"SMOKE DETECTION SYSTEM"

A THESIS SUBMITTED TO

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IN THE SUBJECT OF

ESSENTIALS OF INTERNET OF THINGS (PBL)

UNDER THE GUIDANCE OF

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ABSTRACT

A smoke detection system using Arduino is a project that involves designing and building a smoke detector that is controlled by an Arduino board.

The system is based on detecting smoke particles in the air using a smoke sensor and triggering an alarm when the smoke concentration exceeds a certain threshold.

The system is designed to be low cost and easy to assemble, making it accessible to hobbyists and enthusiasts. The main objective of this project is to create a reliable smoke detection system that can be used in homes, offices, and other indoor environments to provide an early warning of potential fires.

Additionally, the system can be expanded with additional sensors or features, such as wireless connectivity, to enhance its functionality. Overall, this project is a great way to learn about electronics and programming while creating a useful device that can potentially save lives**.**

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1. INTRODUCTION

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 these 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 was 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 .

Reference stated that "fire loss data reveals that in buildings with automatic sprinklers, 96% were controlled and extinguished by these systems". Once there a fire, the fire detection system activates the alert thereby triggering the automatic sprinkler system. It's very important for fire protection system to be installed in all commercial building .

There are concerns associated with automatic smoke detection system arising from inappropriate techniques for quick notification, false noise tolerant and different sensor combinations . Researchers have been studying fire taking place in various places such as residential area and commercial buildings.

A smoke alarm is a device that senses smoke, typically as an indicator of fire. It may issue a signal to a fire alarm control panel as part of fire alarm system ,especially in commercial security devices or may issue a local audible or visual alarm in the household.

Smoke can be detected either optically (photoelectric) or by physical process(ionization). Detectors may use either or both methods.

Smoke detectors have prior detection when compared with heat detectors, hence are preferred for fire detection. They also find application in detecting, and thus deter smoking in premises where it is banned .

2. PROJECT METHODOLOGY

This project therefore seeks to design a microcontroller based smoke alarm that will continuously monitor the presence of significant amount of smoke and activate an alarm to prompt a safety measure to contain the situation.

This system can be of great in domestic as well as industrial settings to detect smoke and alert people on an impending fire since smoke is a precursor for fire, instead of relying on heat/temperature sensors which sounds alarm when the fire has already started. This can go a long way in helping to save human life. This system can also be used to detect and deter smokers in areas where smoking is prohibited.

The cost of implementing this system is relatively low since the components used are relatively cheap and are easily available in the market. The single microcontroller can be used to interface several sensors with alarms located in different locations as long as more pins are freed for multiple inputs multiple outputs.

The Basic Components of the smoke detector alarm

a) Arduino uno
b) PCB design
c) MQ2 sensor
d) LED light
e) Buzzer
f) power supply (9v battery)
g) Resistor
h) Male to Female Jumper Wires

2.1 COMPONENTS

A) ARDUINO BOARD

Arduino is a project made by the largest technical community of engineers, developers and hobbyists whose goal is to develop ideas and interactive control projects around the world, based on different types of electronic panels but programmed in a language Single programming and free. Sure, Arduino is not the only electronic controller in the market, but there are many micro-controllers available in the market such as Parallax, Basic Stamp and the most powerful competitor, Raspberry Pi, all with powerful capabilities and the ability to work.

Full projects, of course depending on the needs of your project, but what distinguishes the following Arduino Open Source platform Open Source Hardware and Software.

This is the most important feature for electronic circuit designers because it makes it easier for them to design anything they want the software is written in C ++, and is available to everyone to download and programmers can modify it according to their needs.

It is the most widely used and widely used one of the many Arduinos. It is the first choice for beginners. It is easy to learn. It operates with an ATmega328 controller.

This type has 14 digital ports (I / O), 6 of which can be used as ports to control the "PWM Outputs ", the most important feature of this type is that the control chip" ATmega328 "is not fixed in the board, but installed on the holder of the integrated circuit" IC".

The ATmega328 controller is similar to the same model. The first-ever type of Arduino's motherboard is theATmega32u4 controller, which has a unique feature that contains a built-in USB connection, eliminating the need to use a secondary processor.

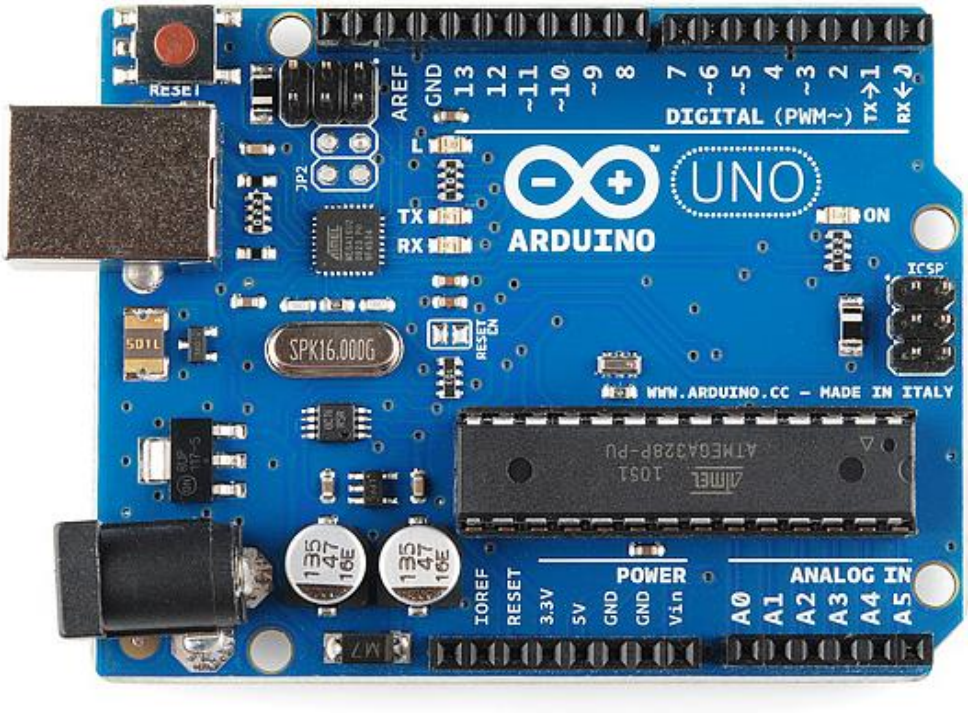

Fig. ARDUINO BOARD

The feature allows the panel as soon as it is connected to your device to appear as a keyboard and mouse, which makes it ideally suited to build various applications that enable you to control your PC.

Advantages of Arduino:

1-Simplicity - Arduino's paintings are designed to suit the needs of all engineers, designers, professors, students, and interactive electronics enthusiasts around the world.

2- The Price - The Arduino Plate is less expensive than any competitor of the same type.

3- Self-Assembly - Easy to deal with and easy to connect circuits, it is an easy solution to the problem of microcontrollers and complex connections.

4- Multi-platform - The Arduino program has the ability to work with all the different operating systems of Windows, Mac and Linux, while most other boards running on Windows only

5- Easy and simple software environment - The "Environment" programming environment is designed to be easy for beginners and powerful professionals and its programming language "Arduino C" is easy to learn.

B) PCB:

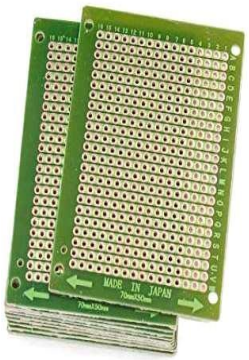

Fig : PCB

A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and otherfeatures etched from one or more sheet layers of copper laminated onto and/or betweensheet yers 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.

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

C) MQ2 SENSOR :

The MQ2 sensor module was selected to serve the purpose of sensing smoke. It has the capability of sensing smoke and other combustible gases. The following are the reasons as to why it was selected:

- Wide detecting scope
- Fast response & high sensitivity
- Stable and long life
- Simple drive circuit

The MQ-2 smoke sensor is sensitive to smoke and to the following flammable gases:LPG

Butane

Propane

Methane

Alcohol

Hydrogen

The resistance of the sensor is different depending on the type of the gas The smoke sensor has a built-in potentiometer that allows you to adjust the sensorsensitivity according to how accurate you want to detect gas

Fig : MQ2 SENSOR DETAILS

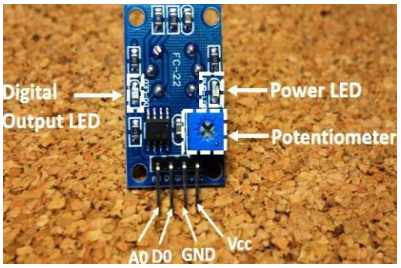

Fig : MQ2 SENSOR PIN OUT

The sensor can detect smoke in the range of 300-10,000 rpm, giving an analog output voltage of between 0v to 5v depending on the quantity of smoke detected. The sensitive material used is SnO2, whose conductivity is lower in clean air. Its conductivity increases as the concentration of combustible gases increases, hence generating a corresponding analog voltage at the output .

D) LED LIGHT:

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–njunction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasingenergy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy bandgap of the semiconductor

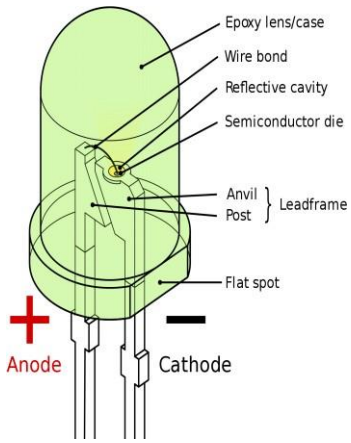

Fig :Parts of an LED

3) CODE

```
int Input = A0;
int R_LED = 2;
int G_LED = 3;
int Buzzer = 4;
// VAL INTEGER
int val;
int MAX = 400;

void setup() {
  Serial.begin(9600);
  pinMode(Input ,INPUT);
  pinMode(R_LED ,OUTPUT);
  pinMode(G_LED ,OUTPUT);
  pinMode(Buzzer ,OUTPUT);
}

void loop() {
  val = analogRead(A0);
  if (val >= MAX) {
    digitalWrite(R_LED ,HIGH);
    digitalWrite(Buzzer ,HIGH);
    digitalWrite(G_LED ,LOW);
    Serial.println("GAS LEAKING");
```

```
  }
  else {
    digitalWrite(R_LED ,LOW);
    digitalWrite(Buzzer ,LOW);
    digitalWrite(G_LED ,HIGH);
    Serial.println("NORMAL");
  }
}
```

4) RESULT

OVERALL VIEW OF THE KIT:

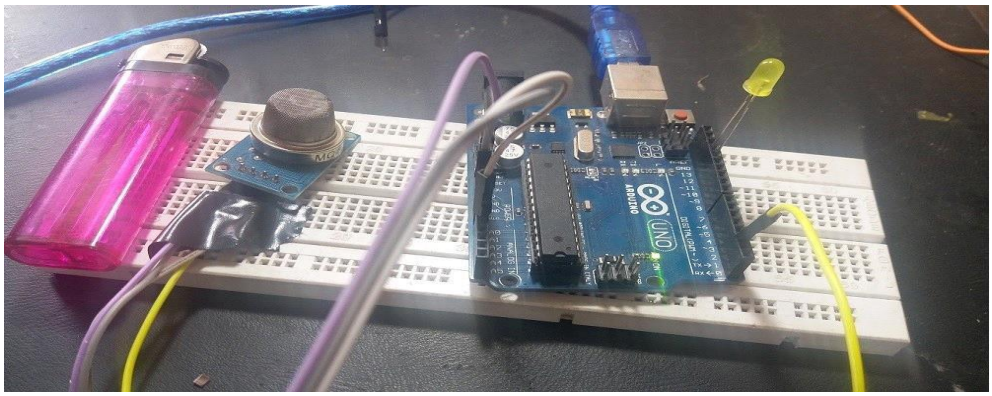

Fig : Smoke Detector Alarm

WORKING OF SMOKE DECTECTOR ALARM:

The voltage that the sensor outputs changes accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of smoke/gas. In other words, the relationship between voltage and gas concentration is the following:

- The greater the gas concentration, the greater the output voltage
- The lower the gas concentration, the lower the output voltage

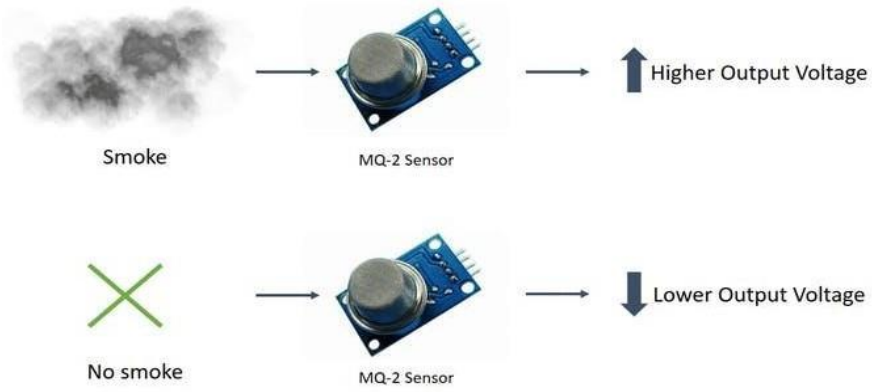

Fig : Working mechanism of Smoke Detector MQ2 Sensor Installation and placement :

The installation of smoke detectors vary depending on the locality. However, some rules and guidelines for existing homes are relatively consistent throughout the developed world. For example, Canada and Australia require a building to have a working smoke detector on every level.

The United States NFPA code cited in the previous paragraph requires smoke detectors on every habitable level and within the vicinity of all bedrooms. Habitable levels include attics that are tall enough to allow access. Many other countries have comparable requirements. In new construction, minimum requirements are typically more stringent. All smoke detectors must be hooked directly to the electrical wiring, be interconnected and have a battery backup.

In addition, smoke detectors are required either inside or outside every bedroom, depending on local codes. Smoke detectors on the outside will detect fires more quickly, assuming the fire does not begin in the bedroom, but the sound of the alarm will be reduced and may not wake some people. Some areas also require smoke detectors in stairways, main hallways and garages.

A dozen or more detectors may be connected via wiring or wirelessly such that if one detects smoke, the alarms will sound on all the detectors in the network, improving the likelihood that occupants will be alerted even if smoke is detected far from their location. Wired interconnection is more practical in new construction than for existing buildings.

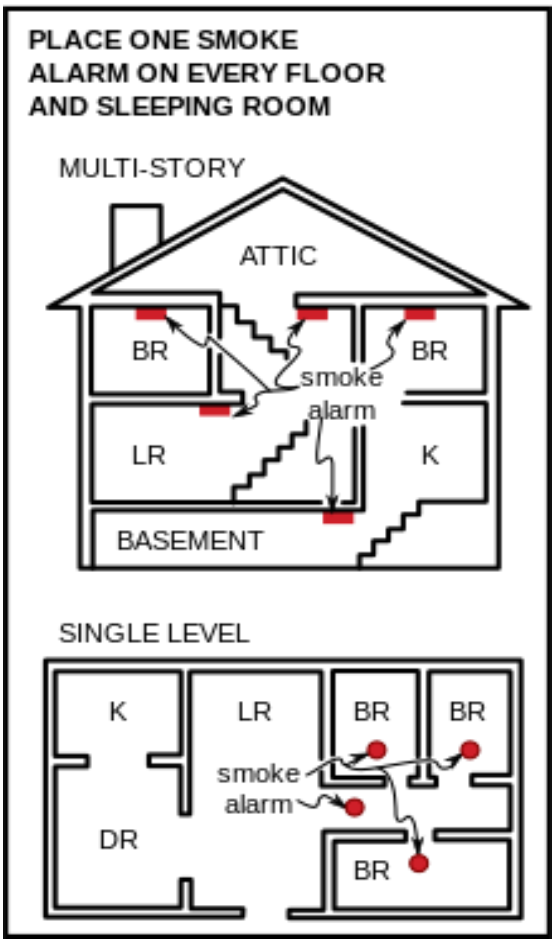

Fig : INSTALLTION AND PLACEMENT OF SMOKE DETECTORSON HOME

5. CONCLUSION

When it come to Fire safety, it's best to have a smoke detector in every bedroom and hall way, as well as on every floor in our home . with so many smoke detector ,we can rest assured our home is protected from the unthinkable. Smoke detector is one of the easiest and low costly. Most of industries use it, because itwork fatly to protect and most effective .This system can be of great in domestic as well as industrial settings to detect smoke and alert people on an impending fire since smoke is a precursor for fire, instead of relying on heat/temperature sensors which sounds alarm when the fire has already started.

This can go a long way in helping to save human life. This system can also be used to detect and deter smokers in areas where smoking is prohibited .The cost of implementing this system is relatively low since the components used are relatively cheap and are easily available in the market. The single microcontroller can be used to interface several sensors with alarms located in different locations as long as more pins are freed for multiple inputs multiple outputs.

This system comes with a power supply that can be directly plugged to the mains (240V AC)source and give the appropriate operating voltage. we can use the project fire accidents can be controlled to a great extract in a place such as forests, home ,colleges industries ,trains and some other public places. Fire accidents leads to deaths of excess of people ,by using this technique we can save those life's easily

6. REFERENCES

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