Project Tiltle:

System for Smoke detection and real time Fire detection using Arduino

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Section – **05**

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INTRODUCTION:

The generation of numerous gases is essential to our everyday existence. Today, the majority of households in our country prepare with natural gas or LPG. (Liquid Petroleum Gas). About 40% of gas usage is accounted for by the commercial sector, 38% by the residential sector, and the remaining 15% by other sectors. Bangladesh, undoubtedly Asia's seventh-largest natural gas exporter, will hold the remaining 22%. Today, the majority of households in our country prepare with either natural gas or LPG (Liquid Petroleum Gas). Despite how simple technology has made life for us, there are still negative aspects. Gas leaks and the mishaps they cause are all too prevalent in modern times. Local fire agencies estimate that between 2012 and 2016, 125,000 gas leaks—whether natural or LPG—inside or close to domestic properties were recorded. As the Bhopal tragedy demonstrates, gas escapes have been occurring for a very long time. A gas release occurred at the Union Carbide India Limited (UCIL) pesticide factory in Bhopal, Madhya Pradesh, India, on the evening of December 2–3, 1984. One of the worst economic disasters in history, according to many. Even the previous year, a sudden detonation caused by a gas leak in the Chawk Bazar district of Old Dhaka badly destroyed a five-story building. Additionally, according to statements made by Bangladeshi authorities in September 2020, there is proof that a mosque blast over the weekend that left 24 people dead and 13 critically burned was caused by a gas leak. Prothom Alo's study indicates that in Dhaka alone, the risers, a solitary portion of the gas distribution line, sees more than 500 leaks every month. In order to elevate subterranean natural gas piping above ground and provide access to the gas moving through it, a riser is a connecting point built at the opening of a gas conduit. The vast majority of these risers are located in domestic or commercial storage areas because gas leaks can cause fires. Therefore, a life-threatening catastrophe could happen at any moment. Smart meters are the name for the upcoming gas and energy meters. Your gas and electricity consumption and costs are tracked by smart meters, which show the data on a useful in-home screen. It can let us know whether or not there is any abnormally high gas consumption. It can be used to detect gas leakage in addition to lowering expenses. When smoke is detected in the structure and a predetermined temperature is reached, the model has a warning system that activates a buzzer, which is much more audible. Along with the smoke alarm and temperature sensor, the kitchen will also have a PIR (Passive Infrared) sensor that recognizes when humans are present. If someone is present, the alarm will alert you to gas or smoke by signaling the PIR sensor. If no one is present, the GSM module will send the proprietor of the property a notification alerting them to a gas spill.

APPLICATION AREAS:

Our approach is cost-effective and might be made accessible to the majority of people in our country. The primary goal of our recommended approach is to lessen the number of home fires and gas leak-related disasters. This is suitable for interior use as well as in gas-powered buildings like hotels and eateries. This technique can also be applied in the industrial sectors to find gas leakage and, to a certain degree, prevent severe mishaps. Because of its immense effect, this technology has the potential to both save lives and make living simpler. Our project's main objectives are as follows:

1. Check for gas or smoke leaks.

2. Establish whether the rise in warmth in the area is connected to a fire.

3. Watch for movement close to the smoke escape and use a buzzer to sound an alarm if a fire or gas leak is present.

4. If nobody is inside right now, an alarm will sound to alert the owner and a message will be sent to the owner's mobile phone via the GSM module.

TECHNOLOGY AND TOOLS:

- Arduino UNO
- Smoke sensor (MQ2)
- Breadboard
- Connecting wires
- GSM module
- LCD display(16x2)
- Buzzer
- Power Supply
- LED
- Temperature sensor (LM35)

LANGUAGE:

To create the code for our device, we'll use the C programming language. In order to make the code usable in Arduino, it will later be compiled as a HEX file and inserted in Arduino.

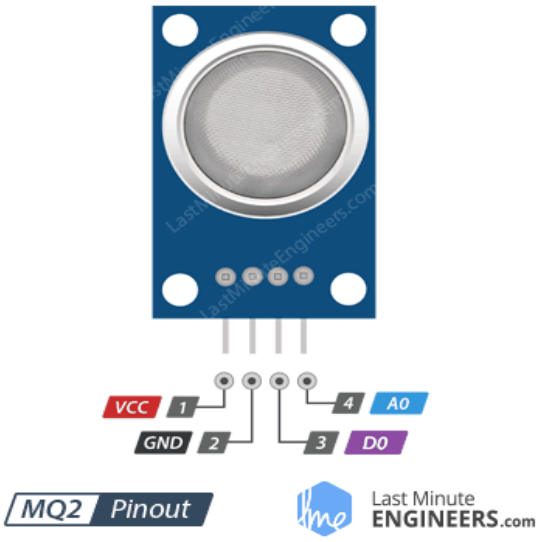
WORKING MECHANISM of SENSORS:

LPG or smoke will initially be detected by the MQ2 gas sensor. This sensor has a sensing component that is mostly a ceramic material made of aluminum oxide that has been coated in tin dioxide (SnO_2) and is housed in a stainless steel mesh. Six connecting legs are linked to the sensing element. The sensing element is heated by two leads, while output signals are generated by the other four. When a sensing material is heated in air to a high temperature, oxygen is adsorbed on the surface of the substance. Then, tin oxide's donor electrons are drawn to this oxygen, blocking the flow of current. The quantity of free electrons increases when smoke or any other gas other than oxygen enters. Consequently, current can flow via the sensor, producing analog voltage values. These voltage readings are taken in order to determine the gas concentration. When there is a high concentration of gas, voltage levels are higher. It can distinguish between LPG, smoke, alcohol, propane, hydrogen, methane, and concentrations of

carbon monoxide between 200 and 10,000 parts per million (ppm).
A temperature sensor, will additionally record the temperature in that interior area in addition to this. The sensor will display a voltage of 10 mV for every 1 degree Celsius change in temperature. For instance, if the temperature is 40 degrees Celsius, the sensor will generate 400 mV, which will be delivered as a digital signal to the microcontroller.
The circumstance would be regarded as a gas or smoke leak if there is no temperature increase but gas or smoke is detected. It would be seen as fire if the temperature were similarly high. If the readings from both sensors are high, it is likely that a combination of smoke, gas, and fire spread. There will be a buzzer sound.
Following the conclusion of this scenario, the GSM module will send a message to the system's owner informing them of the situation, including whether or not there is a fire, a gas leak, or any motion that has been noticed. The GSM module will send a preset text to the fire department with the address and the current state of the problem if the owner doesn't turn off the alarm within a predetermined amount of time.

CONNECTION WITH ICs:

Connecting MQ2 LPG and Smoke Sensor:
The MQ-2 Gas sensor has 4 output pins: A0, D0, GND and VCC.



VCC supplies power to the module. Connect it to the 5V output of your Arduino.

GND is the ground pin.

D0 indicates the presence of combustible gasses. D0 becomes LOW when the gas concentration exceeds the threshold value (as set by the potentiometer), and HIGH otherwise.

A0 produces an analog output voltage proportional to gas concentration, so a higher concentration results in a higher voltage and a lower concentration results in a lower voltage.

The VCC pin supplies power for the module which needs to be connected to 5v and the power LED will glow and when no gas is detected the output LED will remain turned off meaning the digital output pin is 0V . GND is the Ground Pin and needs to be connected to the GND pin on the Arduino.DO pin provides a digital representation of the presence of combustible gases. A0 provides varying voltages in

correspondence to the level of LPG in the air. If we hold the gas sensor near the smoke/gas we want to detect and keep turning the potentiometer until the Red LED on the module starts glowing. Then one has to turn the screw clockwise to increase sensitivity or anticlockwise to decrease sensitivity.

For establishing connection to the Arduino, we have to connect VCC pin 5v and GND pin to

ground of the Arduino. Connecting the D0 output pin on the module to D5 pin on the Arduino

and A0 output pin on the module to Analog pin#0 on the Arduino.

The following image shows the wiring.

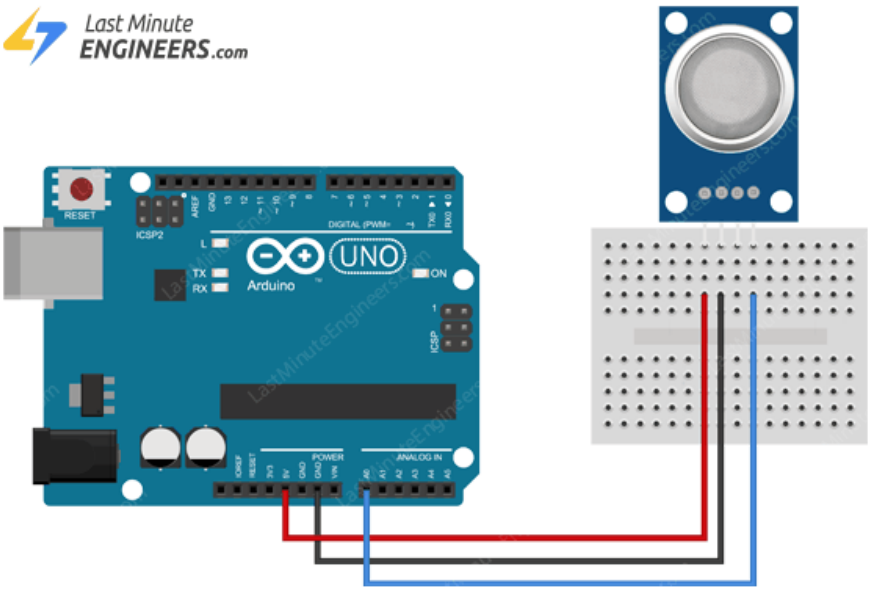
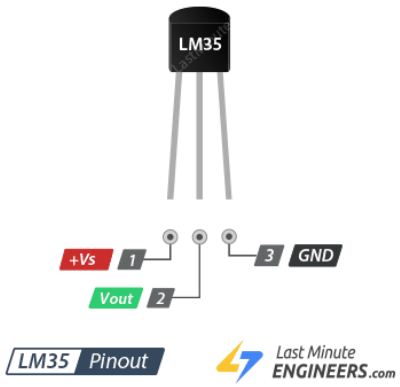


Fig: wiring MQ2 gas sensor to the Arduino.

Connecting LM35 Temperature Sensor:



+Vs is the power supply for the sensor which can be anywhere between 4V to 30V.

Vout pin produces an analog voltage that is directly proportional (linear) to the temperature. It should be connected to an Analog (ADC) input.

GND is a ground pin.

The LM35 temperature sensor has three pins, two of which are used for electricity and one for getting the sensor value. The positive Vs must be connected to 5V, and GND must be connected to the ground wire. The analog signal output port from the sensor, Vout, must be attached to an Arduino's A0 analog input.

Below is the hookup for the experiments with the LM35:

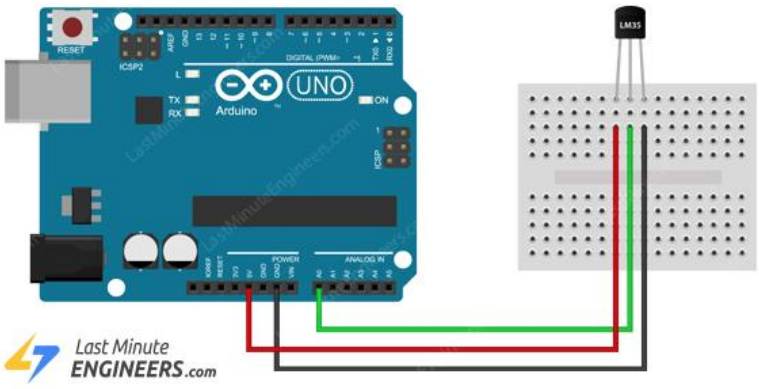


Fig: wiring LM35 temperature sensor to Arduino.

With that, we're now ready to upload some code and get it working.

Data flow from sensors through ICs to I/O Devices:

MQ-2 sensor to IC:

The smoke sensing module is a fundamental smoke detector. When there is a lot of smoke, it can act as a trigger. The gadget includes a power notification LED and a potentiometer for adjusting intensity. Analog output is used by smoke detectors. The DO output will be high and enter the IC, turning on the LED, when the device is fueled by a 5V source and there is no smoke around. When the DO output is insufficient, the switch light illuminates. It produces a high degree when it is returned to its original form.

Temperature Sensor (LM35) to IC:

The LM35 sensor provides an analog signal. It doesn't generate much at typical temperatures. However, when the sensor senses temperature, it generates a lot of data. When the microcontroller detects excessive input from the sensor, it is designed to turn on the GSM module and transmit texts to the owner and the nearest police station. It may be controlled by a mobile phone that is coupled to an Arduino via a hand-off module, which serves as the GSM module in this system. The Tx and Rx pins of the GSM module are attached to the Arduino pin that can become active high when a sensor is triggered, while the other pin is used to control the power source.

GSM module interfacing with Arduino:

Using the GSM library, the Arduino GSM shield allows an Arduino board to connect to the internet, transmit and receive SMS, and place phone conversations. The cellular SIM900A module is a solid, portable option. For client applications, the SIM900A is a full Dual-band GSM/GPRS system that is offered as an SMT module. The SIM900A is a compact, power-efficient phone that supports GSM/GPRS 900/1800MHz for phone, SMS, data, and fax. Additionally, the UI is industry-standard. The SIM900A can efficiently accommodate in any area requirement in user applications thanks to its small configuration of 24mmx24mmx3mm. Particularly true for sleek and compact forms.

ESTIMATE COST ANALYSIS:

- Temperature Sensor - TK.102
- MQ-6 Gas Sensor Module - TK. 150
- Arduino Uno - TK. 900
- Breadboard - TK. 170
- Connecting cable - TK.150
- Buzzer - TK.80
- LED (4) - TK.20
- Power Supply - Tk.1500
- GSM Module - TK.1450
- I2C LCD Display - 210

Total cost – Tk. 4732

RESPONSIBLITIES of EACH MEMBER:

MD. TAMZID HOSSAIN : Introduction, Connection with ICs.

Mahtab Shahriar Chowdhury : Working Mechanism of Sensors, Estimated Cost Analysis.

Nazia Ahmed : Data flow from Sensors through ICs to I/Os.

Kaushik Das : Application area, Reference.

Anika Tabasshum : Language, Conclusion.

CONCLUSION:

"Prevention is preferable to treatment," says a saying. The benefits of focus and sound judgment are unparalleled. Intelligent gas and fire safety solutions are required for a better and secure future. Unless we implement fire safety measures, tragedies like the Narayangonj and Old Dhaka's Chawk Bazar disasters, as well as the Bhopal incidents, may inescapably hit our country in the near future. With the help of our instruments, we can reduce fatalities and unforeseen occurrences. Anyone can use our technology because it is accessible and reasonably priced.

This makes our quick message warning and alert system useful for people who aren't at home. Our technology will be able to lessen human suffering as a consequence, sparing lives in the process.

REFERENCES:

- https://energypedia.info/wiki/Bangladesh_Energy_Situation
- https://www.aa.com.tr/en/asia-pacific/bangladesh-gas-leak-suspected-in-deadly-mosque-blast/1964486
- https://www.thedailystar.net/opinion/news/the-human-and-economic-toll-gas-leaks-2067729
- https://www.researchgate.net/figure/Types-and-uses-of-fire-extinguishers_tbl11_335389372
- https://lastminuteengineers.com/lm35-temperature-sensor-arduino-tutorial/
- https://lastminuteengineers.com/pir-sensor-arduino-tutorial/
- https://techshopbd.com/
- https://lastminuteengineers.com/mq2-gas-senser-arduino-tutorial/
- (PDF) Design of Microcontroller Based Fire Detector with Output Warning SMS Information and Automatic Extinguisher (researchgate.net)