K. L. E Society's

KLE TECHNOLOGICAL UNIVERSITY

HUBBALLI-580031, KARNATAKA

KLE Tech. CREATING VALUE LEVERAGING KNOWLEDGE

"AUTOMATIC GAS LEAKAGE DETECTOR"

Submitted by

351	01FE20BME170	Ajay Hiremath
307	01FE20BME120	Aayush Angadi
319	01FE20BME039	Neeraj Niranjan
304	01FE20BME035	Raghavendra H

Mechatronics (19EMEC202)

INTRODUCTION :

Gas leaks are a major problem and today are seen in many places such as residential, industrial, and motor vehicles such as Compressed Natural Gas (CNG), buses, cars, etc. It is noteworthy that as a result of gas leaks, dangerous accidents occur. Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbons that is used as fuel for many systems such as houses, hostels, factories, cars, and cars because of its desirable properties including high calorie, low, low smoke. moisture, and environmental damage. Liquid petroleum gas (LPG) is highly flammable and can burn up a certain distance from a leak source. This energy source is mainly composed of propane and butane which are highly volatile chemical compounds. These gases can easily catch fire. At home, LPG is mainly used for cooking purposes. If a leak occurs, leaking gases may lead to explosions. Gas leaks lead to various hazards that lead to material loss and personal injury. Home fires have been frequent and the threat to people's lives and property has increased in recent years. The risks of an explosion, fire, breathing are based on their physical properties such as toxins, burns, etc. The death toll from gas cylinder explosions has increased in recent years. The Bhopal gas disaster is an example of the dangers of gas leaks. The reason for such an explosion is due to substandard cylinders, old valves, frequent inspection of gas cylinders, obsolete controls and lack of knowledge to handle gas cylinders. Therefore, gas leaks should be detected and controlled to protect people from danger. A fragrant aroma like ethane thiol was added to the LPG, so that the leak could be easily seen by most people. However, some people with a reduced sense of smell may not be able to rely on this natural safety net. A gas leak detector becomes important and helps protect people from the dangers of gas leaks.

1.1 **AIM OF THE PROJECT** : The aim of the project is to build a prototype which helps in detection of gas and switches off the MCB in case of gas leakage and hence save many lives. This detector should be cost-effective and reliable.

1.2 **PROBLEM STATEMENT** : The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, this system will help to detect the presence of gas leakage.

1.3 **OBJECTIVES :**
- A gas detector is a device that detects the presence of gases in an area, often as part of a safety system.
- A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave.
- This type of device is important because there are many gases that can be harmful to humans and animals.
- Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion.
- Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors.

1.4 METHODOLOGY

Components required & Justification:

- **Arduino UNO** :- Acts as micro-controller.
- **GAS SENSOR (MQ-06)** :- MQ6 semiconductor sensor is used to detect gas which has high sensitivity to Propane, Butane and LPG, as well as natural gas reactions.
- **RELAY MODULE** :- The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.
- **BRUSHLESS DC FAN** :- Acts As Ventilator to disperse the leaked gas.
- **LED LIGHT** :- Acts as light (Part Of MCB).
- **PIZO BUZZER** :- Used to alert the user about gas leakage.
- **DC MOTOR** :- Acts as Fan (Part Of MCB).
- **9V BATTERY** :- Used to power the components.
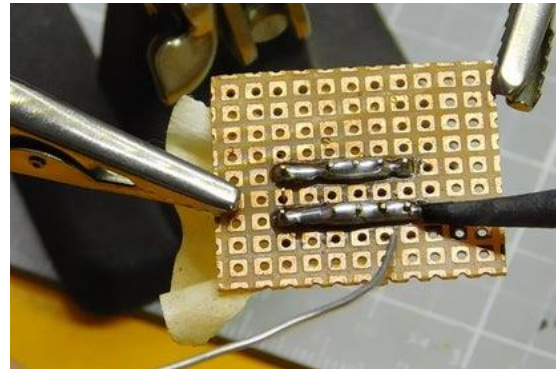
Block Diagram:
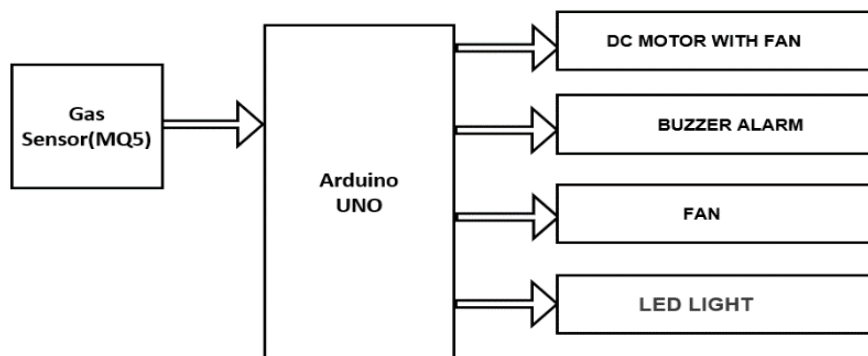
Arduino Connections:-
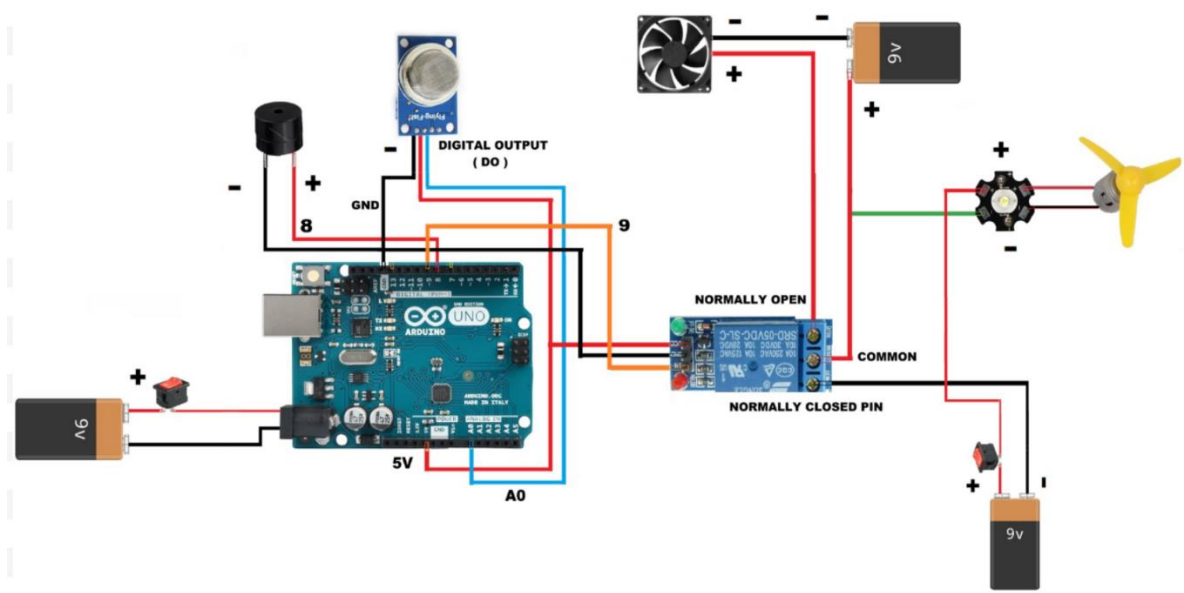
MANUFACTURING PROCESSES INVOLVED

Soldering

Soldering in electronics is a method of joining components permanently to a printed circuit board (PCB). An alloy of tin and lead called solder (63% tin and 37% lead), is normally used to 'metallurgically' bind a component pin/leg to the copper track of a circuit.

SPECIFICATIONS AND DESCRIPTIONS OF COMPONENTS USED

GAS SENSOR (MQ-06) :- The **MQ-6 Gas sensor** can detect or measure gases like LPG and butane. The **MQ-6 sensor module** comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.
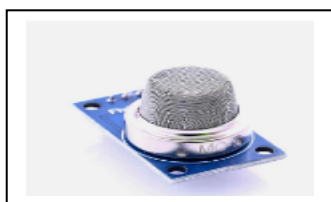

- Operating Voltage is +5V
- Can be used to detect LPG or Butane gas
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

Arduino UNO :- Arduino UNO is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

- Microcontroller: ATmega328P
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Inout Voltage (limit): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 mA


3D MODEL (CONCEPTUAL DESIGN)
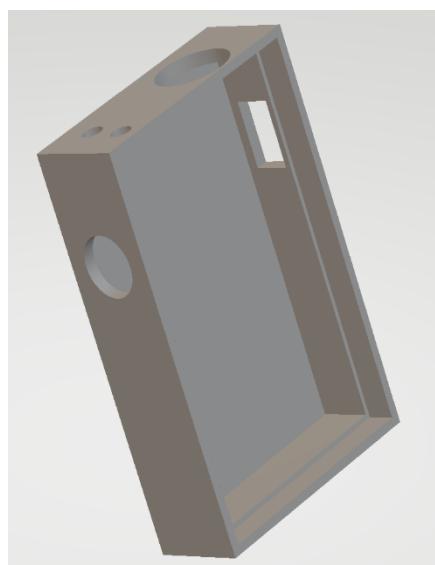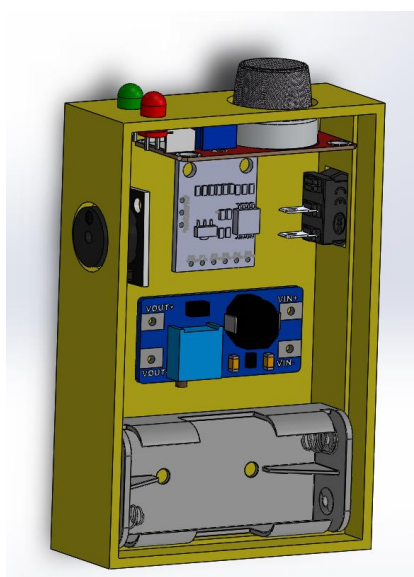
WORKING OF PROTOTYPE :

Our project consists of a MQ-6 gas sensor, micro-controller in the form of Arduino UNO, Brushless DC fan , Pizo Buzzer, Single Channel Relay, LED and DC Motor with Fan. Whenever leakage of gas occurs, the gas sensor detects it and switches off the MCB(LED and DC Motor with Fan in our case), and puts on the Ventilator(Brushless DC Fan) so as to disperse the gas meanwhile the pizo buzzer alerts the user by buzzing. Our prototype can help in saving many lives which can be lost because of unawareness of leaked gas.
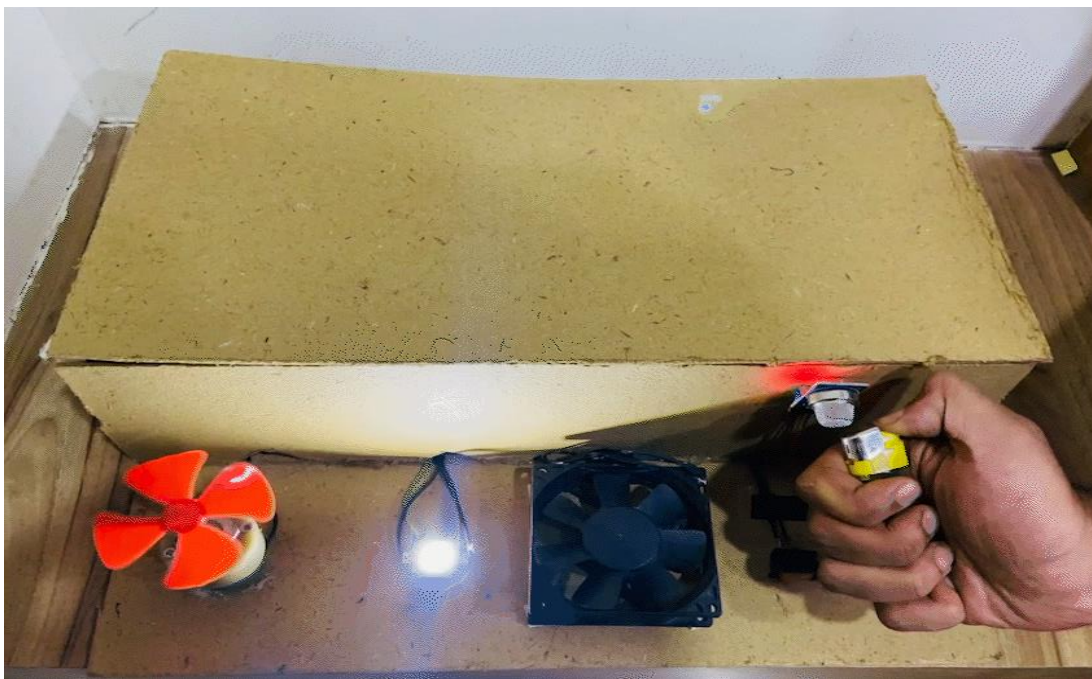
SEMI-SIMULATION IN TINKER CAD
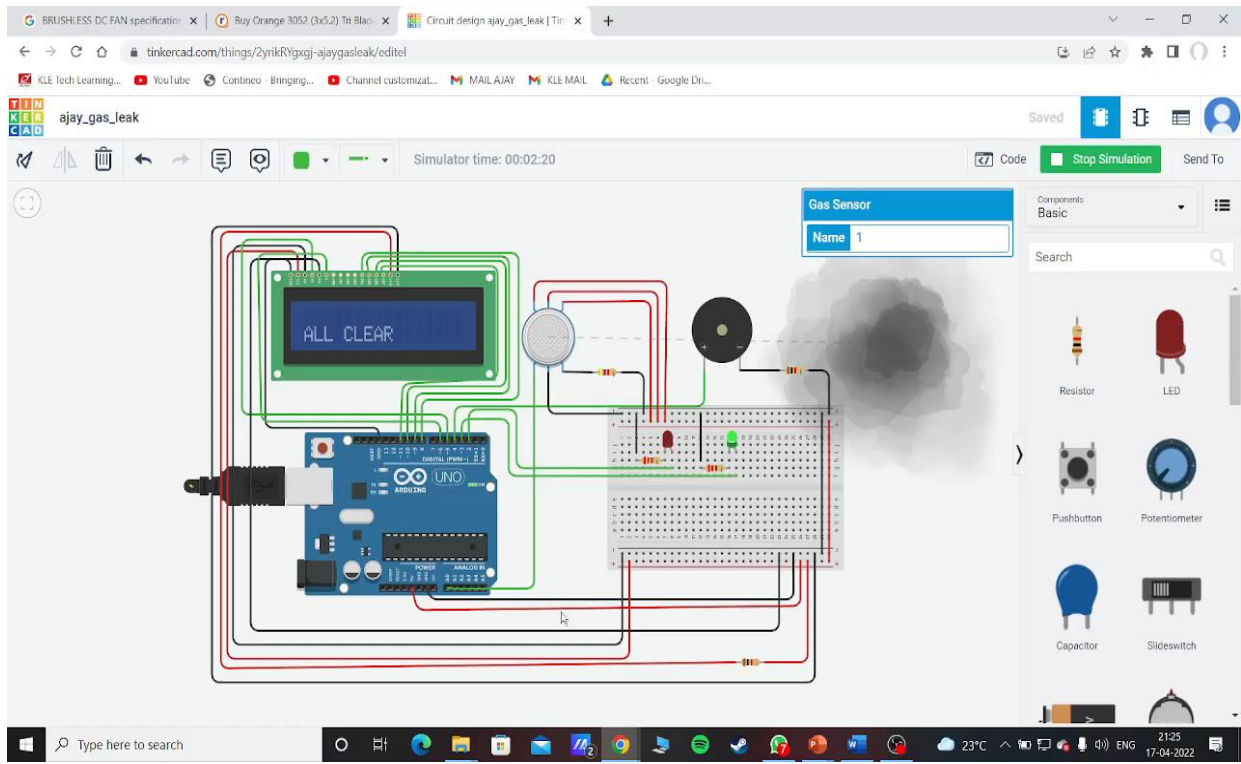
CIRCUIT DIAGRAM OF SEMI-SIMULTION TINKERCAD
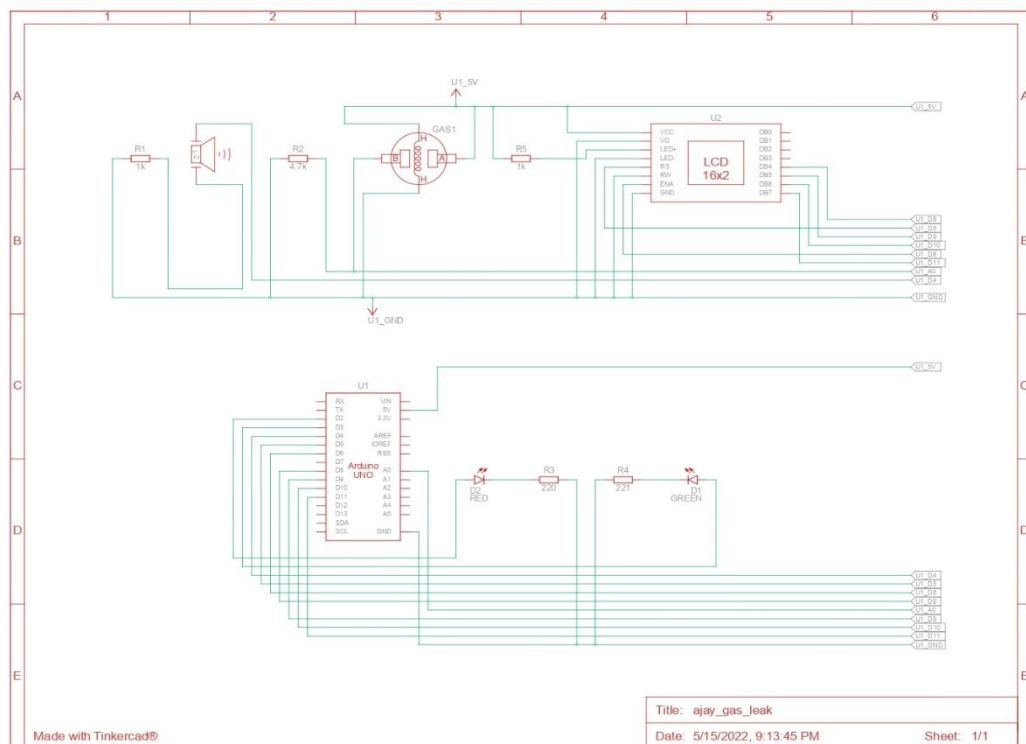
1.5   IMPORTANCE , APPLICATION AREAS AND BENEFITS

The human nose contains some 400 different types of receptors that enable us to smell almost. 1 trillion different scents. Yet, most of us do not know the kind of gas that is present in the atmosphere. Therefore, there are different sensors to measure the precise gas flow in the atmosphere. Gas detection sensors are often used extensively to develop a powerful IoT system and to identify variants of toxic gases in an industrial environment. It helps to benefit factories and cleaners by keeping them safe from any unexpected threats like explosions.

Applications:-

Harmful Gas Detection : Sensitivity to toxic gases such as H2S, Methane, and CO is very important in any industry to avoid unwanted leaks and side effects such as toxins or explosions. The presence of these gases can be easily seen in industrial centers and commercial buildings with the help of IoT-powered gas monitoring solution. In addition, a gas detector or sensor device is an important part of performing safe industrial operations. The sensor-enabled solution helps prevent high risk of gas explosions and affects any injuries inside and outside buildings.

Fire Prevention : Gas sensors help detect the accumulation of gases in the atmosphere to avoid harmful effects such as fire. Also, it is an important solution to keep equipment workers and equipment safe from fire hazards. It effectively detects the presence of harmful gases such as propane and methane and alerts engineers, preventing the area from unexpected combustion. In addition, the gas monitoring solution uses gas analysts to generate warnings about rising temperatures. This allows managers to take immediate steps to prevent dangerous fire outbreaks.

Benefits

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Real-time updates about leakages
- Cost-effective installation
- Get immediate gas leak alerts

1.6 CONCLUSION AND FUTURE SCOPE

Future Work

One of the significant future tasks of this program is to add a small system where gas waste and gas consumption can be monitored using this system. The system is flexible as a large number of sensors and transmissions can be added to it in accordance with all LPG delivery settings, which adds software-based functions to the system. This is an automatic gas discovery, control and alert system. In the future this system may have a feature in which to notify the emergency services in the event of any accidents. A mobile app and a web-based real-time monitoring app can also be added. In the user application of this system many smart features can be added. Complete features will make the system more secure for users. The system will be adapted for use in many areas such as car, home, industry and many other areas. After designing a prototype with intelligent features for multiple tasks, the system will be used in real-life situations as a test project. In the future the final product may compete with the available gas detector systems which is why it has made it available to the consumer market and the most profitable product on the market.

Conclusion

The design of an automatic sensor-based gas leak detector with a warning and control system is proposed and discussed in this paper. This is a low-cost, low-power, lightweight, portable, safe, easy-to-use, efficient, multi-featured and simple gas detection system. Detecting gas leaks will not only give us value in the health sector but will also lead to the growth of our economy, because if gas leaks not only pollutes the atmosphere but also wasting gas will damage our economy. The proposed plan will only cost USD 15 (INR 1100) which is easily accessible to the poor. In the future, more advanced features will be integrated into this system which will provide users with more security and relaxation. The need to ensure safety in the workplace is expected to be the driving force in the market in the coming years.

References

1. Mahalingam, A.; Naayagi, R.T.; Mastorakis, N.E. Design and implementation of an economic gas leakage detector. In Proceedings of 6th International Conference on Circuits, Systems and Signals, Athens, Greece, 7–9 March 2012; pp. 20–24.

2. Attia, H.A.; Halah, Y.A. Electronic Design of Liquefied Petroleum Gas Leakage Monitoring, Alarm, and Protection System Based on Discrete Components. Int. J. Appl. Eng. Res. 2016, 11, 9721–9726.

3. Apeh, S.T.; Erameh, K.B.; Iruansi, U. Design and Development of Kitchen Gas Leakage Detection and Automatic Gas Shut off System. J. Emerg. Trends Eng. Appl. Sci. 2014, 5, 222–228.