"LPG SENSOR INCORPORATING MICROCONTROLLER AND ARDUINO UNO "

A Presentation in partial fulfilment for the award of the degree of
Bachelor of Technology **in Electrical Engineering**

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1.1 INRODUCTION

✓ A gas detector is a device that detects the presence of gases in an area, often as part of a safety system.

✓ This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down.

✓ This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic.

✓ A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave.

1.2 PREVIOUS WORK DONE (HISTORY)

✓Through the 19th and early 20th centuries, coal miners would bring canaries down to the tunnels with them as an early detection system against life threatening gases such as carbon dioxide, carbon monoxide and methane.

✓The canary, normally a very song full bird, would stop singing and eventually die if not removed from these gases, signalling the miners to exit the mine quickly.

✓Before the development of electronic household carbon monoxide detectors in the 1980s and 1990s, carbon monoxide presence was detected with a chemically infused paper that turned brown when exposed to the gas.

1.3 OBJECTIVES AND MOTIVATION

✓ The aim of this project is to monitor for liquid petroleum gas (LPG) leakage to
avoid fire accidents providing houses safety feature where security has been an
important issue.

✓ The output of the sensor goes LOW as soon as the LPG sensor senses any gas
leakage from the storage. This is detected by the microcontroller and the LED
& buzzer is turned ON. The MCB (Miniature Circuit Breaker) is tripped to
isolate the main electric supply of the house.

✓ An additional features, manual reset option which will ensure extra safety in
leakage condition as there may be the case that the area near the sensor has
lowered to negligible concentration of LPG but the adjacent rooms are still
having high concentration of LPG.

✓ With the help of the laptop and Arduino software (IDE) platform, which is an
open-source software user can modify a lot of things and can also monitor the
status of the circuit which can be possible by LED display also.

2. BUILDING THE LOGIC BEHIND THE PROJECT

✓The system mainly consists of LPG gas leakage detection system, Microcontroller and protection circuitry.

✓For the gas leakage detection a solid state gas sensor MQ6 is used. MQ6 gas sensor which offers many advantages like long lifetime, low cast, reliable and high sensitive to LPG.

✓In gas sensors Tin dioxide is the most common material, when any specified gases leak in the air, the electrical resistance in the sensor decreases.

Description of the system block diagram

- Block diagram
- Main Components
- Power Supply
- Microcontroller
- LED (MCB & Alarm)
- Gas Sensor (MQ6)
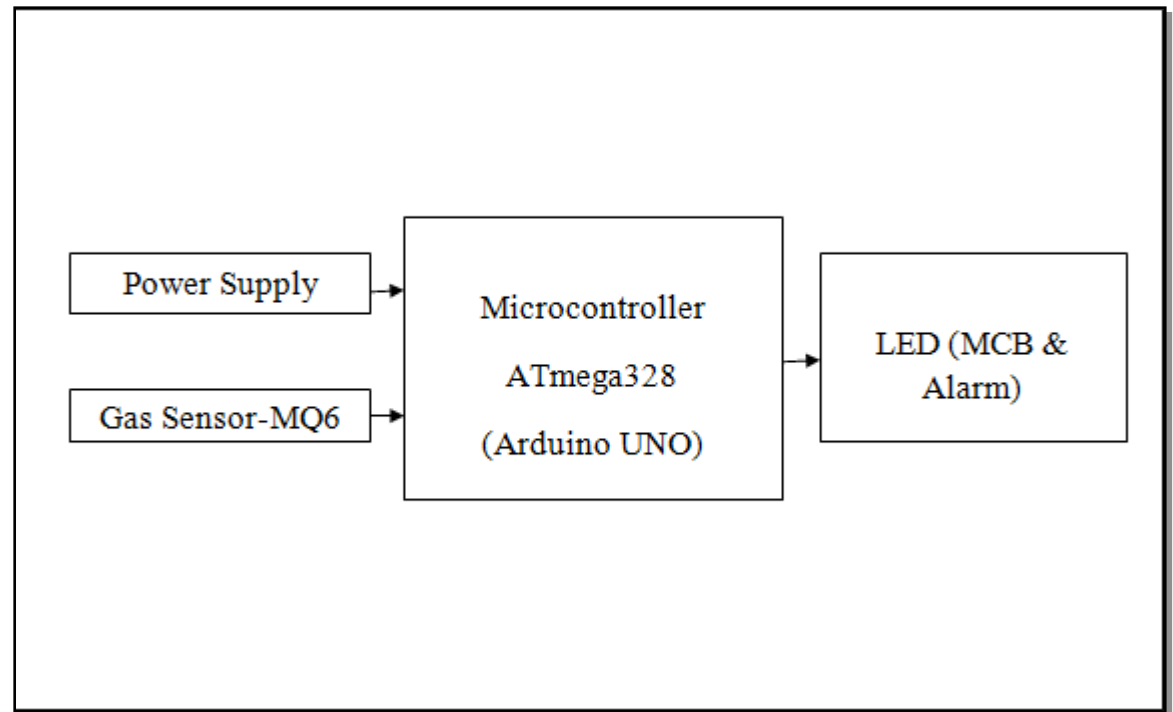
Fig 2.1: The system block diagram
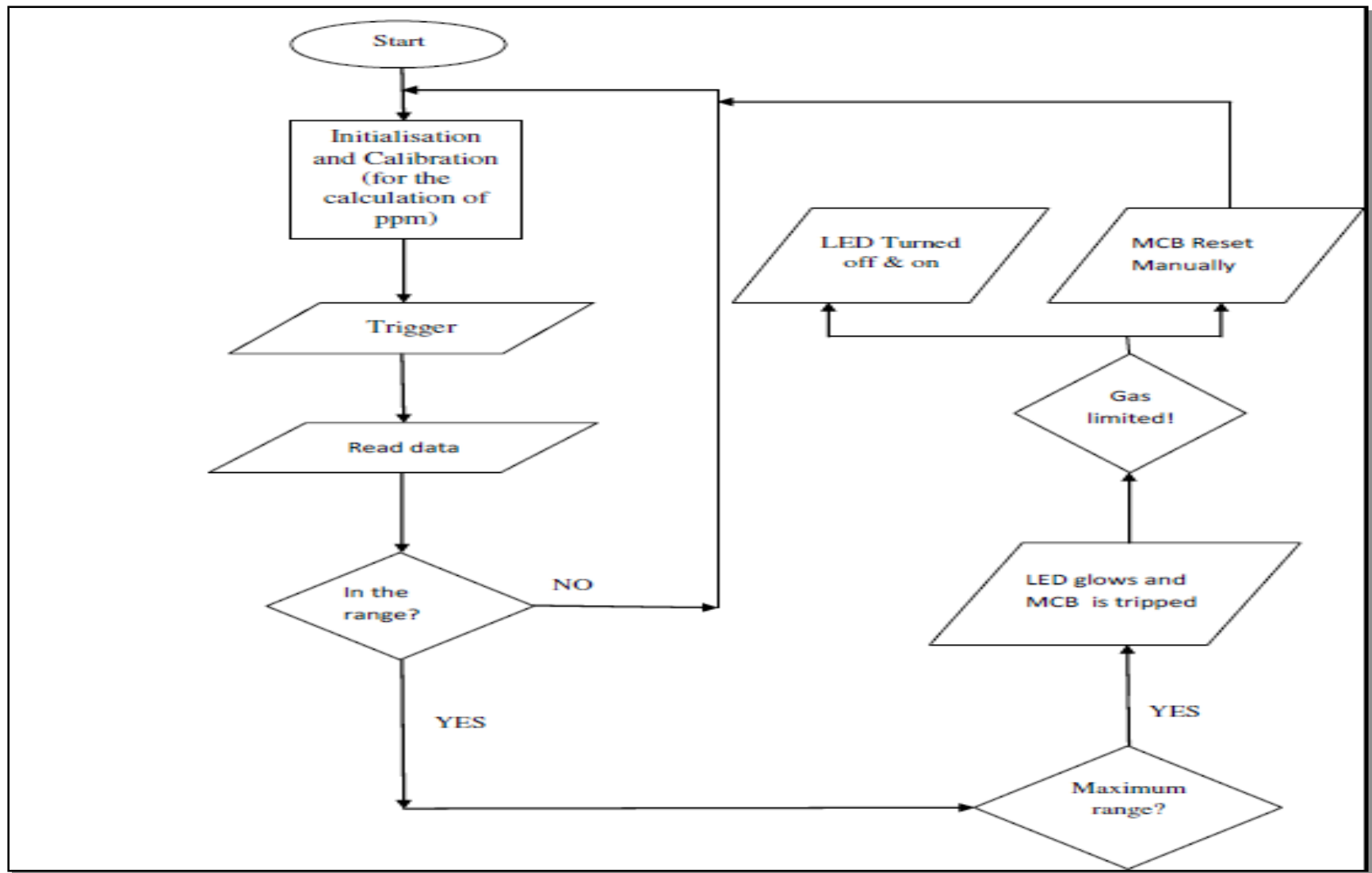
Fig 2.2: Flowchart of the proposed system

3. CHARACTERISTICS OF MQ6 SENSOR

✓MQ-6 is a simple drive gas sensor circuit that is highly sensitive to propane , methane and LPG. Less sensitive to alcohol and smoke.

✓Sensitive material of MQ-6 gas sensor is SnO_2, which with lower conductivity in clean air. When target combustible gas exist. The sensor's conductivity is higher along with the gas concentration rise.

✓**Applications:**
* Domestic gas leakage detector
* Industrial Combustible gas detector
* Portable gas detector

- The sensors are provided with 6 pins, 4 pins are used for fetching signal and 2 for providing heating current.
- Functioning of Gas sensor in details.

	Parts	Materials
1	Gas sensing layer	SnO2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al2O3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni
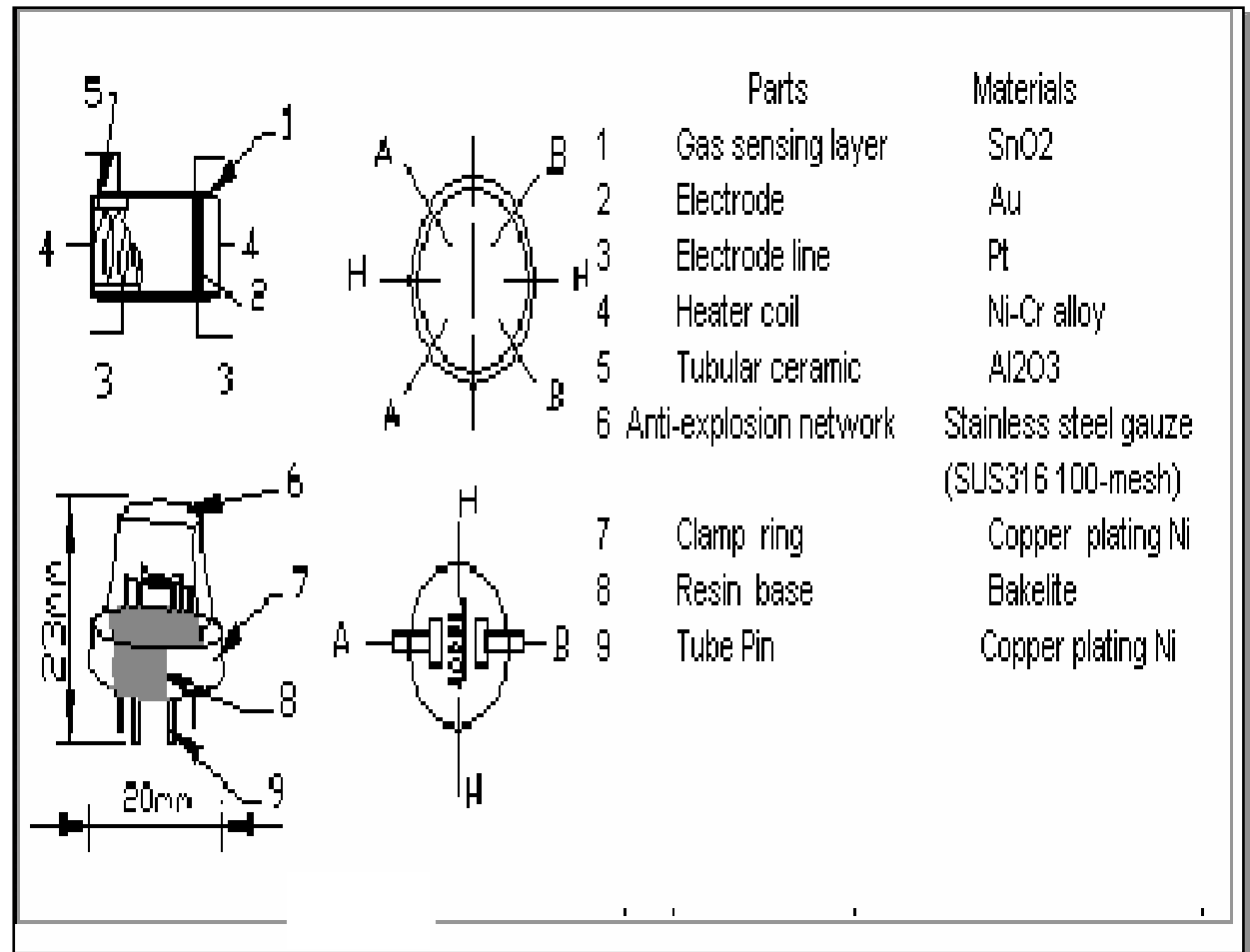
Fig 3.1: Structure and configuration

- Figure 2.1 shows the typical sensitivity characteristics of the MQ-6, ordinate means resistance ratio of the sensor(Rs/Ro),abscissa is concentration of gases. Rs means resistance in different gases, Ro means resistance of sensor in 1000 ppm LPG. All tests are under standard test conditions.
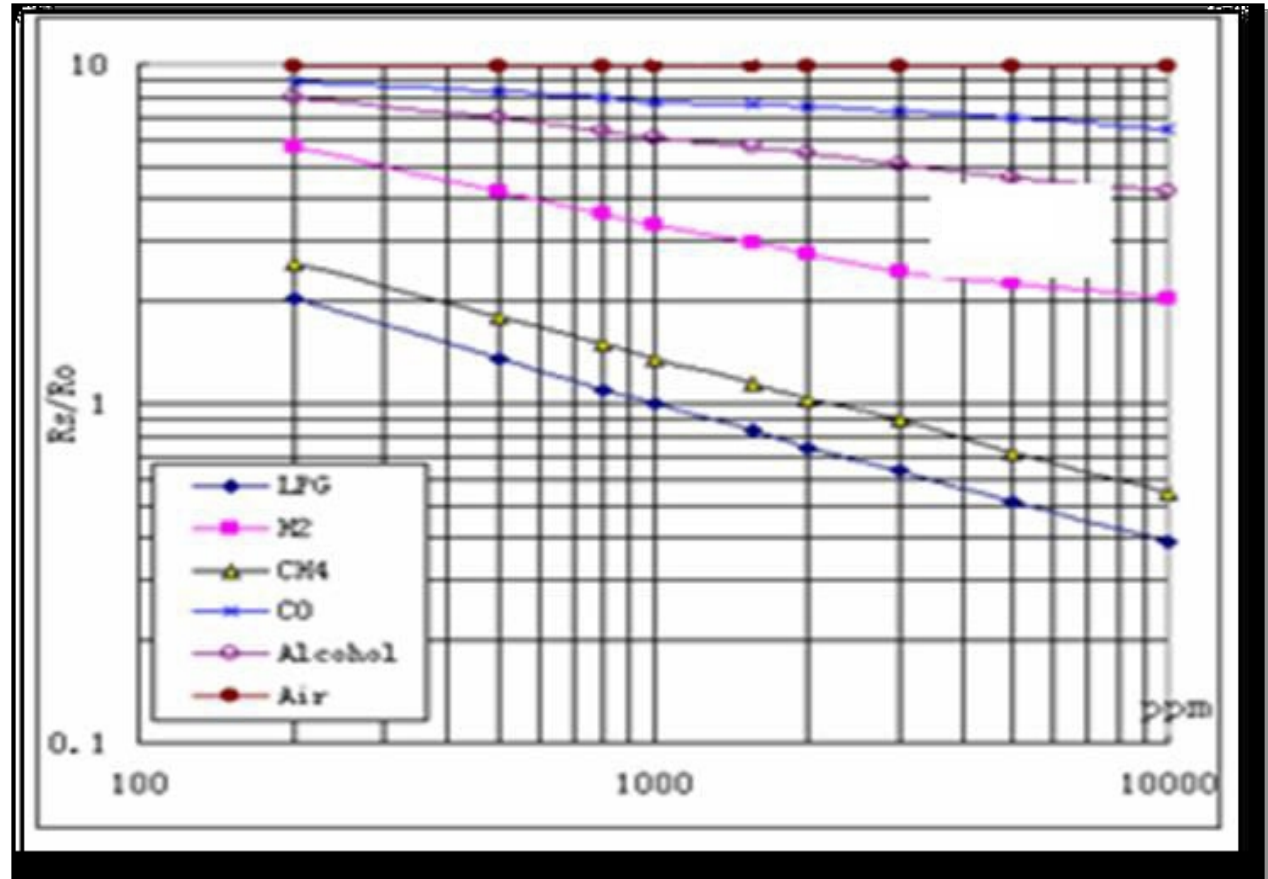
Fig 3.1: Sensitivity characteristics of MQ-6

- Figure shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor (Rs/Ro), Rs means resistance of sensor in 1000ppm Methane under different temperature and humidity. Ro means resistance of the sensor in environment of1000ppm Propane, 20°C/65%RH
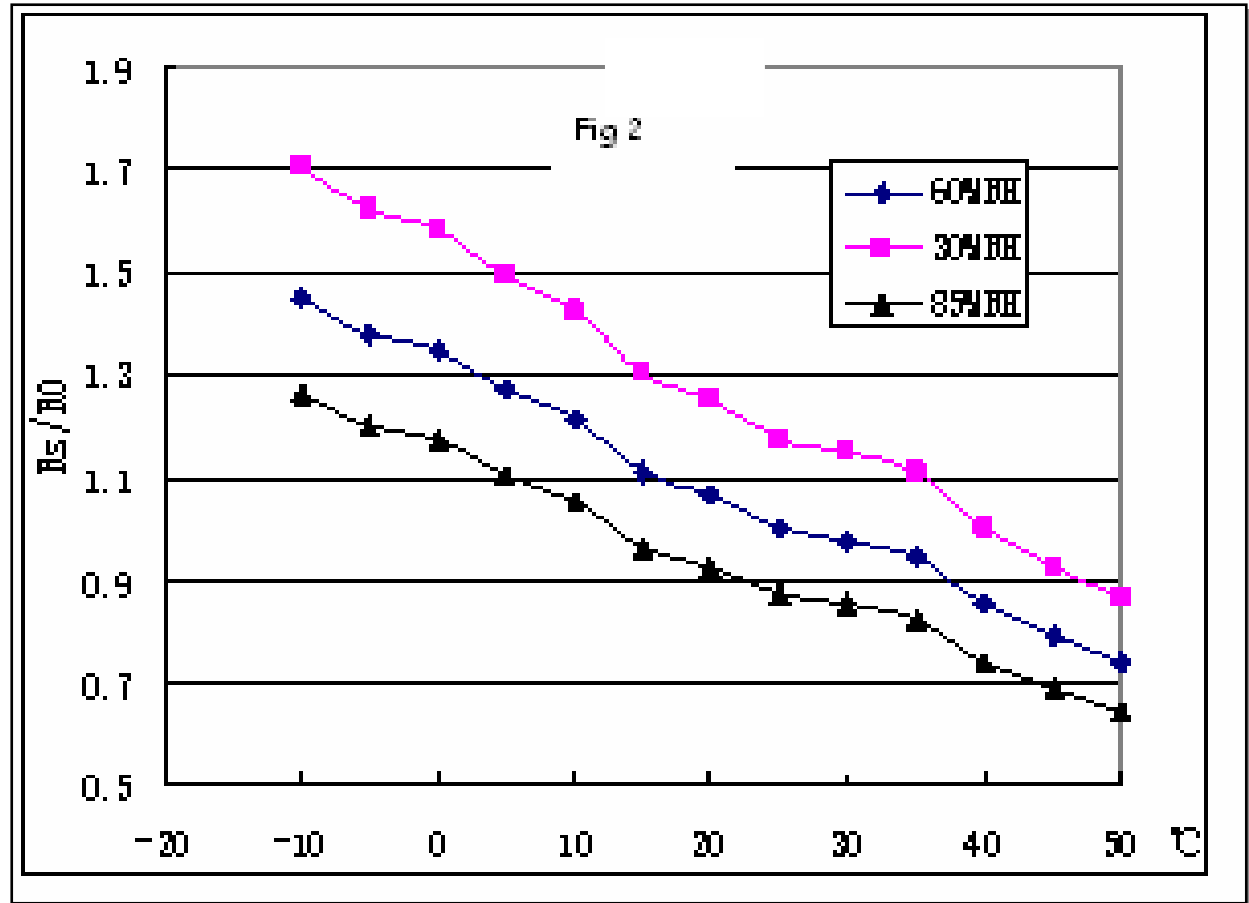
Fig 3.3: Influence of temperature/humidity

4. CIRCUIT REALISATION USING 555-

- Whenever there is LPG concentration of 1000 ppm (parts per million) in the area, the OUT pin of the sensor module goes high
- This signal drives timer IC 555, which is wired as an astable multivibrator.
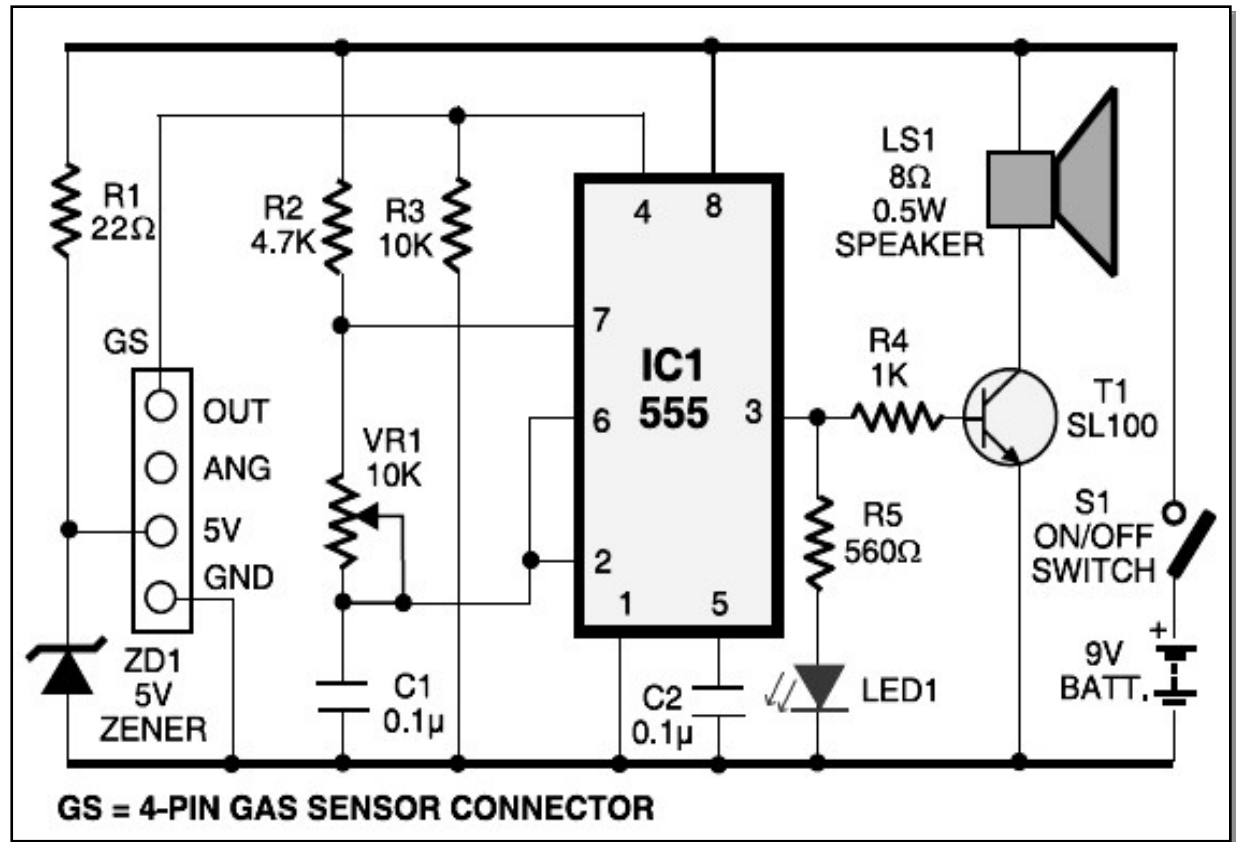
Fig 4.1: Circuit Realisation using 555 timer
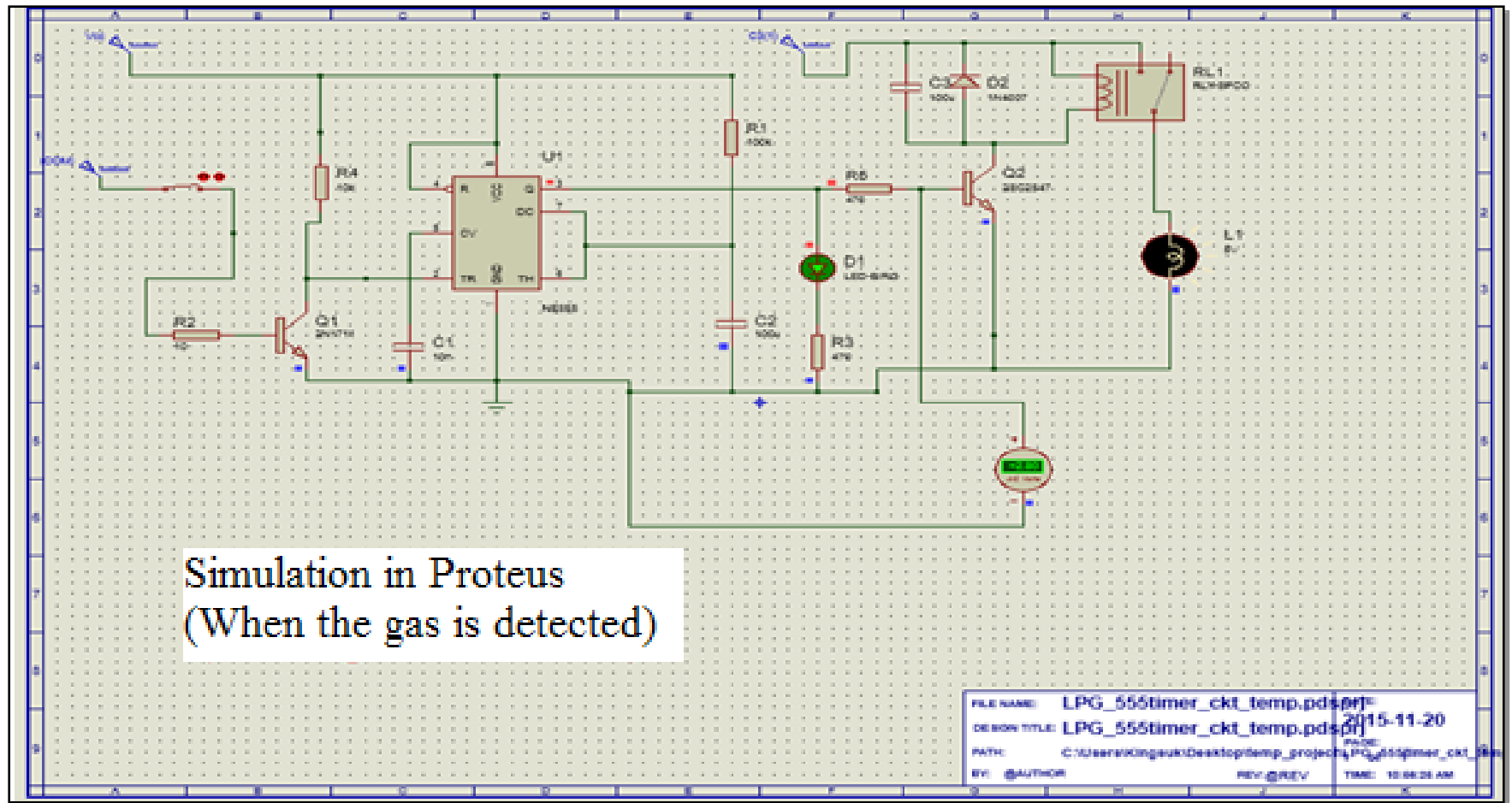
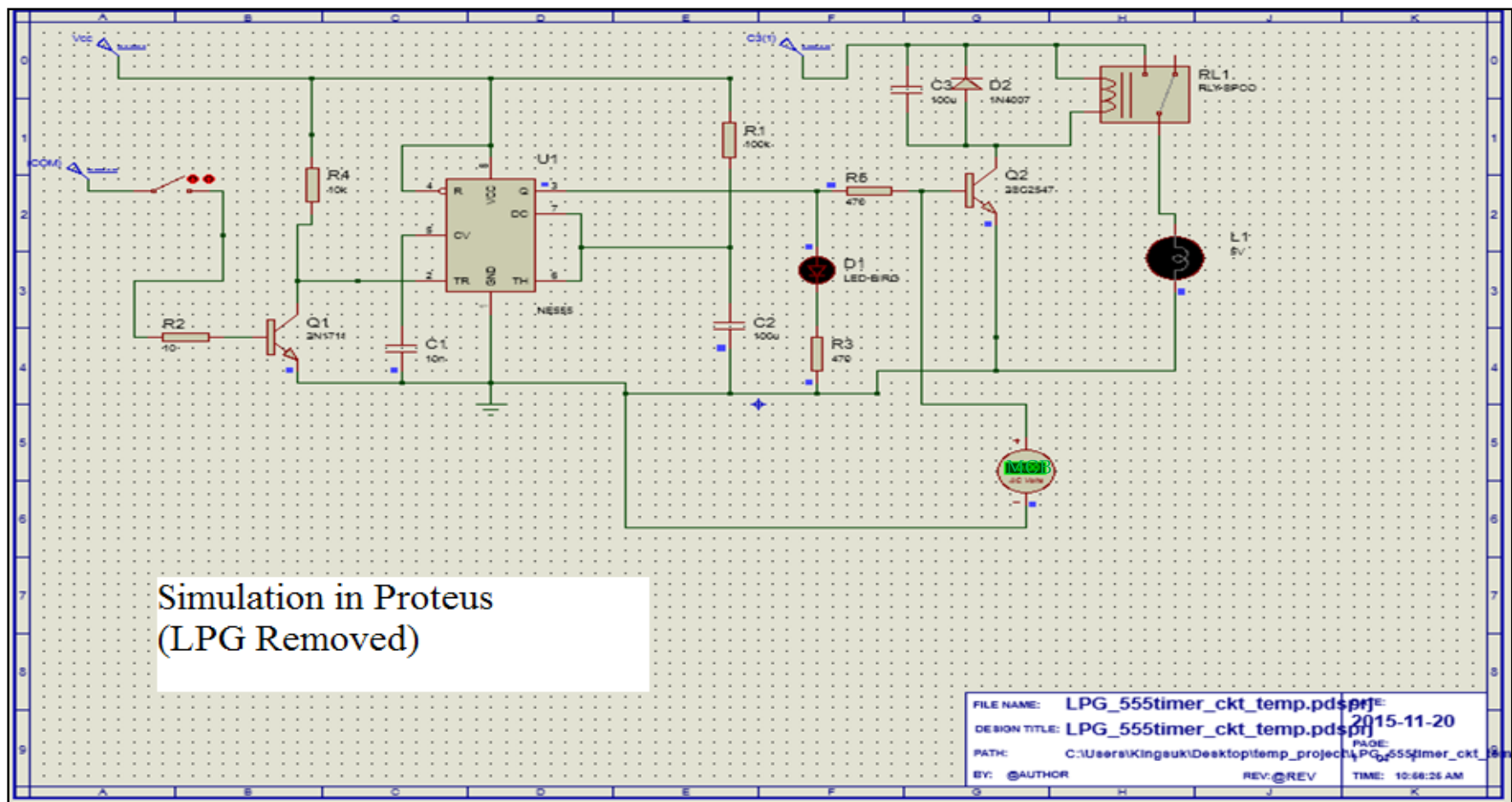Fig 4.2: Simulation using Proteus using 555 timer (when the gas is detected)

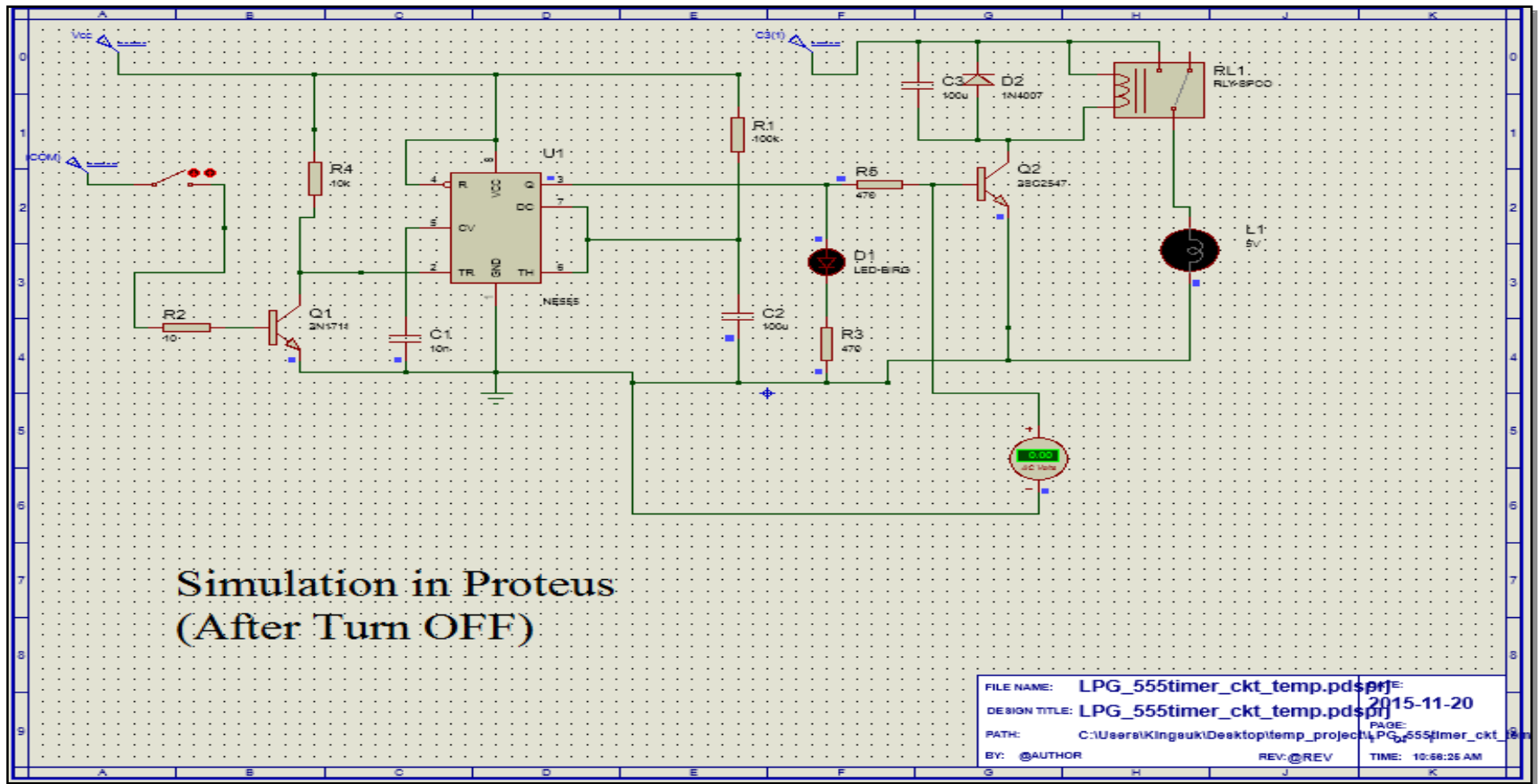Fig 4.3: Simulation using Proteus using 555 timer (LPG removed)

Fig 4.4: Simulation Using Proteus using 555 timer(At Turn OFF).

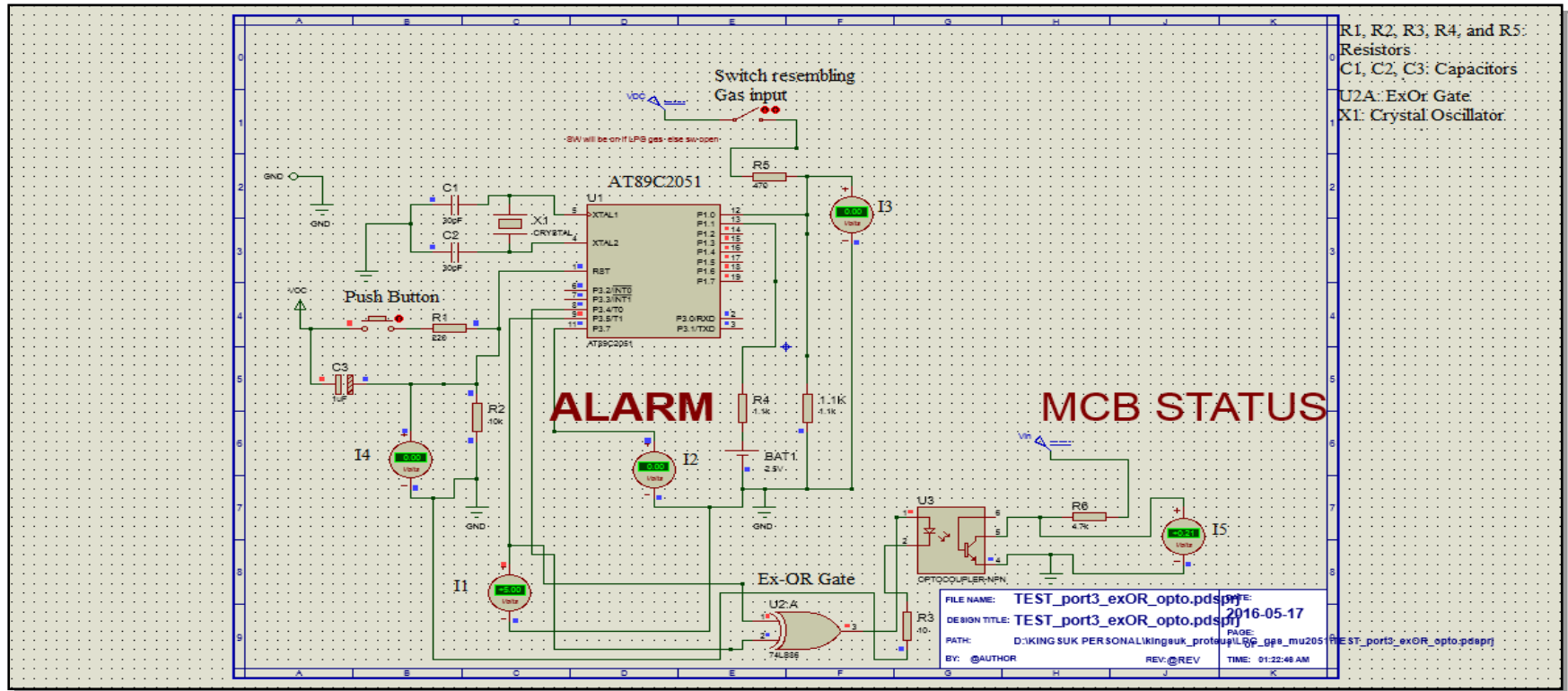# Simulation of the circuit in Proteus using AT89C2051

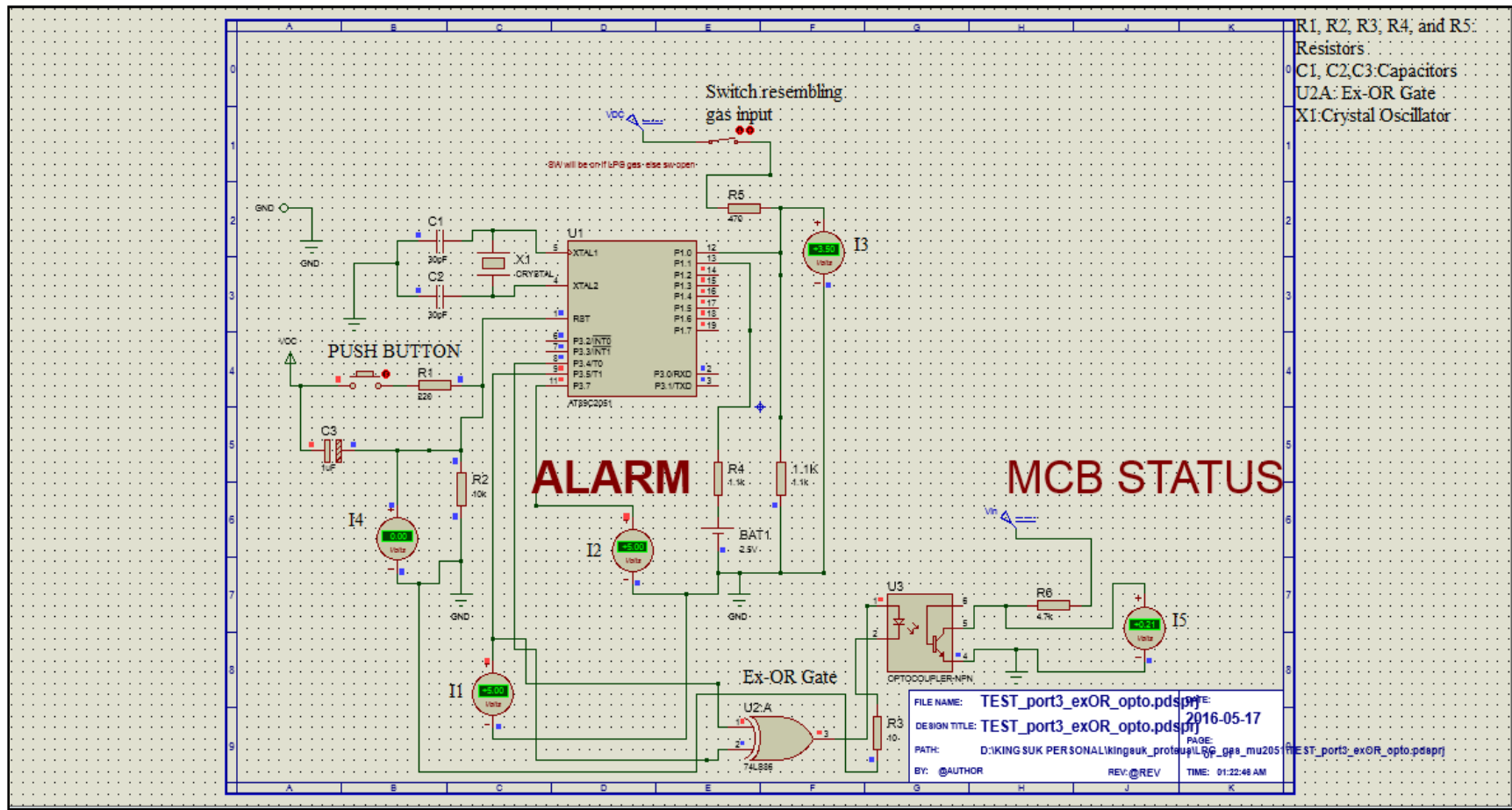Fig 4.5: Simulation using AT89C2051 (No Gas leakage)
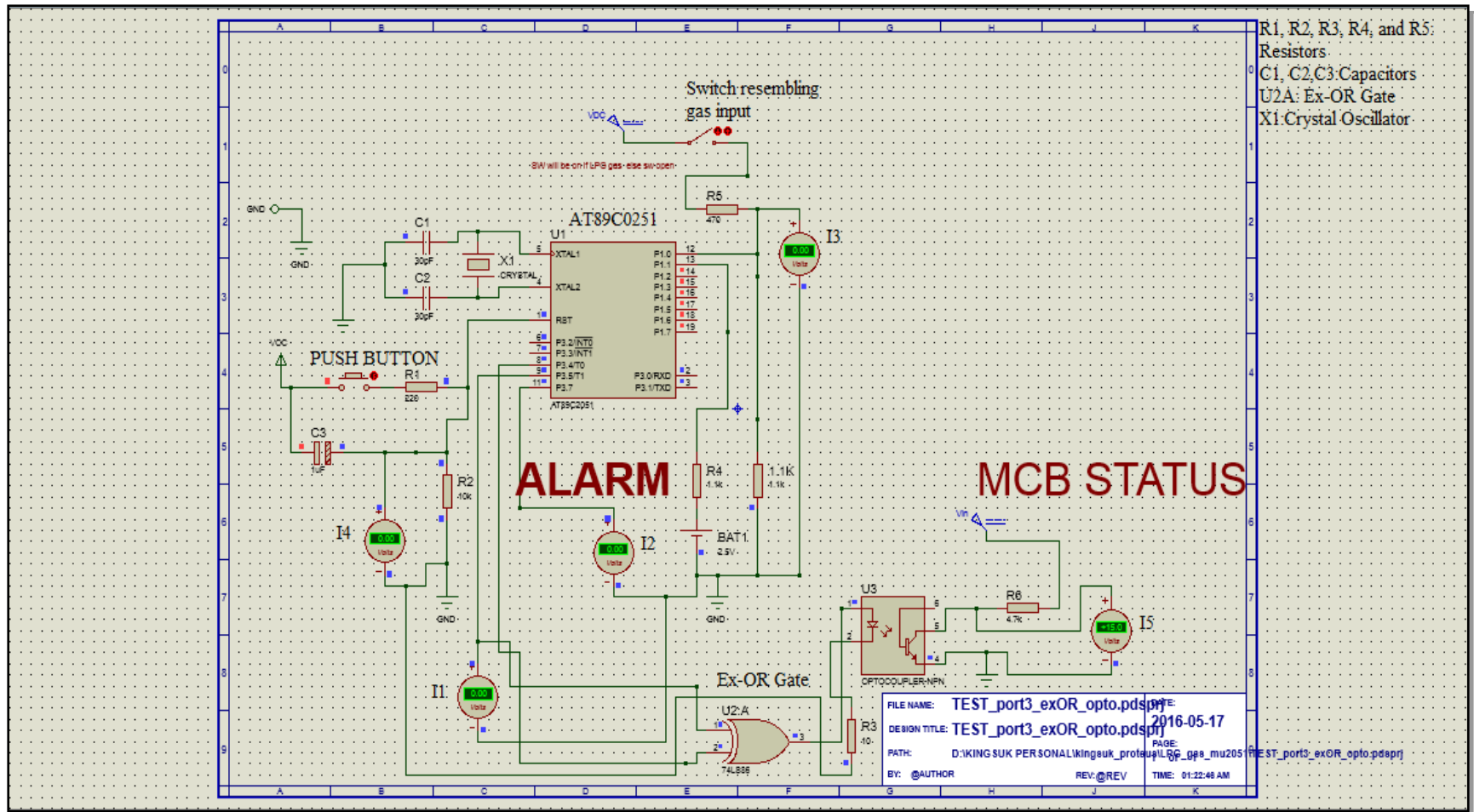
Fig 4.6: Simulation using AT89C2051 (Gas leakage)

Fig 4.7: Simulation using AT89C2051 (LPG removed, MCB still on)

5. BRIEF SUMMARY OF ARDUINO BOARD

✓A Microcontroller board: It contains on board power supply, USB port to communicate with the PC and a Atmel Microcontroller chip

✓Brain of thousands projects: Arduino boards are able to take input and turn it into a program according to our will.

✓An open source platform: It means we can get the details and modify it or make on own.

✓The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers.

Why Arduino?

✓**Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms.

✓**Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

✓**Simple, clear programming environment -** The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.

✓**Open source and extensible software -** The Arduino software is published as open source tools, available for extension by experienced programmers.

✓**Open source and extensible hardware -** The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it.
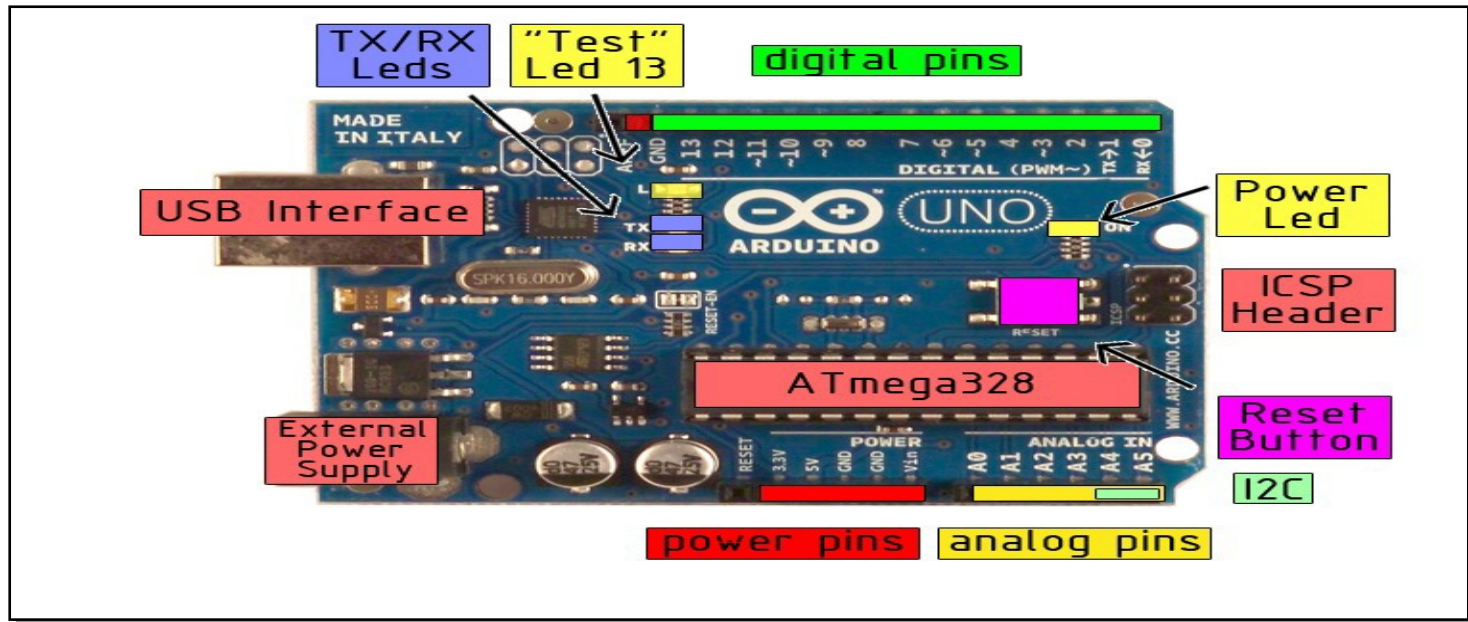
Fig 5.1: Arduino board with label (taken from the official website).

✓ The Arduino UNO is a microcontroller board based on the ATmega328.

✓ It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, 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 name	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14
Analog Input Pins	6
DC Current per I/O Pin	40mA
DC Current for 3.3V Pin	50mA
Flash Memory	32KB
SRAM	2KB
EEPROM	1KB
Clock Speed	16MHz

Table 5.1: Technical specification of Arduino UNO

6. ARDUINO REALIZATION OF THE

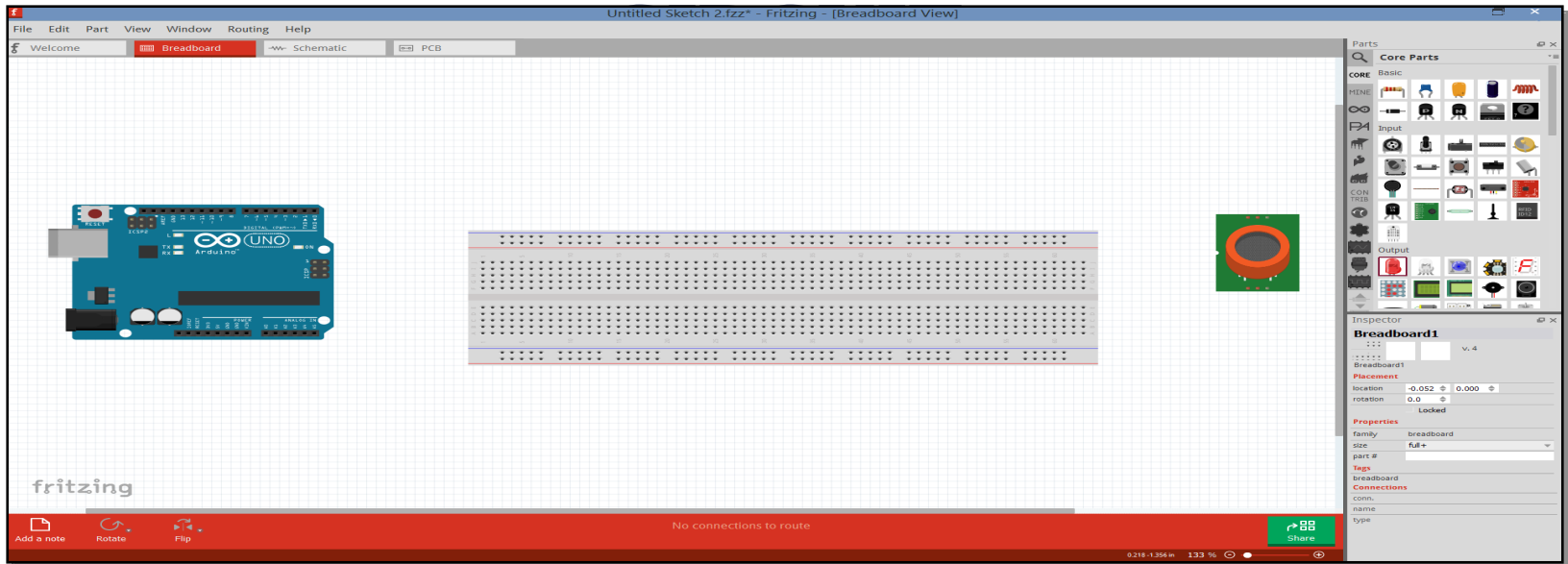

Fig 6.1: A typical layout of the Fritzing window.

✓Fritzing is an initiative that makes electronics accessible as a creative material for anyone.

✓Fritzing is an ultimate tool for document the Arduino-based prototype and create a PCB layout for manufacturing. Similar to Arduino, Fritzing is also an open-source project.
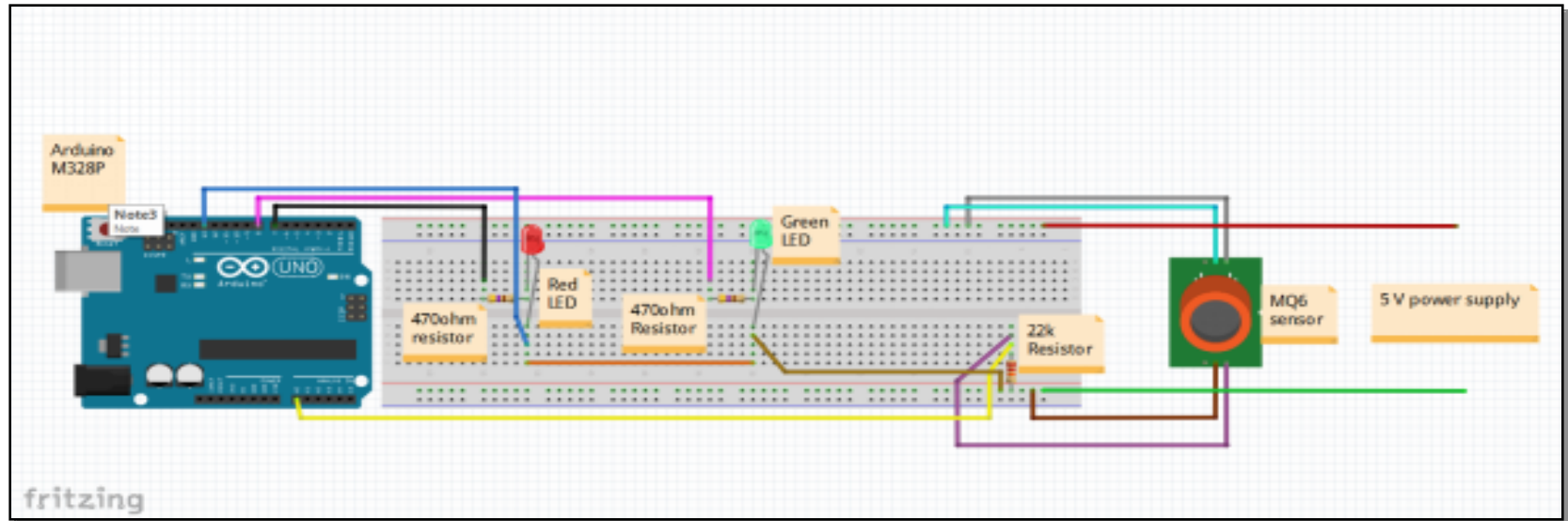
Working principle and description

Fig 6.2: Circuit realization using Fritzing software

✓ In our project, we have used the control circuit in coordination with Arduino UNO board. Pin 7 is connected to the MCB (realised by a LED), Pin 8 is the alarm/Buzzer/LED to indicate the leakage of the gas.

✓ A0 pin of the UNO board is considered as the input of the sensor. GND pin is taken as the ground. Whenever the leakage of the gas is detected, pin 7 and pin 8 goes high. The programming is uploaded in the UNO board.
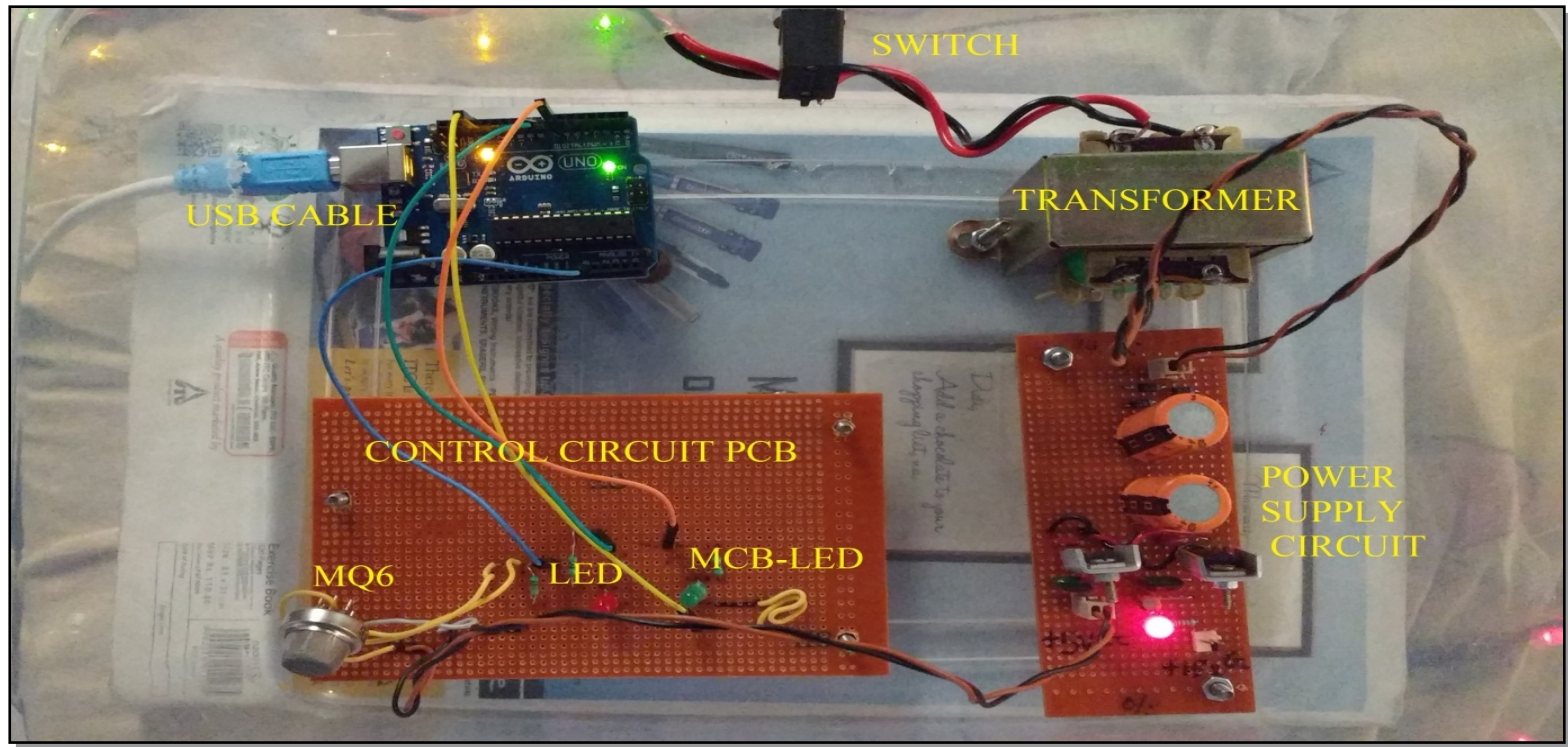
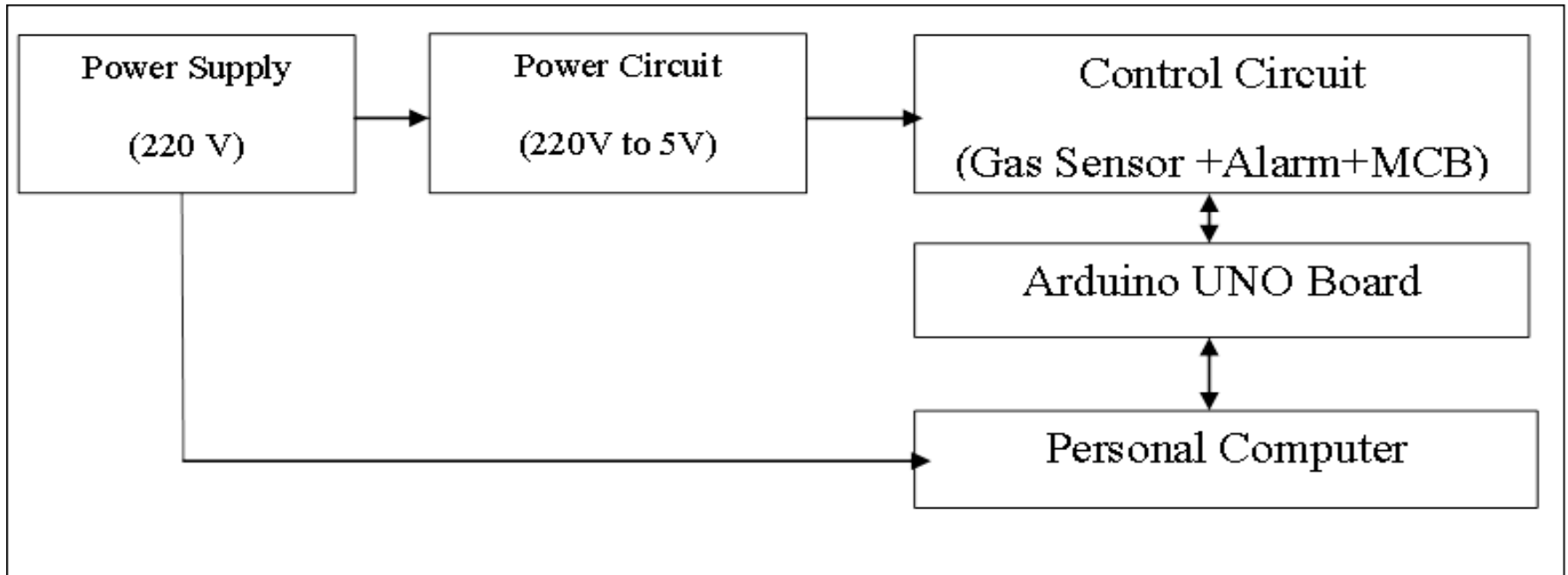Fig 6.2: Circuit realization (Hardware)

7. SIMULATION RESULTS

Fig 7.1: Block diagram of the gas sensor

Building blocks:

✓Power Supply
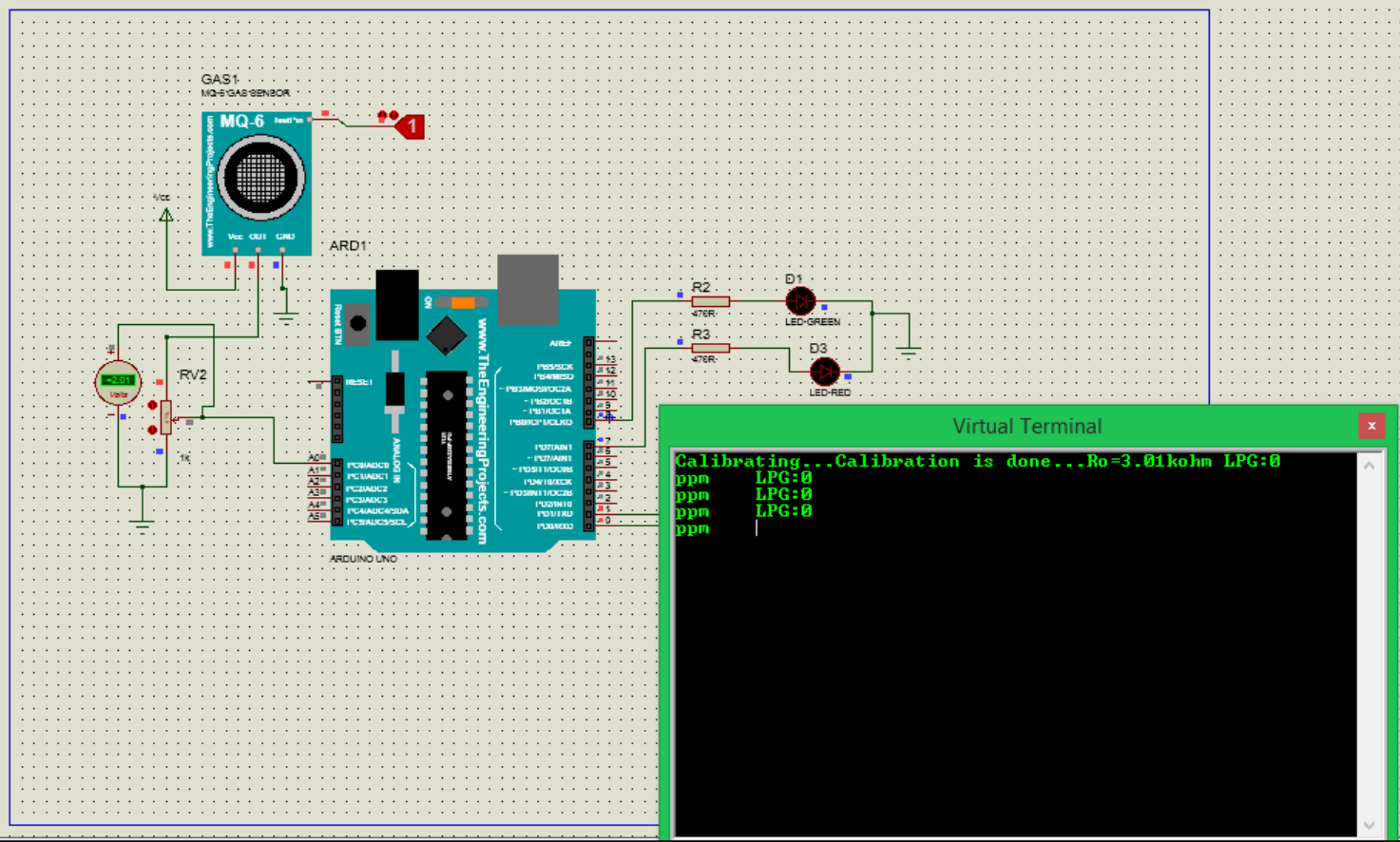
✓Power Circuit

✓Control Circuit

✓Arduino UNO Board

Fig 7.2: Software Results (Calibrating).

Fig 7.3: Software Results (Gas Leakage, Calculating ppm).

Description & working

✓ The software realisation of the whole model is depicted in fig. 7.2 & 7.3. the circuit realisation is done in Proteus software.

✓ The circuit constitutes the gas sensor name MQ6, Arduino Board, oscilloscope, LED red, LED green.

✓ The input to Arduino board is given via input"A0" which is an analog pin. The output of board is taken from pin no. 7 and 8 for MCB and Alarm respectively.

Calculation of ppm using Ms-Excel

Along X-axis:
Log(ppm) = x

Along Y-axis:
Log(Rs/Ro) =y

Where
Rs: Resistance in different gases

Ro: Resistance of sensor in 1000ppm LPG

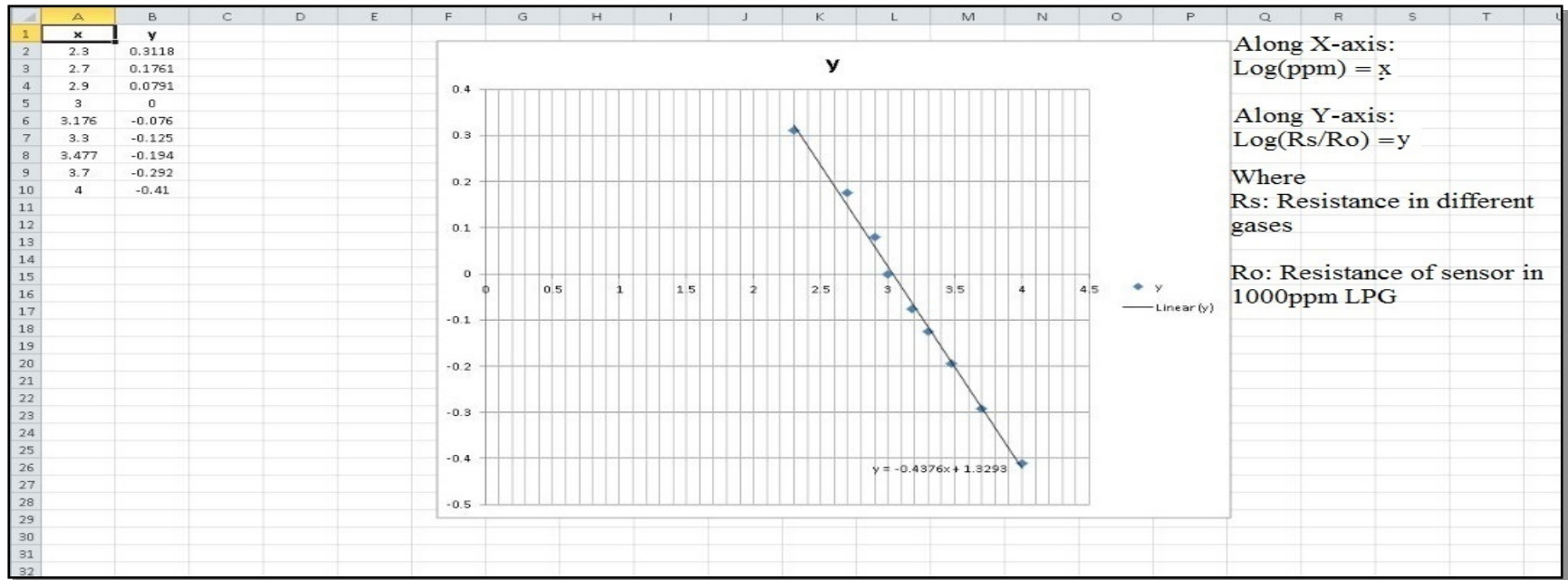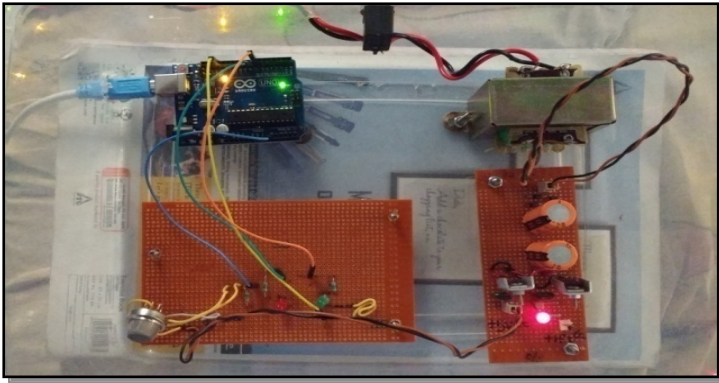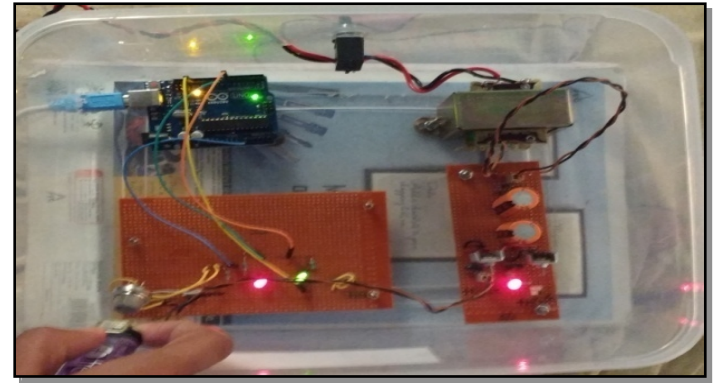Fig 7.4: Deducting formula for the calculation of ppm (amount of gas leaked) using M$-Excel.

Relation Between PPM and Rs and Ro :

$$(Ppm)=10^{\{1.3293-\log(Rsc/Roc)\}/0.4376} \text{----------(1)}$$
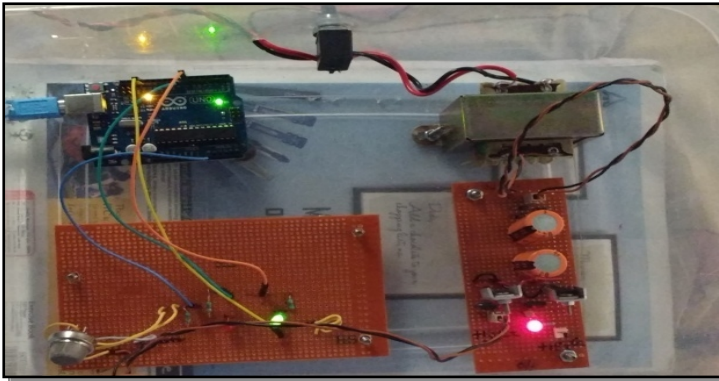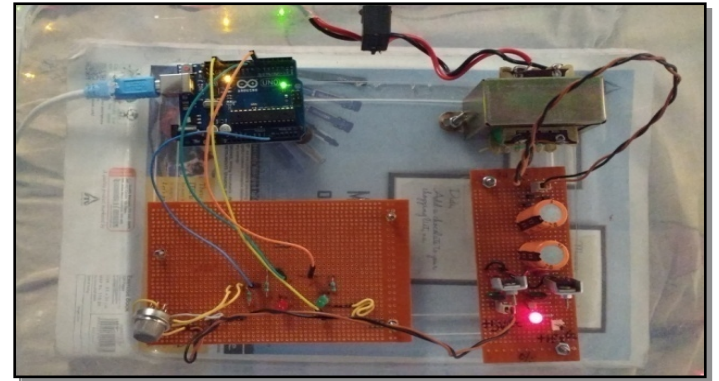where Rsc & Roc is calibrated value

7.5(a) No Gas Leakage

7.5(b) Gas Leakage

7.5(c) Amount of gas reduced

7.5(d) Reset button is pressed

Fig 7.5: Hardware results

8. CONCLUSION AND FUTURE SCOPE

✓ ADVANTAGES

• It is used in house as LPG leakage detection

• It also detects alcohol so it is used as liquor tester.

• The sensor has excellent sensitivity combined with a quick fast response time.

✓ FUTURE SCOPE

• With recent development in technology, Temperature display during periods wherein no message buffers are empty is one such theoretical improvement that is well possible.

• Another very interesting and significant improvement would be to accommodate multiple receiver MODEMS at different positions in the geographical area carrying duplicate SIM cards.

Thank You!

Questions, Please?