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Modelling of Gas Leakage Detector with Safety System

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Abstract: ***Leaking of gas is the major problem with industrial sector, domestic areas and vehicles run by LPG gas. Many accidents occur in day-to-day life like explosion because of gas leakage. If gas leakage is not detected earlier then major harm is caused. Due to leakage of LPG gas, it produces hazardous and toxic impact for living things.[1] LPG and natural gas is highly combustible and can burn even at some distance from the source of outflow. The main aim of this project is to present the detection of leakage, alert the danger to people and on the exhaust fan to throw out the gas to prevent from explosion. The gas will be detected by using MQ5 gas sensor. It will immediately turn on the buzzer and exhaust fan and also off the all of the lights, fans of the house for safety, when the sensor detect any gas leakage. This system is controlled by Arduino platform.***
Keywords: Arduino Uno, Gas sensor, Safety, Leakage.

I. INTRODUCTION

The growing technology is very much useful in everyone's life, but it is to be noted that preventive measures are to be undertaken for ensuring safety operation. Basically, LPG is used for cooking. It's a flammable mixture of hydrocarbon gases which is used in cooking, vehicles, etc. LPG cannot be dispersed easily & it is heavier than air. It leads to suffocation when inhaled. When leakage occurs, suddenly instigate which may lead to explosion. Huge amount of gases is being wasted due to the carelessness of the consumers. Many accidents are occurring mainly due to the leakage of LPG in residential areas. Accidents may occurs when the resident is not in the kitchen due to certain reasons.[2] An efficient technique is required to avoid those accidents. This project finds a solution for it. When leakage occurs, it is required to control the risk effectively before causing damage to the residencies. In this proposed system, when leakage is detected, it will turn on the buzzer and brushless exhaust fan, and also turn off all the lights, fans of the house. The automation is done in order to provide more safety and avoid human interference. Arduino UNO is interfaced with the gas sensor, temperature sensor, MQ5 gas sensor, relay and exhaust fan.

II. BLOCK DIAGRAM REPRESENTATION

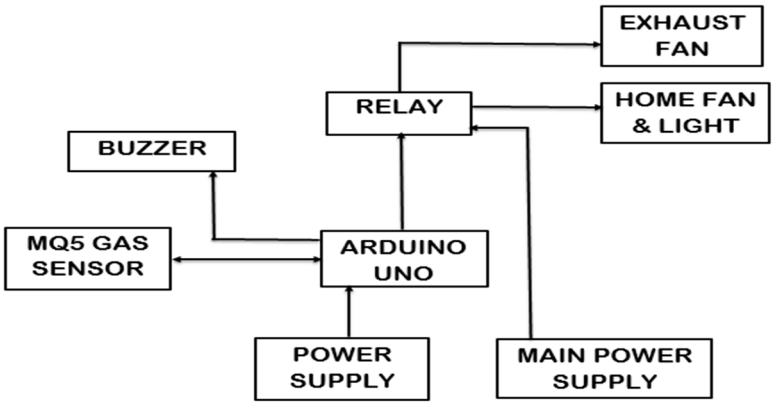

Fig 1: Block diagram of Gas Leakage Detector with safety system

In the above block diagram at first the Arduino get power from power supply. Here MQ5 gas sensor works as input for Arduino. On depending the input from MQ5 gas sensor the Arduino control buzzer and relay. Relay control the exhaust fan and home fan and light. Here we use main power supply to power up home fan and light.

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III. CIRCUIT DESIGN

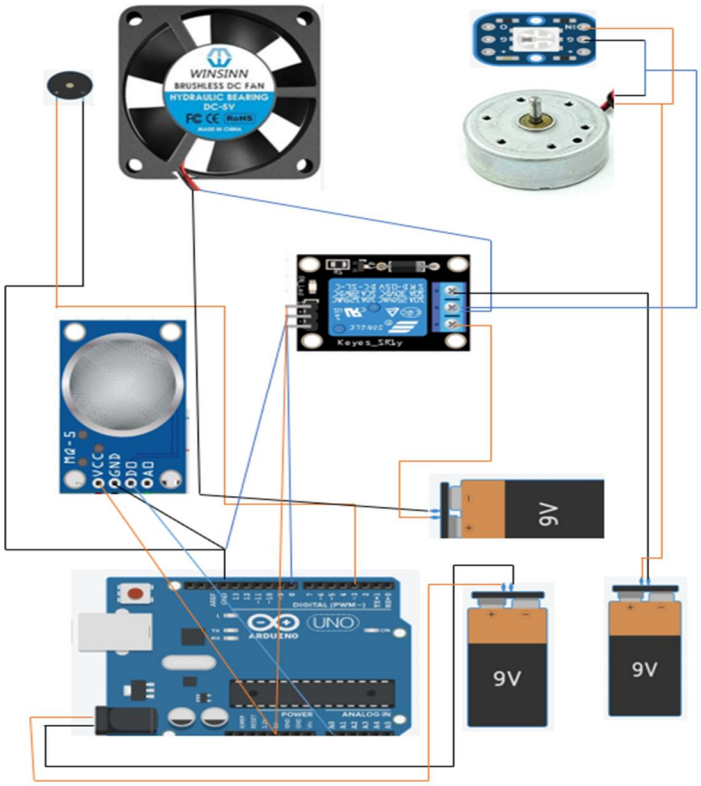

Fig 2: Circuit diagram of Gas Leakage Detector with safety system

IV. COMPONENTS DESCRIPTION

1) *Arduino Uno:* Arduino is an open-source electronics platform based on hardware and software which is easy to use. Arduino boards are able to read inputs from various sensor and turn it into a digital or analog output.
2) *Arduino USB Cable:* An Arduino board is connected to a computer through a USB connector (USB 2.0). It powers the Arduino and transfers data between PC & Arduino.
3) *MQ5 Gas Sensor:* The MQ-5 gas sensor is a low-cost semiconductor sensor commonly used for detecting flammable gases like methane, propane, and butane. It's ideal for building air quality monitors or simple gas leakage detectors at home or work. The sensor works by utilizing a tin dioxide (SnO2) layer that has a higher conductivity in clean air.[3] When exposed to flammable gas, the SnO2 layer's conductivity increases proportionally to the gas concentration. This change in conductivity can be measured by an external circuit which determine the gas concentration.
4) *Brushless Exhaust Fan:* A brushless fan is a type of exhaust fan that uses a brushless DC (BLDC) motor. BLDC motors are different from traditional AC motors in that they don't have brushes. Instead, they use electronic commutation to control the rotation of the motor.
5) *Battery:* A battery can be defined as an electrochemical device (consisting of one or more electrochemical cells) which can be charged with an electric current and discharged whenever required.[4]
6) *LED:* It stands for light emitting diode which is a semiconductor light source that emits light when current flows through it.
7) *Jumper Wire:* A jumper wire is an electric wire which connects electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited & short-cut (jump) to the electric circuit.
8) *Relay Module:* A relay module is a compact circuit board that essentially acts as an electronic switch. It allows you to control a high-power device (like an appliance or motor) using a low-power control signal (often from a microcontroller or other electronic device). A relay module typically consists of a relay itself, some driver circuitry, and connection terminals. The relay is the main part of the module.[4] It has an electromagnet coil & a set of contacts. When the coil is energized with a control signal, it creates a magnetic field that switches the contacts on or off.

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9) *Buzzer:* A buzzer is an audio signalling device that can be mechanical, electromechanical, or piezoelectric. It's basically a small speaker that emits a buzzing or beeping sound when activated.

V. WORKING PRINCIPLE

1) *Sensor Detection:* The MQ-5 sensor continuously monitors the surrounding air for the LPGgas.
2) *Analog to Digital Conversion (ADC):* Arduino's ADC converts the sensor's analogue voltage signal into a digital value the board can understand.
3) *Leak Detection Algorithm:* The Arduino code implements a threshold level. If the sensor reading passes this threshold, it signifies a gas leak.[5]
4) *Alert Activation:* Upon leak detection, the program triggers the buzzer/alarm and turn on the exhaust fan, and also off the light and fan of the house.

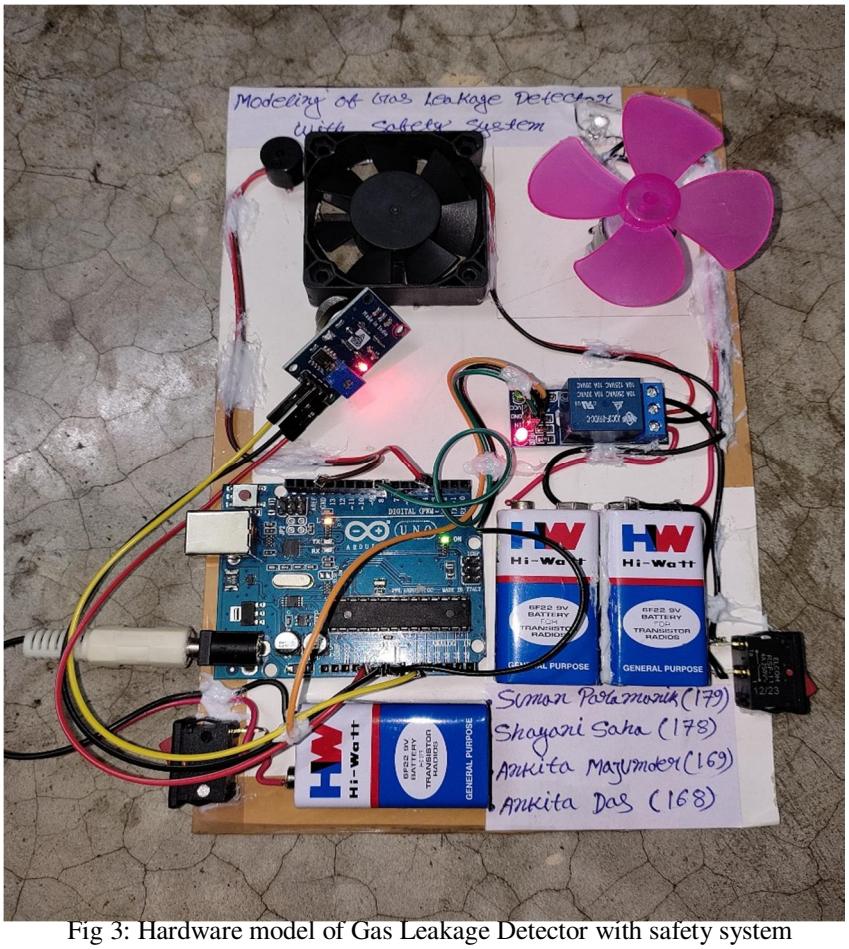

Fig 3: Hardware model of Gas Leakage Detector with safety system

VI. CONCLUSION

The project proposes the methodology for public safety in the terms of flexibility of speed breaker. This project/model is mainly to avoid the accidents on the road by reducing the vehicle speed when vehicle crosses its speed limit. The technology uses Arduino UNO which is interfaced with servo motor and Ultrasonic sensor used for detecting the human being and the speed breaker is going to be flexible in its size by increasing and decreasing depending on the vehicle speed. Means when there is no need of the speed breaker on the road,[6] it vanishes from the road and the road becomes flat and when there is a need then the breaker comes on the road from ground and it can start its working of slowing speed of the vehicles. So whenever needed, it comes on the road by rotating itself from the flat position and when not needed, it rotates itself again and gets flat and combines with flat road. In this manner the speed of the vehicle can be controlled to reduce the accidents.

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[5] https://www.fierceelectronics.com/sensors/what-ultrasonic-sensor
[6] https://www.tinkercad.com/

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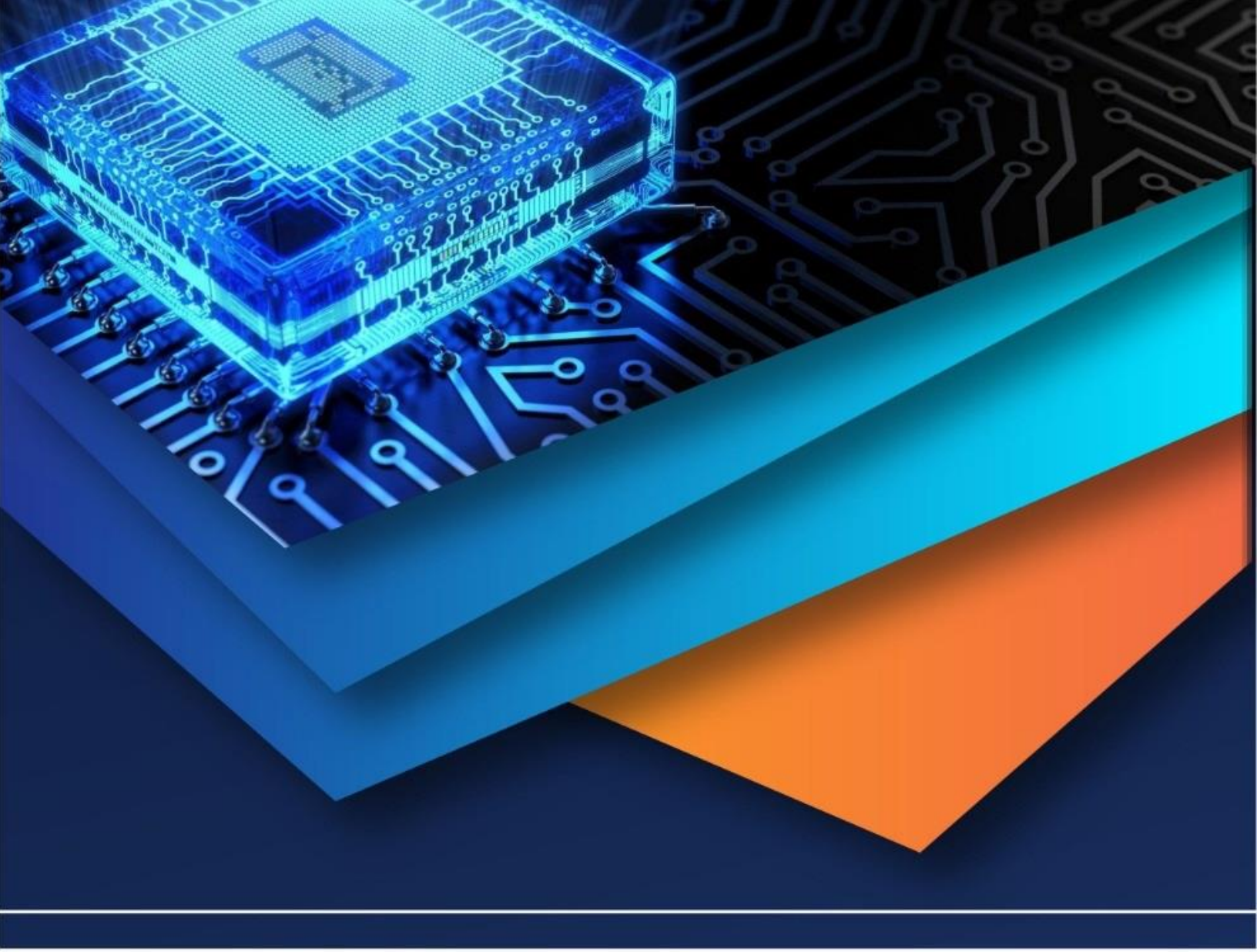

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