

GAS LEAKAGE DETECTOR

The project report submitted to

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LIST OF ABBREVIATIONS

In alphanumeric order

ADC	Analog to Digital Convertor
CMOS	Complementary Metal Oxide Semiconductor
GSM	Global System for Mobile
IC	Integrated Circuit
LCD	Liquid Crystal Display
LNG	Liquified Natural Gas
LPG	Liquified petroleum Gas
MOS	Metal Oxide Semiconductor
PCB	Printed Circuit Board
PPM	Parts per Million
VAC	Volts Alternating current
VDC	Volts Direct Current

ABSTRACT

This report gives an insight into the whole processed by us in our 3rd Semester. LPG gas detection projects main idea is to implement security system for detecting leakage of gas in closed environment. In this project gas leakage is identified by using sensors which works. only in closed environment. In present situation there are many cases related to gas leakage which causes innocent people lives and property damage. Implementing this application can be useful for companies, houses, which can save lives of people.

The presence of dangerous LPG leakage in the cars, service station or in the storage tank environment can be detected using the Ideal Gas Sensor. This unit can be easily integrated into a unit that can sound an alarm or give a visual suggestion of the LPG concentration. The sensor has both admirable sensitivity and rapid response time. This sensor can also be used to sense other gases like ISO-butane, propane, LNG and even cigarette smoke.

The output of the sensor goes LOW as soon as the LPG sensor senses any gas leakage from the storage. This is detected by the microcontroller and the LED & buzzer is turned ON.

INTRODUCTION

WHAT IS L.P.G.

LPG stands for "**Liquefied Petroleum Gas**" and the term is used to describe two Natural **Gas** Liquids: propane and butane, or a mix of the two. LPG is a portable, clean and efficient energy source which is readily available to consumers around the world. LPG is primarily obtained from natural gas and oil production but is also produced increasingly from renewable sources. Its unique properties make it a versatile energy source which can be used in more than 1,000 different applications.

HOW L.P.G. IS MADE:

LPG is prepared by refining petroleum or "wet" natural gas, and is almost entirely derived from fossil fuel sources, being manufactured during the refining of petroleum (crude oil), or extracted from petroleum or natural gas streams as they emerge from the ground. It was first produced in 1910 by Dr. Walter Snelling, and the first commercial products appeared in 1912. It currently provides about 3% of all energy consumed, and burns relatively cleanly with no soot and very few sulphur emissions.

LPG gas is supplied in pressurized steel cylinders. As this gas is heavier than air, when it leaks from a cylinder it flows along floor and tends to settle in low spots such as a basement. This can cause fire or suffocation if not dealt with. Here is a circuit that detects the leakage of LPG gas and alerts the user through audio-visual indications.

This LPG Gas Sensor (MQ6), ideal sensor for use to detect the presence of a dangerous Liquefied petroleum gas (LPG) and it has high sensitivity to propane, butane, isobutene, natural gas. The sensor can also be used to detect combustible gases, especially methane. This circuit can detect leakages in your Home, car or in a service station, storage tank environment. This unit can be easily implemented to industrial level by upgrading its ranges.

This project is designed to detect the LPG from 200parts per million (PPM) to 10,000 PPM. Whenever there is LPG concentration of 1000 ppm (parts per million) in the area, the OUT pin of the sensor module

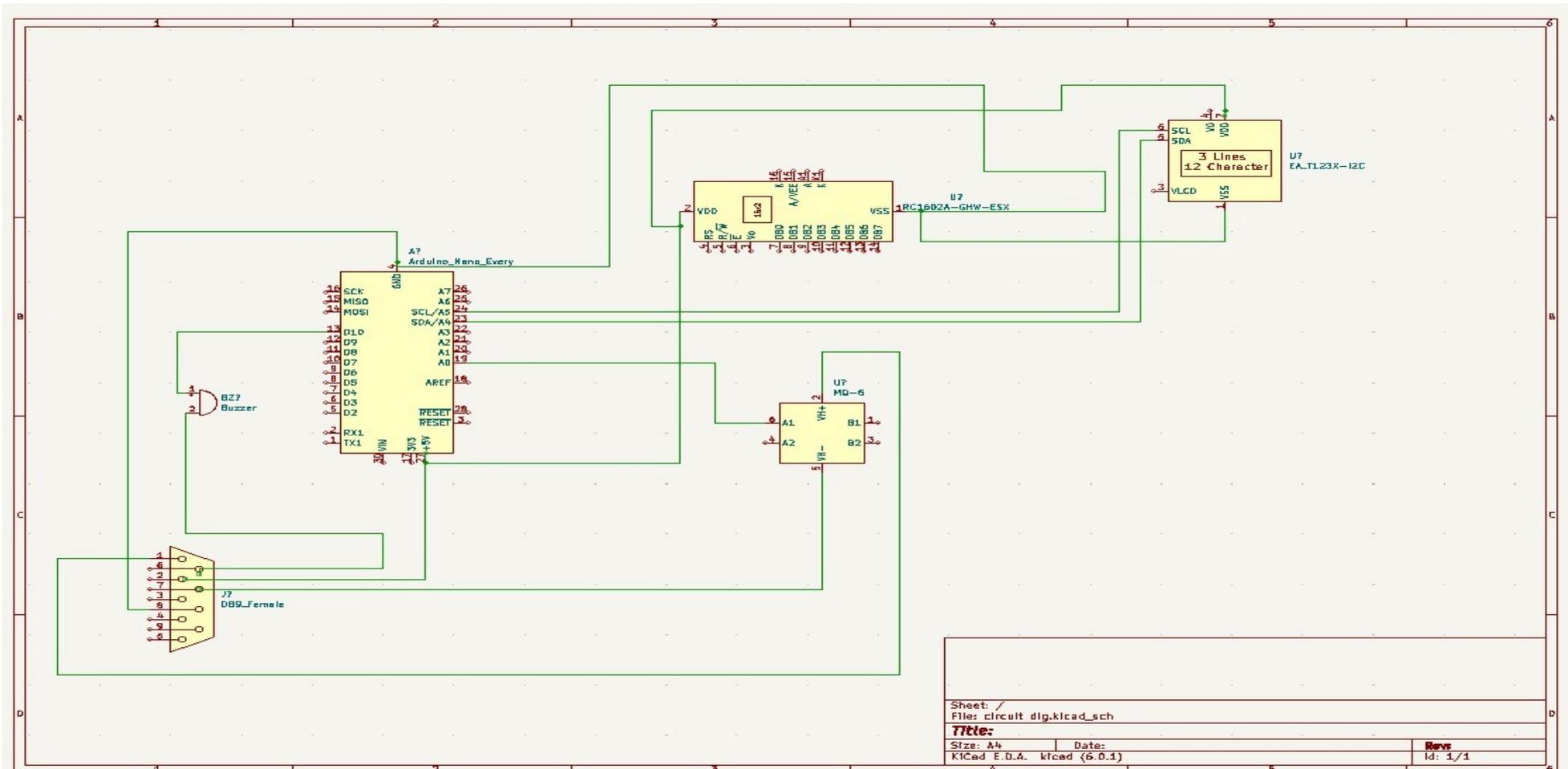
goes high.

LPG gas detection projects main idea is to implement security system for detecting leakage of gas in closed environment. In this project gas leakage is identified by using sensors which works. only in closed environment. In present situation there are manycases related to gas leakage which causes innocent people lives and property damage. Implementing this application can be useful for companies, houses, which can save lives of people.

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CIRCUIT DIGRAM



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Title:			
Size: A4	Date:	Rev:	
KiCad E.D.A. kicad (6.0.1)		Id: 1/1	

Fig. no. 1

BLOCK DIGRAM

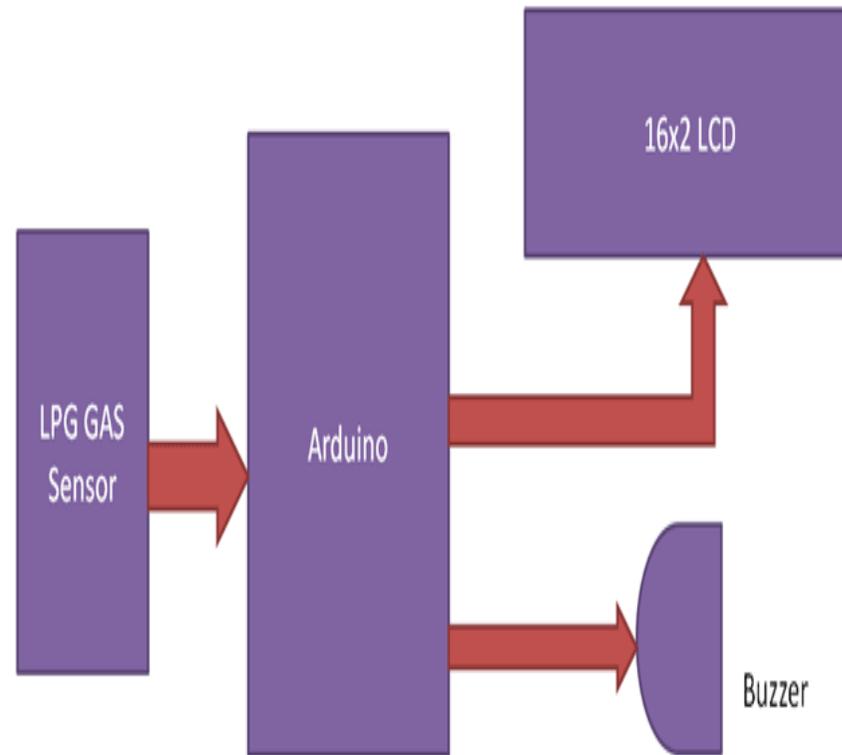


Fig. no.2

DETAILS OF COMPONENTS

1. ARDUINO NANO
2. 16X2 LCD DISPLAY
3. 5V 1A AC TO DC ADAPTER
4. MQ6 SENSOR
5. BUZZER
6. CONNECTING WIRES

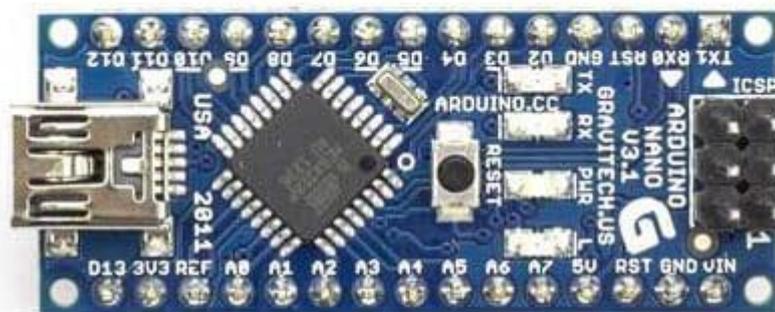
ARDUINO NANO

Arduino boards are introduced for non-tech people who struggle to make heavy electronic circuits with a constant worry to put all wires and components in place. These units are a remarkable addition to the electronic industry as they are easy to learn and easy to integrate into a variety of electronic projects. Everything is combined inside a single package and you can simply plug the device into the computer and start playing with it. All you need to learn is coding – to program the board and you're good to design, develop and modify electronic projects on the go.

What is Arduino Nano?

Arduino Nano is a small, compatible open-source electronic development board based on an 8-bit AVR microcontroller. Two versions of this board are available, one is based on ATmega328p, and the other on Atmega168.

Arduino Nano can perform some functions similar to other boards available in the market, however, it is smaller in size and is a right match for projects requiring less memory space and fewer GPIO pins to connect with.



Arduino Nano

This unit features 14 digital pins which you can use to connect with external components, while 6 analog pins of 10-bit resolution each, 2 reset pins, and 6 power pins are integrated on the board.

Like other Arduino boards, the operating voltage of this device is 5V, while input voltage ranges between 6V to 20V while the recommended input voltage ranges from 7V to 12V.

The clock frequency of this unit is 16MHz which is used to generate a clock of a certain frequency using constant voltage.

The board supports a USB interface and it uses a mini USB port, unlike most Arduino boards that use the standard USB port. And there is no DC power jack included in this unit i.e. you cannot power the board from an external power supply.

Plus, this device is bread-board friendly in nature means you can connect this unit with breadboards and make a range of electronic projects.

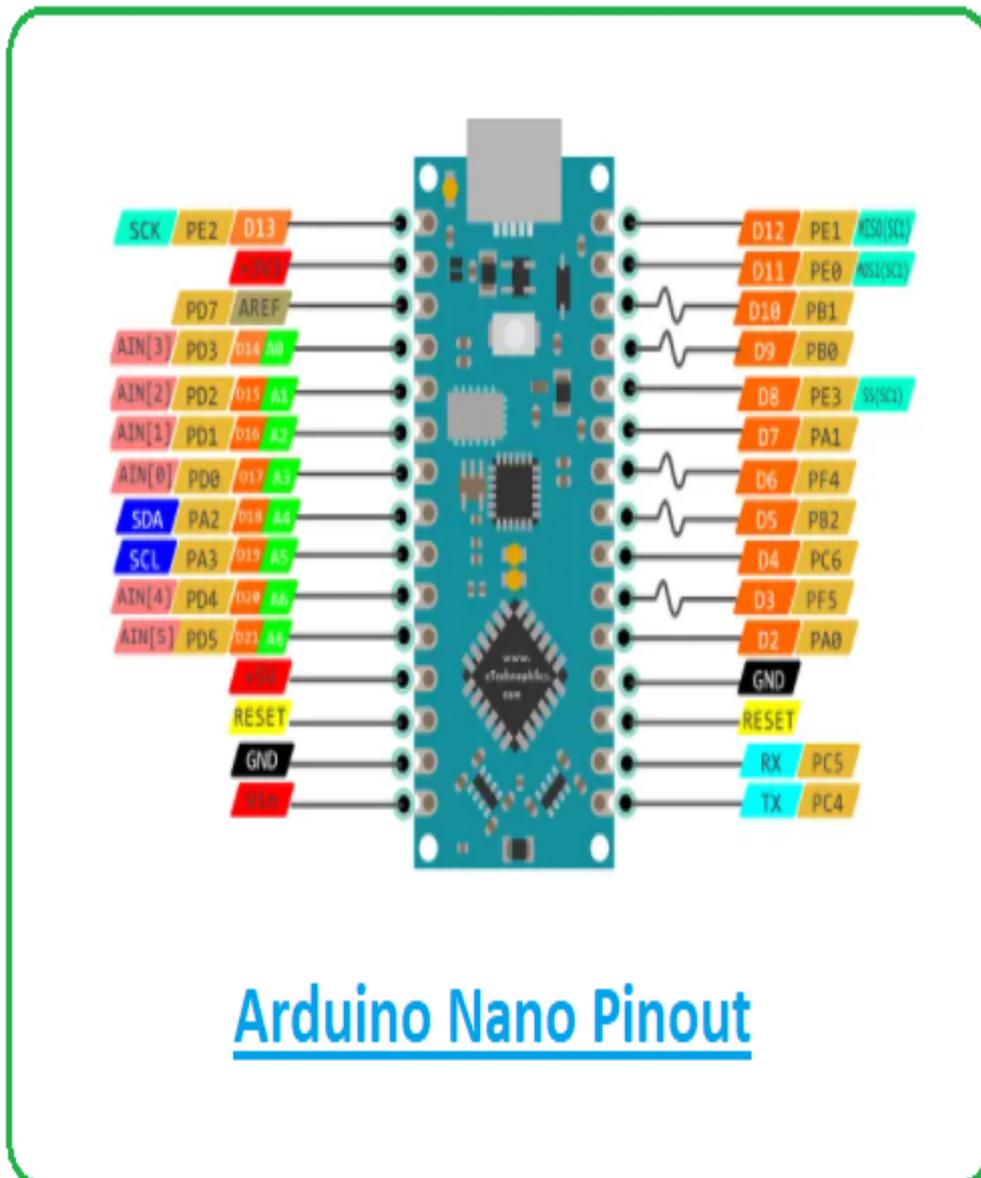
The flash memory is used to store the program and the flash memory of Atmega168 is 16KB (of which 2KB is used for the Bootloader) and the flash memory of Atmega328 is 32KB.

Similarly, the EEPROM is 512KB and 1KB, and SRAM is 1KB and 2KB for Atmega168 and Atmega328 respectively.

The Nano board is almost similar to the UNO board with the former smaller in size with no DC power jack.

Arduino Nano Pinout

The following figure shows the pinout diagram of the Arduino Nano board.



Arduino Nano Pin Description

In this section, we'll cover the Arduino Nano Pinout, we will discuss pin description of each pin integrated on the board.

Digital Pins: There are 14 digital pins on board which is used to connect external component.

Analog Pins: 6 analog pins on board that is used to measure voltage in a range from 0 to 5V.

LED: The unit comes with a built-in LED connected to pin 13 on the board.

VIN: This is an input voltage to the Arduino board when using an external power source (6-12V).

3.3V: It is a minimum voltage produced by the voltage regulator on the board.

5V: Regulated power supply used to power up the controller and other components on board.

AREF: It is an Analog Reference that is applied to the unit as a reference voltage from an external power supply.

GND: Two ground pins are available on the board.

Reset: Two reset pins are integrated on the board. These pins are used to reset the controller internally through software.

External Interrupts: Pin 2 and 3 are used to trigger external interrupts. These pins are used in case of emergency.

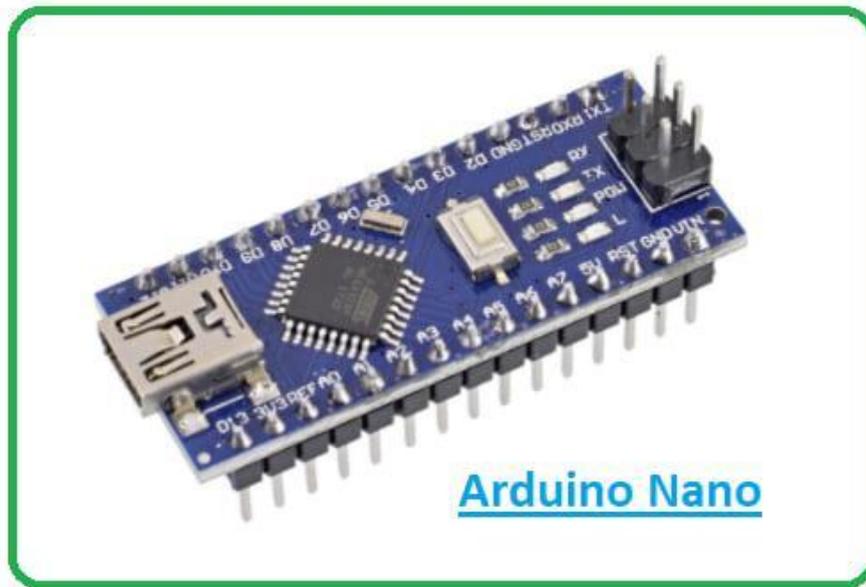
USART: The board supports USART serial communication that carries two pins i.e. Rx which is used for receiving the serial data and Tx which is a transmission pin used to transmit serial data.

I2C: The unit comes with an I2C communication protocol where two pins SDA and SCL are used to support this communication. SDA is a serial data line that carries the data while SCL is a serial clock line used for data synchronization between the devices on the I2C bus. The Wire Library of Arduino Software can be accessed to use the I2C bus.

SPI: The device also supports SPI (serial peripheral interface) communication protocol where four pins (SS, MISO, MOSI, SCK) are used for this communication. This protocol is used to transfer data between the microcontroller and other peripheral devices.

How to Program Arduino Nano

All Arduino boards can be programmed using **Arduino IDE** (Integrated Development Environment) Software – An official software introduced by Arduino. cc. All you need is a code to burn into the board to make it work as per the instructions fed into the board.



Plus, the board features a built-in Bootloader which sets you free from getting an external burner to burn the Arduino program. The unit supports a USB interface with a mini USB port. The USB cable is used to connect the board with the computer.

Arduino Nano Applications

The best thing about Arduino boards is they can work as a stand-alone project or as a part of other electronic projects. You can interface Arduino Nano with other Arduino boards and Raspberry Pi boards. No technical expertise is required to use Arduino boards and anyone with little to no technical knowledge can make amazing projects with these units.

The following are the main applications of Arduino Nano Board.

- Medical Instruments
- GSM Based Projects
- Embedded Systems
- Arduino Metal Detector
- Industrial Automation
- Android Applications
- Virtual Reality Applications
- Real-Time Face Detection
- Automation and Robotics

LCD DISPLAY (16 x 2)

DISPLAY:

Various display device such as seven segment display. LCD display, etc can be interfaced with microcontroller to read the output directly. In our project we use a two line LCD display with 16 characters each.

LCD:

Liquid crystal Display (LCD) displays temperature of the measured element, which is calculated by the microcontroller. CMOS technology makes the device ideal for application in hand held, portable and other battery instruction with low power consumption.

GENERAL SPECIFICATION:

- Drive method: 1/16 duty cycle
- Display size: 16 character * 2 lines
- Character structure: 5*8 dots.
- Display data RAM: 80 characters (80*8 bits)
- Character generate ROM: 192 characters
- Character generate RAM: 8 characters (64*8 bits)
- Both display data and character generator RAMs can be read from MPU.
- Internal automatic reset circuit at power ON.
- Built in oscillator circuit.

Net Media 2x16 Serial LCD Display Module

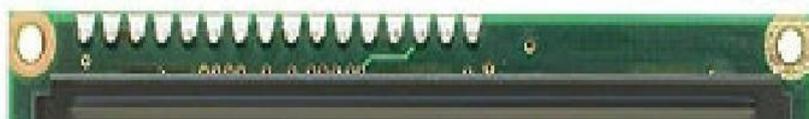


Fig – LCD Display

PIN Configuration

JP1/JP14 Pins 1 – 8	Description	JP1/JP14 Pins 9 -16	Description
Pin1	Ground	Pin9	D2 (Not Used)
Pin2	VCC (+5)	Pin10	D3 (Not Used)
Pin3	Contrast	Pin11	D4
Pin4	Data/Command (R/S)	Pin12	D5
Pin5	Read/Write (W)	Pin13	D6
Pin6	Enable (E1)	Pin14	D7
Pin7	D0 (Not Used)	Pin15	VCC (LEDSV+)
Pin8	D1 (Not Used)	Pin16	Ground

Table no. 1

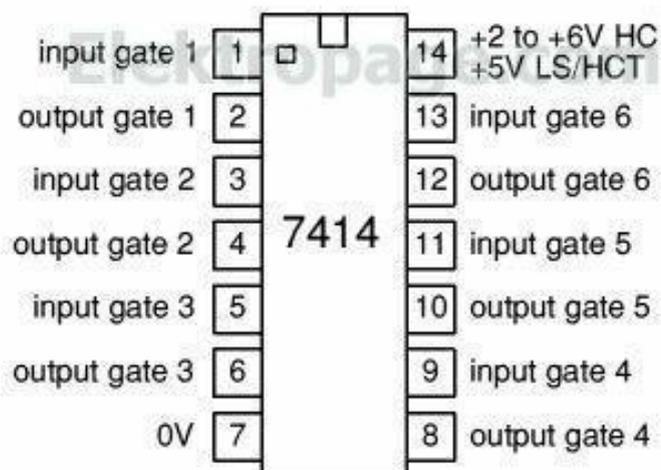
IC 7414

Fig. no. 14

An Inverter aka NOT gate is a fundamental block in Logic Design for Digital Circuits. Its purpose is to invert the signal. So,

- if input is Low (Logic 0), then the output will be High (Logic 1).
- if the input is High (Logic 1), then the output will be Low (Logic 0)

An example of an application is using it to Counting the number of 0's. When using half adders block to add inputs, it cannot add zeros, since $0 + 0 = 0$; So we want to invert them in order to quantify them. Now there are many applications and ways to use inverters.

Some important electrical characteristics are the Logic High. What is it capable of transmitting for Logic 1?

Some chips transmit signals **Low = 0 V, and High = 3.3V** whereas others transmit **Low**

= 0V and High = 5V (not to say these are the only types that exist) So understanding the signal transmission of LOW Level VOLVOL and HIGH Level VOHVOH capability is highly essential. It looks like this particular IC works with signals roughly around 0-3.3V. Don't get me wrong though, all electrical characteristics are there for a reason, and are essential in their own way.

5V 1A AC TO DC ADAPTER



An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Other common names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, power brick, wall charger, and power adapter. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply.

External power supplies are used both with equipment with no other source of power and with battery-powered equipment, where the supply, when plugged in, can sometimes charge the battery in addition to powering the equipment.

Use of an external power supply allows portability of equipment powered either by mains or battery without the added bulk of internal power components, and makes it unnecessary to produce equipment for use only with a specified power source; the same device can be powered from 120 VAC or 230 VAC mains, vehicle or aircraft battery by using a different adapter. Another advantage of these designs can be increased safety; since the hazardous 120 or 240 volt mains power is transformed to a lower, safer voltage at the wall outlet and the appliance that is handled by the user is powered by this lower voltage.

5 Volt 1 Amp Power Adapter takes an AC INPUT of 100-240V and gives 5V 1A DC output

Features:-

- Excellent Quality
- Short Circuit, Over Voltage & Over Current Protection
- Incredibly Low Fault Rates
- No Minimum Load
- This power supply is a regulated Center Positive power supply
- It's plug design is for Indian power socket so, no plug converter is required
- Compact size & light weight
- High Reliability
- Regulated Stable Voltage
- Good quality SMPS Based Adapter
- Stabilized Output, low ripple & low interference
- Single Output Voltage
- High Efficiency & low energy consumption

Specifications:-

- Input - 100-240 VAC 50/60Hz
- Category - Switch Mode Power Adaptor (SMPS)
- Output Type - DC
- Output - 5Volts 1Amp

GAS SENSOR



Gas sensor: MQ-6 Gives analogue output as per concentration of combustible gas in air. Used in gas leakage detecting equipment's for detecting of LPG, iso-butane, propane, LNG combustible gases. The sensor does not get trigger with the noise of alcohol, cooking fumes and cigarette smoke.

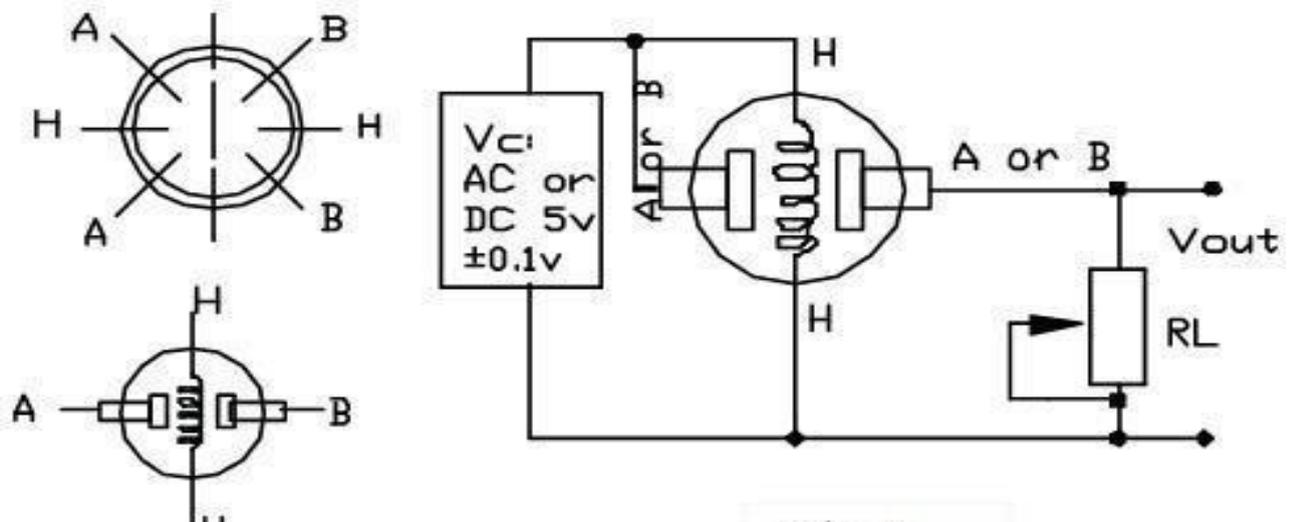
Introduction to GAS Sensors

A GAS sensor or a GAS Detector is a type of chemical sensor which detects/measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure in concentration. They are used in various industries ranging from medicine to aerospace. Various technologies are used to measure Gas concentration such as semiconductors, oxidation, catalytic, infrared, etc. The most common types are as follows

1. Metal Oxide Based GAS Sensor.
2. Capacitance Based GAS Sensor.
3. Acoustic Based GAS Sensor.
4. Calorimetric GAS Sensor.
5. Optical GAS Sensor.
6. Electrochemical GAS Sensor.

Over here we will focus on the most commonly available GAS sensor which is Metal Oxide Gas Sensor or Metal Oxide Semiconductor (MOS) also called as "Chemiresistors". The detection is based upon change of resistance of the sensing material when the Gas comes in contact with the material. These Metal Oxide Gas Sensor are extensively used in industry because of their low cost, flexibility in production; simplicity of their use; large number of detectable gases/possible application fields.

Various gas sensors are available in the market but the most commonly available series is the "**MQ Series**". Various gasses like, LPG, Carbon Monoxide (CO), Methane, Smoke, Alcohol, etc can be monitored using these sensors. A good thing about these series is that all are 6 pin sensors with same footprint, same interfacing circuit and are easily available at low cost



Applications

- Process control industries
- Environmental monitoring
- Boiler control
- Fire detection
- Alcohol breath tests
- Detection of harmful gases in mines
- Home safety
- Grading of agro-products like coffee and spices

Features

- High sensitivity
- Fast response
- Wide detection range
- Stable performance and long life
- Simple drive circuit

PCB (PRINTED CIRCUIT BOARD)

A **printed circuit board (PCB)** mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features fetched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes.

Alternatives to PCBs include wire wrap and point-to-point construction, both once popular but now rarely used. PCBs require additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Specialized CAD software is available to do much of the work of layout. Mass-producing circuits with PCBs is cheaper and faster than with other wiring methods, as components are mounted and wired in one operation. Large numbers of PCBs can be fabricated at the same time, and the layout only has to be done once. PCBs can also be made manually in small quantities, with reduced benefits.

PCBs can be single-sided (one copper layer), double-sided (two copper layers on both sides of one substrate layer), or multi-layer (outer and inner layers of copper, alternating with layers of substrate). Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components. The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper planes was concurrent with the adoption of surface mount technology. However, multilayer PCBs make repair, analysis, and field modification of circuits much more difficult and usually impractical.

BUZZER



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

Modern applications

While technological advancements have caused buzzers to be impractical and undesirable [citation needed], there are still instances in which buzzers and similar circuits may be used. Present day applications include:

- Novelty uses
- Judging panels
- Educational purposes
- Annunciator panels
- Electronic metronomes
- Game show lock-out device
- Microwave ovens and other household appliances
- Sporting events such as basketball games
- Electrical alarms
- Joy buzzer (mechanical buzzer used for pranks)

CONNECTING WIRES



Connecting wires allows an electrical current to travel from one point on a circuit to another, because electricity needs a medium through which to move. In the case of computers, wires are embedded into circuit boards, carrying pulses of electricity that are interpreted as binary signals of zeros and ones.

Most wires in computers and electronic components are made of copper or aluminum. Copper is cheap and electrically conductive. Silver has higher conductivity but is far more expensive.

In a basic circuit, the wire comes from one terminal of a power source, such as a battery. It then connects to a switch that determines whether the circuit is open or closed. The wire then connects to the device that is drawing power, allowing it to draw electricity and perform its task. Finally, the wire connects the load back to the opposite terminal of the power source.

Before a current can travel through the wire, the circuit has to be closed; in other words, there cannot be any breaks in the path. Electricity cannot easily travel through air, and if it does there is a risk of stray current leaking into the surroundings and causing damage or failing to power the appliance.

WORKING -

1. The proposed system uses an LPG gas sensor to sense LPG gas when LPG gas leakage occurs.
2. We have used an LPG gas sensor module to detect LPG Gas.
3. When LPG gas leakage occurs, it gives a HIGH pulse on its DO pin and Microcontroller always reads its DO pin.
4. When the Microcontroller board gets a HIGH pulse from a gas sensor then it displays a message LCD display and activates buzzer to generate beep sound.
5. When an LPG gas sensor gives a LOW pulse to Microcontroller board, then the display shows “no gas leakage” message.

ADVANTAGES :

- 1) Quick reaction from sensor.
- 2) Small sensitivity for MQ6 means alcohol sensor give additional feature in the system.
- 3) High sensitivity of LPG sensor
- 4) It is low of cost and Available in market easily.

DISADVANTAGES :

- 1) It works only when 5V power supply given.
- 2) Its sensitivity depends on Temperature and Humidity.

APPLICATIONS:

1. Home security.

2. Industrial security
3. Enhancement.
4. Automation
5. Car security
6. LPG storage

CONCLUSION

The purpose of this system is to provide safe, simple and cost effective LPG leakage detection system

While designing and developing this project we faced some problems & from that We learnt problem solving, decision making and troubleshooting.

This project also taught us how to execute a project and test it . We also learned about troubleshooting and debugging. This semester project gave us many things which will help us in future projects.

REFERENCES

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- <https://www.projectsof8051.com/low-cost-lpg-leakage-detector-with-buzzer-indication-using-microcontroller/>
- <https://www.youtube.com/watch?v=U6yFL52N5JA>
- <https://bit.ly/3Aoadx2>