

Automated Flame and Gas Detector with Analyzer

This project report is submitted to the Department of Electrical & Electronic Engineering (EEE), Daffodil International University, Bangladesh, in Partial fulfillment of the requirements for the Degree of “Bachelor of Science in Electrical & Electronic Engineering”.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Md. Mahmudur Rahman, Senior Lecturer, Department of EEE, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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-----*Authors*

ABSTRACT

Here we have designed and installed an Automated Flame & Gas Detector with Analyzer. First of all according to the collected information about AFGDA (Automated Flame & Gas Detector with Analyzer) total circuit design has been completed using Proteus software.

Flame sensor was used in this project which detects frequency of a room. It annotates the number of turns completed in one minute around a fixed axis. It is used as a measure of rotational speed of a mechanical component.

Fire alarm system plays an important role in maintaining and monitoring the safe of all kind environments and situations. However the usability of many existing fire alarm system is well known but could be produce with high cost. Subsequently, it is not affordable for the low income users. The main objective of this project is to make a fire control system with low cost.. The detection system operates as the fire detector. This detection system has components like flame detector, smoke detector, light detector, heat detector etc. This paper discusses the design and implementation of a fire alarm system using the microcontroller which operates the entire system. Any signal from each detector at any level is monitored using monitoring system. The entire system is controlled by microcontroller. The microcontroller is programmed in such way by using C-Programming. From the project done, the system can detects smoke, light, flame, heat etc. sensed by the detector, followed by the monitoring system which indicates smoke, light, flame, heat etc. at that particular level. Finally when the sensors form each level triggered individually, the main buzzer operates and disconnect the AC power supply. Then it shows in the control panel LCD display which area is affected and which is safe. Then it runs the emergency exit motor to escape and the water pump motor to the affected zone to stop the fire.

One of the most important actual problems in the gas detection field is that there are strong demands for gas methane leak detection and CO (carbon monoxide) detection to prevent explosions or CO poisoning accidents. In this sense, the present paper describes technical characteristics, test results, and a concluding application for methane and carbon monoxide based gas detection using a sensor which can detect both CO and methane with a single sensing element. The paper presents the detection method as well as the apparatus functional sketch.

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Chapter-1

Introduction

1.1: Background

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.

There are two principal types of detector which are commonly in use in off-shore installations: heat, flame & smoke, and flammable gas instruments. The most significant for risk reduction are gas detection systems, since they give the earliest warning of hazardous situations. Infra-Red (IR), line-of-sight or point type detectors which identify an accumulation of gas and acoustic leak detectors, are also used. The OSD strategy is to promote the use of a combination of sensors, thereby giving early leak detection with the acoustic detectors and identifying a gas cloud accumulation with the IR type sensors.

1.2: Organization of the Project:

In this report there is total (thirteen) chapter in book. The first chapter describes a brief idea about introduction and contains circuit diagram, list of component and working principle. Chapter two describes about the Arduino Uno. Chapter three describes LCD Display. Chapter four describes about the Grove Flame Sensor. Chapter five describes Carbon-Monoxide sensor (MQ-7). Chapter six & seven describes about Buzzer and resistor .Chapter eight and nine describes Variable resistor and Program. Chapter ten make a cost and Data sheet.

1.3: Experimental Setup:

1.3.1: FLAME DETECTOR INSTALLATION:

As with all fire detectors the placement of flame detectors is determined by the environment that they will be operating in. What appears to be a good place to locate a flame detector on paper may be a poor location in reality. Some of the factors to consider are

- The viewing angle of the detector
- The detection range
- Obstructions such as girders, beams, supports, hoists, air conditioners and other solid objects will block the cone of vision and / or hinder access for service
- All high risk fire ignition areas must be covered by at least one detector
- Adequate detector coverage will ensure that ‘voids’ in the optical coverage do not occur
- Optimum detector mounting height is a function of the height of the most likely point of fire ignition

When designing a system we recommend that a manufacturer be contacted as details can be provided on previous installations of a similar nature. This will ensure that the correct number of detectors is provided to ensure the most suitable detection.

1.3.2: GAS DETECTOR INSTALLATION:

As with all detectors the environment that they will be operating in determines the placement of gas detectors. What appears to be a good place to locate a gas detector on paper may be a poor location in reality. Some of the factors to consider are;

- The gas to be detected, some gases are heavier than air, therefore, the detector must be located near the floor.
- Obstructions such as girders, beams, supports, hoists, air conditioners and other solid objects may interfere with the flow of gas to the detector.
- All high risk areas must be covered by at least one detector
- Airflow within the area may prevent the gas from reaching the detector.

When designing a system we recommend that a manufacturer be contacted as details can be provided on previous installations of a similar nature. This will ensure that the correct number of detectors is provided to ensure the most suitable detection.

1.4: Objective: Automated flame and gas detection with analyzer and Showing LCD display

1.5: Major Components:

Arduino Uno

16*2 LCD Display

Grove Flame sensor

Carbon-Monoxide sensor (MQ-7)

Buzzer

Breadboard (PCB)

Variable resistor

M2M wire

Resistor 220 Ω

Resistor 100K Ω

Wooden sheet

Glues

Foam tape

1.5: Circuit Diagram:

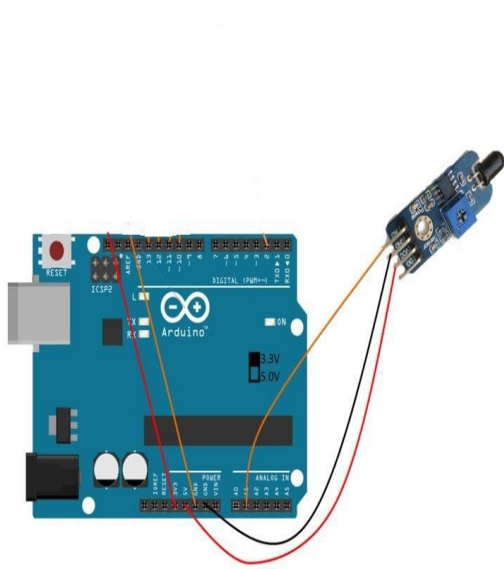


Fig: 1.1 Circuit of Flame Sensor

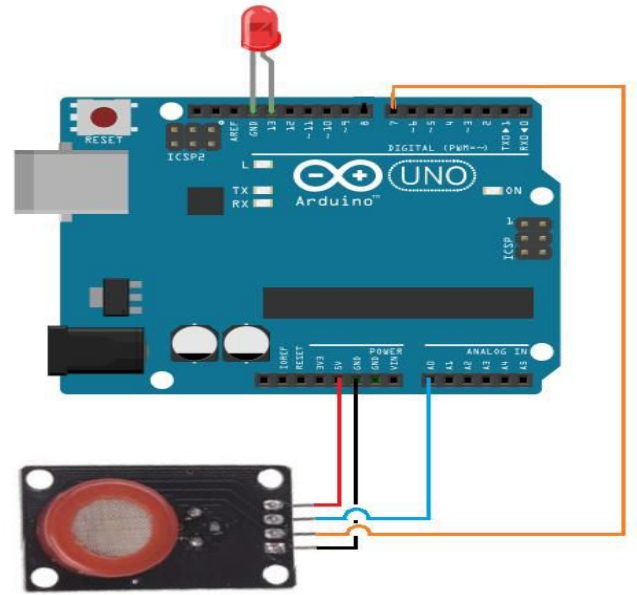


Fig: 1.2 Circuit of Carbon Monoxide (MQ-7)

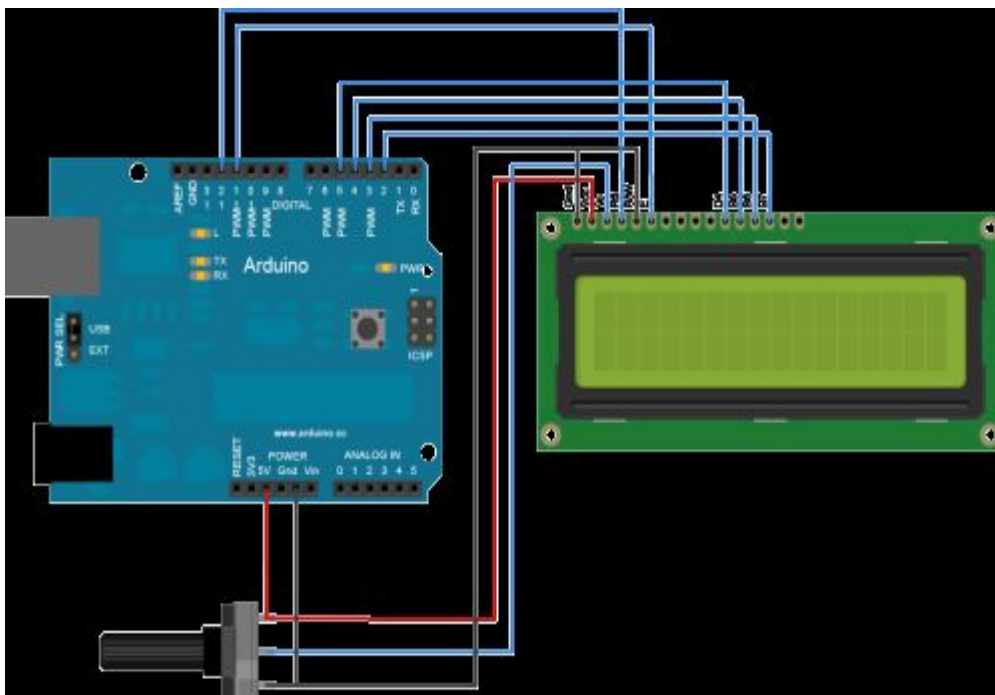


Fig-1.3: Circuit of Arduino to (16*2) LCD

Chapter-2

Arduino Uno

2.1: Introduction:

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino Projects can be stand-alone, or they can communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phidgets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package.

2.2: Arduino Pin Diagram:

A typical example of Arduino board is Arduino Uno. It consists of ATmega328- a 28 pin microcontroller.

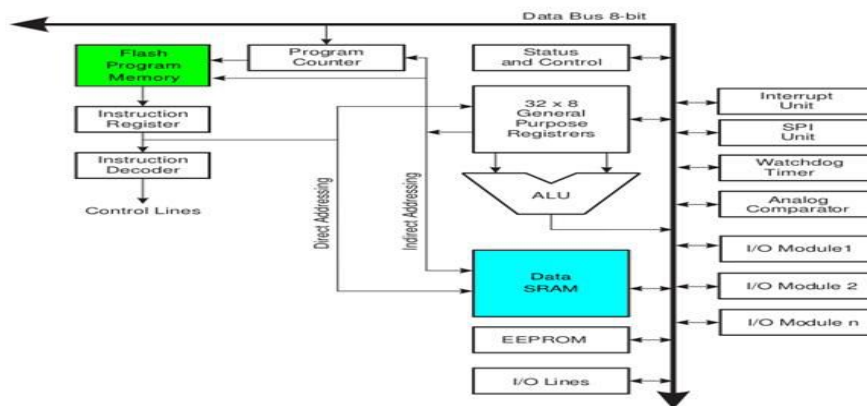


Fig 2.1: Arduino Uno Pin Diagram

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Power Jack: Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IOREf pin.

Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

Are: It provides reference to the analog inputs

Reset: It resets the microcontroller when low.

2.3: Five Steps to Program an Arduino.

- Programs written in Arduino are known as sketches. A basic sketch consists of 3 parts
 1. Declaration of Variables
 2. Initialization: It is written in the setup () function.
 3. Control code: It is written in the loop () function.
- The sketch is saved with .into extension. Any operations like verifying, opening a sketch, saving a sketch can be done using the buttons on the toolbar or using the tool menu.
- The sketch should be stored in the sketchbook directory.
- Chose the proper board from the tools menu and the serial port numbers.
- Click on the upload button or chose upload from the tools menu. Thus the code is uploaded by the boot loader onto the microcontroller.

2.4: Few of Basic Arduino functions are:

- **Digital Read** (pin): Reads the digital value at the given pin.
- **Digital Write** (pin, value): Writes the digital value to the given pin.
- **Pin Mode** (pin, mode): Sets the pin to input or output mode.
- **Analog Read** (pin): Reads and returns the value.
- **Analog Write** (pin, value): Writes the value to that pin.
- **Serial. Begin** (baud rate): Sets the beginning of serial communication by setting the bit rate.

2.5: How to Design your own Arduino?

We can also design our own Arduino by following the schematic given by the Arduino vendor and also available at the websites. All we need are the following components- A breadboard, a led, a power jack, a IC socket, a microcontroller, few resistors, 2 regulators, 2 capacitors.

- The IC socket and the power jack are mounted on the board.
- Add the 5v and 3.3v regulator circuits using the combinations of regulators and capacitors.
- Add proper power connections to the microcontroller pins.
- Connect the reset pin of the IC socket to a 10K resistor.
- Connect the crystal oscillators to pins 9 and 10
- Connect the led to the appropriate pin.
- Mount the female headers onto the board and connect them to the respective pins on the chip.
- Mount the row of 6 male headers, which can be used as an alternative to upload programs.

2.6: Working Principle:

In this paper, we analyze the working principle of an Arduino. These days many people try to use the Arduino because it makes things easier due to the simplified version of C++ and the already made Arduino micro controller (atmega328 microcontroller that you can programme, erase and reprogramme at any given time. In this paper we will discuss the hardware components used in the arduino board, the software used to programme it (Arduino board) with the guide on how to write and construct your own projects, and a couple of examples of an Arduino project, This will give you the overall view of an Arduino uno, that after reading this paper you will get the basic concept and use of an Arduino uno.

Chapter-3

16*2 LCD Display

3.1: Introduction:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. We used here the built-in library function of Arduino coding environment.

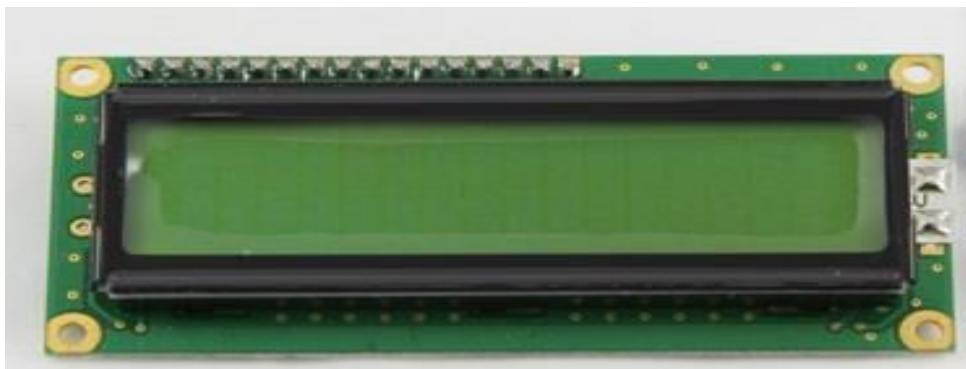


Fig: 3.1: LCD Display

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) Technology. Display screen that are generally used in laptop computer screen, TVs, cell phones and portable video

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid

crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

3.2: Working principle:

The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the

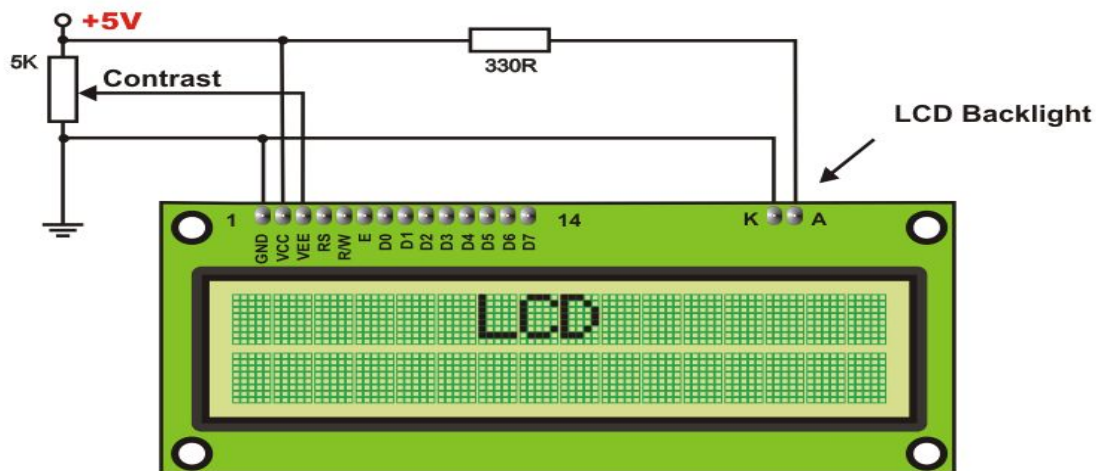


Fig3.2: 16*2 LCD Display

back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter.

Next comes to the second piece of glass with an electrode in the form of the rectangle on the bottom and, on top, another polarizing film. It must be considered that both the pieces are

kept at right angles. When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank.

3.3: Advantage of LCD Display:

- LCD's consumes less amount of power compared to CRT and LED
- LCD's are consist of some microwatts for display in comparison to some mill watts for LED's
- LCDs are of low cost
- Provides excellent contrast
- LCD's are thinner and lighter when compared to cathode ray tube and LED

3.4: Pin Diagram:

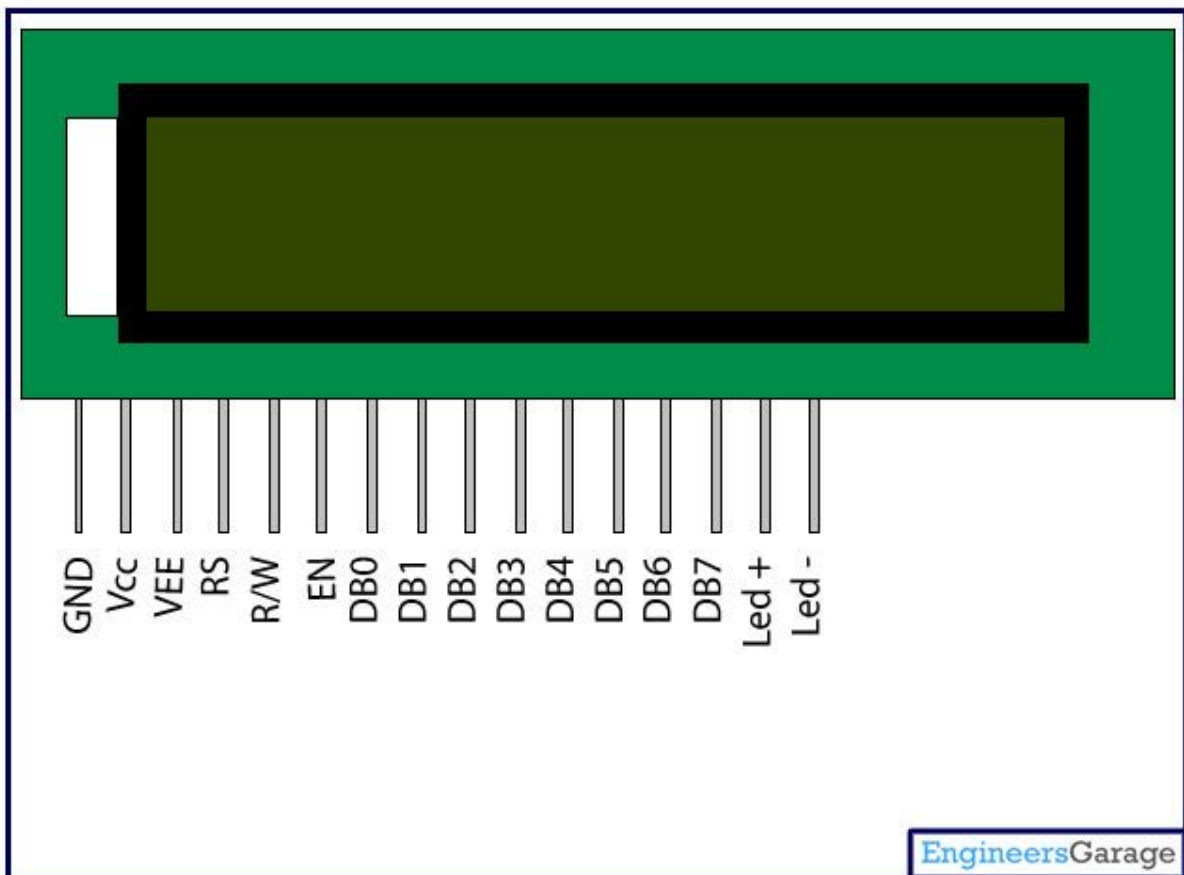


Fig3.3: 16*2 LCD Pin Diagram

3.5: Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	V _{cc}
3	Contrast adjustment through a variable resistor	V _{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V _{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table3.1: Pin Description

3.6: Features:

- High quality STN 16x2 character LCD
- 3.3V power supply
- White LED Backlight
- 5x8 dot characters
- ST7066 controller
- 1/16 duty cycle

Chapter – 4

Grove Flame Sensor

4.1: Introduction:

This module is sensitive to the flame and radiation. It also can detect Ordinary light source in the range of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm. The Flame sensor can output digital or analog signal. It can be used as aflame alarm or in firefighting robots.



Fig4.1: Grove Flame Sensor

4.2: Description:

- Detects a flame or a light source of a wave length in the range of 760nm-1100 nm
- Detection distance: 20cm (4.8V) ~ 100cm (1V)
- Detection angle about 60 degrees, it is sensitive to the flame spectrum.
- Comparator chip LM393 makes module readings stable.
- Adjustable detection range.
- Operating voltage 3.3V-5V
- Digital and Analog Output
- “DO digital switch outputs (0 and 1)
- “AO analog voltage output
- Power indicator and digital switch output indicator

4.3: Interface Description (4-wire):

- 1) VCC -- 3.3V-5V voltage
- 2) GND – GND
- 3) DO -- board digital output interface (0 and 1)
- 4) AO -- board analog output interface
- 5) VCC -- 3.3V-5V voltage
- 6) GND – GND
- 7) DO -- board digital output interface (0 and 1)
- 8) AO -- board analog output interface

4.4: Specifications:

Item	Min	Typical	Max	Unit
Voltage	4.75	5.0	5.30	VDC
Current	/	20	/	mA
Range of Spectral Bandwidth	760	940	1100	nm
Detection range	0	~	1	m
Response Time	15			μS
Operating Temperature	-25	~	85	°C

Table4.1: Data of Grove Flame Sensor

4.5: Circuit Diagram:

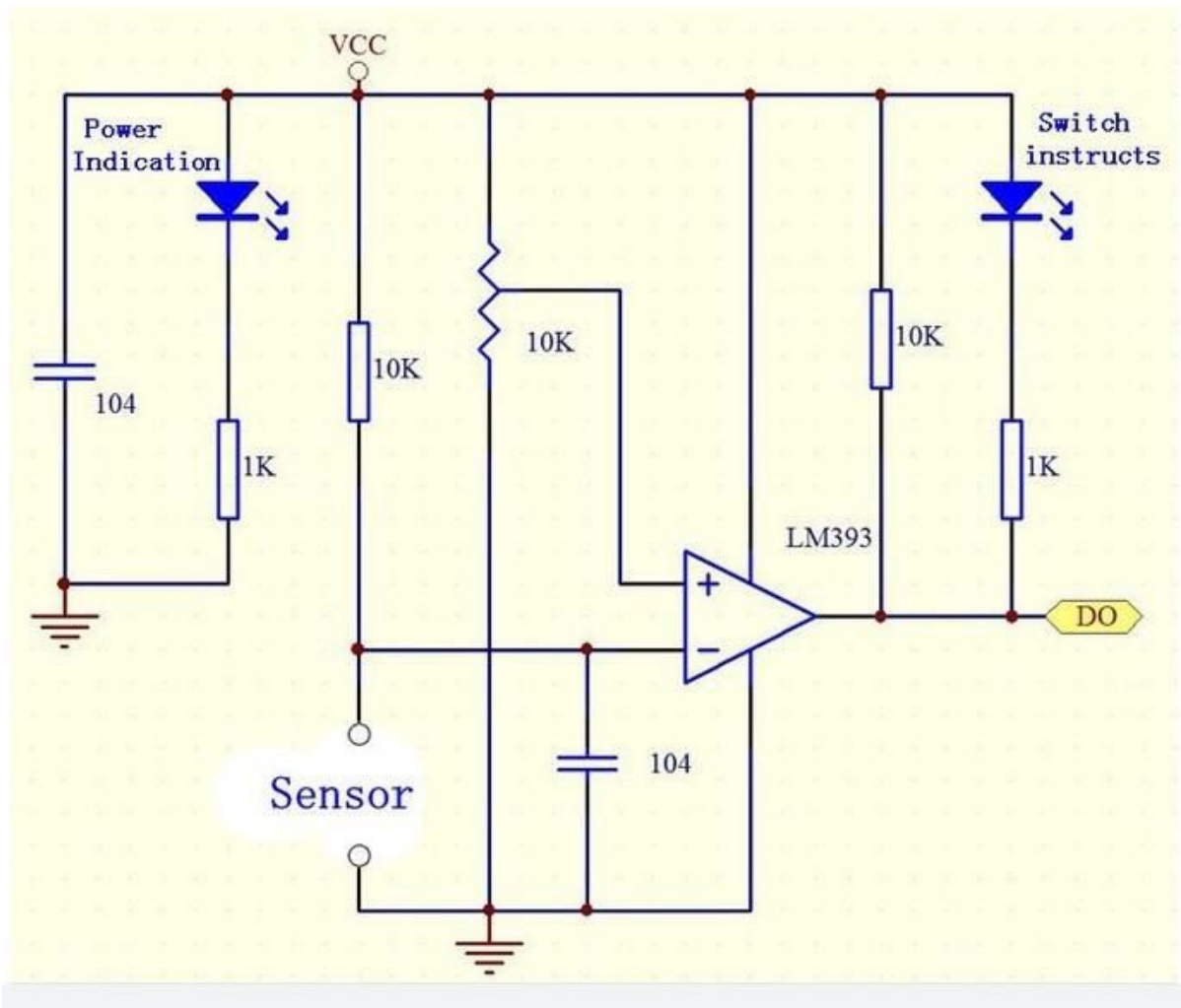


Fig4.2: Circuit of Flame Sensor

4.6: How to Test:

1. Connect your Arduino microcontroller to the computer.
2. Connect the VCC pin of your module to the 5V pin of your Arduino.
3. Connect the GND pin of your module to the GND pin of your Arduino.
4. Connect the Output pin of your module to the A0 pin of your Arduino.
5. Enter this program to your Arduino Integrated Development Environment (IDE):

4.7: When exposed to the fire of an ignited lighter:

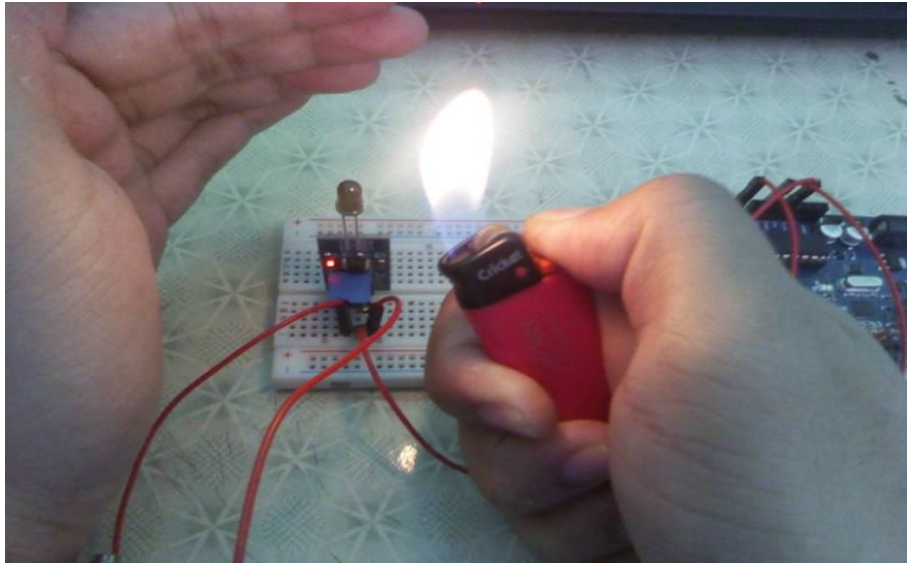


Fig4.3: Fire of an ignited lighter

4.7: Characteristics of Grove Flame Sensor:

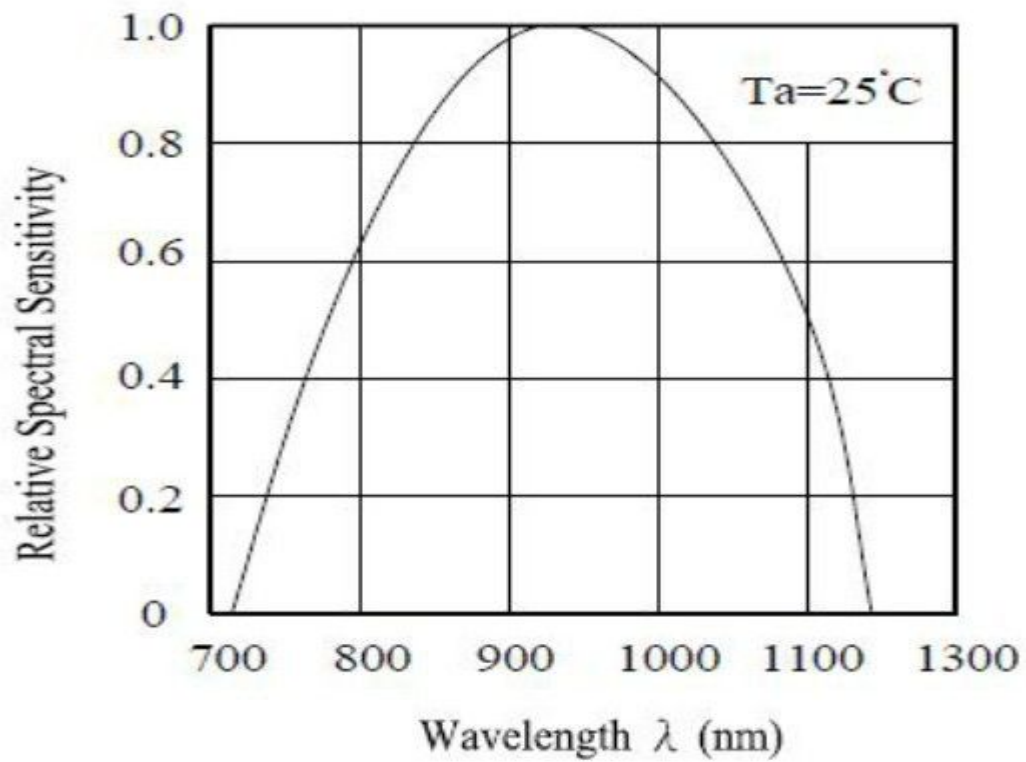


Fig4.4: Characteristics of Grove Flame Sensor

Chapter-5

Carbon- Monoxide Sensor (MQ-7)

5.1: Introduction

The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature.

They can be calibrated more or less (see the section about "Load-resistor" and "Burn-in") but a known concentration of the measured gas or gasses is needed for that.



Fig: 5.1 Carbon- Monoxide Sensor (MQ-7)

5.2: Description:

This is a simple-to-use Carbon Monoxide (CO) sensor, suitable for sensing CO concentrations in the air. The MQ-7 can detect CO-gas concentrations anywhere from 20 to 2000ppm.

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,

MQ-7 GAS SENSOR

5.3: Features:

- * High sensitivity to carbon monoxide
- * Stable and long life

5.4: APPLICATION: They are used in gas detecting equipment for carbon monoxide (CO) in family and industry or car.

5.5: SPECIFICATIONS:

A. Standard work condition

TECHNICAL DATA

Symbol	Parameter name	Technical condition	Remark
Vc	circuit voltage	5V±0.1	Ac or Dc
VH (H)	Heating voltage (high)	5V±0.1	Ac or Dc
VH (L)	Heating voltage (low)	1.4V±0.1	Ac or Dc
RL	Load resistance	Can adjust	
RH	Heating resistance	33Ω±5%	Room temperature
TH (H)	Heating time (high)	60±1 seconds	
TH (L)	Heating time (low)	90±1 seconds	
PH	Heating consumption	About 350mW	

B. Environment conditions

Symbol	Parameters	Technical conditions	Remark
Tao	Using temperature	-20°C-50°C	

Tas	Storage temperature	-20°C-50°C	Advice using scope
RH	Relative humidity	Less than 95%RH	
O ₂	Oxygen concentration	21%(stand condition)the oxygen concentration can affect the sensitivity characteristic	Minimum value is over 2%

C. Sensitivity characteristic

Symbol	Parameters	Technical parameters	Remark
Rs	Surface resistance Of sensitive body	2-20k	In 100ppm Carbon Monoxide
a(300/100ppm)	Concentration slope rate	Less than 0.5	Rs (300ppm)/Rs(100ppm)
Standard working condition	Temperature -20°C±2°C relative humidity 65%±5% RL:10KΩ±5%		
	Vc:5V±0.1V VH:5V±0.1V VH:1.4V±0.1V		
Preheat time	No less than 48 hours	Detecting range: 20ppm-2000ppm carbon monoxide	

Table5.1: Technical Data of (MQ-7)

D. Structure and configuration, basic measuring circuit Structure and configuration of MQ-7 gas sensor is shown as Fig. 1 (Configuration A or B), sensor composed by micro AL₂O₃ ceramic tube, Tin Dioxide (SnO₂) sensitive layer, measuring electrode and heater are fixed

into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components.

5.6: Basic Circuit Diagram:

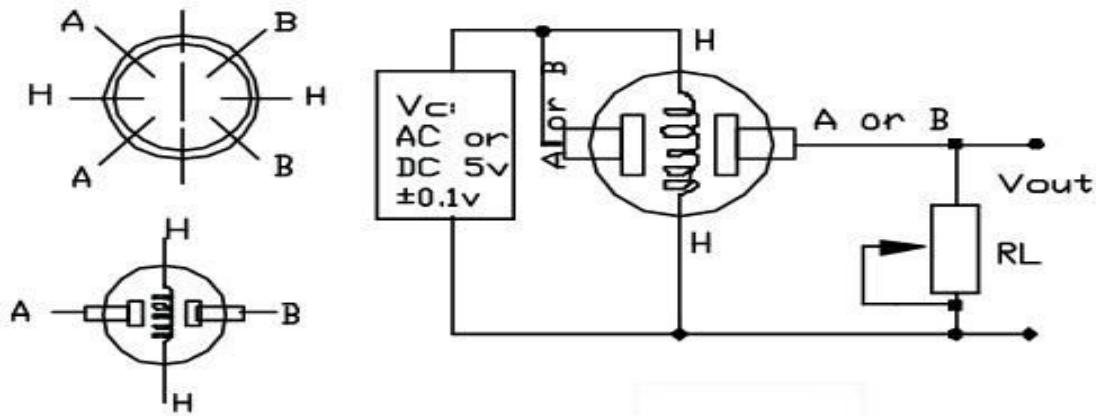


Fig5.2: MQ-7

5.7: Load Resistor:

The sensor needs a load-resistor at the output to ground. Its value could be from 2k Ohm to 47kOhm. The lower the value, the less sensitive. The higher the value, the less accurate for higher concentrations of gas.

If only one specific gas is measured, the load-resistor can be calibrated by applying a know concentration of that gas. If the sensor is used to measure any gas (like in a air quality detector) the load-resistor could be set for a value of about 1V output with clean air.

Choosing a good value for the load-resistor is only valid after the burn-in time.

5.8: Read the Datasheet:

Try to find a few datasheets for the sensor, and read them careful.

Since there are no electronic components inside, therefore most sensors can be used with AC and DC voltages.

Be careful when connecting it for the first time. If the pins are connected wrong, the sensor could get damaged, or it could be broken instantly. There are also shields available with these sensors pre-installed.

5.9: Burn – In:

Some datasheets use the term "preheat", but it is the time to burn-in the sensor. This is meant to make the sensor readings more consistent. A time of 12 or 24 hours is usually used for the burn-in time.

The Burn-in is achieved by applying normal power to the sensor (to the heater and with the 'A' and 'B' pins connected, and with a load-resistor). In some special cases a specific burn-in is needed. See the datasheet if the sensor needs such a specific burn-in.

5.10: Characteristics of MQ-7 CO Gas sensor:

Sensitivity Characteristics

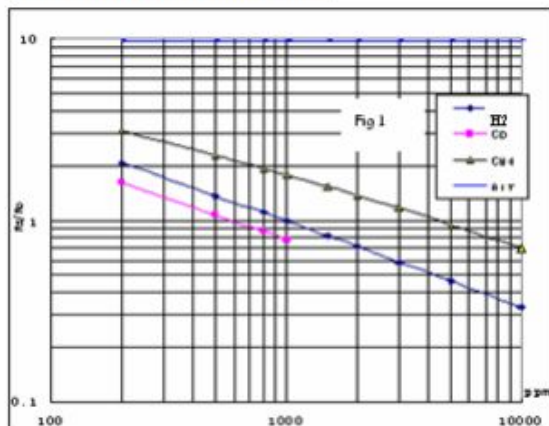


Fig.1 shows the typical sensitivity characteristics of the MQ-7, ordinate means resistance ratio of the sensor (R_s/R_0), abscissa is concentration of gases. R_s means resistance in different gases, R_0 means resistance of sensor in 1000ppm Hydrogen. All test are under standard test conditions.

Influence of Temperature/Humidity

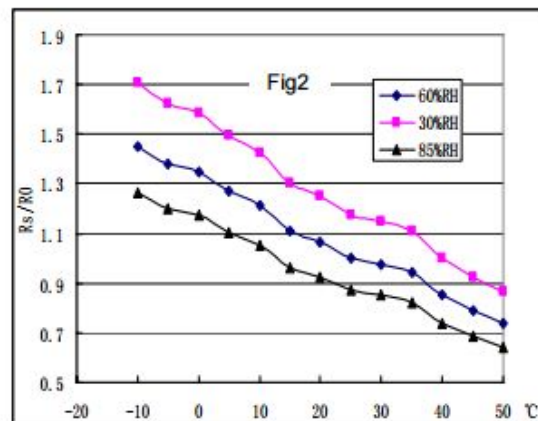


Fig.2 shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor (R_s/R_0), R_s means resistance of sensor in 100ppm CO under different tem. and humidity. R_0 means resistance of the sensor in environment of 100ppm CO, 20°C/65%RH

5.11: Analyzing PPM of Gases:

Parts-per-million by volume is a common way of expressing a concentration in the gas phase. Gases are miscible and, in general, once allowed to come to equilibrium a gas is homogeneous, in other words its constituents are equally mixed. The SI unit of volume is the cubic meter (m³). Suppose a constituent of a gaseous mixture is at a concentration of 1 ppm. If one were to separate the mixture into its components, and measure the volume of each component, there would be 1 m³ of the gas of interest for every 10⁶ m³ of the mixture. $1 \text{ m}^3 \text{ constituent} / 10^6 \text{ m}^3 \text{ of the mixture} = 1 \text{ ppm}$

In liquids, it is common to use ppm by mass as a concentration. In general the calculations are a lot easier than in the gas phase. $1 \text{ ppm solute} = 10^{-6} \text{ kg solute} / 1 \text{ kg solution} = 1 \text{ mg solute} / 1 \text{ kg solution}$ There is a very convenient way to do this calculation in dilute solutions of water. The density of water is 1 kg/liter (there is a small variation with temperature, but I neglect that here. Moreover, in dilute aqueous solutions most of the mass is from water: $1 \text{ ppm solute} = 1 \text{ mg solute} / 1 \text{ kg solution} \approx 1 \text{ mg solute} / 1 \text{ kg water} = 1 \text{ mg solute} / 1 \text{ liter water}$ It is possible to be more accurate by correcting by the known or measured density of the solution.

MQ-7 Semiconductor Sensor for Carbon Monoxide Sensitive material of MQ-7 gas sensor is SnO₂, which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The sensor's conductivity is more higher along with the gas concentration rising. When high temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-7 gas sensor has high sensitivity to Carbon Monoxide. The sensor could be used to detect different gases contains CO, it is with low cost and suitable for different application.

Chapter-6

Buzzer

6.1: Introduction:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Buzzers are available in a variety of styles. Magnetic buzzers emit audio via a coil, while



Fig6.1: Buzzer

Electromechanical buzzers may use a bell in their design.

Mechanical buzzers do not operate with electricity. Instead, they rely on a tightly wound spring. Hand buzzers and alarm clocks that are manually wound are mechanical in design. Piezo buzzers can emit a variety of beeps and buzzes and are often used on car doors and to indicate computer errors.

Buzzers are employed for use on microwave ovens and conventional ovens as well. Timing devices depend on buzzers, as do alarms for seat belts and dashboard warning lights. Buzzers are also used during recreational activities. Most game shows require players to hit a buzzer when they are ready to answer a question or want to signal the host. At college and professional basketball games, buzzers sound when the clock runs out of time.

6.2: Advantages & Disadvantage: Advantage

- Electrically operated device that is good for drawing attention to a condition that requires attention.

Disadvantages:

- Annoying sound to those that don't know its significance.
- Requires training to know what the buzzer means, and how to repair the condition without just shutting off the buzzer.
- Could trigger a fire in an explosive atmosphere.
- Most likely device to receive "emotional outbursts" like misguided forklift strikes, stray bullets, and attacks by roving wire cutters.

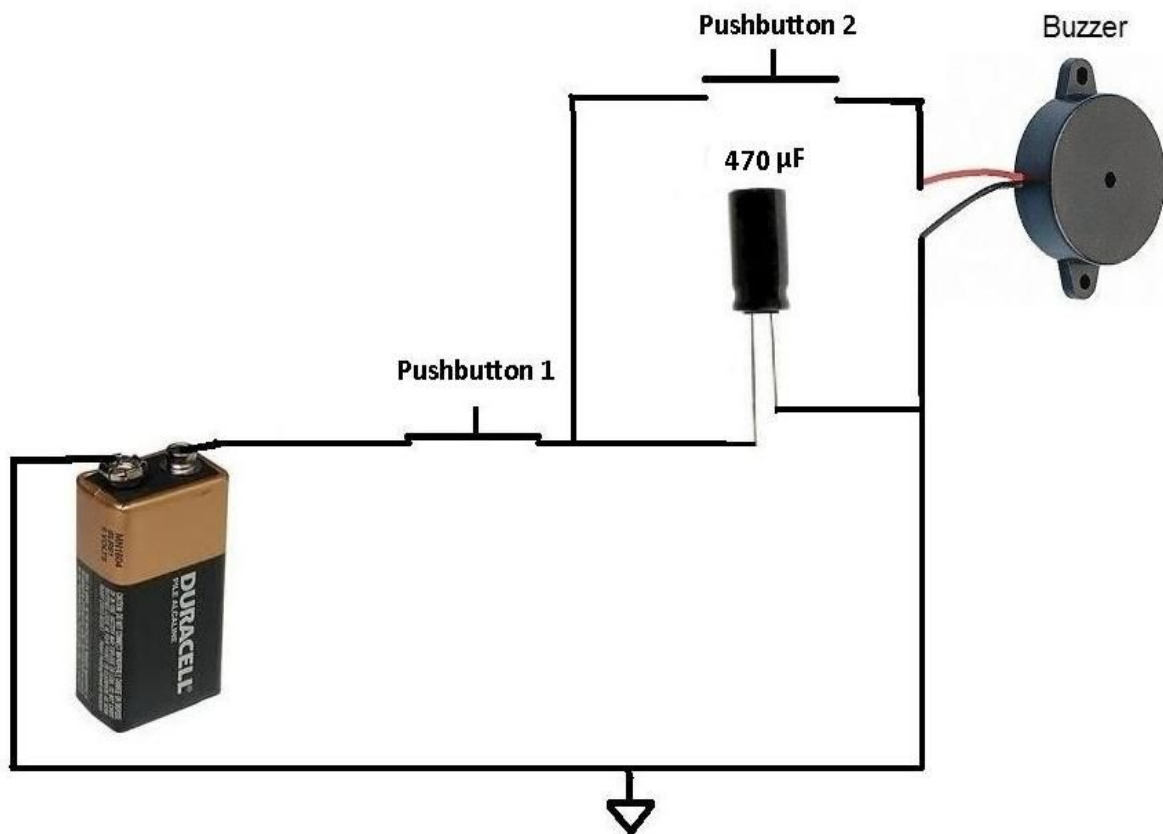


Fig6.2: Structure of Buzzer

An electric buzzer uses an electromagnet to make a loud repetitive sound. Invented in 1831 by Joseph Henry, it is often used as a door bell or alarm. Follow these steps to make your own buzzer.

6.3: How Electromechanical Buzzers Function?

An electromagnet forms the main part of all types of electromechanical buzzers. These may be either AC operated or DC operated.

In AC buzzers, the AC Mains voltage is applied to an electromagnet coil. The alternating voltage induced in the coil generates a varying magnetic field in accordance to the applied voltage, which in turn vibrates an iron plate to produce the required audible buzzing sound.

Chapter-7

Resistor

7.1: Introduction:

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. All other factors being equal, in a direct-current (DC) circuit, the current through a resistor is inversely proportional to its resistance, and directly proportional to the voltage across it. This is the well-known Ohm's Law. In alternating-current (AC) circuits, this rule also applies as long as the resistor does not contain inductance or capacitance.

A resistor is a passive two electrical that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.



Fig7.1: Resistor

7.2: Based on Conductive properties of Resistor: Based on the conductive properties of a resistor resistors can be classified as:

1. Linear Resistor:

A linear resistor is the type of resistor whose resistance remains constant with increase in the potential difference or voltage applied to it Or the Resistance or Current passed through the resistor does not changes as the applied voltage changes. The V-I characteristics of such resistor is a straight line as shown on the figure below or in other words these types of resistors follows Ohm's Law very strictly.

2. Non Linear Resistor:Non-Linear Resistor are those types of resistors in which the Current passed through it is not exactly directly proportional to the Potential Difference applied to it.

These types of resistors have non-linear V-I characteristics and does not strictly follows ohm's Law.



Fig7.2: Linear resistor



Fig7.3: Non Linear resistor

7.3: Resistor color-coding: The value of the resistor is marked on the body using colors. Every color is different number and you can remember these numbers or you can just use the table on next step OR there are much resistor calculators that you can use. It's for the laziest people :D. However it's your decision and I will show you all ways to calculate resistor value. If you want to find out the color bands for a value, use the tool on the left. Enter the value, select the multiplier (Ω , K or M) the desired precision and hit 'Display resistor' or ENTER. You can also type in resistor values in shorthand notation like 1k5, 4M7 or 100R.

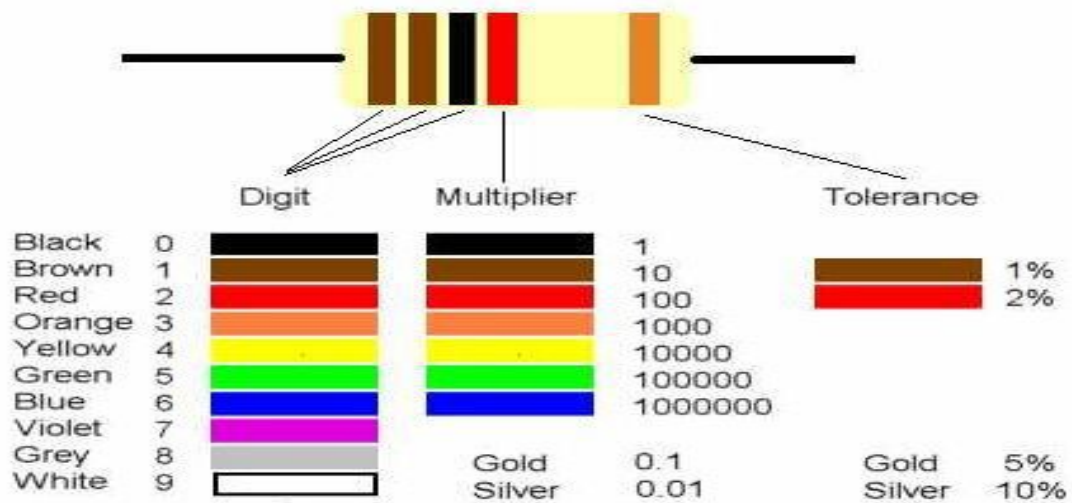
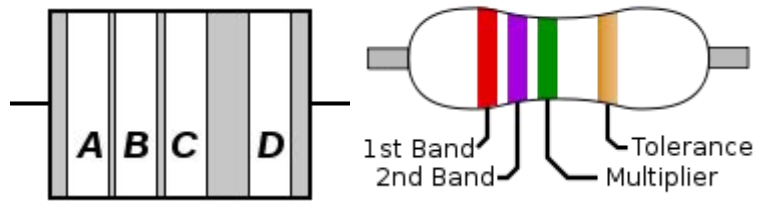


Fig7.4: Color coding

The electronic color code is used to indicate the values or ratings of electronic components, usually for resistors, but also for capacitors, inductors, and others. A separate code, the 25-pair color code, is used to identify wires in some telecommunications cables. The electronic color code was developed in the early 1920s by the Radio Manufacturers Association (now part of Electronic Industries Alliance[1] (EIA)), and was published as EIA-RS-279. The current international standard is IEC 60062.[2] published by International Electro technical Commission. Color bands were used because they were easily and cheaply printed on tiny components. However, there were drawbacks, especially for color blind people. Overheating of a component or dirt accumulation, may make it impossible to distinguish brown from red or orange. Advances in printing technology have now made printed numbers practical on small components. Where passive components come in surface mount packages, their values will be identified with printed alphanumeric codes instead of a color code.



To distinguish left from right there is a gap between the C and D bands.

- Band **A** is the first significant figure of component value (left side)
- Band **B** is the second significant figure (some precision resistors have a third significant figure, and thus five bands).
- Band **C** is the decimal multiplier
- Band **D** if present, indicates tolerance of value in percent (no band means 20%)

Chapter-8

Variable Resistor

8.1:Introduction:

The resistor is one of the most diverse and easiest of all the electrical components you will find in your average radio or TV set. This is because it has been around for many years and plays such a vital role that it will continue to in many new shapes and sizes to come. Today there are many different resistors in circulation, all of which will be explained shortly but for now let's go over some of the most important details.

The variable resistor is a very important component that is found in many electrical for such things as tone and bass controls as well as volume. This is due to the fact that resistors can be joined together with other components to form filters for a desired levels. They can also be found in computer monitors for color or positioning as well as the dimming switch for your lamps.

This is done through digital to analog and analog to digital circuits, one great advantage to this is that you are able to turn a knob instead of typing a value in every time you want to change the tint or brightness.

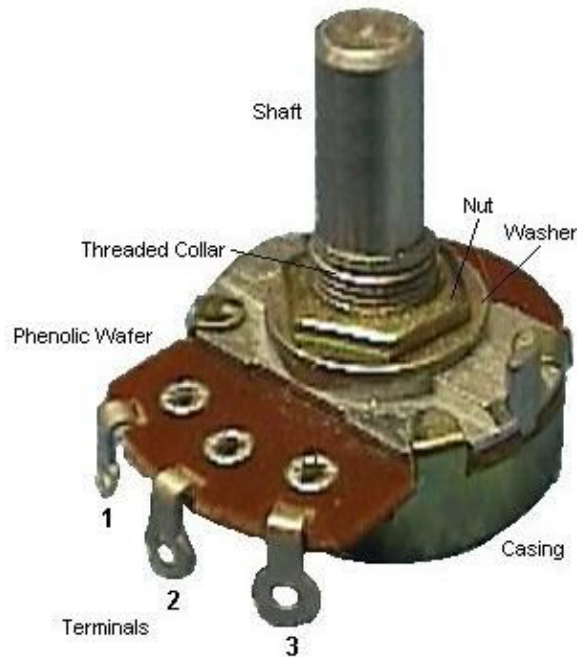


Fig8.1: Variable Resistor

The schematic for the variable resistor has stayed the same for quite some time and can be seen at the illustration to the upper right. As you see it looks somewhat like a typical resistor but is an arrow coming out from one side pointing to the center of the resistor. For more details on such questions like How does it work? How do I use it?

8.2: What is variable register? :

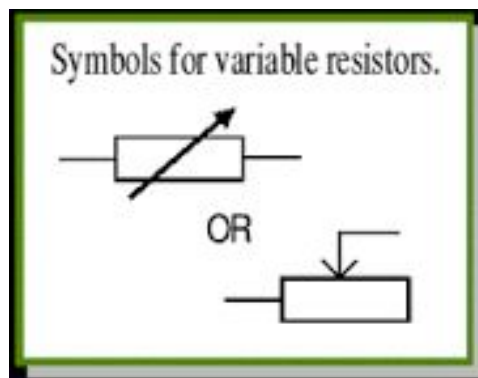


Fig8.2: Structure of Variable Resistor

A resistor restricts current flow in an electrical circuit without switching the current off. A variable resistor allows more control over current flow by changing the amount of resistance. When resistance increases in a variable resistor, the amount of current that is allowed to flow in a circuit decreases. Two basic components make up variable resistors. The resistive material is the first component and is called the element. The second component, called the wiper or brush, is used to set the resistance, and is often controlled with a knob or sliding switch.

8.3: Types of resistor: There are basically two types of resistors.

- (1) Fixed resistors
- (2) Variable resistors

FIXED TYPE:

Fixed resistors are classified into 4 types based on various factors like manufacturing style, resistance range, power rating etc.

The four types of fixed resistors are

- 1) Carbon composition
- 2) Carbon film
- 3) Metal film (again classified into thick film resistors and thin film resistors)
- 4) Wire wound-which consists of power style type and precision style type

VARIABLE TYPES:

They are used in electronic circuits to adjust the value of voltages and currents. Ex. They are used in televisions as volume control, brightness control etc. There are three types of variable resistors. They are

- 1) Potentiometer-classified into carbon potentiometer and wire wound potentiometer
- 2) Rheostat
- 3) Trimmer

Wire-wound, carbon compound, metal strip, and in modern times, the silicon transistors in linear region are used as resistors.

8.4: Circuit Diagram:

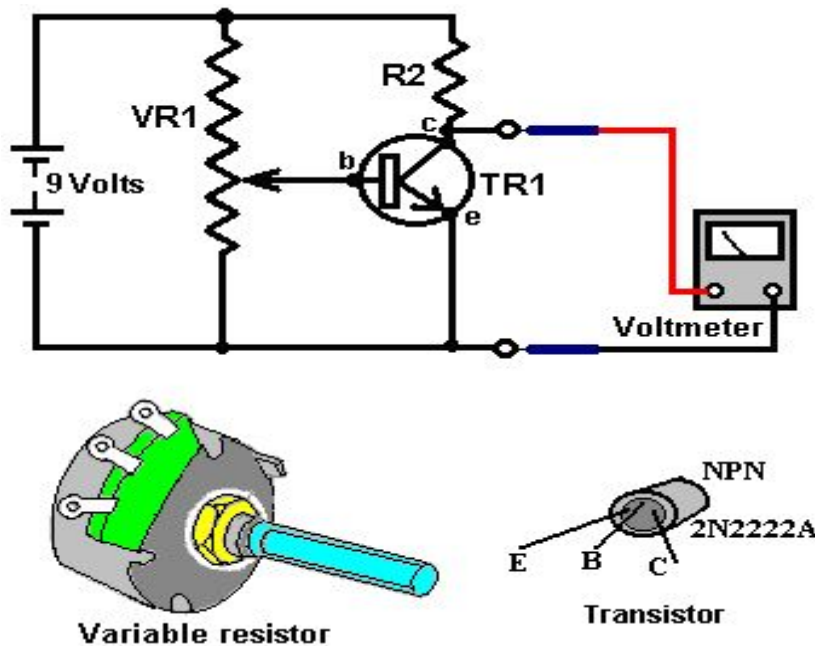


Fig.8.3: Variable register Circuit Diagram

8.5: Working of variable register:

As shown in the diagram below, a variable resistor consists of a track which provides the resistance path. Two terminals of the device are connected to both the ends of the track. The third terminal is connected to a wiper that decides the motion of the track. The motion of the wiper through the track helps in increasing and decreasing the resistance.

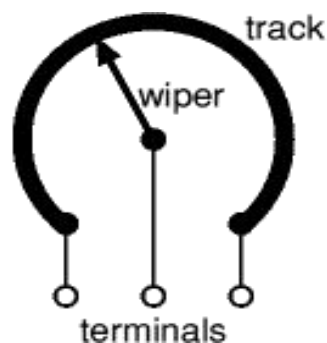


Fig8.4: Variable Resistors

The track is usually made of a mixture of ceramic and metal or can be made of carbon as well. As a resistive material is needed, carbon film type variable resistors are mostly used. They find applications in radio receiver circuits, audio amplifier circuits and TV receivers. For applications of small resistances, the resistance track may just be a coil of wire. The track can be in both the rotary as well as straight versions. In a rotary track some of them may include a switch. The switch will have an operating shaft which can be easily moved in the axial direction with one of its ends moving from the body of variable resistor switch.

The rotary track resistor with has two applications. One is to change the resistance. The switch mechanism is used for the electric contact and non-contact by on/off operation of the switch. There are switch mechanism variable resistors with annular cross-section which are used for the control of equipment's. Even more components are added onto this type of a variable resistor so as to make them compatible for complicated electronic circuits. A high-voltage variable resistor such as a focus pack is an example. This device is capable of producing a variable focus voltage as well as a screen voltage. It is also connected to a variable resistance circuit and also a fixed resistance circuit [bleeder resistor] to bring a change in the applied voltage. For this both the fixed and variable resistor are connected in series.

A track made in a straight path is called a slider. As the position of a slider cannot be seen or confirmed according to the adjustment of resistance, a stopping mechanism is usually included to prevent the hazards caused due to over rotation.

Chapter-9

Program

9.1 Introduction

A program is a set of instructions that tell the computer to do various things; sometimes the instruction it has to perform depends on what happened when it performed a previous instruction. This section gives an overview of the two main ways in which you can give these instructions, or “commands” as they are usually called. One way uses an *interpreter*, the other a *compiler*. As human languages are too difficult for a computer to understand in an unambiguous way, commands are usually written in one or other languages specially designed for the purpose.

Simple programs that says hello world of the computer are among the very basic of programming languages while there are many different types of programming languages. They all have general concepts to write a program

A program is like a recipe. It contains a list of ingredients (called variables) and a list of directions (called statement) that tell the computer what to do with the variables. The variables can represent numeric data text or graphical images.

There are many programming languages -- C, C++, Pascal, BASIC, FORTRAN, COBOL, and LISP are just a few.

These are all high-level languages. One can also write programs in *low-level languages* called assembly languages, although this is more difficult. Low-level languages are closer to the language used by a computer, while high-level languages are closer to human language.

9.2: Instructions:

An instruction set, or instruction set architecture (ISA), is the part of the computer architecture related to programming, including the native data types, instructions, registers, addressing modes, memory architecture, interrupt and exception handling, and external I/O. An ISA includes a specification of the set of opcodes (machine language), and the native commands implemented by a particular processor.

An instruction is an order given to a computer processor by a computer program. At the lowest level, each instruction is a sequence of 0s and 1s that describes a physical operation the computer is to perform (such as "Add") and, depending on the particular instruction type, the specification of special storage areas called registers that may contain data to be used in carrying out the instruction, or the location in computer memory of data.

In a computer's assembler language, each language statement generally corresponds to a single processor instruction. In high-level languages, a language statement generally results (after program compilation) in multiple processor instructions.

In assembler language, a macro instruction is one that, during processing by the assembler program, expands to become multiple instructions (based on a previously coded macro definition).

9.3: Calculation and programming:

Since we know that the microcontroller function based on programming interface, so if we use it according to our application must follow its language, so prepared our programming language with C.

Now we use the software for write the program

```
#define FLAME_SENSOR 7 //connect FLAME_SENSOR to digital pin7

#define LED 13//connect Grove - LED to pin2

#include <LiquidCrystal.h>

intmqx_analogPin = A0; // connected to the output pin of MQ-X

LiquidCrystallcd(12, 11, 5, 4, 3, 2);

void setup(){
pinsInit();
lcd.begin(16, 2);

    // Print a message to the LCD.

lcd.print("CO ppm");
}

void loop()
{
    // give ample warmup time for readings to stabilize

intmqx_value = analogRead(mqx_analogPin);

lcd.setCursor(0, 1);

lcd.print(mqx_value);

    delay(100); //Just here to slow down the output.

if(isFlameDetected() || mqx_value >= 910)

    turnOnLED();
```

```

else turnOffLED();
+
    digitalWrite(LED,LOW);
}
booleanisFlameDetected()
{
    if(digitalRead(FLAME_SENSOR))
        return false;
    else return true;
}

```

9.4: Simulation:

Simulation software is based on the process of modeling a real phenomenon with a set of mathematical formulas. It is, essentially, a program that allows the user to observe an operation through.

After programmed look for simulation, that our made program work properly, before simulation run this program in microcontroller with machine device software to hardware.

Chapter-10

Component Data Sheet

10.1 Data Sheet:

SL No.	Components	Code/Value	Quantity
1	Arduino UNO		1Pcs
2	16*2 LCD Display		1 Pcs
3	Grove Flame sensor		1 Pcs
4	Carbon-Monoxide sensor (MQ-7)		1 Pcs

5	Breadboard		1 Pcs
6	Variable resistor		1 Pcs
7	M2M wire		30 Pcs
8	Resistor	(220Ω,110KΩ)	2Pcs
9	Wooden sheet		1 Pcs
10	Glues		1 Pcs
11	Foam tape		1 Pcs
12	Multi-meter		1 Pcs
13	Soldering Iron & Wire		1 Pcs

Table: 8.1: Data Sheet for Project

10.2: Price List:

Components	Code/Value	Quantity	Unit Price	Estimated Cost
Arduino UNO		1Pcs		900.00
16*2 LCD Display		6 Pcs		485.00
Grove Flame sensor		6 Pcs		192.00
Carbon-Monoxide sensor (MQ-7)		4 Pcs		502.00
Breadboard		1 Pcs	200	200.00
Variable resistor		1 Pcs	75	75.00
M2M Connecting		1 Pcs	60	60.00

wire				
Resistor		1 Pcs	3	6.00
Wooden sheet		5 Pcs	40	200.00
Glues		1 Pcs	30	30.00
Foam tape	(9V,6F22)	1 Pcs	40	40.00
Multi-meter		1 Pcs	180	180.00
Others				200.00
Total=				3070.00
In word: Three Thousand Seventy Taka Only.				

Table: 8.3: Price List for project

Chapter-11

Advantages and Disadvantage

11.1: Advantage & Disadvantage of Flame Detector:

Advantage:

Flame ionization detectors are used very widely in gas chromatography because of a number of advantages.

- Cost: Flame ionization detectors are relatively inexpensive to acquire and operate.

- Low maintenance requirements: Apart from cleaning or replacing the FID jet, these detectors require no maintenance.
- Rugged construction: FIDs are relatively resistant to misuse.
- Linearity and detection ranges: FIDs can measure organic substance concentration at very low and very high levels, having a linear response of 10^6 .

Disadvantage:

Flame ionization detectors cannot detect inorganic substances. In some systems, CO and CO₂ can be detected in the FID using a methanizer, which is a bed of Ni catalyst that reduces CO and CO₂ to methane, which can be in turn detected by the FID.

Another important disadvantage is that the FID flame oxidizes all compounds that pass through it; all hydrocarbons and oxygenates are oxidized to carbon dioxide and water and other heteroatom's are oxidized according to thermodynamics. For this reason, FIDs tend to be the last in a detector train and also cannot be used for preparatory work.

11.2: Advantage & Disadvantage of Natural Gas:

Advantage:

1. Less Harmful than Coal or Oil: As compared to petroleum or coal, natural gas causes less damage to the environment. It is made up of methane and results in less carbon emissions. In fact emissions of carbon dioxide are 45% lesser than other conventional fuels and 30% less than oil.

2. Easy Storage and Transport: Natural gas is easier to preserve than other fuels. It can be stored and transported through pipelines, small storage units, cylinders or tankers on land and sea.

3. Residential Use: Natural gas can be piped into houses for heating and cooking purposes and running a variety of appliances. Where there are no pipes, it can be supplied in small tanks.

4. Vehicle Fuel: Natural gas can be used as a fuel for vehicles (cars, trucks, jet engines). It is a cleaner, cheaper fuel than diesel or gasoline.

5. Burns Cleaner: Natural gas burns cleaner without leaving any smell, ash or smoke.

6. Instant energy: Natural gas is an economic and instant fuel for heating water and large areas as well as cooking. It is ideal because it provides precise control and quick results. It helps in oven cooking as it does not require pre-heating.

7. Precision in Kitchen: Natural gas is the best fuel to power kitchens because of its control, reliability and precision. A gas flame provides for precise temperature control and variety of heat settings allowing shift from hot to cold or vice versa, with the turning of the knob.

8. Industrial use: Natural gas is used for producing hydrogen, ammonia for fertilizers and some paints and plastics.

Disadvantage of Natural Gas:

1. Toxic and Flammable: Leaks of natural gas are tremendously dangerous. Such leaks may cause explosions or fire. When inhaled, the gas is highly toxic. The main danger is that it is odorless and leaks cannot be detected unless some odorant has been added to the gas. It is for this reason that LPG (residentially used gas) is suffused with odorants, that in the event of a leak, detection is easy and appropriate actions can be taken. In the case of an underground leak, we are helpless as odorant becomes weaker and the gas leak goes undetected.

2. Damage to Environment: Burning of natural gas also releases carbon dioxide, carbon monoxide and other carbon compounds which are greenhouse gases that cause global warming and climate change. Even though it is cleaner than oil or coal as far as its by products are concerned, leakage of natural gas can be have serious consequences as methane is more toxic than carbon dioxide.

3. Complex Processing: For use as fuel, except for methane, all other constituents of natural gas have to be extracted. Processing results in many byproducts: hydrocarbons (propane, ethane etc.), sulfur, water, helium, nitrogen, and carbon dioxide.

4. Non-Renewable: Like all fossil fuels, natural gas though found in abundance is non-renewable and hence likely to be exhausted at some point of time. It is not a long term solution to our energy problems.

5. Expensive Installation: The infrastructure for natural gas production and distribution is fairly expensive. This includes separate plumbing systems and specialized tanks.

6. Inefficiency in Transportation: Natural gas when used as a fuel in vehicles provides less mileage than gasoline. In spite of disadvantages, the entire process of producing, transporting and making use of natural gas provides an energy efficiency which is best among all fossil fuels. It proves to be less harmful to environment when it comes to pollution. It may not last forever but as of today it is the most popular energy source.

Chapter-12

Conclusion

12.1: Character:

- * Good sensitivity to Combustible gas in wide range
- * High sensitivity to Natural gas
- * Long life and low cost
- * Simple drive circuit

12.2: Application:

- * Domestic gas leakage detector
- * Industrial CO detector
- * Portable gas detector

12.3: Discussions

12.3.1: Gas Detector:

One of the by-products of most forms of combustion is the gas Carbon Monoxide (CO). This colorless, odorless, tasteless and highly toxic gas is produced by incomplete combustion of carbon containing compounds.

Carbon monoxide fire detectors are generally suitable for a broad range of applications where the use of traditional fixed point heat or smoke detectors may be impractical due to the presence of deceptive phenomena.

Carbon monoxide fire detectors comprise an electronic circuit and an electrochemical cell that produces a small electrical current in the presence of carbon monoxide. The electronic circuit is calibrated to a normal range of atmospheric carbon monoxide. When the concentration of carbon monoxide increases the current produced by the cell also increases which in turn creates an alarm signal.

Carbon monoxide fire detectors have a relatively short life span 5-10 years and should be maintained strictly in accordance with the manufacturer's recommendation for optimal perform.

12.3.2: Flame Detector:

Flame detectors respond to the production of one or a combination of ultra-violet or infrared spectrums of electromagnetic radiation. These detectors are often used in situations where there is a potential for the rapid development of fire such as flammable liquids. These detectors comprise an electronic circuit with an electromagnetic radiation receiver. Flame

detectors are actuated when they receive electromagnetic radiation from one or more defined wave lengths are received according to their design in the ultra-violet or infrared spectrum.

One of the methods to improve the performance of flame detectors and reduce the effect of deceptive phenomena and false alarms has been to combine both ultra-violet and infra-red technologies into the one system and two or three separate wavelengths in the infrared spectrum. Multi-sensor fire detectors Over the last 20 years there has been a dramatic improvement in the ability of manufacturers to incorporate two or more of the technologies discussed this article, This combination of technologies has occurred to; (1) improve the performance of an existing method of fire detection; and (2) in some cases to reduce or eliminate the effect of deceptive phenomena causing false alarms. Multi-sensor detectors are not a panacea and must operate according to their approval. The combination of multiple sensors using clever algorithms that may suppress short term deceptive phenomena.

12.4: conclusion

All gratitude to our project supervisor **Engineer Md. Mahmudur Rahman (Senior Lecturer)** Department Of EEE Daffodil International University for his valuable suggestions and guidance throughout this project work. He always help to our working day in electronic lab and find our project fault. Finally he advice how made the project. We are grateful to our Honorable Vice-Chancellor, **Professor Dr. Md. Lutfar Rahman, Daffodil International University** for providing golden opportunity for achieving our degree of B.Sc.in Electrical and Electronic Engineering and his best Co-Operation.

We are grateful to **Prof. Dr. Samsul Alam**, and Dean, Faculty of **Eng. Dr. Fayzur rahman**, Head, Department of Electrical and Electronic Engineering (EEE), **Daffodil International University** for his valuable suggestions.

Successful completion of the project report a special mention goes to those who directly or indirectly helped for work.

12.5: Recommendation: If this project is manufactured commercially then the price will be reduced.

Chapter-13

Reference

(1) <http://en.wikipedia.org/wiki/Arduino>

(2) www.fut-electronics.com/wp-content/.../fe.../Flame-sensor-arduino.pdf

- (3) <http://playground.arduino.cc/Main/MQGasSensors>**
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- (5) <https://www.sparkfun.com/products/9403>**
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