AUTOMATIC SMOKE DETECTOR ALARM

PROJECT REPORT

Submitted to

Government College of Engineering, Jalgaon 425002
(An Autonomous Institute of Government of Maharashtra)
in Partial Fulfillment of the Requirements for the Third Year of Bachelor of Technology in Electronics and Telecommunication Engineering.

Submitted By

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DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING, JALGAON 425002
(An Autonomous Institute of Govt. of Maharashtra)

Year 2020-2021

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics and Telecommunication Engineering

CERTIFICATE

This is to certify that the mini project report entitled, **"AUTOMATIC SMOKE DETECTOR ALARM"**, which is being submitted herewith for the award of Third Year B. Tech. (Electronics and Telecommunication Engineering), is the result of the work completed by –

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Under my supervision and guidance within the four walls of the institute and the same has not been submitted elsewhere for the award of any degree.

Prof. Dr. D. S Chaudhari (guide) & (HOD)

DECLARATION

We hereby declare that the project progress report entitled, **"AUTOMATIC SMOKE DETECTOR ALARM"** was carried out and written by us under the guidance of Prof. Dr. D. S. Chaudhari Assistant Professor, Department of Electronics and Telecommunication Engineering, Government College of Engineering, Jalgaon. This work has not been previously formed the basis for the award of any degree or diploma or certificate nor has been submitted elsewhere for the award of any degree.

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Place: Jalgaon

Date: 0 9/ 0 6 / 2021

ACKNOWLEDGEMENT

We would like to take this opportunity to express my heartly thanks to our Principal Dr. D. Kokate and my guide Prof. and Head of Electronics and Telecommunication Department Prof. Dr. D. S. Chaudhari for their esteemed guidance and encouragement, especially through difficult times. Their suggestions broaden our vision and guided us to succeed in this work. We are also very grateful for their guidance and comments while designing part of our project progress report and learnt many things under their leadership.

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ABSTRACT

We propose a design of Smoke detector alarm using Arduino Uno At mega 328p and MQ2 gas sensor The reason for using Arduino is we can make the program according to our convince and need.
The MQ2 gas sensor is not only detect the smoke but also detect other flammable gases which can produce fire when get in touch to flammable substance.
To create a smoke-free environment, it is important to have a system that can be used to detect the presence of hazardous gases in cigarette smoke. In this project, we design and implement a wireless smoke detection system. The hardware utility s Arduino and four gas sensors, namely MQ-2 gas sensor to sense, collect, and send data wirelessly to Arduino.
In the software side, we develop programs, i.e. for Arduino.
We show in real experiments that our system successfully gathers sensor readings from the gas sensors, sends data via wireless connection and stores it in the Arduino.

Chapter 1

INTRODUCTION

The basic functions of a fire detection system are to notify the occupants of a building of an emergency conditions for evacuation purposes. Alerting organized assistance such as the fire service departments to undertake firefighting operations and supervising processes for abnormalities that might cause fire. Automatic fire detection and control has become an important device used in securing property and business against fire which serves to reduce the fire in the building and industry. The primary function of an automatic fire detector is to recognize a developing fire in a timely manner, and cause an alarm to notify the people present in the premises for an urgent evacuation. Therefore, fire detection systems which are self-monitoring and have the ability to initiate both audible and visual warning in a spaced building are required. Smoke detector has been reviewed as a fundamental component of active fire detection strategy of modern commercial and residential building. In the 1970's, industries recorded increased use of smoke detectors and this growth was accompanied by several significant research projects that reinforced the life safety protection provided by smoke detectors, thereby providing significant evidence that supported increase in use of smoke detectors. Also, in order to understand the response, working principle of these detectors in the environment, several researches were embarked. Accurate prediction of smoke detector is a very significant way of assessing detector system performance because occupants and fire service notification can be dependent upon smoke detector response. Fire Dynamic Simulator software, can be used to predict the response of smoke detector

1.1 Project motivation and purpose

If you've never experienced what it's like to recover from a fire, consider yourself lucky. According to the National Fire Protection Association (NFPA), over 113,000 non-residential fires broke out in the U.S. in 2015, killing 90 civilians, injuring 1,425 others, and causing $3.1 billion in property damage. Mitigate these risks with a fire alarm.

- **Fire alarms save lives:** The number one reason to install a fire alarm is to make the building safe for your employees, customers, and tenants.

A combination of smoke and heat detectors, sirens and bells, and strobe lights detect fires and alert building occupants, giving them ample time to evacuate in an orderly fashion.

- **Fire alarms reduce property loss:** While strobe lights and sirens don't actively put out fires, they alert the people who can. The fire control process begins when trained personnel attack a small fire with an extinguisher and bystanders, guests, or employees call the fire department. Monitored fire alarm systems automatically notify emergency responders and fire trucks dispatch to your location without delay. The faster these responses happen, the sooner the fire is extinguished and the less damage your building sustains.
- **Fire alarms shorten your recovery time:** Less building damage means shorter downtime until you can reopen for business. This cuts your losses from the fire even more, allowing you to return to business as usual before long.

Fire alarms may qualify you for insurance discounts: Most insurance carriers offer discounted rates on business insurance policy premiums

- if you have a code-compliant fire alarm system. In fact, some providers require you to install a fire alarm before they will insure your business.

1.2 Need of Automatic smoke detector alarm:

Most fire victims die from inhalation of smoke and toxic gases, not from burns.

A majority of fatal fires happen when families are asleep because occupants are unaware of the fire until there is not adequate time to escape.

A smoke alarm stands guard around the clock, and when it first senses smoke, it sounds a shrill alarm. This often allows a family the precious, but limited, time needed to escape.

This can be widely used at public places as follows:

- Hospital's
- Airports & railway stations

- Factories, supermarkets, shopping malls, construction sites
- Institute & Schools
- Banks and Hotels

1.3 Organization of Report:

The report is divided into five sections starting with introduction which includes need and objectives of the proposed work and its various domains followed by literature review defining the previous work that has been carried out in this area. It also included the background and work carried out earlier related to the work provided by different organizations and researchers with problem definition. The third unit comprises of brief description that how system is developed. It also provides description about all the components used for development of the system. The fourth unit deals with the detailed description of performance. Conclusion, future scope related to the system are provided in the fifth unit.

Chapter 2

LITERATURE SURVEY

1.1 Literature Survey:

Before any attempt is made to understand the means by which smoke detector response is predicted, an understanding of the fundamental operating principles of smoke detectors is required. For this study, only spot-type ionization and photoelectric detectors are considered and are therefore the only technologies addressed in this section. For the sake of brevity, from this point forward the use of the phrase smoke detectors will refer only to spottype ionization and photoelectric smoke detectors. More information on detector operating principles,

both those included here and some that are not, is available from [Bukowski & Mulholland, 1978; Schifiliti & Pucci, 1996

Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-9, 2016 :

The quickly detection of smoke in outer areas using video frame is important task of modern surveillance system. Real video includes things that are same to smoke with changing behavior due to low resolution, blurred or weather properties. So, we need a detection of smoke in such cases. Since smoke does not have fixed shape. Smoke is also affected from surroundings areas such as lightning affect. Smoke work as indicator for presence of fire. In image processing, images like video frames or pictures are the inputs and output can be an image or image characteristics. Various tasks like classification, features extraction, recognizing different patterns can be performed using image processing. Image processing techniques greatly help to detect smoke/fire in a good manner and thereby avoid dangerous situation according to the output

Chapter 3

Description of Methods

The design method adopted in this s ye stem was based on these stages of planning and application. The smoke detection system circuit design was carried out using proteus 8 professional software and other components such as 5VDC battery to power the system, first alert smoke detector to sense smoking fire, Arduino to send smoke detection signal, Arduino IDE with embedded C language for programming the microcontroller chip, 5V Arduino Uno board (ATmega328 microcontroller) to control the system by receiving signal of any smoke detection and actuating other sensors, 5VDC and 85 decibel sound buzzer Alarms, 5V NTE3019 light emitting diode (LED) to emit light, , resistors, vb.net to monitor USB interface for receiving of email signal, 1N4007 diode. The approach of the design was to achieve a fast response to smoking fire, low false alarm and low failure rate.

Design of project

The theory of the design was based on the working principle of the First alert 7010b smoke detection system which is generally more sensitive at detecting large smoke particles (smoking fire). The design also applied the NPN transistor theory where the circuit operates on principle of saturation of the collector base junction to be biased why the base emitter junction to be reversed forward biased. That is why a high (5V) of the Arduino UNO is at pin 10, which is connected to the base, the transistor operates in a saturation region of the DC load line and as such it becomes a conductor and a potential is established across the relay which actuates it. The reverse is the case when a low (0) of the Arduino UNO is sent to the pin 10, the base emitter junction becomes reversed biased and its collector base junction is also reversed biased (common emitter configuration transistor); it means that the transistor is operating at its cut of region. The transistor Q1 will function as an open circuit as such the buzzers will remained off.

Selection of Components.

The selection of the electronic components was based on the AT mega 328 Arduino microcontroller which accepts supply voltage ranging from 5V to 12V. A 5V regulator was used to supply the needed voltage of the system. In the case of the Light Emitting Diode, the recommended forward Voltage drop of an LED needed to light very bright without destruction is 2V, the forward current of that same LED is 20mA and output high Voltage of Arduino 5V

ARDUNIO UNO :

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter

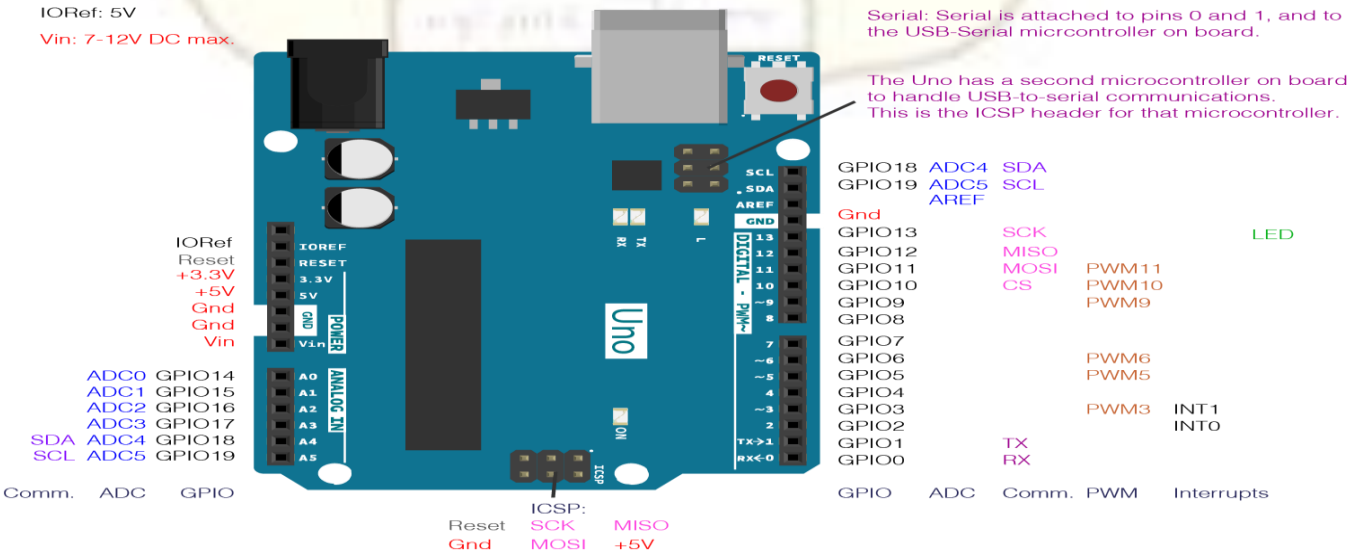
message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts like.

Arduino uno specification:

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0-A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Arduino Pin diagram:



The Arduino Uno board can be built with power pins, analog pins, ATmegs328, ICSP header, reset button, power LED, digital pins, test led 13, TX/RX pins, USB interface, an external power supply.

Power Supply

The Arduino Uno power supply can be done with the help of a USB cable or an external power supply. The external power supplies mainly include AC to DC adapter otherwise a battery. The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, the battery leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12 volts.

Input & Output

The 14 digital pins on the Arduino Uno can be used as input & output with the help of the functions like pin M ode() , digital Write(), & Digital Read().

Pin1 (TX) & Pin0 (RX) (Serial): This pin is used to transmit & receive TTL serial data, and these are connected to the ATmega8U2 USB to TTL Serial chip equivalent pins.

Pin 2 & Pin 3 (External Interrupts): External pins can be connected to activate an interrupt over a low value, change in value.

Pins 3, 5, 6, 9, 10, & 11 (PWM): This pin gives 8-bit PWM o/p by the function of analog Write ().

SPI Pins (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK): These pins maintain SPI-communication, even though offered by the fundamental hardware, is not presently included within the Arduino language.

Pin-13(LED): The inbuilt LED can be connected to pin-13 (digital pin). As the HIGHvalue pin, the light emitting diode is activated, whenever the pin is LOW.

Pin-4 (SDA) & Pin-5 (SCL) (I2C): It supports TWI-communication with the help of the Wire library.

AREF (Reference Voltage): The reference voltage is for the analog i/ps with analog Reference ().

Reset Pin: This pin is used for reset (RST) the microcontroller.

 smoke Sensor:

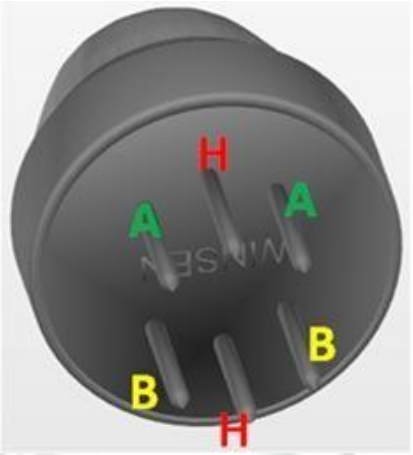
Sensors are the electronic devices used for interaction with the outer environment. There are various types of sensors available that can detect light, noise, smoke, proximity etc… With the advent in technology, these are available as both analog and digital forms. Besides forming a communication with the outer environment, sensors are also a crucial part of safety systems. Fire sensors are used to detect the fire and take appropriate precautions on time. For smooth functioning of control systems and sensitive electronics, humidity sensors are used for maintaining humidity in the unit. One of such sensr used in safety systems to detect harmful gases is MQ2 Gas sensor.

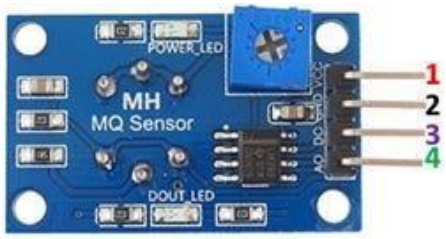
MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.

MQ2 gas sensor is also known as c he mi resistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.

MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

Pin Configuration:





Pin No.	Pin Name
1	Vcc(+5V)
2	Ground
3	Digital Out
4	Analog out

For Module

1 VCC

This pin powers the module, typically the operating voltage is +5V

2 Ground

Used to connect the module to system ground

3 Digital Out

You can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer

4 Analog Out

This pin outputs 0-5V analog voltage based on the intensity of the gas

For Sensor

1 H -Pins

Out of the two H pins, one pin is connected to supply and the other to ground

2 A-Pins

The A pins and B pins are interchangeable. These pins will be tied to the Supply voltage.

3 B-Pins

The A pins and B pins are interchangeable. One pin will act as output while the other will be pulled to ground.

Features:

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V

Digital Output Voltage: 0V or 5V (TTL Logic) ○ Preheat duration 20 seconds

- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

Working principal**:**

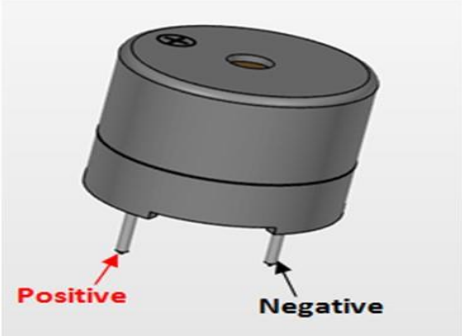
This sensor contains a sensing element, mainly aluminum-oxide based ceramic, coated with Tin dioxide, enclosed in a Stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals. Oxy gen gets adsorbed on the surface of sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted towards this oxygen, thus preventing the current flow. When reducing gases are present, these oxygen atoms react with the reducing gases thereby decreasing the surface density of the adsorbed oxygen. Now current can flow through the sensor, which generated analog voltage values. These voltage values are measured to know the concentration of gas. Voltage values are higher when the concentration of gas is high.

Buzzer

A piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product. Yet at the same time, depending on the piezo ceramic buzzer specifications, it's also reliable and can be constructed in a wide range of sizes that work across varying frequencies to produce different sound outputs.

For instance, at APC International, Ltd., we offer piezo buzzers without signal generators, self-oscillating buzzers that have signal generators and even multi-tone sound generators — often used in alarms and sirens. Regardless of the model you choose, our piezo buzzers offer high sound outputs. Plus, since they can be mounted on circuit boards, they're highly useful in a wide range of applications and assemblies.
Despite different construction methods that affect the cost of piezo buzzers, all of our prices are highly competitive. In addition, thanks to our state-of-the-art production facility, our delivery times are some of the fastest in the industry.
The frequency range is from 31 Hz to 65535 Hz.

Buzzer Pin Configuration



1 Positive
Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC

2 – Negative
Identified by short terminal lead. Typically connected to the ground of the circuit

Buzzer Features and specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package

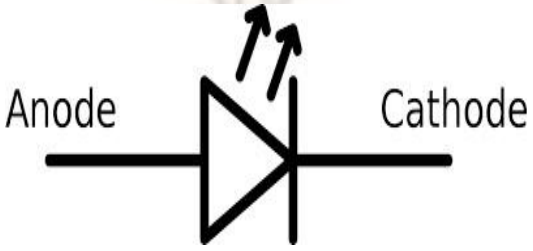
□ JUMPER WIRES (GENERIC)

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a

breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering

- **LED**

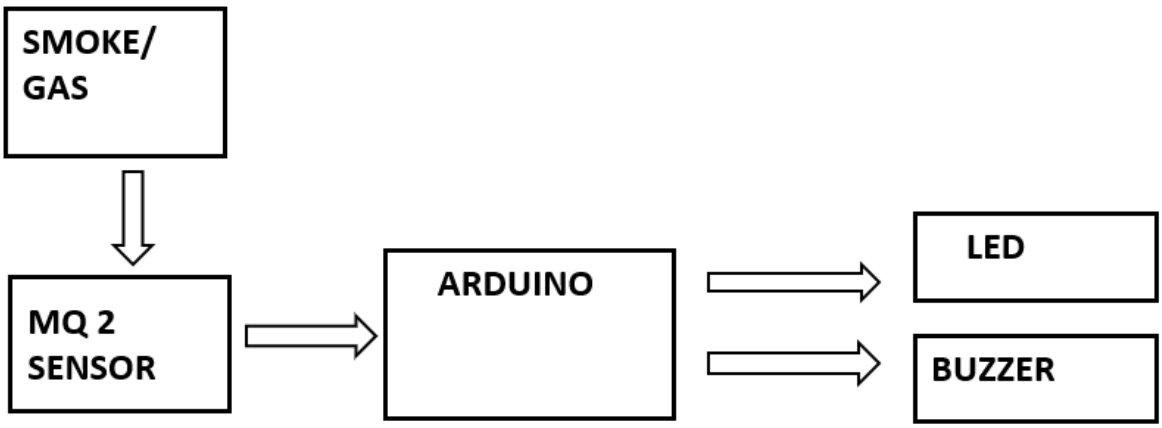
A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.



RED LED:

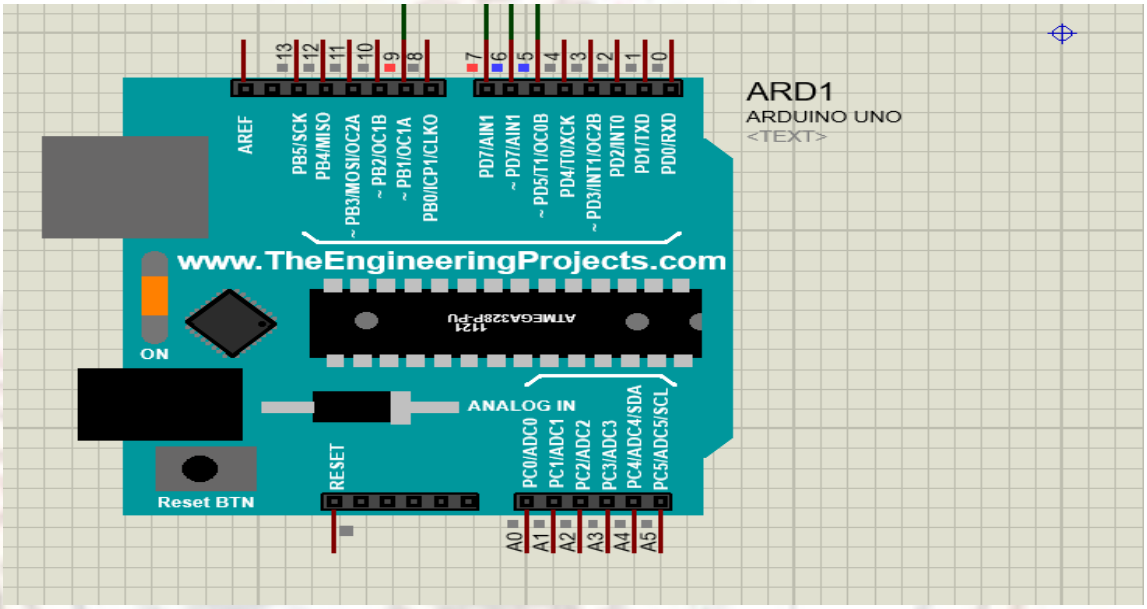
GREEN LED:

Block diagram:

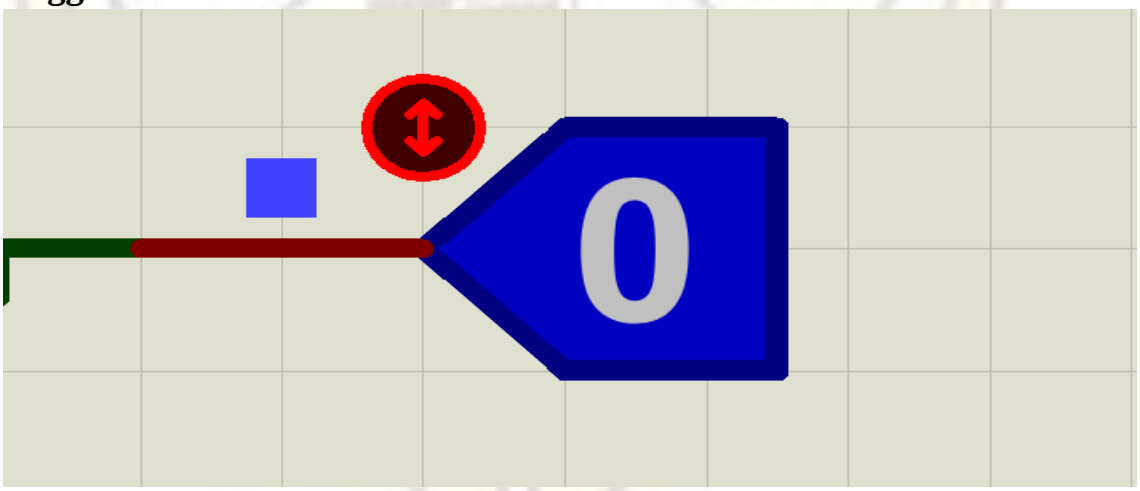


SIMULATOIN

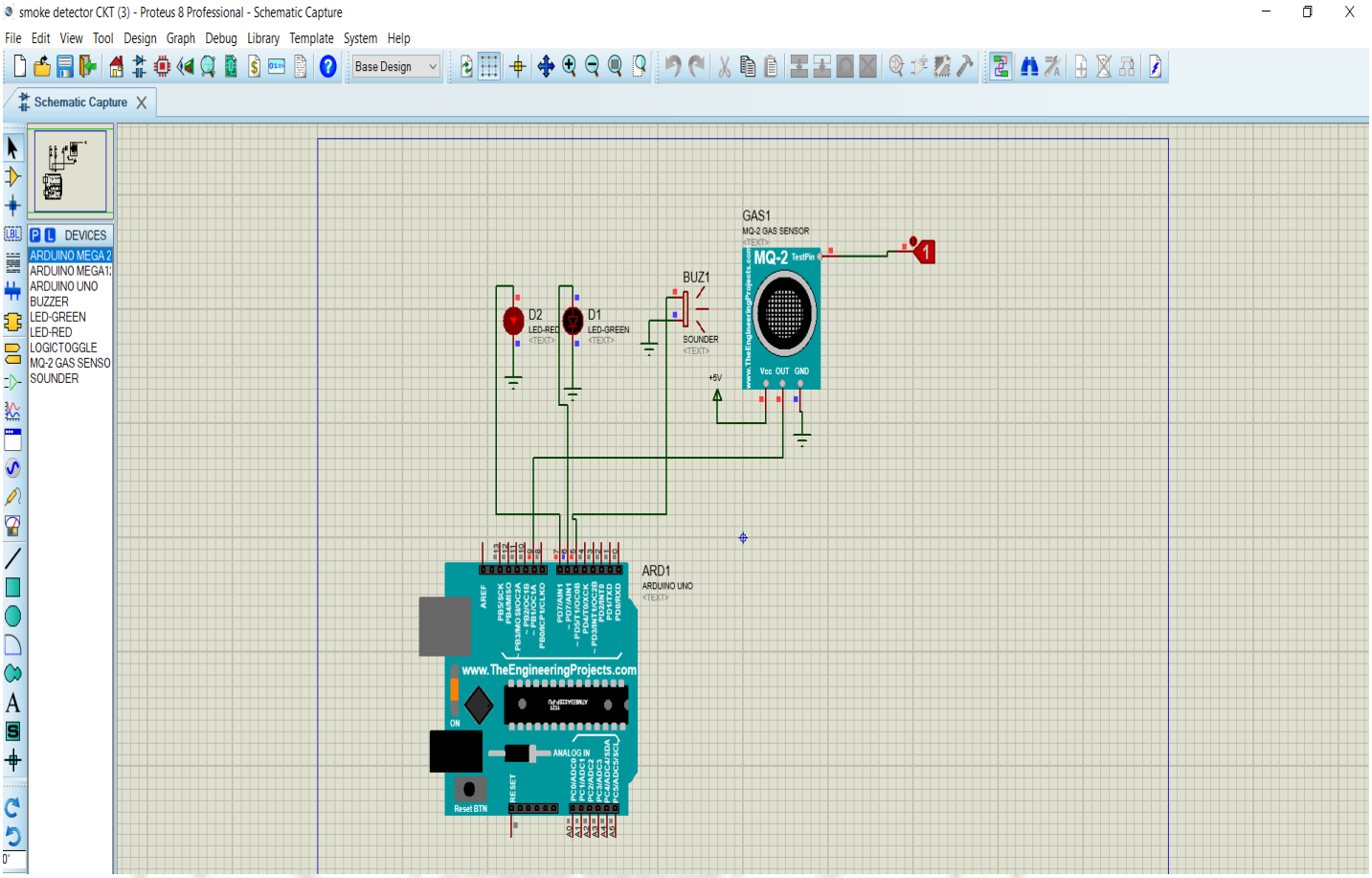
1) Arduino uno:



2) Toggle switch:



3) *Simulation window with circuit diagram*



Simulation summary

Software's used:

1) Arduino Studio
2) Proteus Simulation 8.6

The program code for the Arduino was first run on Arduino studio Software. After running code successfully on android studio the compilation option is selected which then generates the Hex file link. That is then copied.

After that we open Proteus Simulation software. The necessary components are mounted on the simulation window. The proper connection are made through connecting wires. Then by double clicking on Arduino a dialog box will appear. In that box we paste the Hex File link and save it.

Similarly, In smoke sensor file we have to paste the Hex file link.
After that we have to save the project. And then click on run.
The message will appear after successful run.
Here our Simulation Finally Ends Arduino Mini (ATmega328P).

Code:

```
int Gas = 9;
int redLed = 7;
int greenLed = 6;
int buzzer = 5;
void setup() {

pinMode(Gas , INPUT);
pinMode(redLed , OUTPUT);
pinMode(greenLed , OUTPUT);
pinMode(buzzer , OUTPUT);

}

void loop() {

 if(digitalRead(Gas) == HIGH){
    digitalWrite(7 , HIGH);
  digitalWrite(6, LOW);
  tone(buzzer, 1000, 200);
 }
else{

 digitalWrite(6, HIGH);
 digitalWrite(7 ,LOW);
 noTone(buzzer);
}
delay(500);
}
```

Cost conclusion

1) Arduino uno AT mega328p - **1000/-**

2) Smoke detector 450/-

3) Buzzer - 100/-

4) LED - 30/-

5) Power battery - 50/-

6) Jumper wire (male to male) – 150/- total = 1630 /-

Advantages

1. More Effective Detection

Smart smoke detectors use the latest technology to detect the presence of smoke using photoelectric smoke-sensing technology. Their ultra-sensitivity prevents false alarms. In addition to sensing smoke, they also have heat sensors that detect rapid rises in heat that come from a fire, even when there is no smoke.

This is a significant upgrade from many standard smoke detectors.

2. 27/7 Monitoring

Even if you forget to set your smart home system, your smart smoke detector is always at work. Systems like AMP Smart's smoke detector have long battery life that can last 3-5 years. These systems provide peace of mind by always being on guard and accessible to you no matter where you are.

3. Automatic Alert

Smart smoke detectors also keep your local monitoring stations on alert. If you are away from your home, your smoke detector will alert the proper authorities if it detects smoke or fire. This provides extra peace of mind if you are away for extended periods of time for vacation or work.

Disadvantages

Very sensitive, which can lead to false alarms as a product of cooking.

1. Not as responsive to smoldering fires - they are minutes slower than photoelectric sensors in detecting smoke particles from smoldering fires.
2. Use of radioactive material is a concern.

Applications

It can use at various places like:

- Malls & Hospitals
- All public places (Airport, stations & etc.)
- Apartment's and more

Conclusion

This study is to design an improved smoke detection system, capable of providing real-time surveillance, monitoring, and notifying people in the premises of emergency conditions for evacuation. The simulation of the smoke detection circuit provided the insight into the behavior of the circuit and validated my result by energizing the 3 buzzers, LED (D2 and D3) emitting light and virtual terminal displaying string E, evidence of the mailing part which helps to inform or send pre-configured emails to fire fighters, etc.
The area covered was 50 m2 and the maximum distance between any points of an area to the smoke detector was 7.5m, maximum spacing between detectors was reduced when obstruction were present such as walls or partitions while minimum distance between detector and wall or partition was 500 mm. The height of the building considered ranged from 2.92m to 3m which was far less than the maximum recommended height of 10.5m for First Alert BRK 7010B hardwire sensor.

Recommendations

In view of the investigations and conclusion of this study, the following recommendations may hold well for improved smoke detection system

1. Maintenance procedures should always be carried out to ascertain the functionality of the equipment so that at the moment of fire outbreak, this equipment will not fail to operate and also to reduce unwanted alarms and malfunction of equipment.
2. Testing of the effectiveness and working condition of these equipment's are very necessary and need to be carried out by a qualified professional on a regular basis set out in a formal

fire risk assessment. Inspection and servicing of fire alarm should always take place at least 2-4 times per year

Future Scope

- Interconnection between multiple system.
- Android application for the system to control it either automatic or manually.
- Different Gas Sensor can be used.

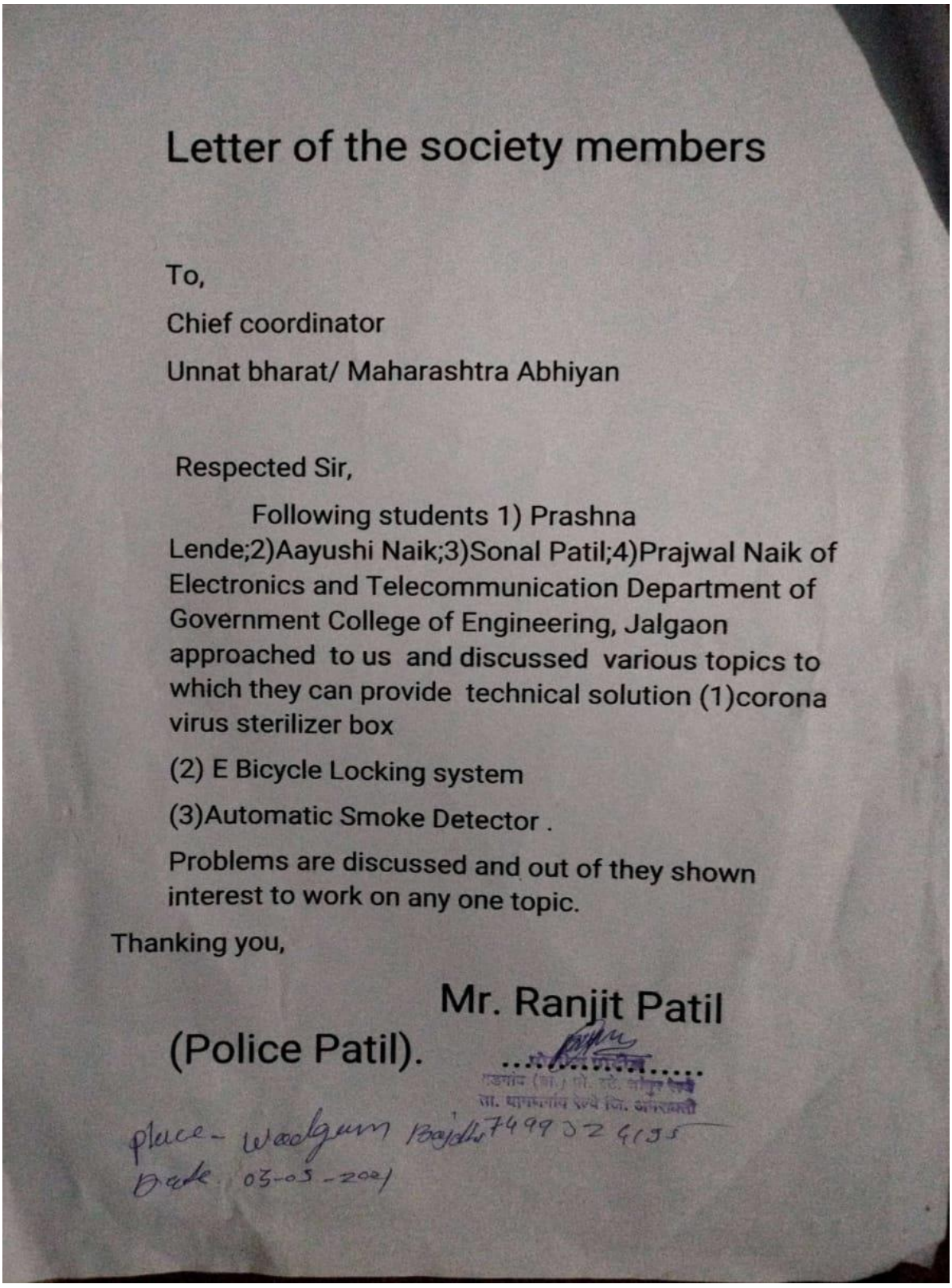
Reference:

1. M. Kiron ji, ―Evaluation of Fire Protection Systems in Commercial Buildings for Fire Safety Optimization‖, International Journal of Scientific and Research Publication, vol. 5, No. 10, pp. 2250-3153, 2015.

2. A. L e r a r di, & J. Barnett, ―A Methodology for Predicting Smoke Detector Response‖. WPI Center for Fire Safety Studies, Worcester, 2000. Retrieved from: ierardi@wpi.edu, on 2nd April, 2017.

3. C. Belo, J. Aurea, F. Rangel, J. A l d a, & N. Grace, ―Design of Fire Protection, Particularly Fire Sprinkler System in South Building of M a nu a‖, Institute of Technology, Environmental and Sanitary Engineering, vol. 1, pp. 1-10, 2014

4.



Letter of the society members

To,

Chief coordinator

Unnat bharat/ Maharashtra Abhiyan

Respected Sir,

Following students 1) Prashna Lende;2)Aayushi Naik;3)Sonal Patil;4)Prajwal Naik of Electronics and Telecommunication Department of Government College of Engineering, Jalgaon approached to us and discussed various topics to which they can provide technical solution (1)corona virus sterilizer box

(2) E Bicycle Locking system

(3)Automatic Smoke Detector .

Problems are discussed and out of they shown interest to work on any one topic.

Thanking you,

Mr. Ranjit Patil

(Police Patil). .....

place- Waalgaon Bajdhe 7499324135

Date 03-03-2021

Features

- High Performance, Low Power AVR® 8-Bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 20 MIPS Throughput at 20 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
  - 4/8/16/32K Bytes of In-System Self-Programmable Flash progam memory (ATmega48PA/88PA/168PA/328P)
  - 256/512/512/1K Bytes EEPROM (ATmega48PA/88PA/168PA/328P)
  - 512/1K/1K/2K Bytes Internal SRAM (ATmega48PA/88PA/168PA/328P)
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - Programming Lock for Software Security
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Six PWM Channels
  - 8-channel 10-bit ADC in TQFP and QFN/MLF package
    Temperature Measurement
  - 6-channel 10-bit ADC in PDIP Package
    Temperature Measurement
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Byte-oriented 2-wire Serial Interface (Philips I^2C compatible)
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
  - Interrupt and Wake-up on Pin Change
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- I/O and Packages
  - 23 Programmable I/O Lines
  - 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF
- Operating Voltage:
  - 1.8 - 5.5V for ATmega48PA/88PA/168PA/328P
- Temperature Range:
  - -40°C to 85°C
- Speed Grade:
  - 0 - 20 MHz @ 1.8 - 5.5V
- Low Power Consumption at 1 MHz, 1.8V, 25°C for ATmega48PA/88PA/168PA/328P:
  - Active Mode: 0.2 mA
  - Power-down Mode: 0.1 µA
  - Power-save Mode: 0.75 µA (Including 32 kHz RTC)

8-bit AVR® Microcontroller with 4/8/16/32K Bytes In-System Programmable Flash

ATmega48PA
ATmega88PA
ATmega168PA
ATmega328P

Summary

Rev. 8161CS–AVR–05/09

TECHNICAL DATA MQ-2 GAS SENSOR

FEATURES

Wide detecting scope — Fast response and High sensitivity
Stable and long life — Simple drive circuit

APPLICATION

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane ,alcohol, Hydrogen, smoke.

SPECIFICATIONS

A. Standard work condition

Symbol	Parameter name	Technical condition	Remarks
Vc	Circuit voltage	5V±0.1	AC OR DC
V_H	Heating voltage	5V±0.1	ACOR DC
R_L	Load resistance	can adjust	
R_H	Heater resistance	33Ω ±5%	Room Tem
P_H	Heating consumption	less than 800mw	

B. Environment condition

Symbol	Parameter name	Technical condition	Remarks
Tao	Using Tem	-20℃-50℃	
Tas	Storage Tem	-20℃-70℃	
R_H	Related humidity	less than 95%Rh	
O_2	Oxygen concentration	21%(standard condition)Oxygen concentration can affect sensitivity	minimum value is over 2%

C. Sensitivity characteristic

Symbol	Parameter name	Technical parameter	Remarks
Rs	Sensing Resistance	3KΩ-30KΩ (1000ppm iso-butane)	Detecting concentration scope: 200ppm-5000ppm LPG and propane 300ppm-5000ppm butane 5000ppm-20000ppm methane 300ppm-5000ppm H_2 100ppm-2000ppm Alcohol
α (3000/1000) isobutane	Concentration Slope rate	≤0.6	
Standard Detecting Condition	Temp: 20℃±2℃ Humidity: 65%±5%	Vc:5V±0.1 Vh: 5V±0.1	
Preheat time	Over 24 hour		

D. Structure and configuration, basic measuring circuit

	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

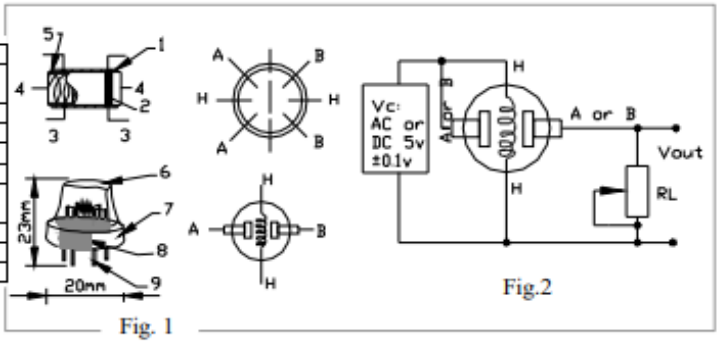
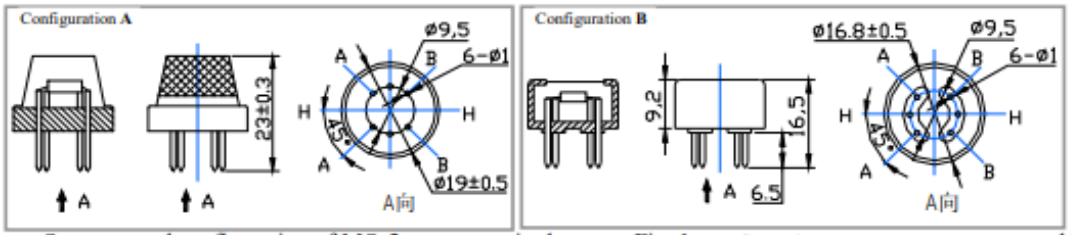


Fig.2

Fig. 1



Structure and configuration of MQ-2 gas sensor is shown as Fig. 1 (Configuration **A** or **B**), sensor composed by micro AL_2O_3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a

High Intensity LED, Ø 5 mm Clear Package

FEATURES

- Exceptional brightness (I_{Vtyp} = 2500 mcd at I_F = 20 mA)
- Narrow viewing angle (φ = ± 4°)
- Low forward voltage
- 5 mm (T-1¾") clear package
- Very high intensity even at low drive currents
- Deep red color
- Categorized for luminous intensity
- Outstanding material efficiency
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
e3
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

DESCRIPTION

This LED contains the double heterojunction (DH) GaAlAs on GaAs technology.

This deep red LED can be utilized over a wide range of drive current. It can be DC or pulse driven to achieve desired light output.

A clear 5 mm package is used to provide an extremely high light intensity of more than 2000 mcd at a very narrow viewing angle.

PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: 5 mm
- Product series: standard
- Angle of half intensity: ± 4°

APPLICATIONS

- Bright ambient lighting conditions
- Battery powered equipment
- Indoor and outdoor information displays
- Portable equipment
- Telecommunication indicators
- General use

PARTS TABLE

PART	COLOR	LUMINOUS INTENSITY (mcd)			at I_F (mA)	WAVELENGTH (nm)			at I_F (mA)	FORWARD VOLTAGE (V)			at I_F (mA)	TECHNOLOGY
		MIN.	TYP.	MAX.		MIN.	TYP.	MAX.		MIN.	TYP.	MAX.		
TLDR5800	Red	1000	2500	-	20	-	648	-	20	-	1.8	2.2	20	GaAlAs on GaAs
TLDR5800-AS12Z	Red	1000	2500	-	20	-	648	-	20	-	1.8	2.2	20	GaAlAs on GaAs

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)
TLDR5800

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Reverse voltage [1]		V_R	6	V
DC forward current		I_F	50	mA
Surge forward current	$t_p \leq 10$ µs	I_{FSM}	1	A
Power dissipation		P_V	100	mW
Junction temperature		T_j	100	°C
Operating temperature range		T_{amb}	-40 to +100	°C
Storage temperature range		T_{stg}	-55 to +100	°C
Soldering temperature	t ≤ 5 s, 2 mm from body	T_{sd}	260	°C
Thermal resistance junction/ambient		R_{thJA}	350	K/W

Note

[1] Driving the LED in reverse direction is suitable for a short term application

Buzzer

pro-SIGNAL

Features

- Black in colour
- With internal drive circuit
- Sealed structure
- Wave solderable and washable
- Housing material: Noryl

RoHS Compliant

Applications

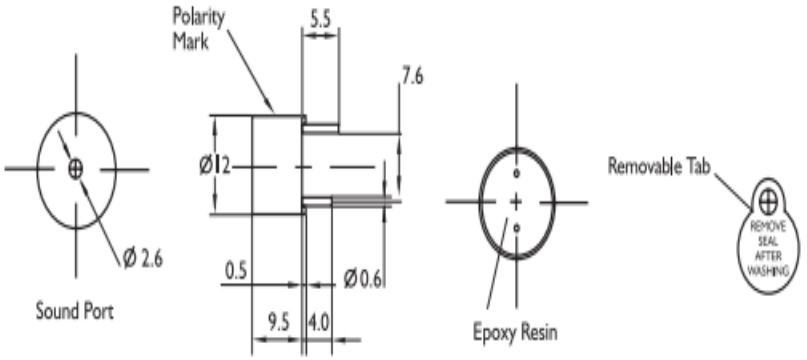
- Computer and peripherals
- Communications equipment
- Portable equipment
- Automobile electronics
- POS system
- Electronic cash register

Specifications:

Rated Voltage	: 6V DC
Operating Voltage	: 4 to 8V DC
Rated Current*	: ≤30mA
Sound Output at 10cm*	: ≥85dB
Resonant Frequency	: 2300 ±300Hz
Tone	: Continuous
Operating Temperature	: -25°C to +80°C
Storage Temperature	: -30°C to +85°C
Weight	: 2g

*Value applying at rated voltage (DC)

Diagram



Dimensions : Millimetres
Tolerance : ±0.5mm

Part Number Table

Description	Part Number
Buzzer, Electromech, 6V DC	ABI-009-RC