

Gas Leakage Detection and Prevention using IOT

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Abstract – For the sake of lives safety and fulfilment of social duties, and keeping in focus the life-threatening instances of blasts and injuries due to leakage of gas in industries, vehicles and houses, a gas leakage system has been designed whereby application of embedded systems and involvement of Internet of things (IoT). The main objective of the work is designing micro controller based toxic gas detecting and alerting system. LPG is a significant and effective fuel, for the most part utilized as a part of private spots for cooking. LPG for the most part filled in cylinder which is solid and can't be harmed effortlessly. In any case, breaks may happen from gas cylinder, controller and gas pipe tube when these are definitely not in a decent condition and may cause a mishap. Mischance's may prompt medical problems like suffocation and potentially cause an impact on the start of any fire or electric supply. One of the important preventive methods to stop mischance related with the gas spillage is to introduce gas leakage detector at vulnerable places. The main focus of this paper is to present such an outline that can consequently identify and remove gas spillage in defenceless premises. The gas spill sensor is such a gadget which distinguishes the gas spills at beginning levels and cautions the individuals of the same. This paper fundamentally manages the advancement of a straightforward gas spill locator at the underlying stage and after that changing this basic gadget into a most progressive gas identifier framework later on. Gas sensors have been specifically utilized which has high affectability for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM (Worldwide System for versatile communication) module, which sends SMS as soon as gas leakage is detected. **Keywords:** Arduino, MQ-6 Gas Sensor, LCD, LPG, Stepper.

Keywords– Arduino , MQ-6 Gas Sensor, IOT, Wifi ESP8266, LCD, LPG, Servo Motor, Buzzer, GSM, Exhaust Fan.

I. INTRODUCTION

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented. The main objective of the work is designing microcontroller based toxic gas detecting and alerting system.

1. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation.
2. If the gases exceed the normal level then an alarm is generated immediately and also an alert message.
3. The LCD screen shows the current gas value, the system puts on the buzzer when the level of gas crosses the set limit and to outlet the gas exhaust fan gets on.
4. Embedded systems described as, 'a computer system with a dedicated function within a larger mechanical and electrical systems, often with real-time constraint', are being employed to detect the excess of gas in the marked environment.

5. A GSM module is used to send SMS to the user if gas leakage is detected and the status is displayed on an LCD.
6. The Node MCU carries out all the processing of the signal received from the MQ6gas sensor and activate the GSM module and LCD to inform the user.
7. Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity. These
8. systems do not require any human interaction and same is the case with IoT based gas leakage detection system, it does not require human attention.
9. This gas detection and alert system will not only alert us of the leakage but will also mechanically turn off the knob of the gas cylinder to seize any leakage of gas.
10. The app is designed for the purpose of intimating the user with the gas values as the values will be updated continuously in the app and to know the status of the system.

II. ARCHITECTURE

Power Supply Circuit

This circuit is made up of one 9V dc battery which supply

power to the node MCU and a 12 volt dc voltage supplied from a rectifier. The 9V is stepped down for the use of the MCU which in turn supplies the sensor, the fan and the buzzer.

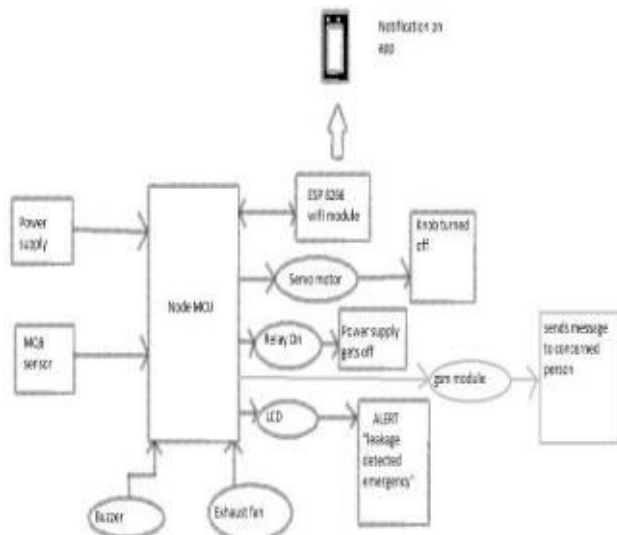


Fig.1.architecture.

Sensing Circuit

The sensing circuit consists of an MQ6 sensor MQ-6 which has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost & suitable for different application.

ESP8266 DESIGN

The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications. Flash memory attachable: 16MB max (512K normal). Analog to Digital: 1 input with 1024 step resolution.

GSM Transmit Circuit

We are be using SIM300 GSM Module in our Project. SIM300 is a Tri-band GSM/GPRS engine from SIMCOM Ltd.,that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900MHz. The physical interface between SIM300 and the mobile application is through a 60 pins board-to-board connector, which provides all hardware interfaces from module to customer's boards except the RF antenna interface.

THREAT AWARENESS AND MITIGATION CIRCUIT

This consists of the buzzer and the fan.

III.SYSTEM REQUIREMENT SPECIFICATION

A software requirements specification (SRS) is a comprehensive description of the intended purpose and environment for software under development. The SRS

fully describes what the software will do and how it will be expected to perform. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules.

The software requirements specification document enlists enough and necessary requirements that are required for the project development. To derive the requirements, we need to have clear and thorough understanding of the products to be developed or being developed. This is achieved and refined with detailed and continuous communications with the project team and customer till the completion of the software.

3.1Hardware Requirements

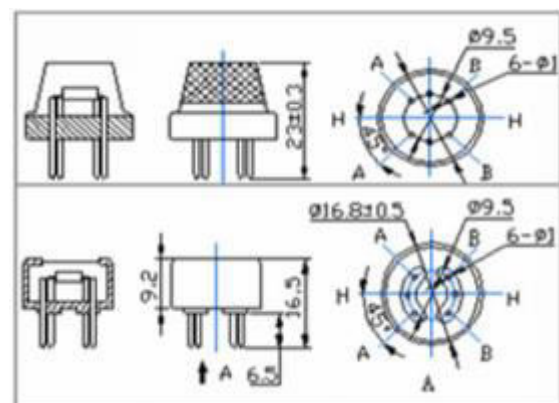
We use the following hardware requirements:

3.1.1 MQ6 Sensor

MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.



Fig.2.MQ6 Sensor.



To detect the LPG, MQ-6 gas sensor is employed. This sensor can be operated at +5V. The sensitivity of this sensor is very high and it has quick response time. It can LPG Gas Leakage Detection and Alert System detect the LPG concentration in the range of 200-10000ppm. The

gas sensing layer of this sensor is made of Tin Dioxide (SnO₂) and gold (Au) electrodes.

Character

- Good sensitivity to Combustible gas in wide range
- High sensitivity to Propane, Butane and LPG

- Long life and low cost
- Simple drive circuit

3.1.2 ESP8266 NODE MUC

SP8266EX is embedded with Tensilica L106 32-bit micro controller (MCU), which features extra low power consumption and 16-bit RSIC. The CPU clock speed is 80MHz. It can also reach a maximum value of 160MHz. Real Time Operation System (RTOS) is enabled. Currently, only 20% of MIPS has been occupied by the WiFi stack, the rest can all be used for user application programming and development.

The ESP8266 itself is a self-contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications.



Fig.3.Wifi ESP8266.

The interfaces can be used to connect to the MCU embedded in ESP8266EX:

- Programmable RAM/ROM interfaces (iBus), which can be connected with memory controller, and can also be used to visit external flash;
- Data RAM interface (dBus), which can be connected with memory controller;
- AHB interface can be used to visit the register.

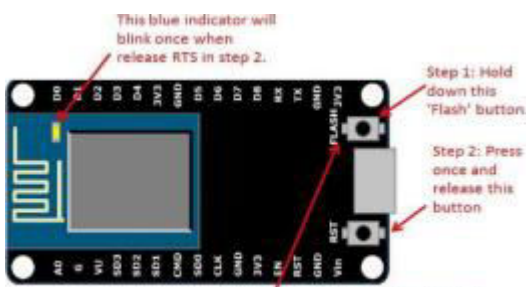
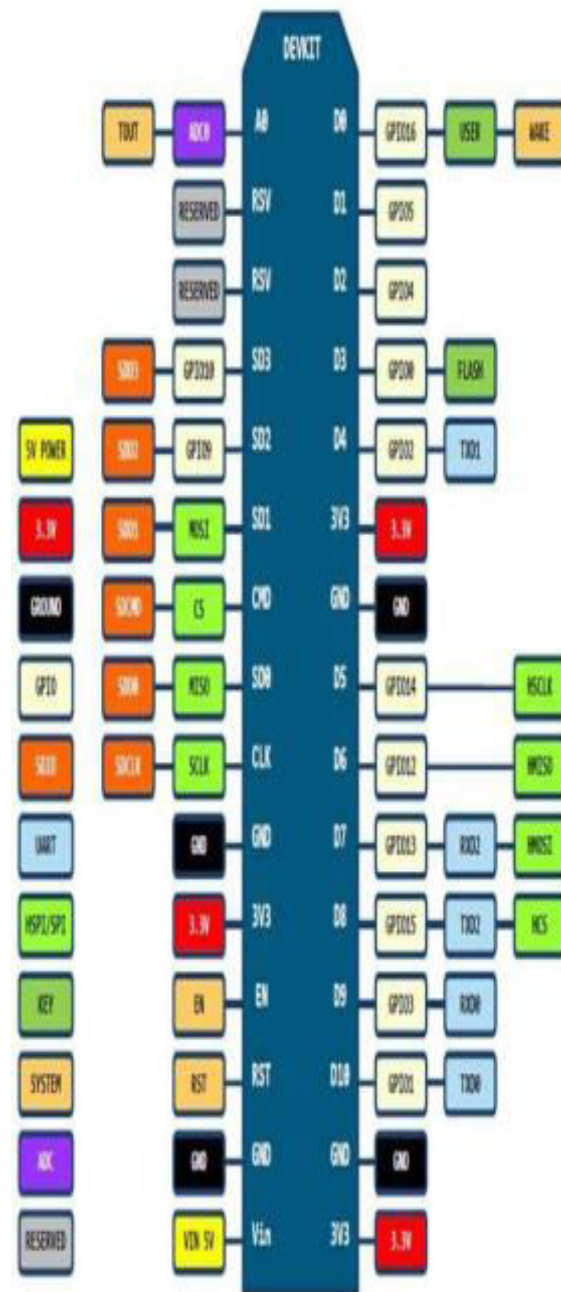


Fig .4. wifi restart.

Specification:

1. Voltage:3.3V.
2. Wi-Fi Direct (P2P), soft-AP.
3. Current consumption: 10uA~170mA.
4. Flash memory attachable: 16MB max(512K normal).
5. Integrated TCP/IP protocol stack.
6. Processor: Tensilica L106 32-bit.

7. Processor speed: 80~160MHz.
8. RAM: 32K + 80K.
9. GPIOs: 17 (multiplexed with other functions).
10. Analog to Digital: 1 input with 1024 step resolution.
11. +19.5dBm output power in 802.11b mode
12. 802.11 support: b/g/n.
13. Maximum concurrent TCP connections: 5.
14. ESP8266 PIN DIAGRAM



00(GPIO16) can only be used as gpio read/write, no interrupt supported, no pwm/I2c/iw supported.

Fig.5. ESP8266 PIN DIAGRAM

Note: GPIO2, GPIO0, MTDO can be configurable as 3-bit SDIO mode.

| Pin | Name | Type | Function |
|-----|---------|------|---|
| 1 | VDDA | P | Analog Power 3.0-3.6V |
| 2 | LNA | I/O | RF Antenna Interface. Chip Output Impedance=50Ω. No matching required but we recommend that the pi-type matching network is retained. |
| 3 | VDD3P3 | P | Amplifier Power 3.0-3.6V |
| 4 | VDD3P3 | P | Amplifier Power 3.0-3.6V |
| 5 | VDD_RTC | P | NC (1.1V) |

| | | | |
|----|------------|-----|---|
| 6 | TOUT | I | ADC Pin (note an internal pin of the chip) can be used to check the power voltage of VDD3P3 (Pin 3 and Pin4) or the input voltage of TOUT (Pin 6). These two functions cannot be used simultaneously. |
| 7 | CHIP_EN | I | Chip Enable. High: On, chip works properly; Low: Off, small current |
| 8 | XPD_DCDC | I/O | Deep-Sleep Wakeup: GPIO16 |
| 9 | MTMS | I/O | GPIO14, HSP1_CLK |
| 10 | MTDI | I/O | GPIO12, HSP1_MISO |
| 11 | VDDP_ST | P | Digital IO Power Supply (1.8V-3.3V) |
| 12 | MTCK | I/O | GPIO13, HSP1_MOSI, UART0_CTS |
| 13 | MTDO | I/O | GPIO15, HSP1_CS, UART0_RTS |
| 14 | GPIO2 | I/O | UART Tx during flash programming, GPIO2 |
| 15 | GPIO0 | I/O | GPIO0, SPI_CS1 |
| 16 | GPIO4 | I/O | GPIO4 |
| 17 | VDDP_ST | P | Digital IO Power Supply (1.8V-3.3V) |
| 18 | SDIO_DATA2 | I/O | Connect to SD_D0 (Series R: 200Ω); SPI_M0, HSP1_M0, GPIO9 |
| 19 | SDIO_DATA3 | I/O | Connect to SD_D8 (Series R: 200Ω); SPTWP, HSP1WP, GPIO10 |
| 20 | SDIO_CMD | I/O | Connect to SD_CMD (Series R: 200Ω); SPI_CS0, GPIO11 |
| 21 | SDIO_CLK | I/O | Connect to SD_CLK (Series R: 200Ω); SPI_CLK, GPIO6 |
| 22 | SDIO_DATA0 | I/O | Connect to SD_D0 (Series R: 200Ω); SPI_MISO, GPIO7 |
| 23 | SDIO_DATA1 | I/O | Connect to SD_D1 (Series R: 200Ω); SPI_MOSI, GPIO8 |
| 24 | GPIO5 | I/O | GPIO5 |
| 25 | U0RXD | I/O | UART Rx during flash programming, GPIO3 |
| 26 | U0TXD | I/O | UART Tx during flash programming, GPIO1, SPI_CS1 |

LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The

data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

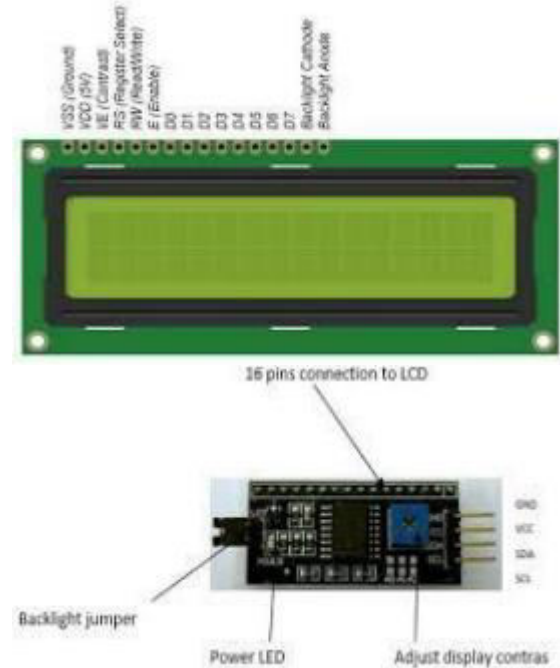


Fig.6. I2C LCD Display.

The I2C is a type of serial bus developed by Philips, which uses two bidirectional lines, called SDA (Serial Data Line) and SCL (Serial Clock Line). Both must be connected via pulled-up resistors. The usage voltages are standard as 5V and 3.3V. I2C connector: VCC, GND, SCL, SDA

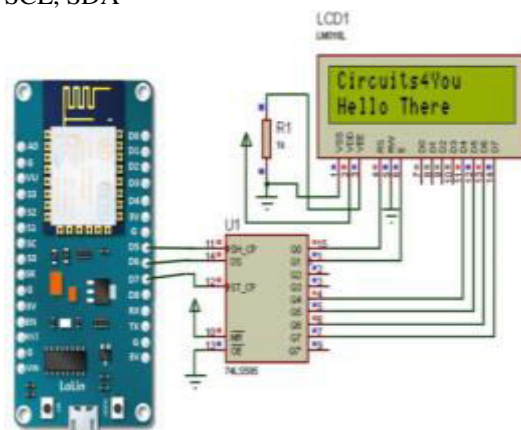


Fig. 7. I2C LCD with Microcontroller.

Specifications & Features: -

3.1.3 I2C 16X2 LCD Display

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 5x7pixel matrix. This LCD has two registers, namely, Command and Data. The command

Arduino IIC/I2C interface was developed to reduce the IO port usage on Arduino board
I2C adapter allows flexibility in connections and reduces the overall wirings.
White text on the Blue background, Character Color: White, Backlight: Blue
Single LED backlight included can be dimmed easily with a resistor or PWM.

Interface: I2C, Interface Address: 0x27 Supply voltage: 5V
register stores the command instructions given to the

LCD with Node MCU

Connect adapter's SCL pin with NodeMCU D1 pin
Connect adapter's SDA pin with NodeMCU D2 pin
Connect adapter's GND, VCC pins with NodeMCU GND, Vin accordingly LCD with I2C Serial Adapter on NodeMCU v2 using ArduinoIDE and available libraries.

3.1.4 Relays

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts.

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example, a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. Relays thus enables controlling an AC device through DC.

Commonly used Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.



Fig.8. RELAY.

The relay's switch connections are usually labeled COM, NC and NO:

COM = Common, always connect to this, it is the moving part of the switch.

NC = Normally Closed, COM is connected to this when the relay coil is off.

NO = Normally Open, COM is connected to this when the relay coil is on.

Connect to COM and NO if you want the switched circuit to be on when the relay coil is on.

Connect to COM and NC if you want the switched circuit to be on when the relay coil is off.

Protection diodes for relays

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (eg 1N4148) is connected 'backwards' across the relay coil to provide this protection.

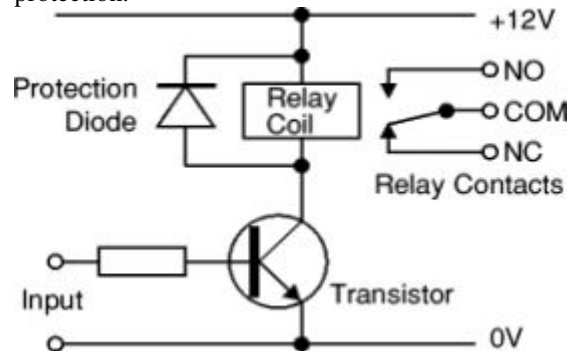


Fig.9. protection diode.

Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and IC's.

Basic Relay circuit:

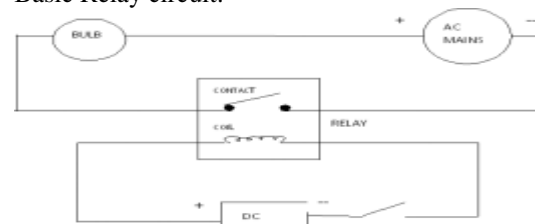


Fig.10. Basic relay ckt.

When Switch near DC source is closed the Relay, coil gets energized and it attracts the Relay contact towards it. The Relay Contact is closed and the AC Mains circuit gets a closed path and the Bulb glows. Thus, a Relay is DC operated but controls AC.

SPDT Relay used in this Project:

"3G") UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (or "4G") LTE Advanced standards. "GSM" is a trademark owned by the GSM Association.

GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

RELAY 1

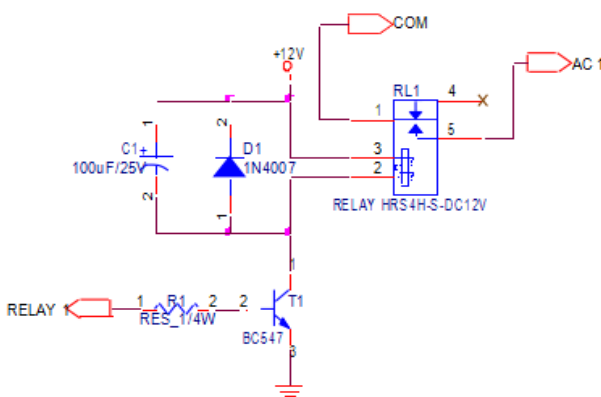


Fig.11. Relay ckt.

The i/p pins of relays are controlled through the Microcontroller port pins.

The o/p of relays are AC circuits shown as AC 1

3.1.5 GSM

GSM stands for Global System for Mobile Communications formerly called as Groupe Spécial Mobile. This is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (or "2G") digital cellular networks.

The GSM standard initially was used originally to describe switched circuit network for full duplex voice telephony to replace first generation analog cellular networks

The standard was expanded over time to include first circuit switched data transport, then packet data transport

via GPRS(General packet radio service). Packet data transmission speeds were later increased via EDGE. The GSM standard is succeeded by the third generation (or "3G") UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (or "4G") LTE Advanced standards. "GSM" is a trademark owned by the GSM Association.

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| | | |
|-------|--------------|------------|
| India | GSM 900 | 5 carriers |
| | GSM 900/1800 | 3 carriers |

Regardless of the frequency selected by an operator, it is divided into timeslots for individual phones to use. This allows eight full-rate or sixteen half-rate speech channels per radio frequency. These eight radio timeslots (or eight burst periods) are grouped into a TDMA frame. Half rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms. The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

SIM300 is a Tri-band GSM/GPRS engine from SIMCOM Ltd. that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10 / class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS(General packet radio service). Packet data transmission speeds were later increased via EDGE. The GSM standard is succeeded by the third generation (or "3G") UMTS standard developed by the 3GPP. With a tiny configuration of 40mm x 33mm x 2.85 mm , SIM300 can fit almost all the space requirement in an application, such as Smart phone, PDA phone and other mobile device.

The physical interface between SIM300 and the mobile application is through a 60 pins board-to-board connector, which provides all hardware interfaces from module to customer's boards except the RF antenna interface.

The keypad and SPI LCD interface will give you the flexibility to develop customized applications.

- Two serial ports can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs. These audio interfaces can be easily configured by AT command.
- One ADC input
- Two GPIO ports and SIM card detection port

Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low.

You can use AT Commands "AT" meaning attention, to communicate with the SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit).

The "AT" or "at" prefix must be set at the beginning of each command line.

To terminate a command line enter <CR>.

Commands are usually followed by a response that includes "<CR><LF><response><CR><LF>".

1. Commands in detail

1. Manufacturer identification +CGMI Description:

This command gives the manufacturer identification.

Syntax:

Command syntax: AT+CGMI

| Command | Possible responses |
|--------------------------------------|------------------------------------|
| AT+CGMI | FLYFOT MODEM OK |
| Note: Get manufacture identification | Note: Command valid. FLYFOT modem |
| AT+CGMI=? | OK |
| AT+CGMI? AT+CGMI=1 | +CME ERROR: 3 Note: not support |

2. New message indication +CNMI Description:

This command selects the procedure for message reception from the network.

Syntax:

Command

AT+CNMI=<mode>,<mt>,<bm>,<ds>,<bfr>

syntax:

| Command | Possible responses |
|---|---|
| AT+CNMI=2,1,0,0,0 (default value) Note: <mt>=1 | OK Note: message received and saved in sim, then route the SMS-DELIVERS with unsolicited result codes: +CMTI: SM, <index> |
| AT+CNMI=2,2,0,0,0 Note: <mt>=2 | OK Note: message received, then route the SMS-DELIVERS with unsolicited result codes: +CMT: [<alpha>] <length> <CR> <LF> < pdu> |
| AT+CNMI=2,0,0,1,0 Note: <ds>=1 | OK Note: SMS-STATUS-REPORTS are routed using unsolicited code: +CDS: <length> <CR> <LF> < pdu> |
| AT+CNMI=2,0,0,0,0 Note: <ds>=0 | OK Note: No SMS-STATUS-REPORTs are routed. |
| at+cnmi? Note: Read | +CNMI: 2,2,0,1,0 |
| at+cnmi=? | +CNMI: (0-3),(0-3),(0-3),(0-1),(0,1) |

3. Send message +CMGS Description :

The <address> field is the address of the terminal to which the message is sent. To send the message, simply type, <ctrl-Z> character (ASCII 26). The text can contain all existing characters except <ctrl-Z> and <ESC> (ASCII 27). This command can be aborted using the <ESC> character when entering text. In PDU mode, only hexadecimal characters are used ('0'...'9','A'...'F').
Syntax :

Command syntax in PDU mode : AT+CMGS= <length> <CR> PDU is entered <ctrl-Z / ESC >

| Command | Possible responses |
|---|--|
| AT+CMGS=28.<CR> 0031000BA13105119226F4000AD0AA8C3F6 30885E9ED301 <ctrl-Z> | +CMGS: <mr> OK Note: Successful transmission |
| Note: Send a message in PDU mode | |
| AT+CMGS=? | +CMGS: OK |
| AT+CMGS AT+CMGS? | +CME ERROR: 3 Note: not supported. |

The message reference, <mr>, which is returned to the application is allocated by the product. This number begins with 0 and is incremented by one for each outgoing message (successful and failure cases); it is cyclic on one byte (0 follows 255).

2. Few Worked Examples Command to send SMS

AT+CMGS="9876543210"

> HI

+CMGS: 9 OK

at+cpin? // To check network connectivity

+CPIN: READY

AT+COPS?

+COPS: 0,0,"Hutch-Kamataka"

AT&F // To store Factory default OK

// Use the next 2 commands if we face any problem to send and receive SMS.

// If we type SMS send command, then error comes.

// If we enable in SMS receive command, then the SMS received will be in

numbers and alphabets format. AT+CMGF=1

OK AT+CMGR=1

+CMGR: "REC

READ", "+919876543210" , "10/03/08,17:48:53+22"

OK

Command to set in receive mode

AT+CNMI=2,2,0,0,0 OK

+CMT: "+919876543210" , "10/05/12,08:18:40+22" //

Total 45 characters SYSTEM STARTS

AT+CNMI=2,2,0,0,0 OK

+CMT: "+919876543210" , "09/12/25,23:44:42+22"

Hello

3.1.6 Power Supply Circuit Circuit Diagram:

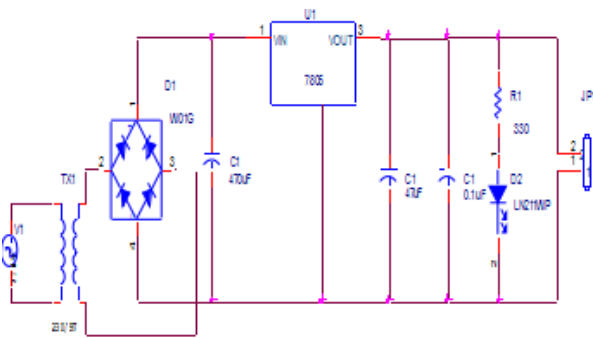


Fig.12. Power supply ckt.

The operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an AC voltage, a steady DC voltage is obtained by rectifying the AC voltage, Then filtering to a DC level, and finally, regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC voltage regulator Unit, which takes a DC voltage and provides a somewhat lower DC voltage, Which remains the same even if the input DC voltage varies, or the output Load connected to the DC voltage changes.

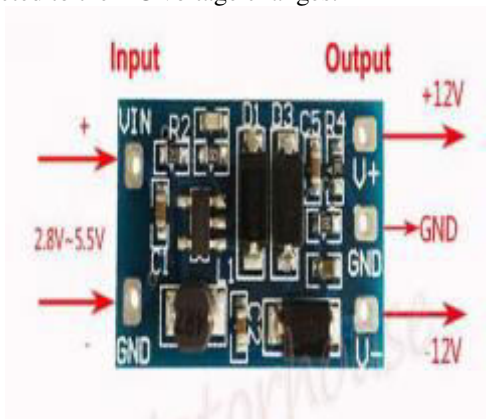


Fig.13. Power Supply.

3.1.7 Buzzer

A buzzer or beeper is an audio signaling 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.



How the Buzzer Works:

For a better understanding of the buzzer's operation, look at the circuit diagram.

Circuit Diagram:

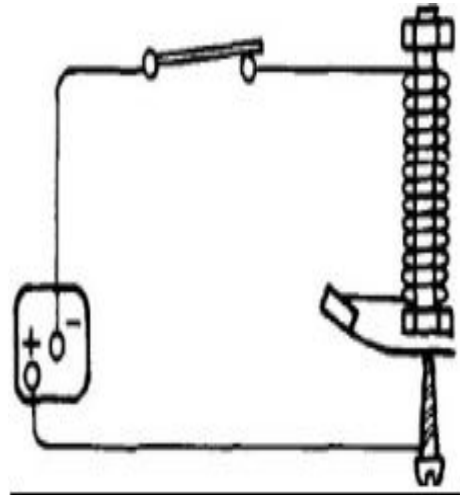


Fig .14. Buzzer ckt.

Instantly, current shoots downward to the brass contactor screw. Since the screw is touching the vibrator arm, the current continues on its way into the coil. Out of the coil it streaks past the closed code key and back to the battery.

As in the electric pencil, this flow of current creates a magnetic field around the iron bolt. Having become an electro-magnet, the bolt attracts the vibrator arm. But as the arm starts to swing toward the bolt, it opens the circuit. Hence, the current stops. As a result, the magnetic field collapses, allowing the vibrator arm to spring back against the contactor. With the circuit now restored, current starts flowing again and the cycle starts a new. No matter how quickly we press and release the code key, the current will still make hundreds of round trips through the circuit. And because of the resulting rapid motions of the vibrator arm, a buzzing sound is heard. Not only is the code set fun to build, but it is even more fun to use, especially with a fellow operator. So that both of you can send as well as receive messages, you will want to build two identical sets of buzzers and code keys. They're really not hard to make.

3.1.8 Exhaust Fan

Exhaust fans in the home are very beneficial for maintaining ideal temperature and air quality. Kitchen, bathroom, or whole home systems improve ventilation, letting out the bad to better the indoor environment. Learn how they work, their benefits, and exhaust fan options for your home.

Exhaust fans are used to pull excess moisture and unwanted odors out of a particular room or area. They are commonly found in bathrooms and kitchens, where

moisture can build up due to activities such as showering, washing, or cooking. They provide ventilation to areas, reducing chemical fume buildup and removing other contaminants that can be harmful when breathed



How the Buzzer Works:

For a better understanding of the buzzer's operation, look at the circuit diagram.



Fig.15. Servo motor.

3.1.9 Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

Servo motors are rated in kg/cm (kilogram per centimetre) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors

shaft, the greater the distance the lesser the weight carrying capacity.

The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

It consists of three parts:

Controlled device Output sensor Feedback system

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Working principle of Servo Motors

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

3.2 Software Requirements

We use the following software requirements: Coding Language: C/C++

IDE: Arduino

Operating System: Windows 7 and above

3.2.1. Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor

development boards. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub

main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open source compilers & tools (cores) that can build and upload sketches to other MCUs that are not supported by Arduino's official line of MCUs. In October 2019 the Arduino organization began providing early access to a new Arduino Pro IDE with debugging and other advanced feature.

IV. DATAFLOW DIAGRAM

A data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. Data flowcharts can range from simple, even hand-drawn process overviews, to in-depth, multi-level DFDs that dig progressively deeper into how the data is handled.

- Each process should have at least one input and an output.
- Each data store should have at least one data flow in and one data flow out.
- Data stored in a system must go through a process.
- All processes in a DFD go to another process or a data store.

A data flow diagram can dive into progressively more detail by using levels and layers, zeroing in on a particular piece. DFD levels are numbered 0, 1 or 2, and occasionally go to even Level 3 or beyond.

DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modeled. It's designed to be an at-a-glance view, showing the system as a single high-level process, with its relationship to external entities. It should be easily understood by a wide audience, including

stakeholders, business analysts, data analysts and developers.

DFD Level 1 provides a more detailed breakout of pieces of the Context Level Diagram. You will highlight the main functions carried out by the system, as you break down the high-level process of the Context Diagram into its subprocesses.

DFD Level 2 then goes one step deeper into parts of Level 1. It may require more text to reach the necessary level of detail about the system's functioning.

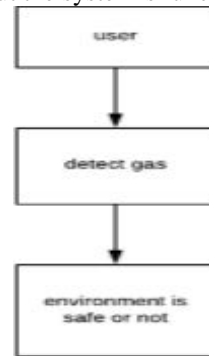


Fig.16. DFD.

1. Data Flow diagram at 0th level

The user starts the system by connecting to a hotspot or a wifi connection. The sensor will sense or detect the gas value in the atmosphere and based on that, it is decided whether the environment is safe or not and accordingly a message will be sent.

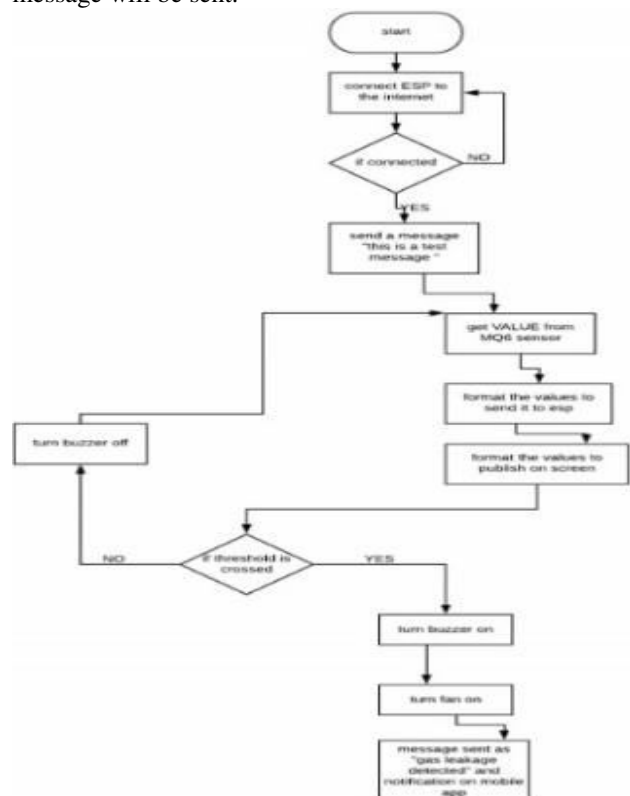


Fig .17. Flow Chart.

2. Data Flow Diagram at 1st Level

The proposed system after connecting to the internet, send a message to the user saying that the system is activated and is ready to perform. The MQ6 sensor detects the gas value in the atmosphere and send the details to the Node MCU which will further send the details to the LCD screen which will display the gas content in the atmosphere at all the times. This information is also forwarded to the cloud which is updated in the app. A certain threshold value will be set, if the calculated value is lesser than the threshold value then the system does not perform any action, and continues to sense the gas value in the atmosphere. If the calculated value is greater than the threshold value, then the Node MCU will inform the buzzer to ring and the exhaust fan to be turned on and the servo motor to rotate which will cause the knob to be turned off. A message will be sent to the concerned user regarding the gas leak.

V. RESULT

The result of this project is determined by using a lighter to collect leaked gas around the gas sensor, after sensing procedure if sensor value is greater than the threshold value then micro-controller will perform its programmed tasks :

Immediately turn off the regulator knob to stop further leakage.

After detecting the gas leakage, the relay will cut off the main power supply to prevent any further accidents.

Buzzer starts beeping and a message is displayed on lcd to alert the nearby people.

The exhaust fan will fan out all enclosed gas from the environment.

The gsm module is used to send message to the concerned user via sms when the leakage is detected .

The wi-fi module updates the information to the cloud.

The user can get to know the gas values and status of the system through the app and also control of the power supply can be done manually by the user through the app.

VI. CONCLUSION

This paper aimed at monitoring and detection system to meet the safety standards and to avoid free accidents due to the leakage. The system detects gas in the atmosphere and will be continuously update and display the gas value, the value can be seen by the user through the mobile app easily. This system provides a quick response rate and the diffusion of the critical situation can be made faster than the manual methods.

The system alerts and responds quickly in case of leakage with help of alerting and by sending SMS to concerned authority.

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