# PRESSURE COOKER AUTOMATION

by

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A project report submitted to

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**SCHOOL OF ELECTRONICS ENGINEERING**

in partial fulfilment of the requirements for the course of

**ECE4003 – EMBEDDED SYSTEM DESIGN**


VIT®

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(Deemed to be University under section 3 of UGC Act, 1956)

**Vandalur – Kelambakkam Road**

**Chennai – 600127**

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# BONAFIDE CERTIFICATE

Certified that this project report entitled "**PRESSURE COOKER AUTOMATION**" is a bonafide work of **RACHEL C.N (19BEC1136)**, **CHIMATA SHRIYA (19BEC1144), RUFUS SAM JOHN IMMANVEL J (19BLC1031)** and **SHERYL MATHEW (19BLC1124)** who carried out the project work under my supervision and guidance for ECE4003 – Embedded System Design.

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**Chennai – 600 127.**

# ABSTRACT

A common issue faced in most households is forgetting to turn off the gas stove after a particular number of cooker whistles is reached or after a specific amount of time has passed. This can lead to small losses in most cases but major disasters in some cases. Thus, there is a need for a system that would automatically detect the number of cooker whistles and also check for the time that the stove has been on for and switch it off when necessary. Another issue that has been brought to light over the years is that of gas leakage from stoves. This indeed is very harmful to human life and can lead to catastrophic disasters.

The project described here emphasizes the need to improve and prioritize safety of people in their kitchens . This project aims at developing an automatic system which would turn off the gas stove as soon as the required number of whistles is reached, or the timer limit is reached(whichever is earlier) and when there is any gas leakage detected thus saving time and improving safety.

A sound sensor is used to detect whistle sound and an Arduino is used to filter only high pitch sound via the ADC port, count whistles, control the DC motor and timer. The DC motor is used to rotate the gas stove knob, in order to turn it off when the required number of whistles are counted. MQ-6 LPG Gas Sensor is used to detect gas leakage. Stove would be automatically switched off in case of gas leakage.

## ACKNOWLEDGEMENT

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**RUFUS SAM JOHN IMMANVEL J** **SHERYL MATHEW** **CHIMATA SHRIYA**

**RACHEL C N**

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# 1. INTRODUCTION

## 1.1 OBJECTIVES AND GOALS

- To design a safe and secure embedded system that would be able to count the number of whistles based on inputs from the sound sensor.
- To be able to control the turning off of the gas stove based on a timer set by the user and the required number of whistles, also set by the user.
- To detect gas leakages and automatically turn off the gas stove in case a leakage is detected.
- To provide a comfortable and user- friendly interface for consumers.

## 1.2 APPLICATIONS

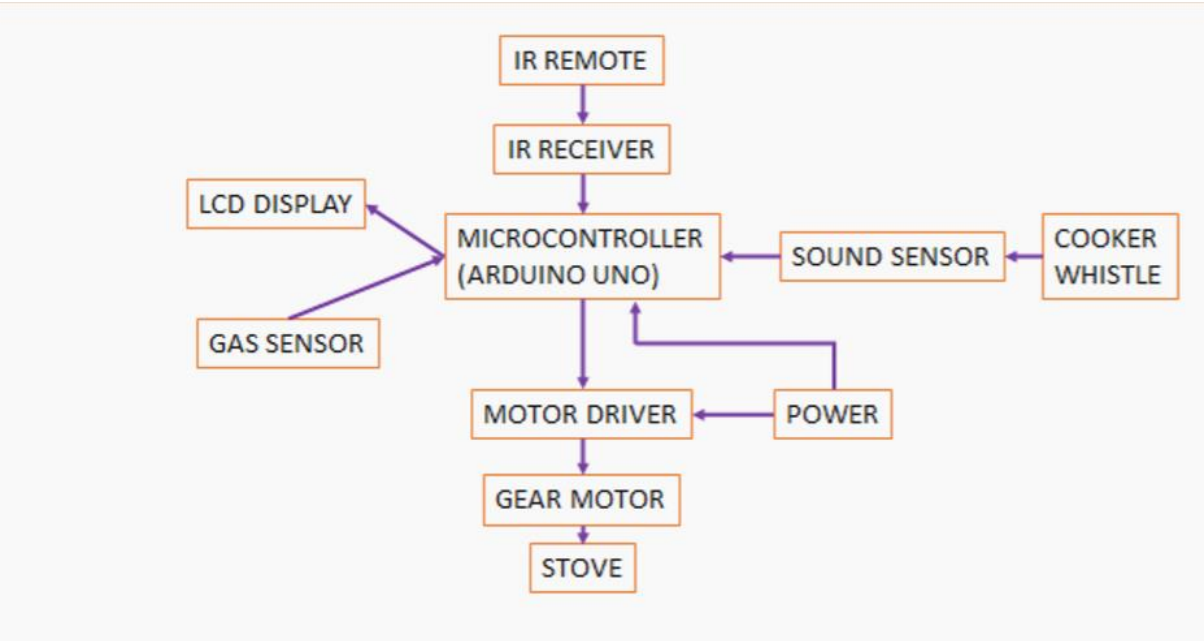
- The system developed can be used in households where people often forget to turn off the stove after a particular time.
- The system can also be used in cases where the users have to leave the stove unattended for long periods of time due to some reason.
- The system can also be used in households where gas leakage is often suspected and occurs quite often.

## 1.3 FEATURES

- Users can manually set the number of whistles required at each instance.
- Users can also set the time for which they want their stove to be on, manually.
- LCD display continuously displays the time left and the number of whistles remaining.
- Gas leakage can be detected using MQ6 gas sensor.
- User- friendly interface through IR remote.

# 2. DESIGN

## 2.1 BLOCK DIAGRAM




## 2.2 HARDWARE ANALYSIS

**Arduino UNO**

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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.

**Arduino UNO Pin out configuration**

| Pin Category | Pin Name | Details |
|---|---|---|
| Power | Vin, 3.3V, 5V, GND | Vin: Input voltage to Arduino when using an external power source.<br>5V: Regulated power supply used to power microcontroller and other components on the board.<br>3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA.<br>GND: ground pins. |
| Reset | Reset | Resets the microcontroller. |
| Analog Pins | A0 – A5 | Used to provide analog input in the range of 0-5V |
| Input/Output Pins | Digital Pins 0 - 13 | Can be used as input or output pins. |
| Serial | 0(Rx), 1(Tx) | Used to receive and transmit TTL serial data. |
| External Interrupts | 2, 3 | To trigger an interrupt. |
| PWM | 3, 5, 6, 9, 11 | Provides 8-bit PWM output. |
| SPI | 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK) | Used for SPI communication. |
| Inbuilt LED | 13 | To turn on the inbuilt LED. |
| TWI | A4 (SDA), A5 (SCA) | Used for TWI communication. |
| AREF | AREF | To provide reference voltage for input voltage. |

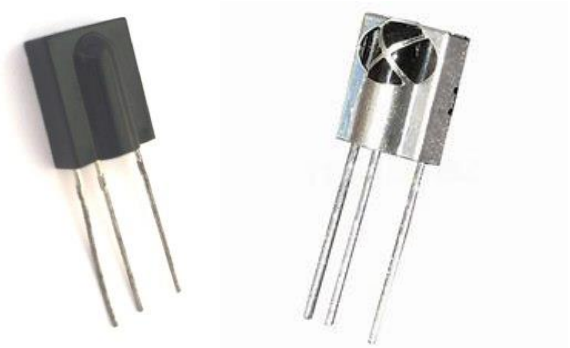
**specifications**

- 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
- Flash Memory: 32 KB (ATmega328P) of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328P)
- EEPROM: 1 KB (ATmega328P)
- Clock Speed: 16 MHz
- LED_BUILTIN: 13
- Length: 68.6 mm
- Width: 58.4 mm
- Weight: 25 g

**TSOP1738**

The TSOP1738 is an infrared sensor, from the series of TSOP17.. ICs. The TSOP17.. – series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. TSOP17.. is the standard IR remote control receiver series, supporting all major transmission codes.



**Pin out configuration**

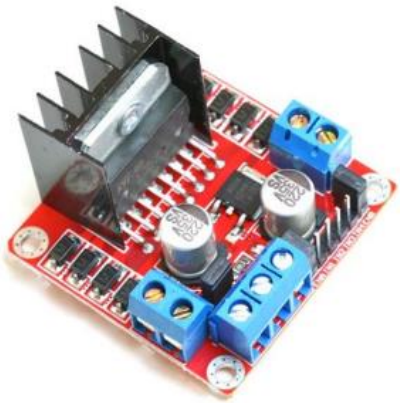
| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | Ground | Connected to the Ground of circuit |
| 2 | Vcc | Typically connect to +5V, maximum of 6V can be given |
| 3 | Signal | The signal pin gives out the sequence based on the IR signal detected |

**Specifications**

- Supply Voltage: 5 V
- Power consumption: 0.4 to 1.0 mA
- Min. Ee irradiation: 0.35 mW/m2 typ.
- Angle of detection: 90
- Dimensions of the casing (mm): 12.5 x 10 x Thickness 5.8
- Temperature range: -25 C to +85 C

**L298 dual H- bridge motor driver**

This dual bidirectional motor driver, is based on the very popular L298 Dual H-Bridge Motor Driver Integrated Circuit. The circuit will allow you to easily and independently control two motors of up to 2A each in both directions.It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple of control lines per motor. It can also be interfaced with simple manual switches, TTL logic gates, relays, etc. This board equipped with power LED indicators, on-board +5V regulator and protection diodes.



**Pin out configuration**

| Pin Name | Description |
|---|---|
| IN1 & IN2 | Motor A input pins. Used to control the spinning direction of Motor A |
| IN3 & IN4 | Motor B input pins. Used to control the spinning direction of Motor B |
| ENA | Enables PWM signal for Motor A |
| ENB | Enables PWM signal for Motor B |
| OUT1 & OUT2 | Output pins of Motor A |
| OUT3 & OUT4 | Output pins of Motor B |
| 12V | 12V input from DC power Source |
| 5V | Supplies power for the switching logic circuitry inside L298N IC |
| GND | Ground pin |

**Specifications**

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

**Dual shaft BO motor 100 RPM**

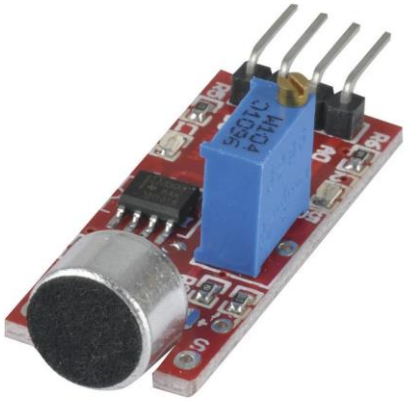
The 100 RPM Dual Shaft BO Motor - Straight motor gives good torque and rpm at lower operating voltages, which is the biggest advantage of these motors. Small shaft with matching wheels gives an optimized design for your application or robot. Mounting holes on the body & light weight makes it suitable for in-circuit placement. This motor can be used with 69mm Diameter Wheel for Plastic Gear Motors. It is an alternative to our metal gear DC motors. It comes with an operating voltage of 3-12V and is perfect for building small and medium robots. The motor is ideal for DIY enthusiasts. This motor set is inexpensive, small, easy to install, and ideally suited for use in a mobile robot car. They are commonly used in our 2WD platforms.

**Specifications**

- Shaft length: 7 mm
- Motor Design: Straight Dual Shaft
- Shaft Diameter: 5.5 mm
- Size: 55 x 48 x 23 mm.
- Operating Voltage: 3 to 12V.
- Current (without loading): 40-180mA.
- RPM: 100 rpm.
- Output Torque: 0.35 kg cm.

**Sound Detection Sensor Module (KY-037)**

Sound Detection Module Sensor for Intelligent Vehicle Compatible With Arduino is a Single channel signal output Sensor. The output is effective to the low-level sound signal with good fidelity, When there is sound, outputs low level and signal light. It can be used for Acoustic control light, give sound and light alarm working with the Photosensitive sensor, and sound control, sound detect. (The Maximum induction distance is 0.5M).



**Pin out configuration**

| Pin | Description |
|---|---|
| Digital Out | You can use a potentiometer to configure an extreme value for the sonic. If the value exceeds the extreme value, it will send a signal via digital out. |
| Analog out | Direct microphone signal as voltage value |
| VCC | Supplies power to the board |
| GND | Ground |

**Specifications**

- IC Chip: LM393
- Operating Voltage(VDC): 3.3 to 5V
- Induction Distance:0.5 Meter
- Length (mm): 43
- Width (mm): 17
- Height (mm): 8
- Weight (gm):3

## MQ-6 LPG gas sensor module

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.


**Pin out configuration**

| **Pin No:** | **Pin Name:** | **Description** |
|---|---|---|
| **For MQ6 Sensor 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 MQ6 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 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. |

**Specifications**

- **Detection Gas**: Isobutane, Propane, LPG
- **Concentration**: 300-10000ppm
- **Supply Voltage**: <24V
- **Heater Voltage**: 5.0V ± 0.2V
- **Load Resistance**: Adjustable
- **Heater Resistance**: 31Ω ± 3Ω
- **Heater Consumption**: <900mW

## 16x2 LCD display

The term LCD stands for liquid crystal display. It is a kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are- it is inexpensive, simply programmable, animations are possible and there are no limitations for displaying custom and special characters as well.


**Pin out configuration**

| Pin No: | Pin Name: | Description |
|---|---|---|
| 1 | Vss (Ground) | Ground pin connected to system ground |
| 2 | Vdd (+5 Volt) | Powers the LCD with +5V (4.7V – 5.3V) |

| | | |
|---|---|---|
| 3 | VE (Contrast V) | Decides the contrast level of display. Grounded to get maximum contrast. |
| 4 | Register Select | Connected to Microcontroller to shift between command/data register |
| 5 | Read/Write | Used to read or write data. Normally grounded to write data to LCD |
| 6 | Enable | Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement |
| 7 | Data Pin 0 | Data pins 0 to 7 forms a 8-bit data line. They can be connected to Microcontroller to send 8-bit data.<br>These LCD's can also operate on 4-bit mode in such case Data pin 4,5,6 and 7 will be left free. |
| 8 | Data Pin 1 | |
| 9 | Data Pin 2 | |
| 10 | Data Pin 3 | |
| 11 | Data Pin 4 | |
| 12 | Data Pin 5 | |
| 13 | Data Pin 6 | |
| 14 | Data Pin 7 | |
| 15 | LED Positive | Backlight LED pin positive terminal |
| 16 | LED Negative | Backlight LED pin negative terminal |

**Specifications**

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters

- Available in Green and Blue Backlight

**IR remote**

Most remotes that we use in our everyday life work based on the principle of infrared transmission and reception. In most cases transmission and reception is possible within a range of 8m. In this project we have utilised an ultrathin IR remote, which has 20 function keys.

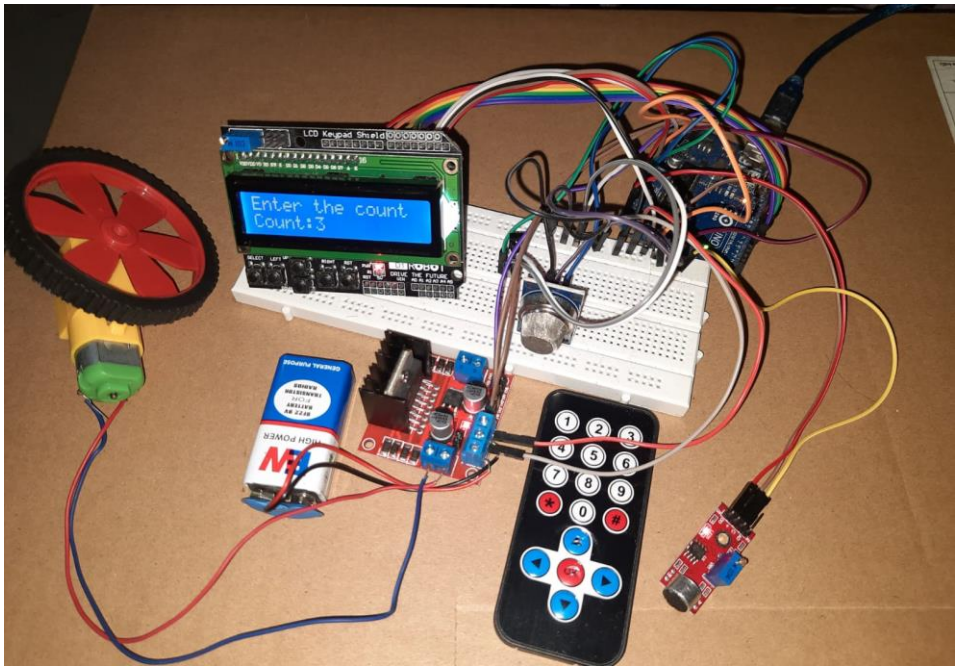

**Specifications**

- Effective angle: 60
- Transmission distance : up to 8m(depending on the surrounding environment, the sensitivity of the receiver, etc).
- Sticking material: 0.125mmPET
- Effective life: 20,000 times
- Static current: 3uA 5uA
- Dynamic current: 3mA 5mA
- Battery: CR2025 Button batteries
- Length (mm): 86
- Width (mm): 40
- Height (mm): 6.5
- Weight (gm): 10

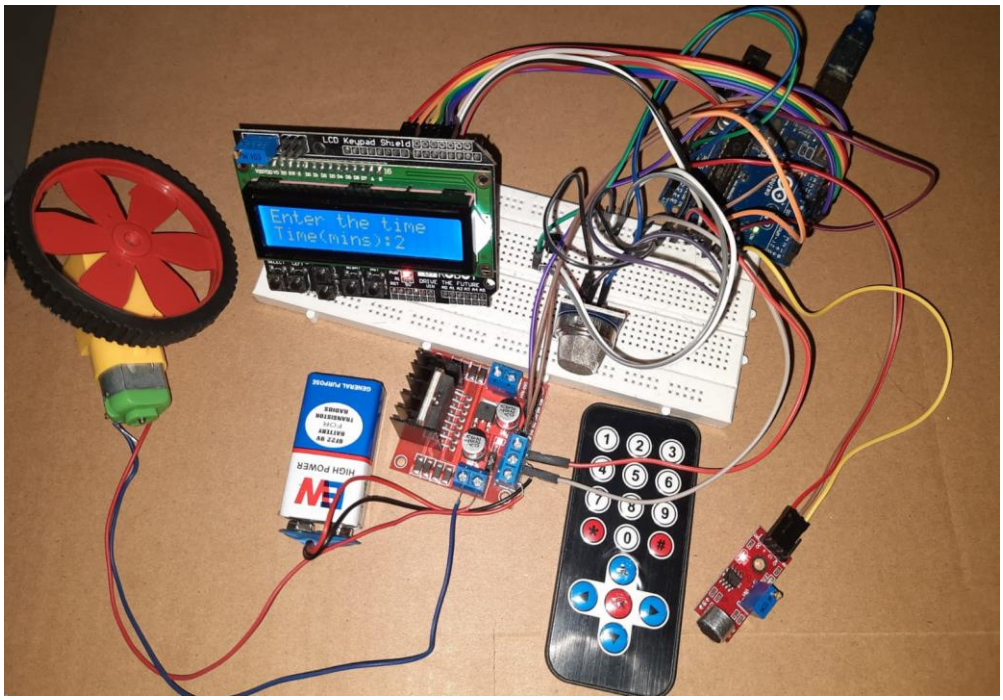
## 2.3 SNAPSHOTS

Results

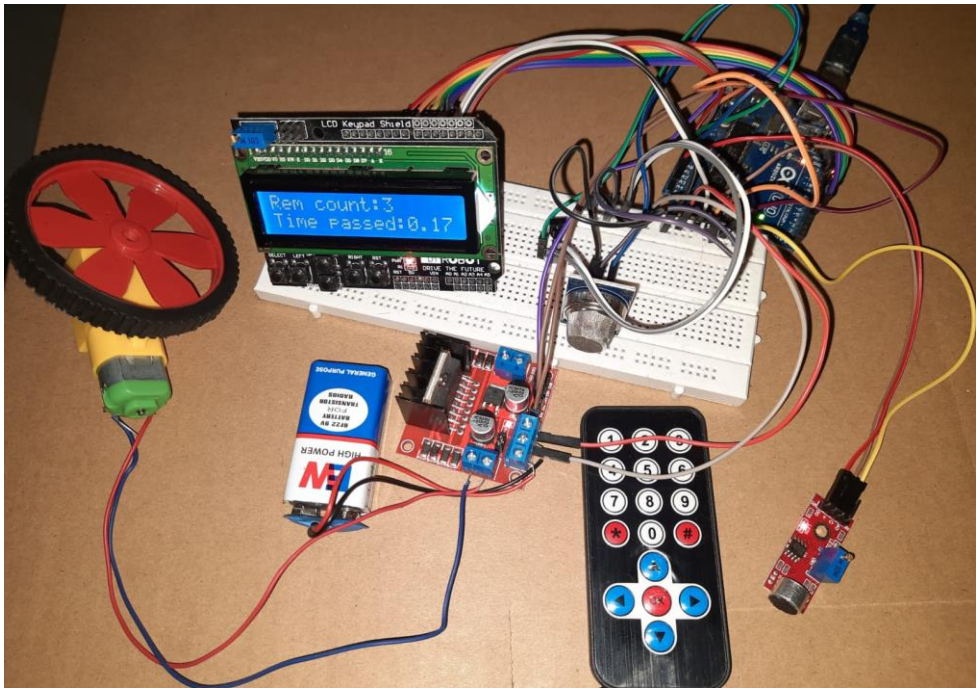
User can manually set the value of number of whistles required



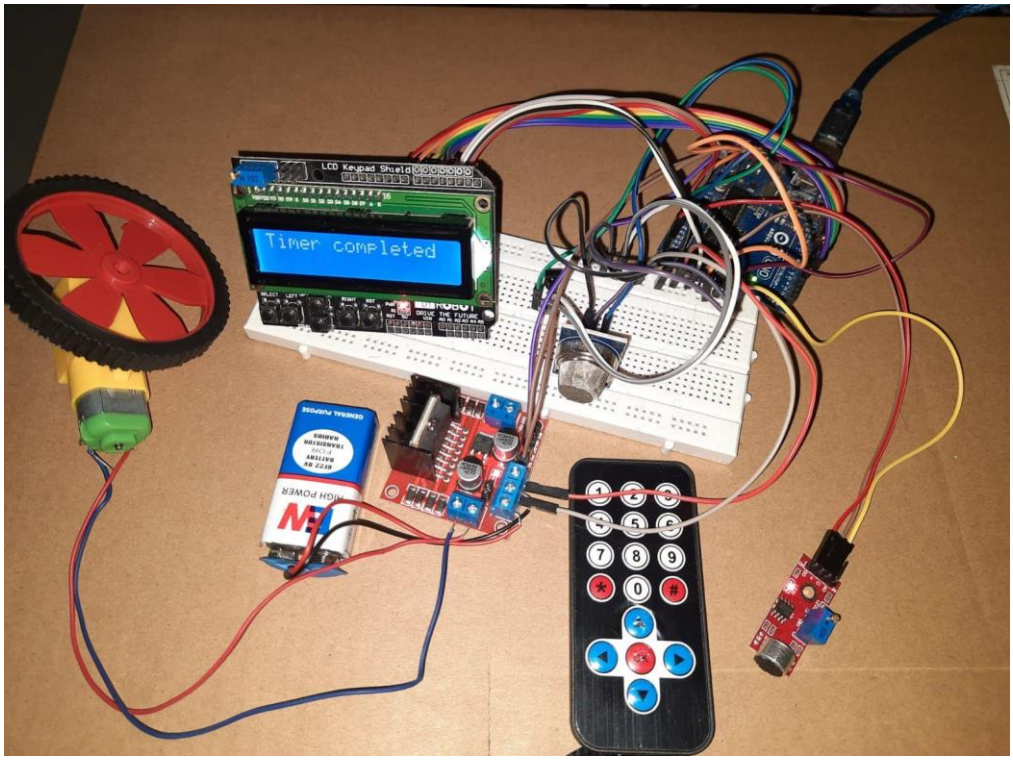

User can manually set the value of timer



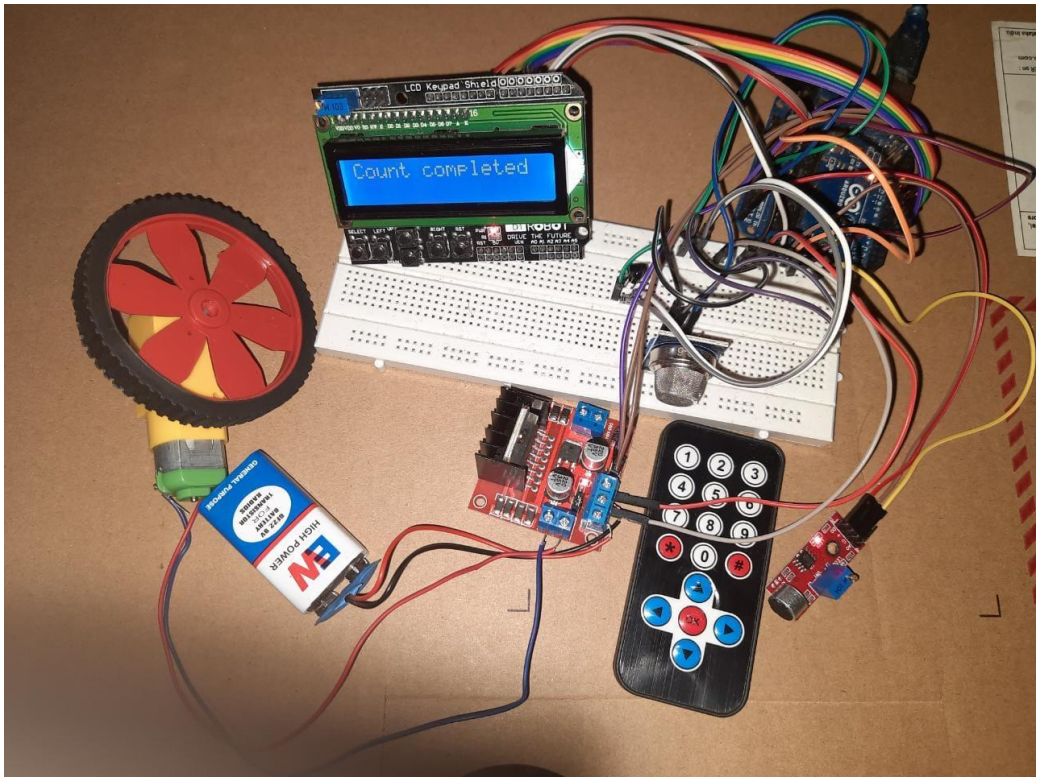
The circuit continuously monitors timer values and number of whistles




When timer value is completed before the number of whistles is reached

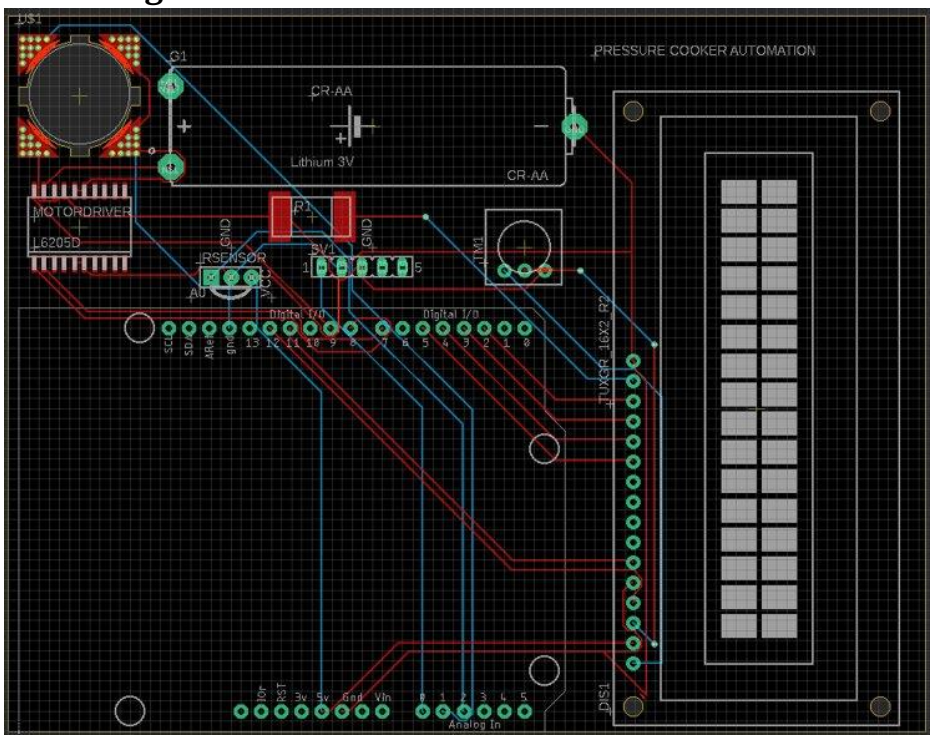


When number of whistles required is completed before timer value ends




## 3. SOFTWARE - CODING AND ANALYSIS

### PCB design



**CODE:**

```
#include<IRremote.h>
#include <LiquidCrystal.h>
#define dec 33439935
#define inc 33472575
#define power 33441975

//ir input pin
int RECV_PIN = 16;
//motor driver inputs
int in1 = 2;
int in2 = 3;
int enable = 11;
//threshold values
int thresholdSound = 200;
int thresholdGas=500;
//intermediate values
int count=0,timer=0;
//user input
int finalCount;
float finalTimer;
//For timer
float starttime,endtime;
//for interval b/w sound check
float gapstart,gapend;
//flags f=getStartTime, g=init,s=stop program,k=soundTimeCheck,
// sub = count or timer input
int f=0,g=0,s=0,k=1,sub=0;
//LCD pin defining
LiquidCrystal lcd(8,9,4,5,6,7);

IRrecv irrecv(RECV_PIN);
decode_results results;


void setup() {
  pinMode(enable, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  irrecv.enableIRIn();
  lcd.begin(16, 2);
  lcd.display();
  Serial.begin(9600);
}
```

```
void getWhistleCount(){
  //show lcd for count
  if (irrecv.decode(&results))
  {
      if (results.value == inc)  count++;
      if (results.value == dec)  count--;
      if (results.value == power) sub += 1;
      irrecv.resume();
  }
  lcd.clear();
  Serial.print("Enter the count");
  lcd.print("Enter the count");
  lcd.setCursor(0, 1);
  Serial.print("Count:");
  lcd.print("Count:");
  Serial.print(count);
  lcd.print(count);
}

void getTimeRequired(){
  //show lcd for timer
  if (irrecv.decode(&results))
  {
      if (results.value == inc) timer++;
      if (results.value == dec) timer--;
      if (results.value == power) sub += 1;
      irrecv.resume();
  }
  lcd.clear();
  Serial.print("Enter the time");
  lcd.print("Enter the time");
  lcd.setCursor(0, 1);
  Serial.print("Time(mins):");
  lcd.print("Time(mins):");
  Serial.print(timer);
  lcd.print(timer);
}
```

```
void lcdDisplay(int key){
  switch(key){
    case 1:
      lcd.clear();
      lcd.setCursor(0, 0);
      Serial.print("Count completed");
      lcd.print("Count completed");
      break;
    case 2:
      lcd.clear();
      lcd.setCursor(0, 0);
      Serial.print("Timer completed");
      lcd.print("Timer completed");
      break;
    case 3:
      lcd.clear();
      lcd.setCursor(0, 0);
      Serial.print("Gas leakage");
      lcd.print("Gas leakage");
      break;
    default:
      lcd.clear();
      lcd.setCursor(0, 0);
      Serial.println("Rem count:");
      lcd.print("Rem count:");
      Serial.println(finalCount);
      lcd.print(finalCount);
      lcd.setCursor(0, 1);
      Serial.println("Time passed:");
      lcd.print("Time passed:");
      Serial.println((endtime - starttime)/60000);
      lcd.print((endtime - starttime)/60000);
      break;
  }
}

void motorTrigger(){
    digitalWrite(in1, HIGH);
    digitalWrite(in2, LOW);
    digitalWrite(enable, 100);
    delay(2000);
    digitalWrite(in1, LOW);
    digitalWrite(in2, LOW);
    digitalWrite(enable, 0);
}
```

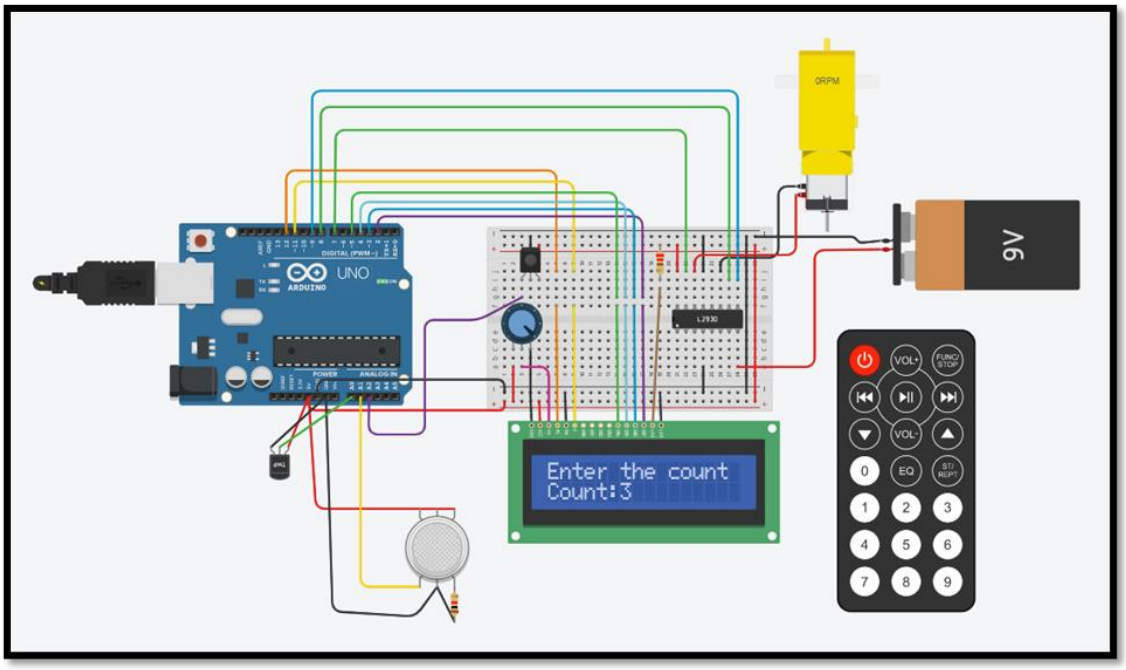
```
void checkWhistleCount(){
  if (finalCount == 0)
  {
      lcdDisplay(1);
      motorTrigger();
      s = 1;
  }
}
void checkTimer(){
  endtime = millis();
  if (endtime - starttime >= finalTimer)
  {
      lcdDisplay(2);
      motorTrigger();
      s = 1;
  }
}
void monitorGasSensor(){
  int gasValue = analogRead(A1);
  Serial.println(gasValue);
  if(gasValue > thresholdGas){
      lcdDisplay(3);
      motorTrigger();
      s = 1;
  }
}

void monitorSoundSensor(){
  int soundsens = analogRead(A3);
  Serial.println(soundsens);
  if(soundsens>=thresholdSound && k==1 ){
    finalCount--;
    k=0;
    gapstart = millis();
    delay(1000);
  }else{
    gapend = millis();
    if(gapend-gapstart >= 7000) k=1;
  }
}
```

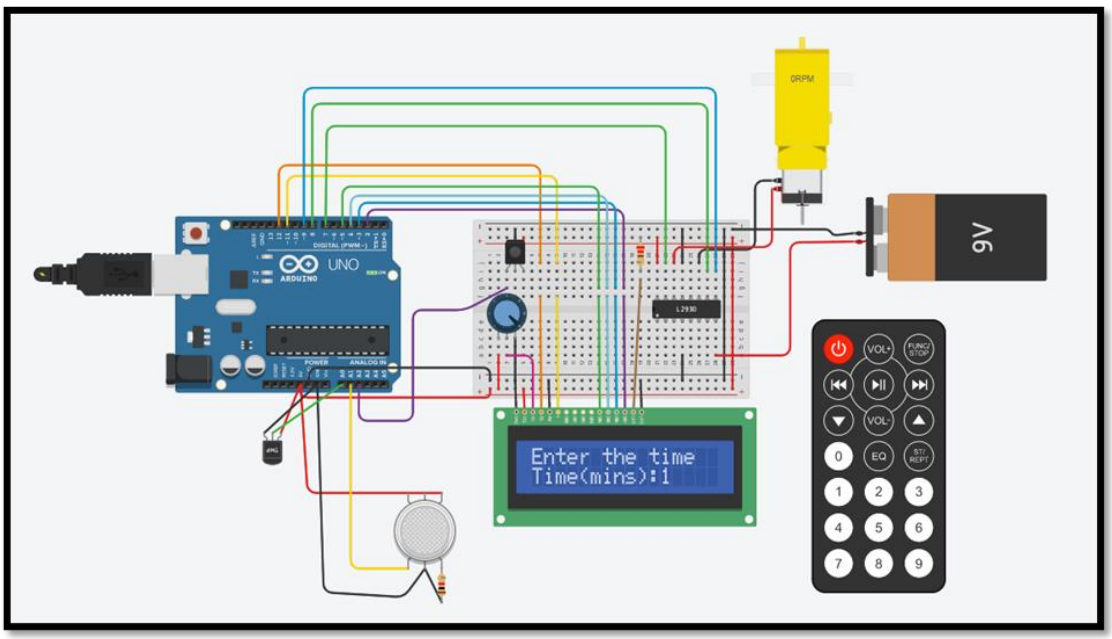
```
void loop()
{
    if (s == 0)
    {
        if (g == 0)
        {
            //input
            if (sub == 0) getWhistleCount();
            if (sub == 1) getTimeRequired();
            if (sub == 2)
            {
                finalCount = count;
                finalTimer = timer;
                finalTimer = 60000 * finalTimer;
              g = 1;
            }
        }
        else
        {
            //program started
            if (f == 1)
            {
                lcdDisplay(0);
                monitorSoundSensor();
                checkWhistleCount();
                monitorGasSensor();
              checkTimer();
            }
            else
            {   starttime = millis();
                f = 1; }
        }
    }
    delay(1000);
}
```

**CIRCUIT SCREENSHOTS:**

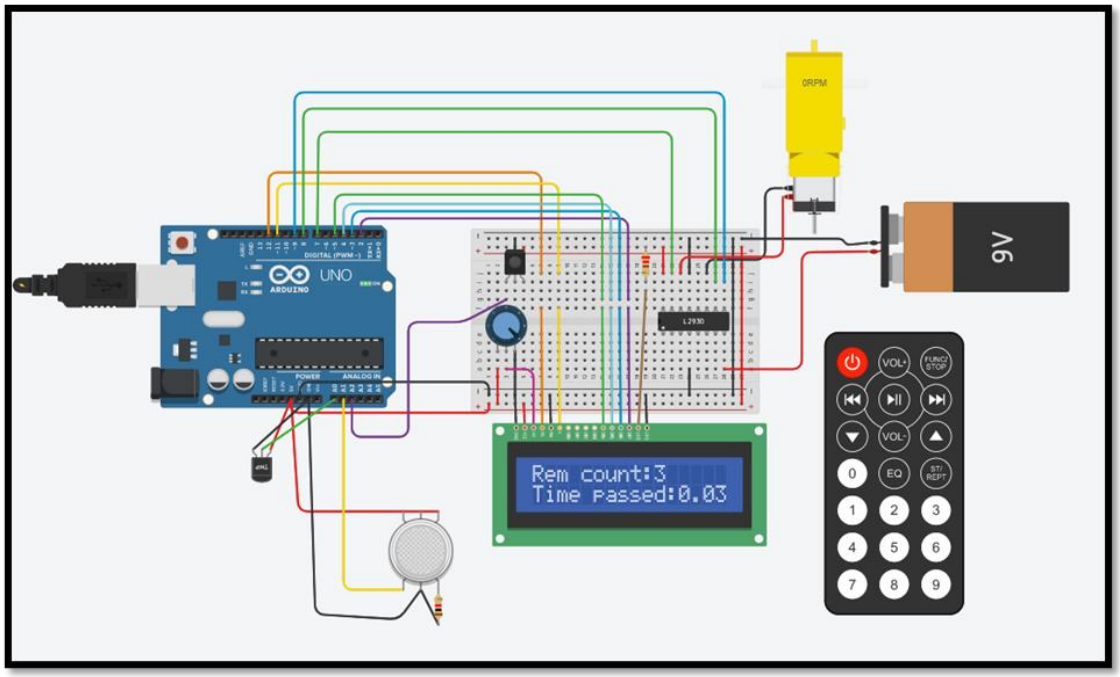
Total number of whistles is set to 3:




Total time is set to 1:

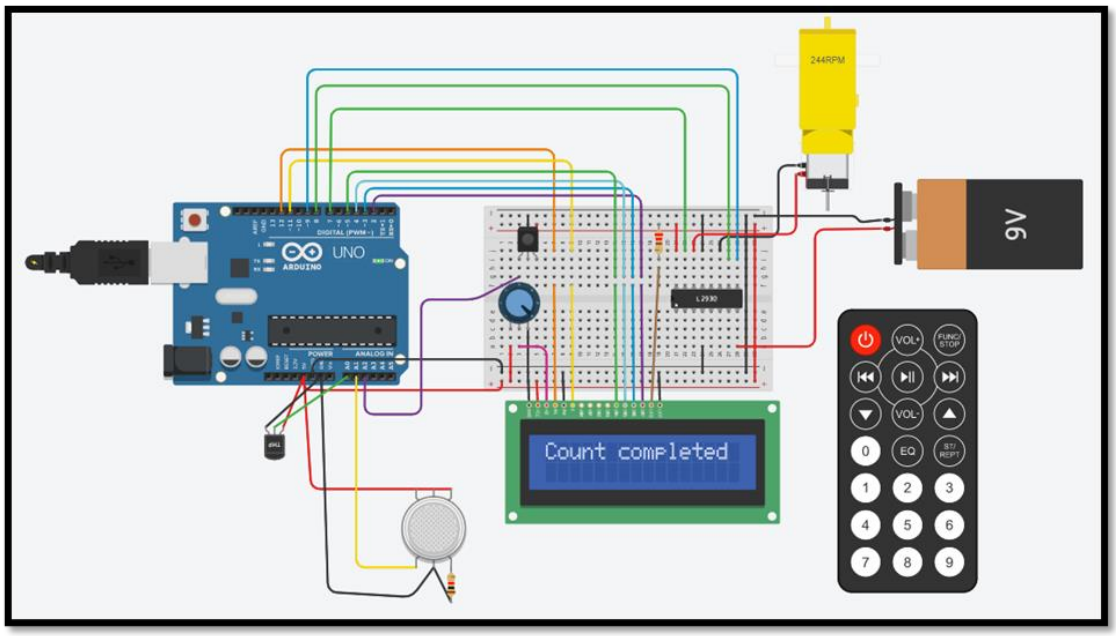


The simulation has started:



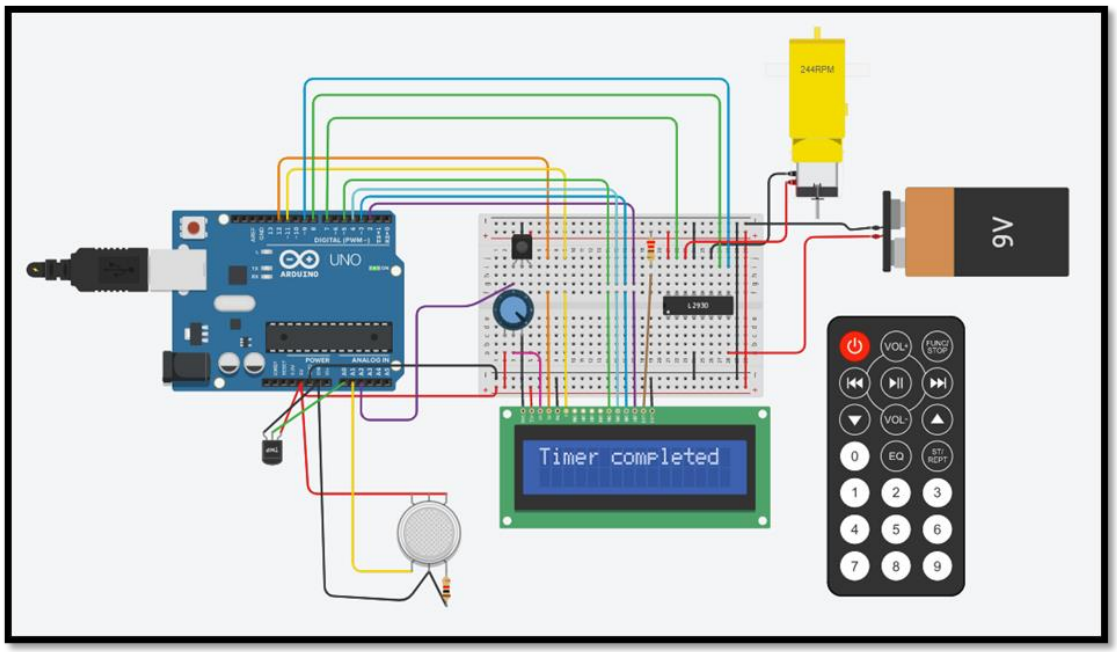

**CASE-1:**

Motor is triggered when the required number of whistles is reached.



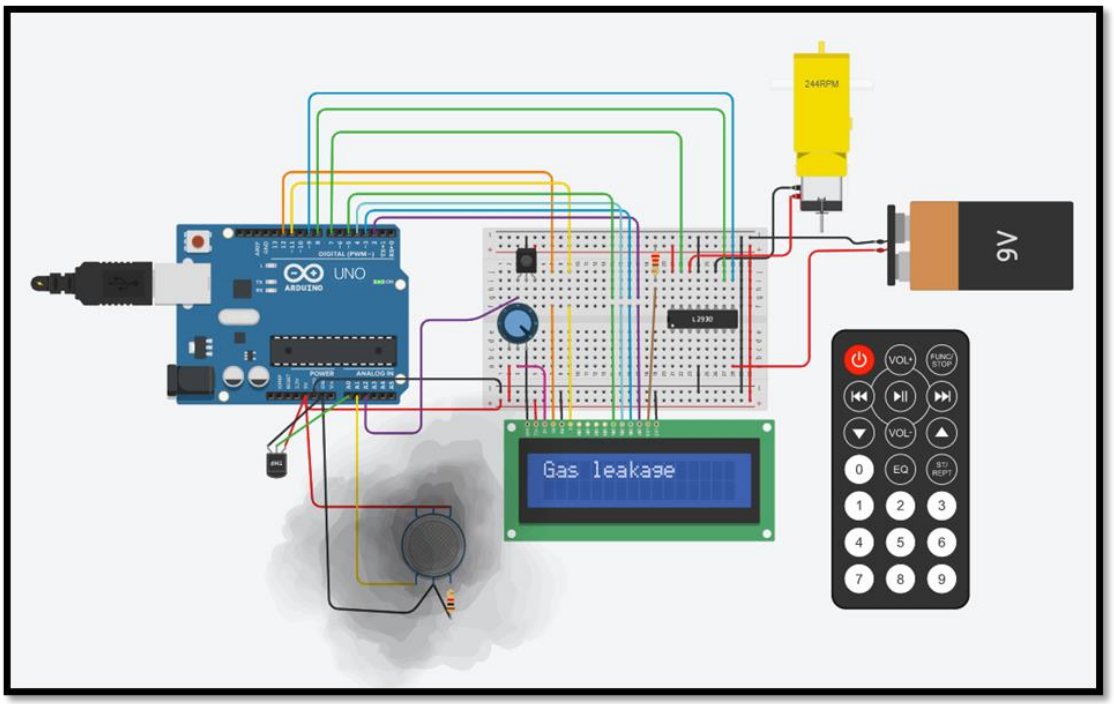
**CASE-2:**

Motor is triggered when the timer has completed.




**CASE-3:**

Motor is triggered when a gas leakage is detected.



**ANALYSIS:**

Once the circuit is turned on, the user is prompted to enter the total number of whistles to be counted. The user can increase or decrease the count value by pressing the up and down buttons on the IR remote respectively. The value is parallely displayed on the LCD. Once the count value is set, the user presses the ‘Power’ button on the IR remote. Then the user is prompted to enter the maximum time, after which the stove must be turned off automatically. The up and down buttons on the IR remote can be used for incrementing or decrementing the time value, and once the time is set, the user presses the ‘Power’ button to confirm.

Once the whistle count and timer value is set, the system starts continuously monitoring for the whistle sound. If a whistle sound is detected through the sound sensor, the number of whistles remaining is decremented by 1. This process is repeated until the number of whistles remaining becomes 0 or if the stove was already turned off due to the time elapsing/gas leakage. Once the number of whistles remaining becomes 0, the motor is triggered and the stove is turned off.

If the timer elapses before the whistle count is reached, then the motor is triggered and the stove is turned off.

While keeping track of the time and monitoring the sound sensor for whistle sound, the system also concurrently monitors the gas sensor to detect a gas leakage. In a scenario where a gas leakage is detected, the system immediately triggers the motor, and the stove is turned off.

While the program is running, the number of whistle counts remaining and the time passed are continuously displayed on the LCD.

If the motor was triggered after the total number of whistle counts set by the user was reached, the LCD displays the message ‘Count completed’.

If the motor was triggered because the maximum time was reached, the LCD displays the message ‘Timer completed’.

If the motor was triggered due to gas leakage, the LCD displays the message ‘Gas leakage’.

# 4. CONCLUSION AND FUTURE WORK

## 4.1 RESULT, CONCLUSION AND INFERENCE

We were able to get the desired results after we ran the entire hardware. We were able to set the timer and also the count for our system. We were also able to test the LCD display and our sensors. The entire system was controlled with the help of an IR remote which helped in increasing the efficiency of the system. Sound sensor was able to detect the cooker whistle sound and the motor rotated the wheel to turn off the gas.

Through the course of incorporating this project we learnt that small daily life problems can have efficient solutions if we resort to embedded systems. A seemingly simple daily life issue i.e. turning off the gas along with managing other chores of the house can be hectic for any person. That is where our system would come into play. This pressure cooker automation would be really helpful in solving this problem. Along with pressure cooker automation our system also has a gas leak detection system inbuilt in it which would prove to be of great benefit since it will help in reducing accidents and also it would help in detecting early gas leakages.

## 4.2 FUTURE WORK AND COST-

**A)Future Work-** The device which we currently use is wired . This could be upgraded and a wireless version could be developed. We can also have an inbuilt noise cancellation system so that the system would turn off the gas only to the desired sound and not to the noise which could be there in the surroundings. We can also develop this system in a much more usable form by incorporating vacuum stands so that the device can be left unmonitored.

**B)Cost-**

| S.No | Component Name | Price |
|---|---|---|
| 1. | Arduino UNO | Rs. 400 |
| 2. | Dual shaft BO motor 100 | Rs. 55 |

| | | |
|---|---|---|
| | RPM | |
| 3. | Potentiometer | Rs.4 |
| 4. | LCD | Rs.230 |
| 5. | L298 motor driver | Rs.106 |
| 6. | Battery | Rs.20 |
| **7.** | Wires | Rs.15 |
| **8.** | MQ6 LPG gas sensor module | Rs. 100 |
| **9.** | IR remote control kit | Rs. 98 |
| **10.** | Sound sensor module | Rs. 64 |
| **11.** | Wheel | Rs. 18 |
| | **Total** | Rs 1110 |

## 5. REFERENCES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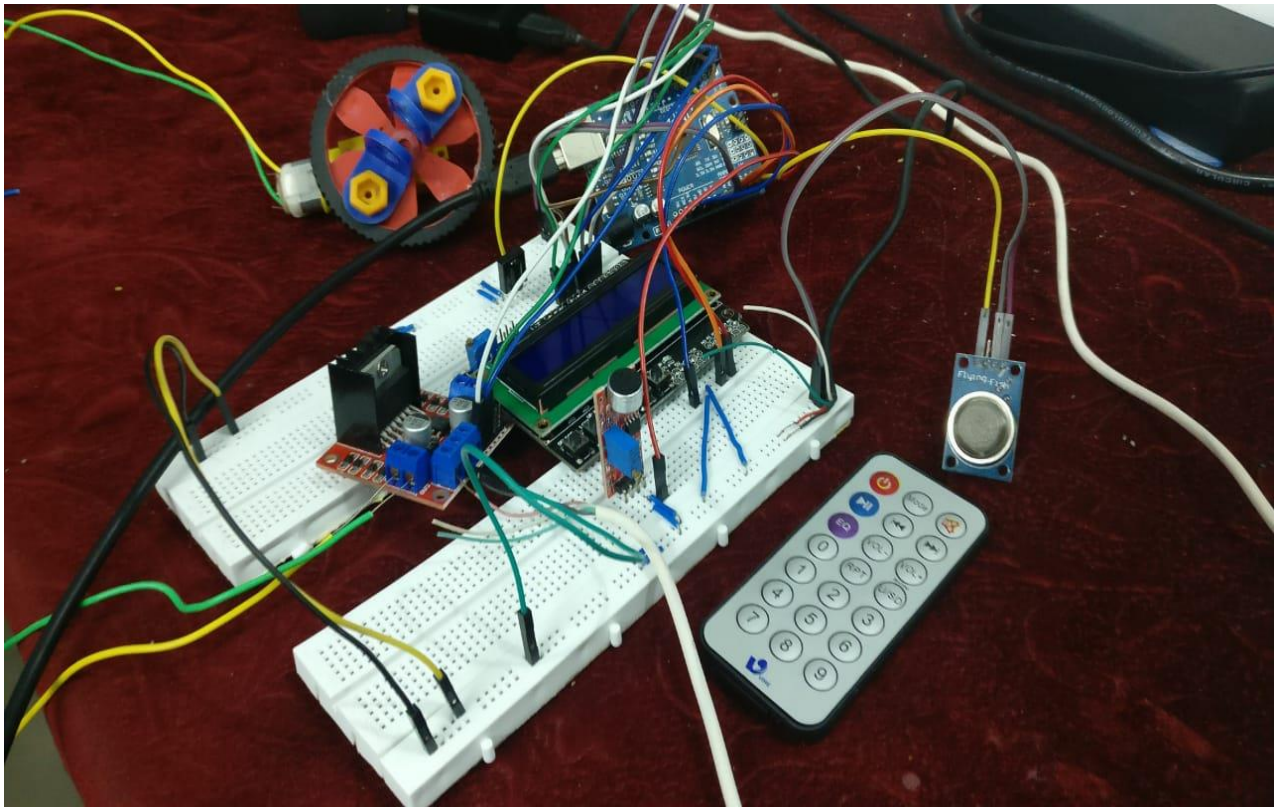
## 6. PHOTOGRAPH OF PROJECT



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