

EE322: Embedded Systems Design - Project

GAS LEAKAGE / SMOKE DETECTOR

Project Proposal

Date of Submission : 25 / 06 / 2021

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GAS LEAKAGE / SMOKE DETECTOR

Introduction

We were asked to do an embedded system project in EE 322 as a group using PIC Microcontroller. So, we decided make an embedded system for a day today application. In this project we decided to make a system to detect domestic, industrial smoke or gas leakage. It can be also used to detect combustible gas leakage. To make our project a success we decided to use PIC16F877A microcontroller to fulfill our tasks. Decision was made to use PIC16F877A microcontroller, because it has quite a bit more I/O than PIC16F84A and has about more RAM & FLASH.

Mainly this project can also introduce as a fire alarm system. In here what we do is, we detect a smoke or gas leakage using sensor and simply display it on a LED screen. (Can use an additional buzzer to make a noise).

Problem Identification

Domestic and industrial gas leakage and combustible gas leakage are major problem in these days. Accidents due to gas leaks are increasing with the high usage of gases. Gas leakage causes several damages to the people.

- I. Fire and explosion safety – Most of the useful gases (natural gases) that we use in domestic and industries are highly inflammable. And fire and gas explosions cause to human and animal deaths and property damages.
- II. Harm to animals – Gas leaks can reduce the normal oxygen concentration in breathing air. This cause death to small and sensitive animals and birds and breathing difficulties to humans also the death.
- III. Harm to vegetation – gas leaks can damage or kill plants
- IV. Greenhouse gas emissions

To avoid and reduce these damages, we need to detect gas leaks or smoke and stop gas leaks.

Proposed Solution

MQ-2 gas detector interfacing with pic microcontroller will be a solution to avoid and reduce the damages. MQ-2 gas sensor is used to detect the presence of smoke and gas in surrounding. It can be used to gas leakage detection in household and industrial equipment's. It has the ability to detect combustible gases (Hydrogen, Methane and LPG related gases). Also, the sensor has high sensitivity and very fast response rate. It can even be used in harsh environments. So, we can easily use it to detect the presence of gas or smoke in your surroundings. This sensor interfacing with pic16f877a microcontroller can be built at low cost.



Figure 01: MQ-2 gas detector



Figure 02: PIC16F877A microcontroller

Market Analysis

The above embedded system we described is, mainly about to detect smoke and gas leakage in the surroundings. If we talk about the market analysis of our above project, it can only detect smoke and gas leakage in a small area. So marketwise it has limited advantages with current sensors and implementations. To get a better market value or to make it more applicable for the market we should enhance it to a complicated embedded system. we can develop our above system to a market level by upgrading it to an industrial level fire alert system.

Market fire detection systems are designed to discover fires early in their development when time will still available for the safe evacuation of occupants. Early detection also plays a significant role in protecting the safety of emergency response personnel.

To be useful, our system should upgrade with detectors that can be coupled with alarms. Alarm systems which can provide a notice to at least the building occupants and usually transmit a signal to a staffed monitoring station either on or off site. In the other hand it can develop with some alarms which may go directly to the fire department.

We can also develop this embedded system by giving access to suppression systems such as automatic sprinklers to control the fire, automatic openings of window systems and emergency exit systems... etc.

Implementation (Methodology)

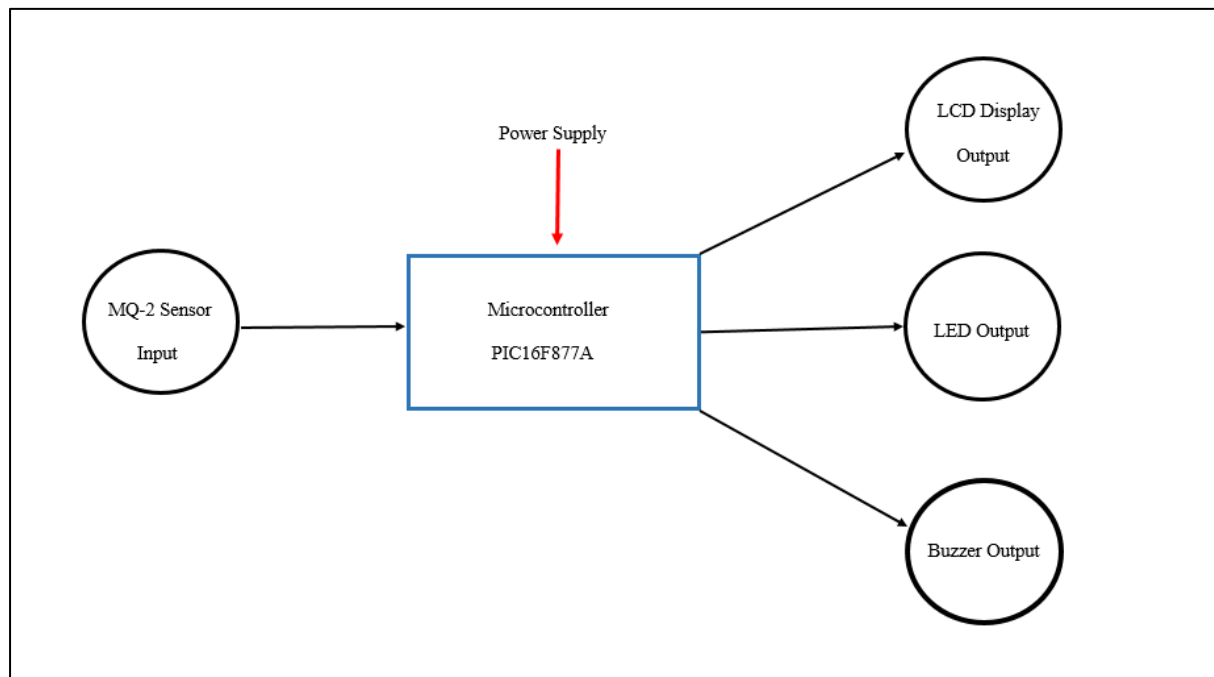


Figure 03: Main Block Diagram

The implementation of the circuit is done using the above block diagram. This can be used as a multi output system. Hence, the programmer has the freedom to add any kind of an output. Since we are planning to build the project in the purpose of detecting smoke & gas in an air saturated surrounding may cause hazards for human being, an alarm system and a Direct message in LCD display with LEDs are used as outputs.

MQ-2 gas sensor is chosen as the device to recognize the input. This sensor is mainly applicable for combustible gases including Hydrogen, Methane and LP gases. The main reasons to choose this sensor are its wide operating range, high sensitivity, fast response rate and ability to use in harsh conditions. The amount of air is detected by the sensor & it is controlled accordingly to our purpose using the microcontroller.

Analog output pin of the sensor is connected with the analog input pin of the microcontroller. For the project PIC16F877A microcontroller is used. This PIC is selected mainly because it contains sufficient number of input & output pins (8 pins). Analog channel of the PIC is used to measure the output voltage of sensor. There are three output ports with 8 pins in this PIC. Corresponding output pins needed for the alarm, LCD and the LEDs will be decided in the schematic implementation step.

Implementation of the schematic circuit will be designed using Proteus simulation software and corresponding program will be written using assembly language. After the simulation, the hardware designing will be done to achieve the final prototype.

Cost Analysis

Description	Unit Price / Rs	Quantity	Total /Rs
PIC16F877A IC	520.00	1	520.00
MQ-2 Gas Sensor	300.00	1	300.00
Resistors	2.00	5	10.00
LEDs	2.50	4	10.00
5V Passive buzzer	40.00	1	40.00
Breadboard (For implementation purposes if needed)	250.00	1	250.00
Wires / cable set	80.00	2	160.00
16x2 LCD Display	600.00	1	600.00
Other expenses	1110.00		1110.00
Total			3000.00

TABLE 01: Approximated cost analysis

Time line (Gantt chart)

Task		Week										
		1	2	3	4	5	6	7	8	9	10	11
1 ST Discussion among group members	Identify a problem											
	Find a solution & Decide a Project title											
Project proposal												
Buy & Order materials online												
Basic project design												
Working on assembly programming part												
Modify the basic schematic design according to the design												
Circuit Implementation & Troubleshooting												
Hardware design & testing												
Finalization & report												

TABLE 02: Approximated Gantt chart