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Documentation

Introduction:

Lifestyle in the modern society along with human behavior and thinking is changing dramatically with the advancement of technology, and the concept of a simple home is changing into a smart home. The advancement of technology has increased the safety and security of people along with their belongings. Safety and Security describes protection of life and property. The wireless communication is increasing day by day. Mobile phones today are not just used to make calls. The use of mobile phones is changing with the development of technology and they can be used for different purposes as well. This has motivated us to use mobile phones to remotely control household security and to receive a feedback SMS about the security and safety of the house like gas leakage or fire hazards.

Systems Specifications

The following are the clauses that must be included while describing the system specifications.

Introduction

Safety and Security describes protection of life and property. The wireless communication is increasing day by day. Mobile phones today are not just used to make calls. The use of mobile phones is changing with the development of technology and they can be used for different purposes as well. This has motivated us to use mobile phones to remotely control household security and to receive a feedback SMS about the security and safety of the house like gas leakage or fire hazards.

Scope of the System

- To send feedback to the owner of the house.
- To measure sensitivity of the sensors.
- To Send data to owner using SMS.
- Real-time communication between owner.
- LCD Display for giving status of the system.
- In case of emergency ringing the alarm.
- Sense objects or person at the main door.
- Detect knocks on the front door.
- Ring the alarm in case of fire or gas leakage.

Identifying External Entities

The Identification of External Entities is done in two phases.

Specify Entities from Abstract:

On the basis of the Abstract, one might identify the entities from the problem.

- Customer
- System
- Sensors
- Keypad
- LCD
- GSM

Tools and Technology with reasoning

Here is the list of all the hardware components along with the reasons. Software Tools and reasons also given below in the table.

Hardware Components

Tools	Reasoning
Arduino Uno/Mega	An open-source microcontroller board for controlling all functions
GSM Module	For sending and receiving SMS to the user.
LCD	For displaying information and status of sensors
MQ2 (Optional)	They are used in gas leakage.
Flame Sensor	This sensor will measure the Flame.
PIR (Optional)	Sensors that will detect infrared heat waves.
Piezo (Optional)	For detecting knocks on the front door.
Alarm	The sound will alert the surroundings for counter measure.
More Sensors	On consumer demand....

Software's

Tools	Reasoning
Arduino IDE	For writing, compiling and uploading C/C++ programs to Arduino board.

Use Case Diagrams:

A use case diagram is a graphic depiction of the interactions among the elements of a system. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements.

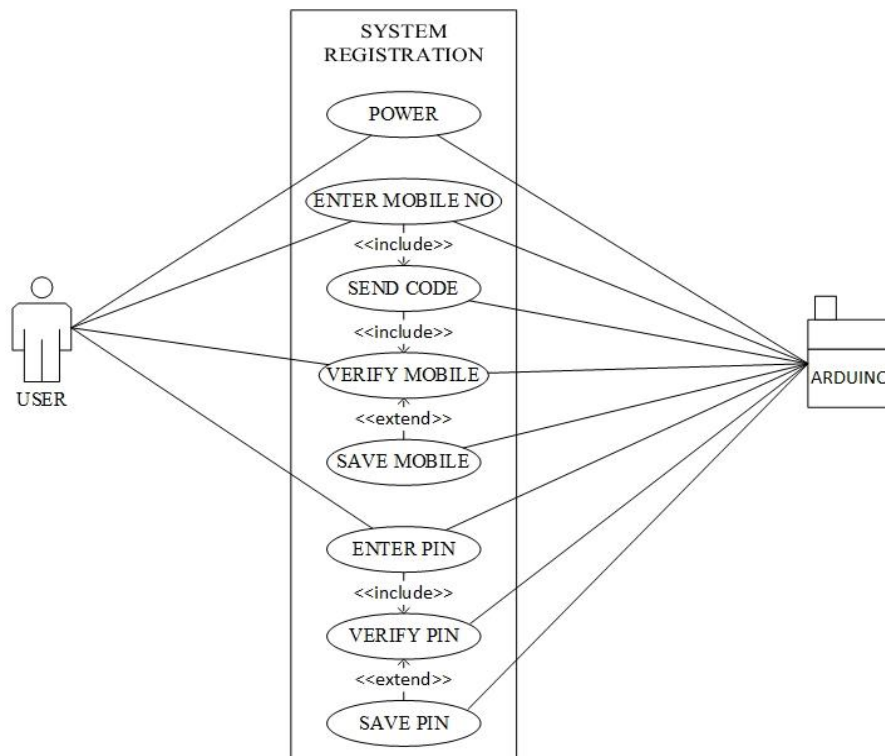
System Registration

System is connected to a power source, display is turned on and the system is configured to accept the inputs.

System Registration

Number	1
Name	GSM Security System
Summary	Owner turn on the system for the first time.
Priority	5
Precondition	System is connected to a power source, display is turned on and the system is configured to accept the inputs.
Post Conditions	Owner successfully get registered in the system
Primary Actor	Owner
Secondary Actors	System

Main Scenario	Steps	Action
	Step 1	Owner press the power button
	Step 2	System prompt user to enter mobile number
	Step 3	User Enter mobile number
	Step 4	<i>Owner Verify his mobile number and get registered</i>
	Step 5	<i>Owner Enter Pin Number</i>
	Step 6	<i>Save Pin number</i>



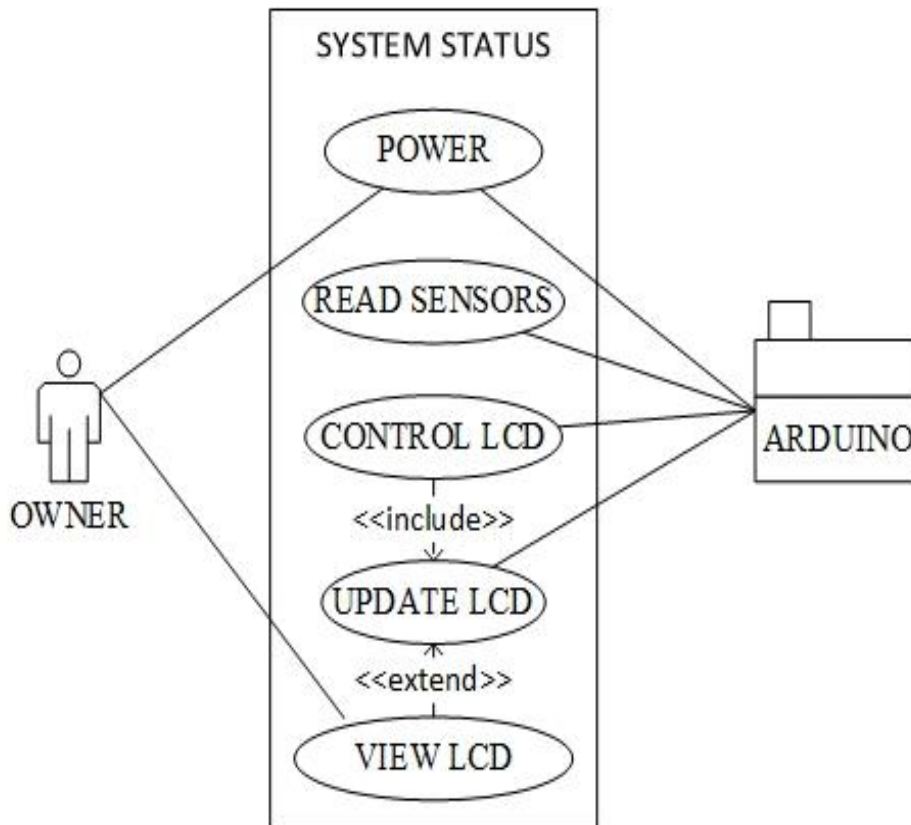
System Registration Use Case Diagram

System Status

System is connected to a power source, display is turned on and the system is configured to accept the inputs. LCD screen displaying the status of the system.

System Status

Number	2	
Name	GSM Security System	
Summary	LCD screen displaying the status of the system	
Priority	5	
Precondition	System is connected to a power source, display is turned on and the system is configured to accept the inputs.	
Post Conditions	Owner successfully get registered in the system	
Primary Actor	Owner	
Secondary Actors	System	
Main Scenario	Steps	Action
	Step 1	Owner press the power button
	Step 2	System show data on LCD
	Step 3	Owner View data on LCD
	Step 4	<i>System updates sensor data on LCD every second</i>



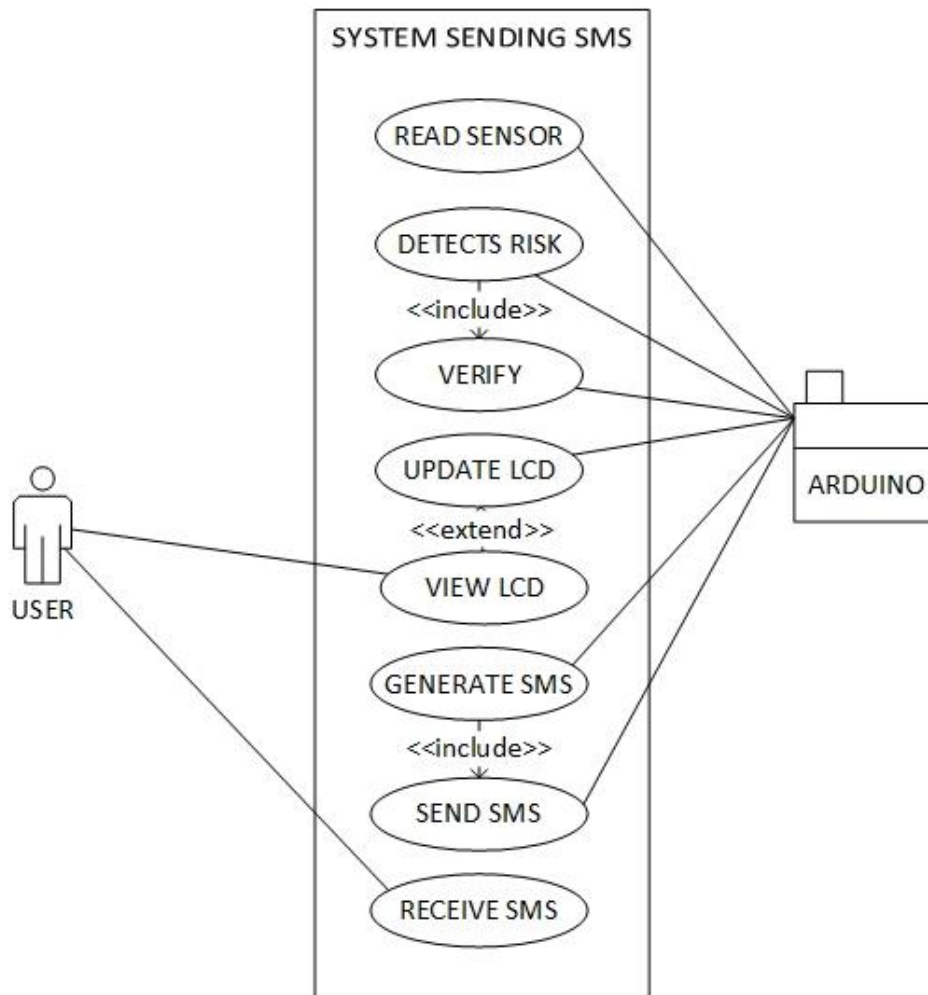
System Status Use Case Diagram

Sending SMS

The system will send alert SMS to the owner of the house. Here we discuss that in detail.

Sending SMS

Number	3	
Name	GSM Security System	
Summary	The system will send alert SMS to the owner of the house	
Priority	5	
Precondition	System is connected to a power source, display is turned on and the system is configured to accept the inputs.	
Post Conditions	The owner successfully receives the SMS	
Primary Actor	System	
Secondary Actors	User	
Main Scenario	Steps	Action
	Step 1	System is reading sensor data
	Step 2	System detects risk in the house
	Step 3	System confirms the sensor data
	Step 4	System sends alert SMS to owner



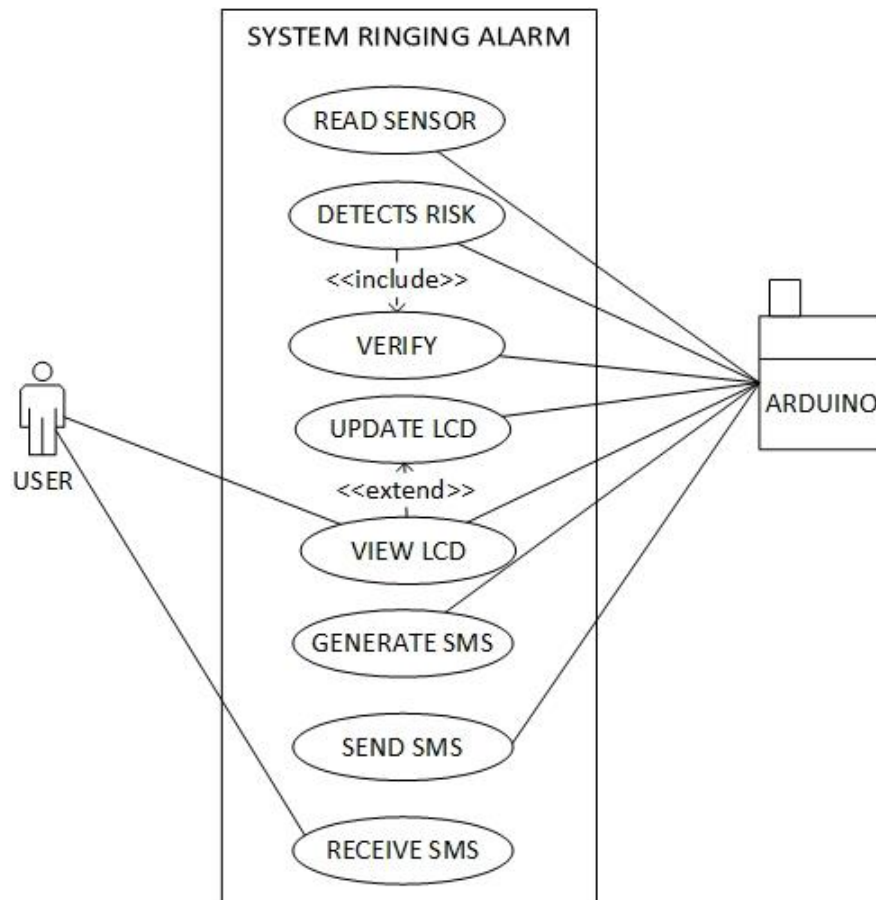
System Sending Use Case Diagram

Ringling Alarm

System is connected to a power source, display is turned on and the system is configured to accept the inputs. The system will ring the alarm to alert the surroundings

Ringling Alarm

Number	4	
Name	GSM Security System	
Summary	The system will ring the alarm to alert the surroundings	
Priority	4	
Precondition	System is connected to a power source, display is turned on and the system is configured to accept the inputs.	
Post Conditions	The system will successfully ring the alarm after detecting risk	
Primary Actor	System	
Secondary Actors	Arduino	
Main Scenario	Steps	Action
	Step 1	System is reading sensor data
	Step 2	System detects risk in the house
	Step 3	System confirms the sensor data
	Step 4	System will ring the alarm to alert the surroundings



Major keypionts of project:

Complex:

The development of project includes various complexities in a way that we faced various complex tasks like gsm module integration with the system and different sensors working inside the project and the language used in Arduino system.

Applicable:

GSM security system is vastly applicable as it can be used in different locations irrespect of home. Its applicability is improved since it can be used with a smart phone and the whole system can be controlled with it.

Innovative:

This project is innovative in a way that in early times we have only security cameras that donot having the adequate functunalities in it so our project can be called innovative since it has various functunalities and these functunalities can be improved with respect to the custumers needs.

Suitable size:

The project we choose to develop is of suitable size in a way that it covers all the necessary requirements that complete the home security and safety.

Suitable Scope:

The scope the project covers includes the issues regarding home security and safety that it can detect motion if a thief invades the security, has capability to detect gas leakage and detection of fire that has occurred in the home prmises and all the other required security purposes.

We will now discuss about the hardware components in details and look at their methodology.

1. Hardware Overview of the System
2. Hardware Implementation Methodology
3. Arduino Uno
4. GSM Module
5. Sensors

Hardware Overview of the System

The system consists of two units: the mobile station and the microcontroller unit with the SIM900-GPRS module, sensors and the gas sensors. Arduino Uno Board is used as the microcontroller board. The mobile phone is used as a controller to send instructions and as a recipient to receive the responses and alerts from the microcontroller unit, whereas the Arduino Board is the unit responsible for controlling the different parts and acts as the brain of the system. The SIM900 GSM/GPRS module is responsible for communication between the microcontroller unit and the mobile station. It is important to have some idea about the physics and the working principle behind the sensors and other hardware devices before using it.

Arduino Platform

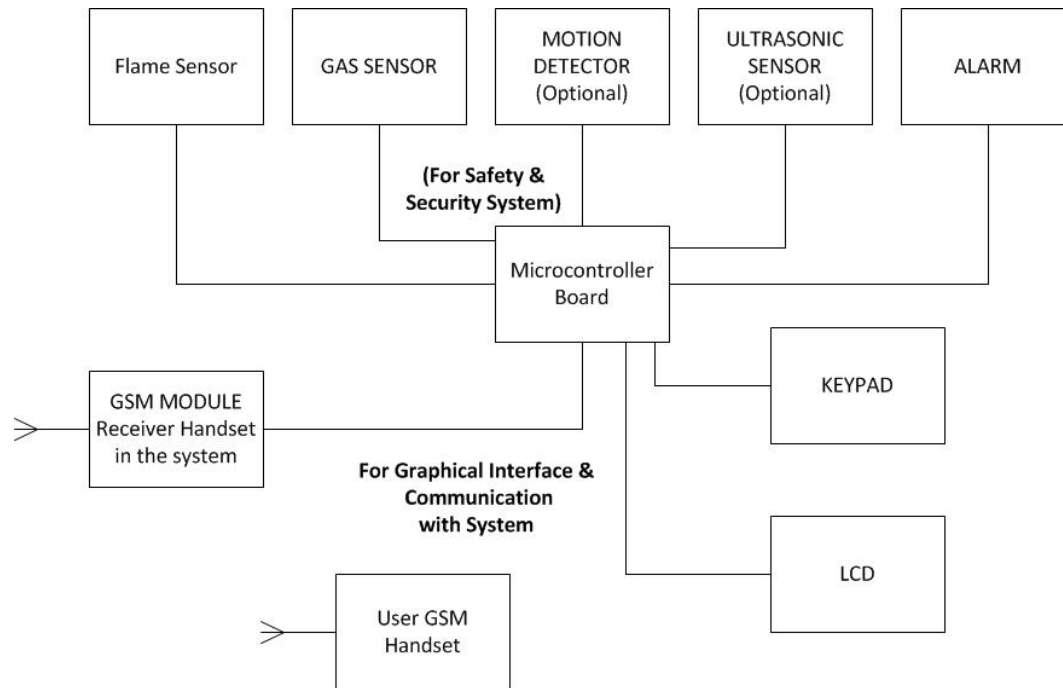
Arduino is an open source electronics prototyping platform based on flexible hardware and software. The Arduino is a simple yet sophisticated device which is based on Atmel's AT mega microcontrollers. The Arduino software is supported by Windows, Macintosh OSX and Linux operating systems despite the fact that most microcontrollers are limited to Windows operating system. The software language is based on AVR C programming language and can be expanded through C++ libraries. There are various types of Arduino microcontroller board available in the market including the Arduino kits and Arduino shields.

Hardware Implementation Methodology

Based on the design requirements and specifications, the system block diagram is given below. This block diagram defines all the function to be performed by the system. A modular approach to system design was taken. The system is designed based on an Arduino Uno/Mega. It is one of the microcontroller boards manufactured by the Arduino and it is a microcontroller board based on the Atmel's ATmega328 microcontroller. In this paper, some of the basic concepts of circuits that are used in the system design are explained. The system contains gas sensors to detect leakage and fire sensor to detect fire hazards. The sensors collect information and the system is controlled by the Arduino UNO/Mega, the controller decides the risk and sends SMS to the owner using a GSM module, according to the sensors information. After hitting the threshold value, it also sounds the alarm. An LCD is also used to display necessary information to the owner of the system. The information contains sensors live feed and other useful information.

Hardware Implementation Diagram

An overview of the application architecture describing the communication between each components of the system.



Hardware Implementation

Flame Sensor

It takes the input from the temperature sensors and checks if the temperature is higher than the normal, it notifies the user by sending the alert message.

Motion Detector

This module checks whether there is any intruder at home, it checks the mike value by a sound sensor. If the mike value is higher than the normal, then it generates the alert message to the user and also it displays on the LCD screen.

Gas Sensor:

This sensor detects the LPG gas molecules in the air. And gives respective voltage output to the Arduino.

GSM Modem

User receives SMS indication with the help of GSM modem connected to the Arduino Uno board.

LCD Display

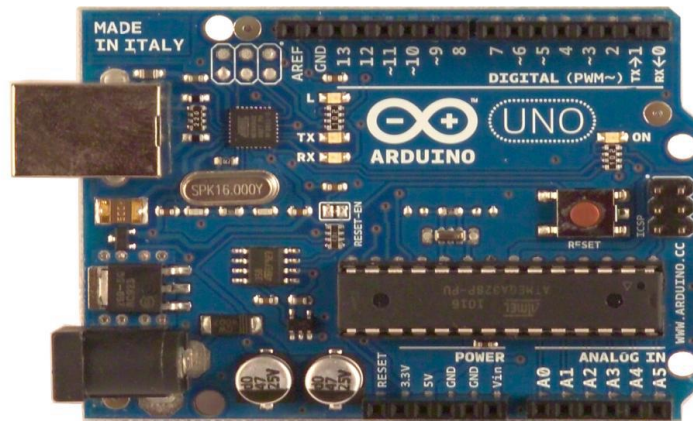
An LCD display is used to give necessary information to the user. It provides the path of graphical communication between system and the user.

Alarm

An is used to generate high pitch sound to alert the surrounding for safety.

Arduino UNO

Most useful part of the system is Arduino Uno. All the output devices are controlled by Arduino. At the same time, it reads and manipulates the input from sensor. LCD Display receives various messages from Arduino.

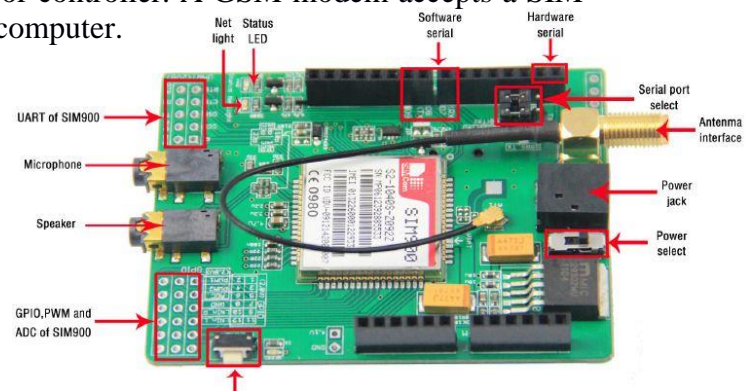


Arduino UNO

Arduino Uno is one of the microcontroller boards manufactured by the Arduino and it is based on the Atmel's ATmega328 microcontroller. "Uno" means one in Italian and the Uno board is the latest in a series of USB (Universal Serial Bus) Arduino boards which is the reference model for the Arduino platform. The Arduino Uno board has a USB connection, a power jack, a reset button, 6 analog inputs and 14 digital input/output pins (of which 6 can be used as PWM outputs). It uses the Atmega16U2 programmed as a USB-to-serial converter. The board has 32 KB flash memory of which 0.5 KB is used by boot-loader, 2 KB of SRAM, 1 KB of EEPROM and 16 MHz clock speed.

GSM module

The GSM modem unit is built using SIMCOM SIM900 modem that specialized for Arduino controller and support GPS technology. This unit can send SMS to user mobile phone and also can receive SMS from user. The working of GSM modem is based on commands, the commands always start with AT (which means Attention) and finish with a character. The AT commands are given to the GSM modem with the help of PC or controller. A GSM modem accepts a SIM card, and basically acts like a mobile phone for the computer.

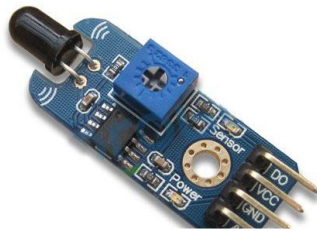


Sensors

The device which provides a usable output (electrical quantity) in response to a measured (physical quantity, property or condition which is measured) is sensor according to the Instrument Society of America. There are different definitions and different views about the sensors and they have been adopted by scientists and engineers

Flame Detection Module

To detect fire flame sensor module has been used in this project. This module is sensitive to the fire and basically flame spectrum. The way it works it just detects the light wave length between the range of 760nm-1100 nm which is actually the range of typical infrared light. It is very low cost sensor, light weight (8 grams only), response time is very fast and easy to use, which makes it a right choice to work with, for prototyping and experiment. There are digital and analog pin output with the module and a potentiometer to change the flame sensitivity.



Flame Detection Module

Gas Sensor

MQ-2 gas sensor module is used to detect smoke. Basically gas sensor module has a small heater inside and a chemical sensitive sensor to detect a range of gases. For an instance, MQ-2 gas sensor module can distinguish Liquefied Petroleum Gas (LPG), Carbon Monoxide (CO), Hydrogen (H₂), Methane (CH₄), Smoke, Propane (C₃H₈) and Alcohol (C₂H₅OH) gases. This sensor is popular because of its precision, fast response time, and sensitivity, high reliability, longevity and cost effectiveness. By reading the resistance level, leakage gas can be detected. MQ2 sensor can detect gas as low as 200ppm to high limit 10000ppm. Therefore, it has the capability to sense gas very low density to high volume of range.



Gas Sensor

LCD

Liquid Crystal Display is very useful in providing graphical interface to the user. User can view necessary information on an LCD. When typing using the keypad user can view its input. LCD screen guides the user to perform basic functions. User can view live sensor information.



LCD

Keypad

The keypad in Arduino helps to take inputs from the user. It provides a mean of communication between user and the system. User can perform simple functionality just by navigating through the menus. Every press of key is capture as single value and then Arduino matches the value with onboard functions to perform basic actions.



Keypad