abstract

Smart cities is a major outbreak in implementation of different IT and computer technology. The focus is on providing environmental sustainability and efficiency, sustainable homes and buildings, efficient use of energy resources by implementing smart roads and buildings monitoring system, smart transportation, healthcare, global warming monitoring and security system. Various sensors are used to collect data like temperature, light, pressure and process it to form a meaningful interpretation. Gas detection technology is one of the major application of the smart city idea. Smart gas detection system can provide domestic as well as industrial safety from any hazardous gas related accidents. The implementation of the technology ranges from homes and schools to large industries. The gas detectors used in the device will detect the concentration of any hazardous presence in the air composition. The device also contains temperature and humidity module that will help to calculate the risk posed by the gas at certain environmental conditions and audio and visual alert signals can be sent accordingly. The smart alerting system of the device enables text and call alerting system which can be helpful in alerting the concerned authorities to take appropriate measures.

Keywords: *gas detector, arduino, sensor.*

I. Introduction

Safety has always been an important criteria while designing home, buildings, industries as well as cities. So the primary concern is safety towards any gas leakage related accidents. Gas leakage is open or closed area can be lethal. In order to have a control over such conditions this paper proposes an arduino based leakage detecting device that would detect any such leakage. Arduino is a microcontroller board that comes pre-programmed with a boot loader that allows to upload new code to it without the use of an external hardware programmer. It is a source of open electronics prototyping platform based on flexible, easy to use hardware and software. This is used to connect different sensors to collect data from the surrounding and configure them together. This system uses MQ2 sensor which is capable of detecting harmful LPG leakage at homes or in work places, storage equipments as well as in vehicle in which fuel used is LPG and its smart alerting system would alert the concerned individuals through SMS alert or via email.

II. Related work

Gas detectors have been in the market for a very long time and have been vastly used. They are characterized on the basis of which category of risk the fall in, Ex-Ox-Tox, the three categories of risk. Ex- risk of explosion by flammable gases, Ox- Oxygen risk of asphyxiation by oxygen displacement risk of increase of flammability by oxygen enrichment, Tox- risk of poisoning by toxic gases. As a result we

cannot have a single system or a group of systems which we can call the best but instead there is a plethora of devices available for matching the categories some of which are listed below:

A. Handheld EGD101
   This device delivers high-sensitivity, and is easily adjustable of detecting a wide variety of combustible gases, including methane, propane, butane. It is used by the building inspectors.

B. Amprobe GSD600 gas leakage detector
   This is a portable gas detector for detecting gases such as methane and butane. It has stainless steel probe. The probe allows the user to get into a hard-to-reach places.

C. Analox Sensor Technology
   Safety of campus in terms of gas leakage detection in laboratory environment, canteens, and other areas of possible gas leakage have been ensured by using devices such as O2NE+, SAFE-OX+ etc, provided by Analox sensor technology and many more such devices by various other producers are used all around the world in all the campuses.

III.   Advantages

Various gas detecting devices have already been developed, like, Handheld EGD01, Amprobe GSD600 Gas Leak Detector, etc for detecting wide range of combustible gases including methane, propane, and butane with very high precision. Mostly battery operated and share the mode of transmitting warnings which is audio and visual techniques.The proposed arduino based system is taking this traditional approach a notch up by adding smart alerting system. A gas at certain concentration might not be flammable at low temperature but might have explosive nature at high temperature. Our system contains temperature and humidity module to calculate more accurately the risks posed by the gas. The system also has a smart alerting system that would alert the concerned individuals in the time being. Apart from these, the system is cost effective as the installation and maintenance cost is significantly low.

IV.   System requirements

1. Arduino Microcontroller: It is a source of open electronics prototyping platform based on flexible, easy to use hardware and software. It is capable to sense the environment by getting input signals from different sensors and can accordingly control different operations.
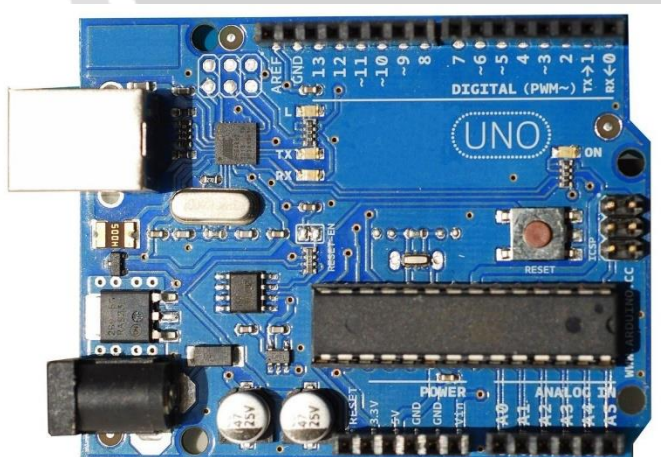

Fig1: Arduino UNO microcontroller

2. MQ2- Sensor: It is an ideal sensor which is used for the detection of harmful LPG leakages at homes or in work places, storage equipments as well as in vehicles in which fuel used is LPG. It can also sense

natural gas. It is economic and handy.

<p style="text-align:center">Fig2: MQ2 gas sensor</p>

3. LCD Display: It is an electronic module which is used for displaying information. It will display the concentration of the gas (ppm) in the surrounding based on the readings of the sensor.

4. DHT11 digital temperature and humidity sensor.: It is required check the temperature and humidity of the surrounding so that the actual risk of the gas could be calculated.

5. LED &Buzzer: It will set an audio and visual alarm to alert the people in the surrounding.

Apart from these hardware requirements, this project needs an arduino IDE that will help in configuring all these components together.

V.   Architecture

The functionality of the system is divided into four main steps:

o   The gas leakage(LPG) is detected by the gas sensor and the signal is sent to the microcontroller along with the data from the temperature and humidity module .
o   The microcontroller receives the signal sent by the sensors and sends activation signal to other external devices based on the concentration of gas and temperature of the surrounding.
o   The auto ignition temperature for LPG is aroung 410-580 deg. If the concentration of the LPG exceeds 900ppm, the GSM module will be activated and an immediate phone call will be sent to the concerned authorities. The audio and visual signals will be activated as soon as the gas is detected in the surrounding.
o   The LCD display will display the concentration of the gas in the surrounding and the buzzer will be activated when the reading exceed the threshold value.

VI.   Working steps

o   The MQ2 gas sensor detects the concentration of gases in order to stabilize the sensor reading. It is important to preheat it. The gas sensor module consists of a steel exoskeleton under which a sensing element is housed which is subjected to current through connecting leads. This current is known heating current through it the gases coming close to the sensing element get ionised and are absorbed by the it which changes the resistance of the sensing element which alters the value of current going out of it.
o   Every value recorded by the sensor is checked against a threshold value. This threshold values is decided based upon the nature of gases and also on the behaviour of the sensor.

o   Based on the threshold value, any increase and decrease in the gas concentration is calculated. The temperature sensor sends the value of external temperature to the processor which calculates the risk posed by the gas concentration at a certain temperature.
o   Activation signals are sent to external devices based on the risk level calculated by the processor.

VII.   Conclusion and future work

The proposed gas leakage detector is promising in the field of safety. The attempt while making this prototype has been to bring a revolution in the field of safety against leakage of harmful and toxic gases against the leakage of harmful and toxic gases to minimize and hence nullify any major or minor hazard being caused due to them.

Nevertheless, there is always scope of improvement and some of the featurs that will improve the system and make it even better have been mentioned below:

- Mobile application for the system.
  A dedicated mobile application could be built for the system. Getting the details of the concentration levels of the house within a tap of a button. The user can add or remove the recipients who will receive the information of leakage whenever they require.
- Big data analytics on the sensor readings.
  Analytics could be performed on the sensor readings. The readings from the sensors could be used for forming predictions of situations where there can be mishap.

VIII.   Reference

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