KITCHEN HAZARD MANAGEMENT SYSTEM

Project report submitted to the Amrita Vishwa Vidyapeetham in partial fulfilment of the requirement for the Degree of

B.Tech. Computer Science and Engineering
Artificial Intelligence

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July 2021

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING AMRITA VISHWA VIDYAPEETHAM
(Estd. U/S 3 of the UGC Act 1956)
Amritapuri Campus Kollam -690525

BONAFIDE CERTIFICATE

Your Guides

Project Guide

Coordinator name

Project Coordinator

Reviewer
Chairperson
Dept. of Computer Science & Engineering
Place: Amritapuri
Date: 28 July 2022

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING AMRITA VISHWA VIDYAPEETHAM

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DECLARATION

We,**Abhinav Pandey, Abishek A., Anfas Hassan, Aravind MJ, Rithesh R, D.S.S. Sandeep Chandra** hereby declare that this project entitled **KITCHEN HAZARD MANAGEMENT SYSTEM** is a record of the original work done by us under the guidance of **SEEMA P N** , Dept. of Computer Science and Engineering, Amrita Vishwa Vidyapeetham, that this work has not formed the basis for any degree/diploma/associations/fellowship or similar awards to any candidate in any university to the best of our knowledge.

Place: Amritapuri Date: 28 July 2022

Signature of the student

Signature of the Project Guide

ACKNOWLEDGEMENTS

Humble pranams at the lotus feet of Amma, Sri Mata Amritanandamayi devi

We thank Seema P N, Department of Computer Science and Engineering, Amrita Vishwa Vidyapeetham, for her timely advice and constructive suggestions. We thank the faculty of the CSE Department for giving us an opportunity to explore our capabilities and widen our knowledge. We also thank our team members for their cooperation and hard work put into this project. We also thank our batch mates for their support and our parents for their support and encouragement.

ABSTRACT

Gas is a molecule that is not bound, formless, invisible. LPG gas is one of the needs for industry and household needs, namely for cooking. LPG gas leakage is the cause of many fires, a factor that often causes LPG gas fires is a damaged gas regulator. Therefore prevention and security are needed to minimise fires.

Seeing this and given the technological developments, an intelligent Arduino-based device was to be created that was able to overcome this problem. But we implemented this solution in a management system for the kitchen which manages any hazards that can happen. We have used two analog sensors: temperature sensor(TMP-36) and gas sensor(MQ6). The system simultaneously measures the temperature and gas leakage in our kitchen. It shows the output and current level of gas and temperature. It also alarms us if the gas leakage level is very intense. If the temperature exceeds, it will prompt the LCD screen to open the windows. Overall, it prevents kitchen hazards this way.

Keywords: MQ2, TMP-36, LCD, Analog sensor.

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INTRODUCTION

Nowadays, the use of kerosene stove and/or electric cooker is rapidly replaced by the gas cooker which is abundant and more cost effective for domestic use. Gas is also used in laboratories and industries for various purposes also used in some vehicles as a fuel due to hiking prices of diesel or petrol. LPG are usually stored in compressed air tight steel vessels that are meant to be at room temperature, or even less to prevent explosion. In addition if the temperature of the kitchen is also high we have to open the door and manage air flow.

Our kitchen hazard management system is an arduino-based temperature and gas leakage detection system. Our system uses two analog sensors: temperature sensor(TMP-36) and gas sensor(MQ6). We have used a gas sensor to detect the gas concentration and we have also used a piezo buzzer which sends an alarm if the intensity of gas leakage is more than the limit. We have used a temperature sensor to detect if the temperature of the kitchen is high. In that case, we have used an LCD display to prompt the user to open the doors, fans, windows and manage the air flow.

The system aims to prevent any hazards such as explosion or suffocation that could happen in the kitchen. It will alarm the user using the piezo buzzer and the LCD display that we have used in our system. We have fixed the alarms to only go when a certain concentration of gas leakage is detected by the sensor. Similarly if the temperature rises over 100°C is detected, a message comes in the LCD prompting the human to open windows, doors and turn on the fan. This system is therefore called the kitchen hazard management system.

SYSTEM DESIGN

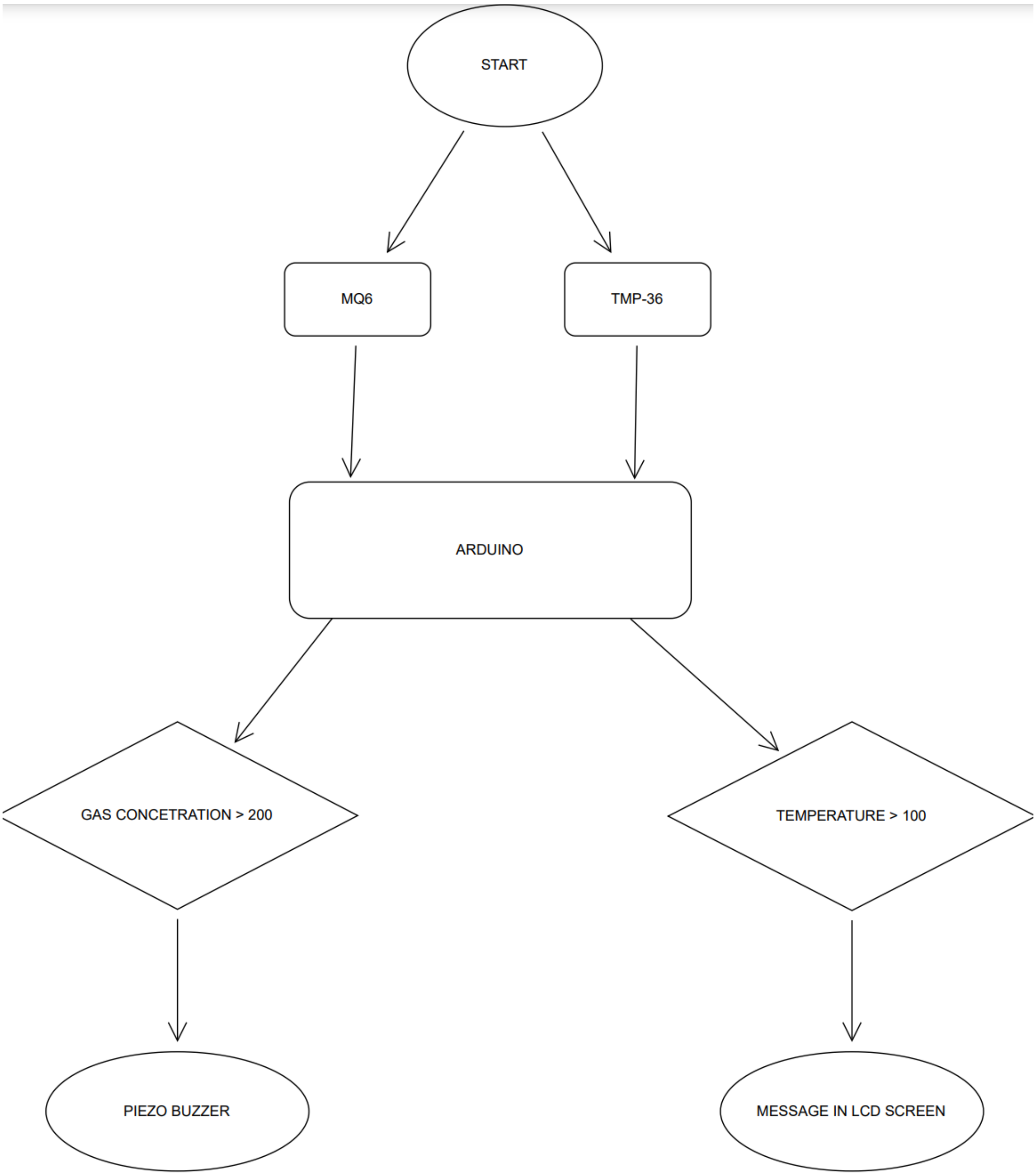


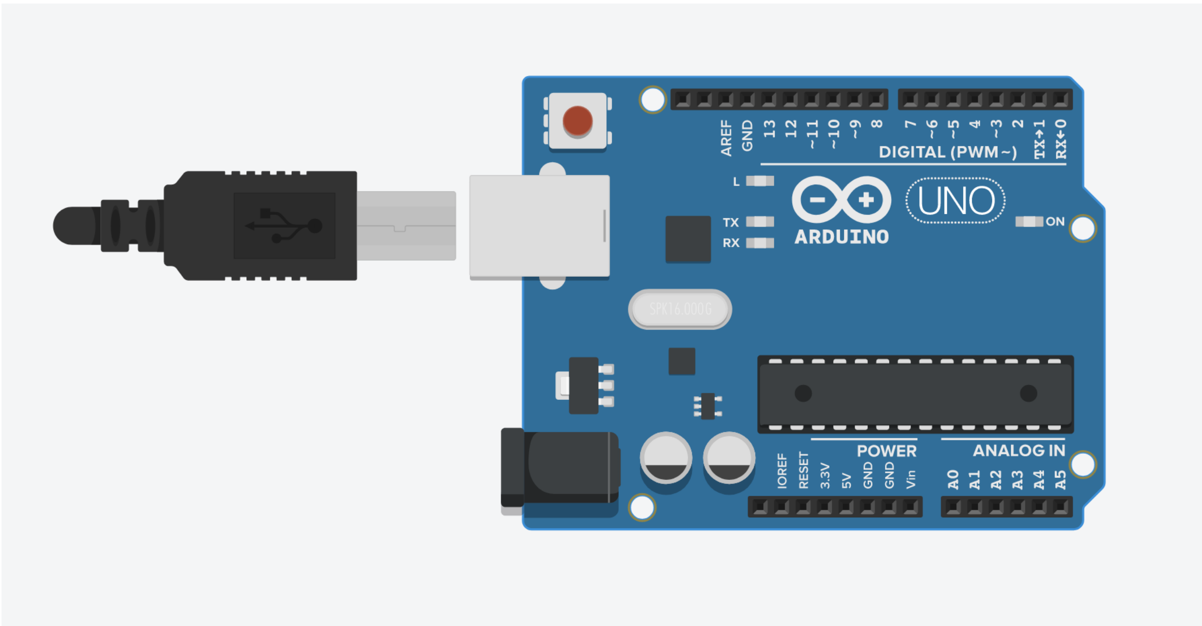
Fig: Block Diagram

COMPONENTS USED

Following are the components used in our kitchen hazard management system:

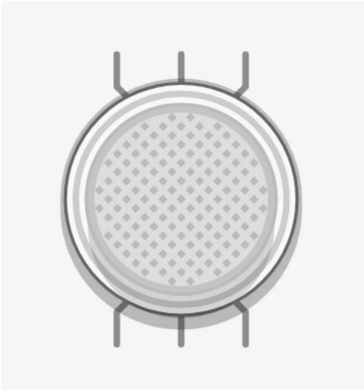
1. Arduino UNO R3

   Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits.



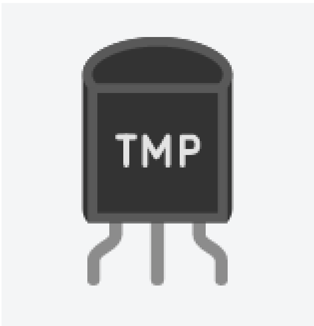
2. MQ6 Gas Sensor

   The MQ6 is a simple-to-use liquefied petroleum gas (LPG) sensor. It can be used in gas leakage detecting equipment in consumer and industry applications,this sensor is suitable for detecting LPG, iso-butane, propane,etc.



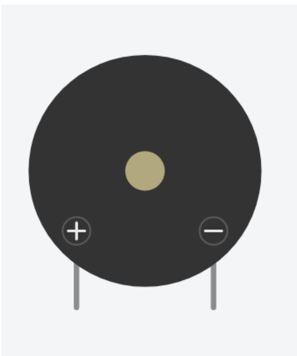
3. Temperature Sensor (TMP-36)

   The TMP36 is a low voltage, precision centigrade temperature sensor. It provides a voltage output that is linearly proportional to the Celsius temperature.



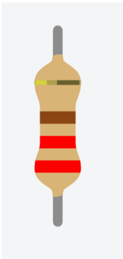
4. Piezo buzzer

   A piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound.



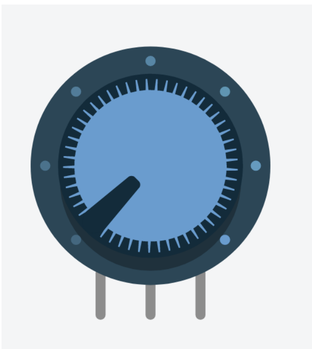
5. 220Ω resistors – x2

   A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.

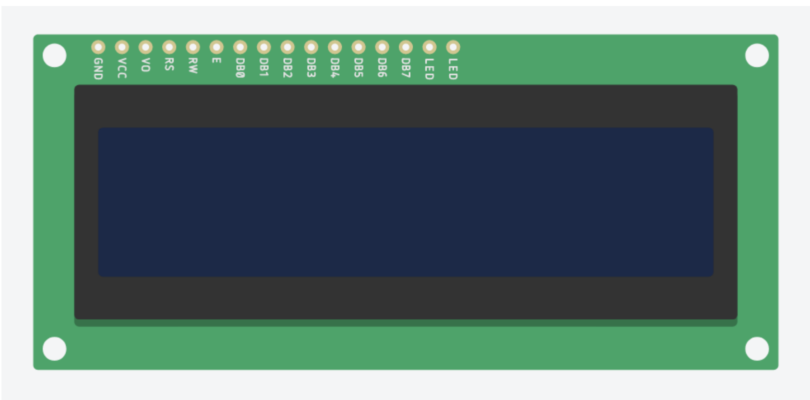


6. A 250 kΩ potentiometer

   A potentiometer is an instrument used for measuring the unknown voltage by comparing it with the known voltage.

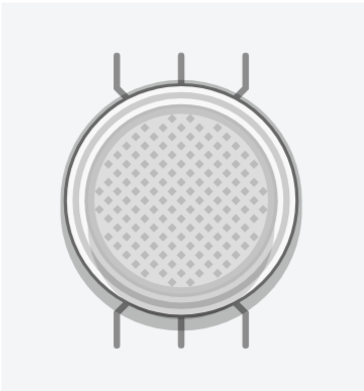


7. A 16x2 LCD display.



SENSORS

MQ6-Sensor:



It is a device used to detect specific gas. Its detection ranges from 300 to 10,000 ppm. In MQ 6, MQ stands for the name of the sensor and 6 identifies the type of gas (Butane, LPG). This sensor is composed of Aluminium Oxide Ceramic tube, sensitivity layer of Tin oxide (Sno2). Sno2 is an N-type semiconductor that has free electrons to donate in normal state (high resistance). But when this sensor recognizes LPG, the free electrons come back to their original state and then its resistance becomes low. MQ 6 Gas Sensor Module Pin Configuration:

- Vcc-This pin powers the module.
- Ground-This pin is connected to the system ground.
- Digital out-This pin is connected to get digital output, by setting a threshold value using the potentiometer.
- Analog out-This pin outputs 0-5V analog voltage based on the intensity of the gas.

Features of MQ6 gas sensor Module:

- High sensitivity to LPG, iso-butane, propane
- Small sensitivity to alcohol and smoke
- Fast response
- Stable and long life
- Simple drive circuit

The procedure to measure PPM using an MQ sensor is the same but few constant values will vary based on the type of MQ sensor used. The LTspice implementation of MQ-6 sensor is:

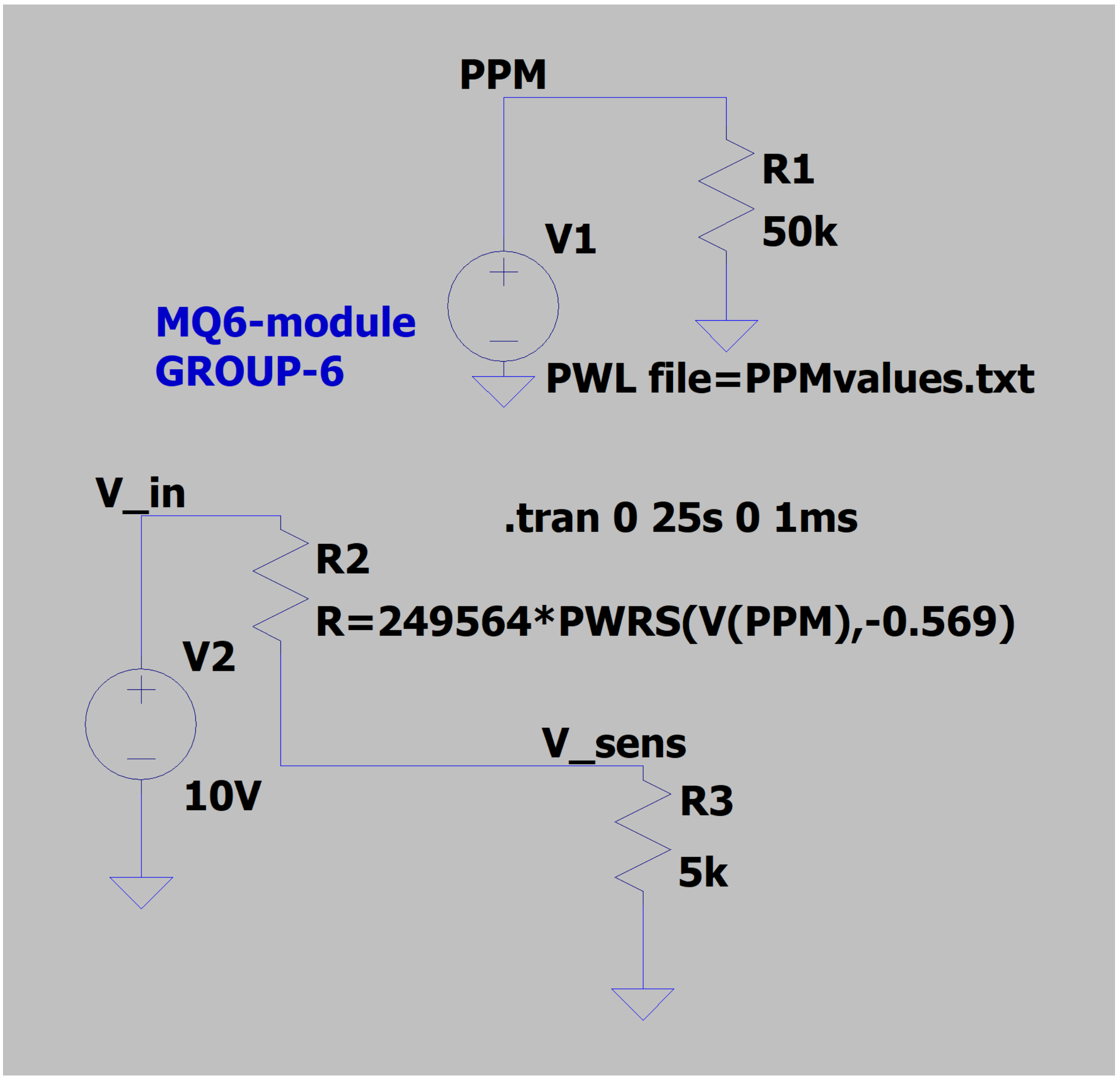


Fig: MQ6 implementation in LTspice

In the given circuit, V1 value is the voltage corresponding to the concentration of the gas detected in PPM. The value of V1 varies according to the PPM value which is given in a text file "PPMvalues.txt" which contains the values of concentration of gas varying with each second. For LPG detection, the value of R2 is given by

$$y=249564*(x^{-0.569})$$

Basically we need to look into the (Rs/Ro) VS PPM graph given in the MQ-6 specification in the file "PPMvalues.txt", which is shown below:

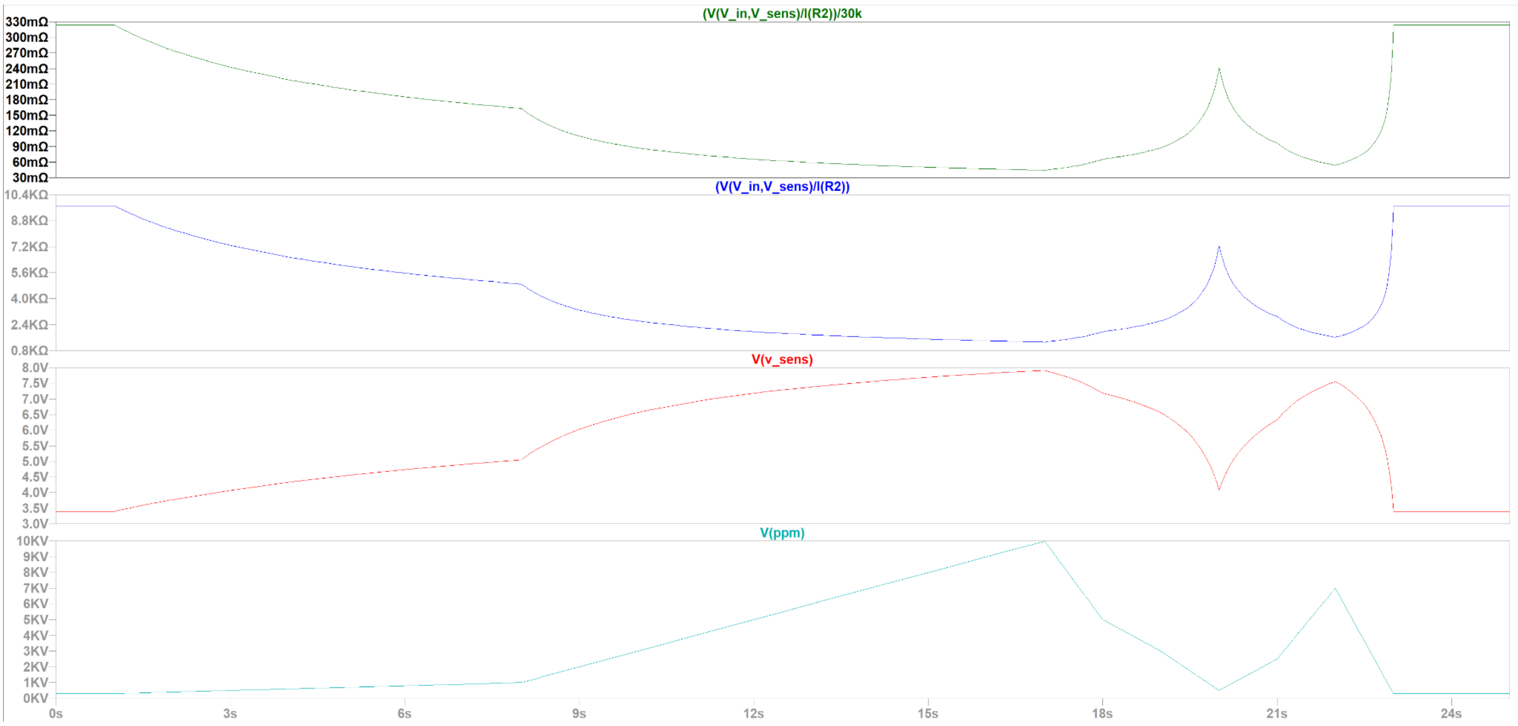
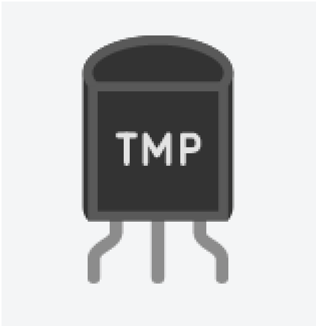


Fig: Load resistance VS varying PPM

TMP-36 Sensor:



The TMP36 is a low voltage, precision centigrade temperature sensor. It is fairly precise, never wears out, works under many environmental conditions and requires no external components to work. In addition, the TMP36 sensor does not require calibration and provides a typical accuracy of ±1°C at +25°C and ±2°C over the −40°C to +125°C temperature range.

The sensor can be powered with a 2.7V to 5.5V power supply and consumes only 50µA during active temperature conversions, providing very low self-heating. The direct proportionality of voltage change with temperature change is what makes the sensor detect the rise or fall in temperature. Instant values of the surrounding temperature are fed to the microcontroller as voltage variations according to which the microcontroller carries out the output functions.

Its specifications are as follows:

- Power supply : 2.7V to 5.5V
- Current draw : 50µA
- Temperature range : -40°C to 125°C
- Accuracy : ±2°C
- Output scale factor : 10mV/°C
- Output range : 0.1V (-40°C) to 1.75V (125°C)
- Output at 25°C : 750mV

The LTspice implementation of TMP-36 temperature sensor is:

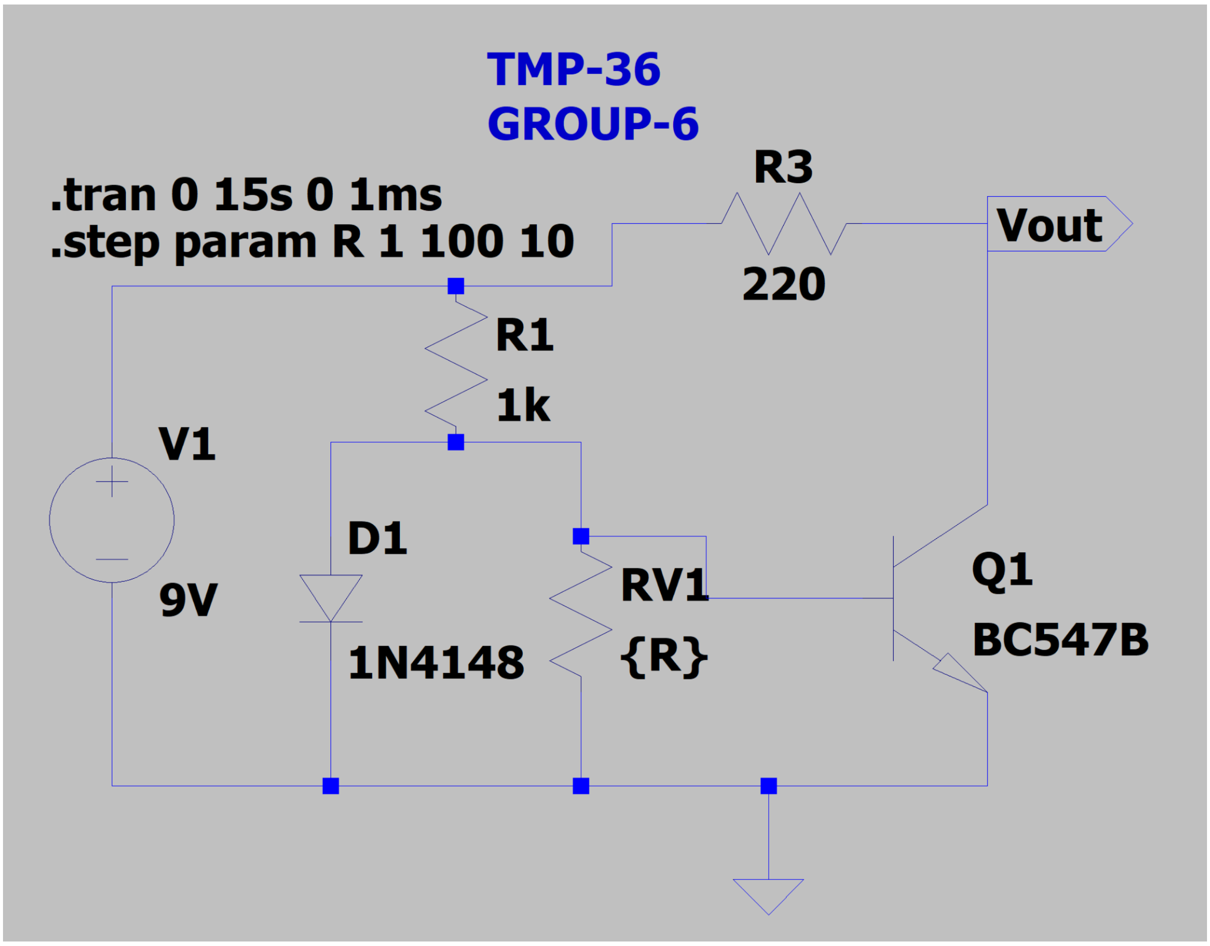


Fig: TMP-36 implementation in LTspice

When there is heat or increase in temperature to the level where it crosses the threshold, the collector current increases. We then supply Vout to Arduino which then checks whether the temperature is in the specified range. Before testing the circuit, the Variable Resistor should first be set. When you rotate the potentiometer completely in one direction, Vout will be 0, and when rotated completely in another direction, Vout will increase.

Base-Emitter voltage (V_{BE}) drops approx. -2.5 mV/°C, negative sign indicates the drop or decrease of voltage across B and E.

A NPN transistor must act like a diode if we short the Base (B) and collector (C) of the transistor. In that case B-C acts as Positive terminal and Emitter (E) acts as negative terminal. And if we keep the voltage source constant, then the voltage across the transistor becomes the function of the temperature. For PNP transistors E will be positive terminal and B-C will be negative. Hence by shorting the B and C, we can use the transistor as a temperature sensor.

If we vary the resistance, we get the following output:

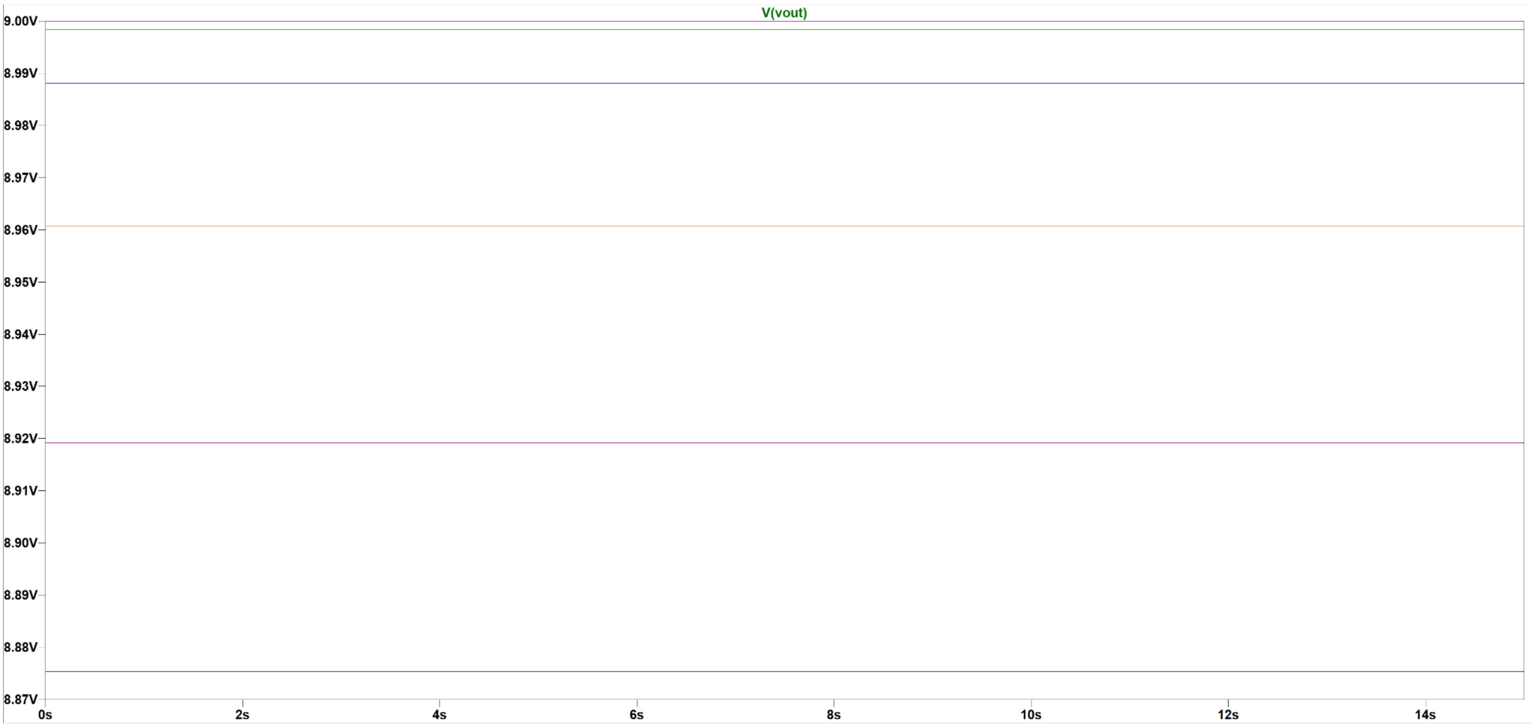
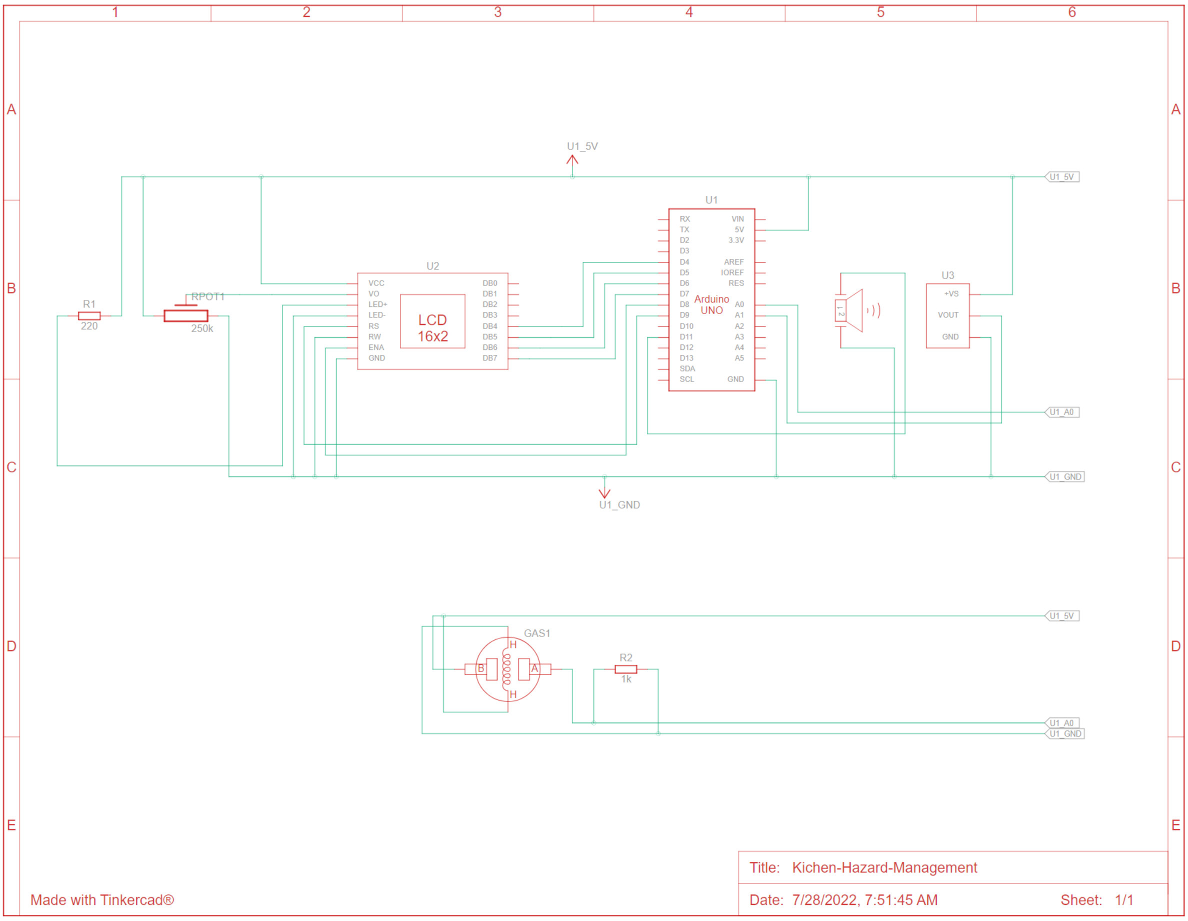


Fig: Output voltage for varying resistance

CIRCUIT IMPLEMENTATION

IN TINKERCAD



Snapshots:

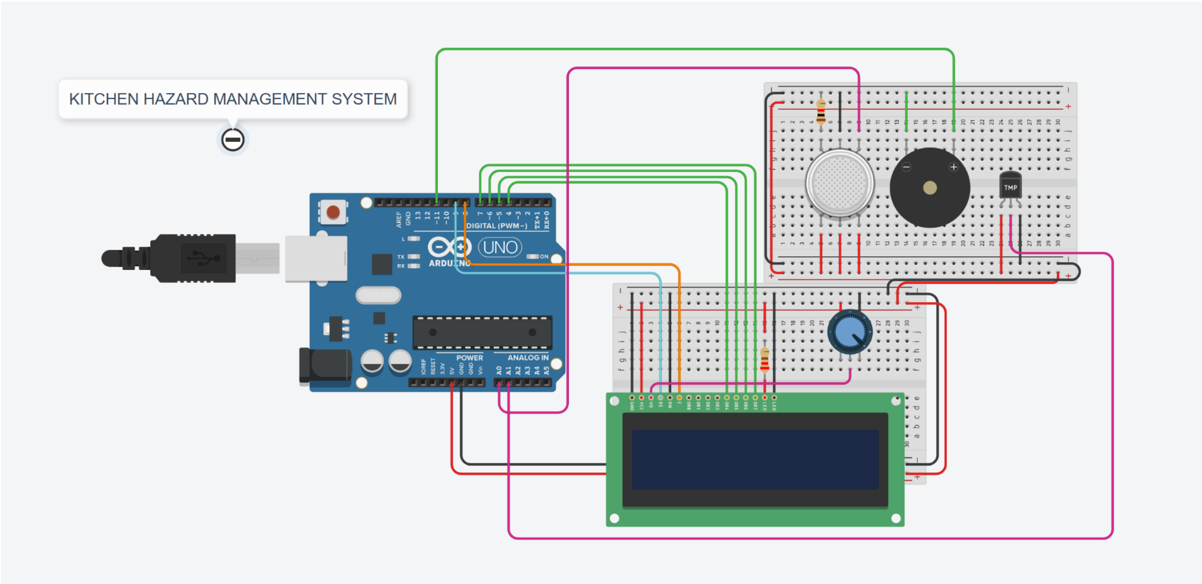


Fig: Circuit design

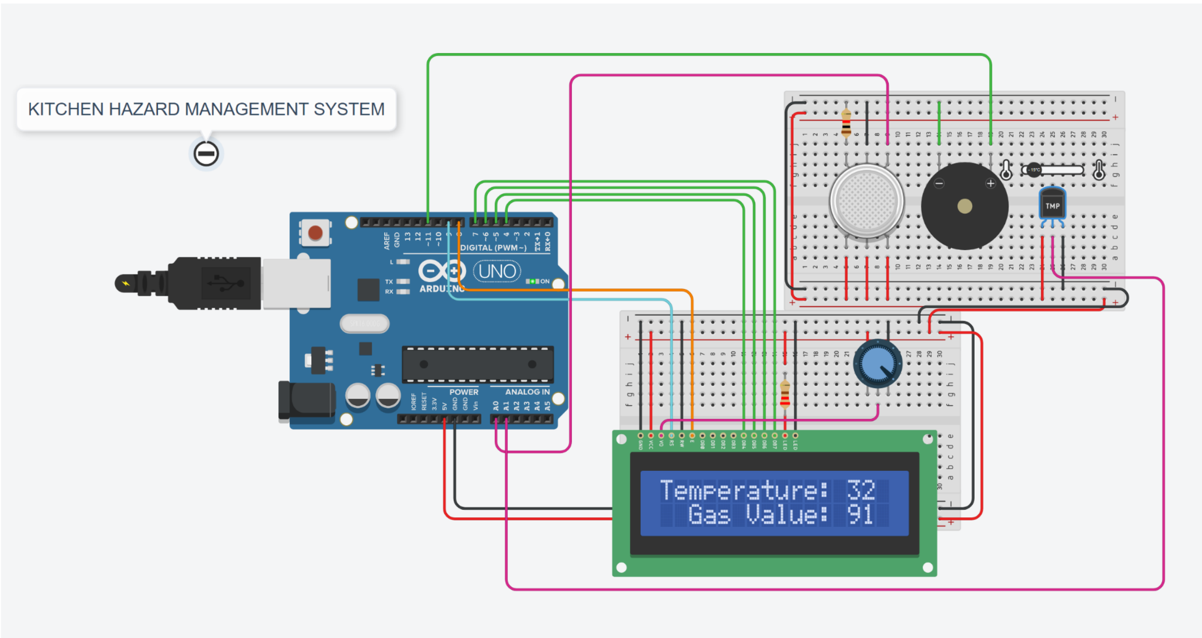


Fig: Normal working of system

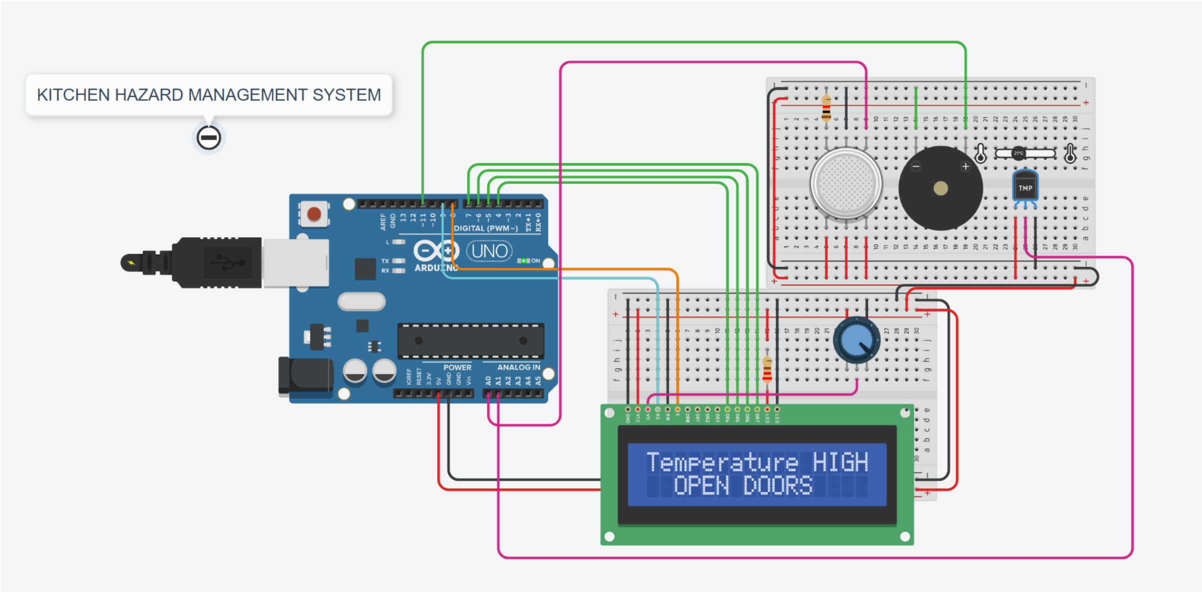


Fig: Temperature above 100

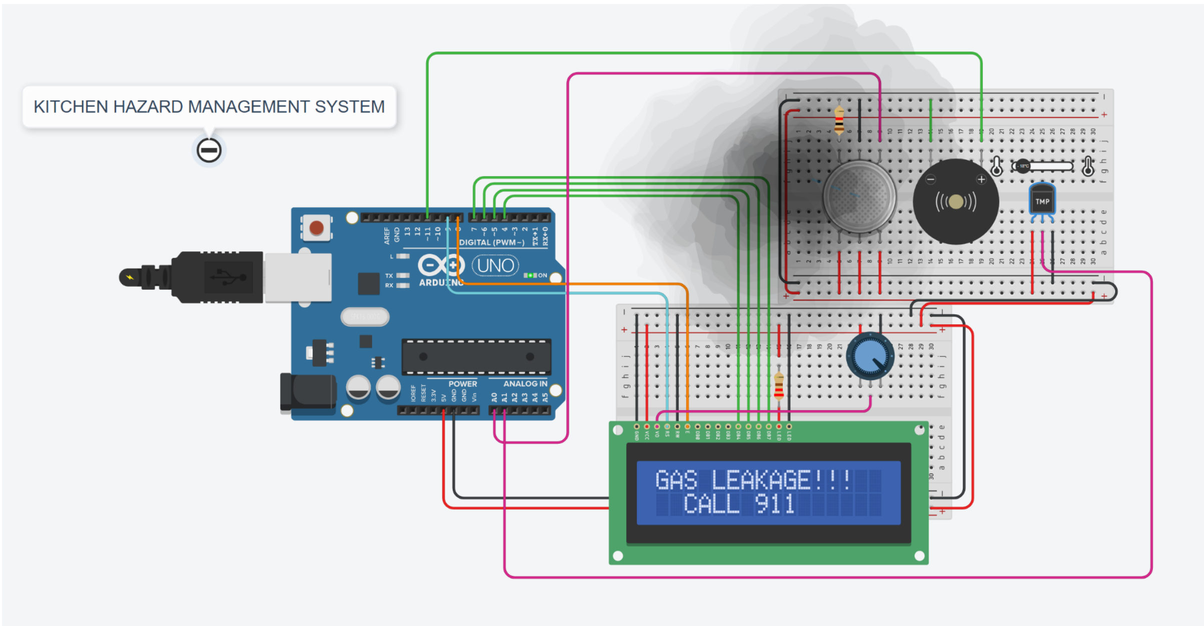


Fig: Gas concentration above 200

TINKERCAD CIRCUIT CODE

```
#include <LiquidCrystal.h>

#define D4 4
#define D5 5
#define D6 6
#define D7 7
#define E 8
#define RS 9

//defining the nodes at where the pins are connected in arduino
int sensorValue = 0;
int tempValue = 0;
int C = 0;
int buzzer = 11;

LiquidCrystal LCD(RS, E, D4, D5, D6, D7);

void setup() {
	LCD.begin(16,2);
	pinMode(A0,INPUT);
	pinMode(A1,INPUT);
	pinMode(buzzer, OUTPUT);
}

void loop() {

	sensorValue = analogRead(A0);

	tempValue = analogRead(A1);
	C = map(tempValue,0,1023,30,70);

  //if the gas concentration increases over 200
  if(sensorValue > 200){
	tone(buzzer, 500, 200);
    LCD.setCursor(0,0);
```

```
        LCD.print("GAS LEAKAGE!!!   ");
        LCD.setCursor(2,1);
        LCD.print("CALL 911       ");
    return;
  }
  else{
     noTone(buzzer);
  }

  //if the temp increases over 100
  if(tempValue>100){
    LCD.setCursor(0,0);
        LCD.print("Temperature HIGH!");
        LCD.setCursor(2,1);
        LCD.print("OPEN DOORS       ");
    return;
  }
  else{
  }

  //display the temperature and gas concentration
        LCD.setCursor(0,0);
        LCD.print("Temperature: ");
        LCD.print(C);
        LCD.print("     ");
        LCD.setCursor(2,1);
        LCD.print("Gas Value: ");
        LCD.print(sensorValue);
}
```

CONCLUSION

Kitchen hazard management system successfully alerts and prevents others about any kind of mishappenings that could occur in the kitchen including lpg gas leakage, suffocation. We have combined the use of 2 analog sensors: MQ6 and TMP-36, arduino, buzzer and LCD display to manage the working of the system. This system can be applied and made in real life and can save many lives.

As students of the Computer Science and Engineering Department, this project was valuable for us as we learnt about several electrical components, their working mechanism, construction of circuit diagrams and their simulation. We learned how to do signal conditioning of sensors, implementation of sensors, and their use in the system.

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