



Air Quality Monitoring and Alert System Using MQ135 Gas Sensor with Arduino Controller

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ABSTRACT:

In this project, we'll build an IoT-based air pollution monitoring system that will track air quality via an internet-connected web server and sound an alarm when it drops below a certain threshold, which occurs when harmful gases like CO₂, smoke, alcohol, benzene, and NH₃ are present in sufficient quantities. On the LCD and on the website, the air quality will be displayed in PPM for easy monitoring. The MQ135 sensor is the ideal option for monitoring air quality as it can detect the majority of dangerous gases and can precisely measure their amount. Previously, we constructed the LPG detector using the MQ6 sensor, the smoke detector using the MQ2 sensor, and the air quality analyzer. With this IOT project, you may use a PC or a mobile device to check the pollution level from anywhere. This system may be installed anywhere, and it can also activate a device—for example, turning on the exhaust fan or notifying the user through SMS or mail—when pollution levels exceed a certain threshold.

I. INTRODUCTION TO GAS SENSOR

A device that detects the presence or concentration of gases in the atmosphere is called a gas sensor. By altering the resistance of the material inside the sensor, the sensor generates a corresponding potential difference based on the gas concentration, which may be recorded as output voltage. The type and concentration of the gas can be inferred from this voltage value. The sensing substance that is contained inside the sensor determines the sort of gas that it is capable of detecting. These sensors are typically sold as modules with comparators, as was demonstrated above. These comparators can be configured for a certain gas concentration threshold value. The digital pin swings high when the gas concentration surpasses this level. The gas concentration can be determined using the analogue pin.

Applications of Gas Sensors

- Used in industries to monitor the concentration of the toxic gases.
- Used in households to detect an emergency incidents.
- Used at oil rig locations to monitor the concentration of the gases those are released.
- Used at hotels to avoid customers from smoking.
- Used in air quality check at offices.
- Used in air conditioners to monitor the CO₂ levels.
- Used in detecting fire.
- Used to check concentration of gases in mines.
- Breath analyzer.

II. MQ135 AIR QUALITY SENSOR

One sort of MQ gas sensor used to identify, quantify, and keep track of a variety of airborne gases, including ammonia, alcohol, benzene, smoke, carbon dioxide, etc. is the MQ135 air quality sensor. It uses 150mA while running on a 5V supply. To get an accurate outcome, the operation needs to be preheated for 20 seconds.



Fig.1

Table: 1 different type of sensors

Sensor Name	Gas to measure
MQ-2	Methane, Butane, LPG, Smoke
MQ-3	Alcohol, Ethanol, Smoke
MQ-4	Methane, CNG Gas
MQ-5	Natural gas, LPG
MQ-6	LPG, butane
MQ-7	Carbon Monoxide
MQ-8	Hydrogen Gas
MQ-9	Carbon Monoxide, flammable gasses
MQ131	Ozone
MQ135	Air Quality
MQ136	Hydrogen Sulphide gas
MQ137	Ammonia
MQ138	Benzene, Toluene, Alcohol, Propane, Formaldehyde gas, Hydrogen
MQ214	Methane, Natural Gas
MQ216	Natural gas, Coal Gas
MQ303A	Alcohol, Ethanol, smoke
MQ306A	LPG, butane
MQ307A	Carbon Monoxide
MQ309A	Carbon Monoxide, flammable gas

It is a semiconductor air quality sensor that can be used for applications that monitor air quality. The presence of NH₃, NO_x, CO₂, benzene, smoke, and other hazardous chemicals in the air greatly affects its sensitivity. For applications involving the detection and monitoring of dangerous gases, it is inexpensively priced.

The digital output pin goes high if the air's gas concentration is more than the threshold limit. The sensor's potentiometer can be used to adjust the threshold value. The analogue pin of the sensor is used to obtain the analogue output voltage, which provides an approximation of the gas level in the air.

MQ-135 Sensor Features

- Wide detecting scope
- Fast response and High sensitivity
- Stable and long life
- Operating Voltage is +5V
- Detect/Measure NH₃, NO_x, alcohol, Benzene, smoke, CO₂, etc.
- Analog output voltage: 0V to 5V
- Digital output voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

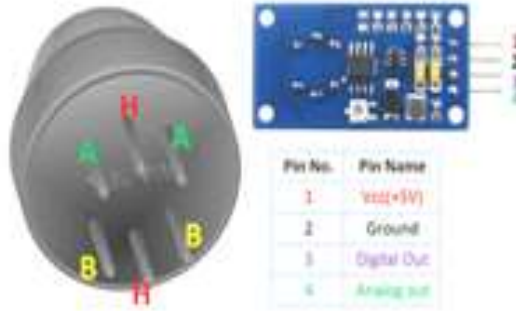


Fig.2

Pin No:	Pin Name:	Description
1	Vcc	Used to power the sensor, Generally 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.

MQ-135 Sensors to detect gases

To do this, you can either utilise an analogue pin or a digital pin. Simply apply 5V to the module to start seeing the power LED shine. When no gas is detected, the output LED will remain out, leaving the digital output pin at 0V. Keep in mind that these sensors must be kept on during the pre-heating period (discussed in the features above) before you may use it. The output LED and digital pin should now both go high as you introduce the sensor to the gas you wish to detect; if not, adjust the potentiometer until the output does. The digital pin will now go high (5V) if your sensor is exposed to this gas at this specific concentration, else it will stay low (0V).

The analogue pin can be used to accomplish the same goal as well. Using a microcontroller, read the analogue values (0–5V), and this value will be directly proportional to the amount of gas the sensor is detecting. You can play about with these settings to see how the sensor responds to various gas concentrations and adjust your programme as necessary.

III. ARDUINO BOARD

Technology and software firm Arduino. It has a somewhat convoluted history. However, a group of students founded it in 2003, which is when it first started. Arduino boards were first designed with teaching in mind. Since then, the focus has shifted to technology that supports embedded systems, 3D printing, and the internet of things (IoT). Arduino boards are still available to amateur electronics hobbyists, though. The vibrant community is one of the main benefits of choosing Arduino devices for your project.. The technology's open-source nature makes it an ideal environment for modding and communal improvement. When you choose Arduino, you get access to a wealth of information from some of the top software developers, designers, engineers, and other experts. They can be used to create basic everyday items or scientific tools for calculations and testing. They are capable of running Microsoft, Linux, and Windows operating systems. Additionally, you may programme the boards using the C/C++-derived Arduino Language and Arduino IDE. The programme code can then be loaded via one of Arduino's I/O ports. The remainder of this manual will go through all the official boards that are available for Arduino and how to utilise each one..

Arduino Uno



Fig.3

One of Arduino's most well-known microcontrollers is the Uno. This technology is entirely open-source, much like their previous products. Three adjustments have been made to the board. ATmega328P architecture is featured in Arduino Uno Rev 3. It features 14 digital I/O pins altogether. Pulse width modulation is made possible by six of them (PWM). It also contains a USB-B port, a power jack, six analogue input pins, a reset button, and 32

kilobytes of flash memory. The Arduino Uno can be used for countless projects. The development of a digital compass, a handheld game console, a card reader, and a motor control are some worthwhile undertakings.

Technical specifications

Microcontroller: [Microchip ATmega328P](#)[7]

Operating Voltage: 5 Volts

Input Voltage: 7 to 20 Volts

Digital I/O Pins: 14

PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)[9]

UART: 1

I2C: 1

SPI: 1

Analog Input Pins: 6

DC Current per I/O Pin: 20 mA

DC Current for 3.3V Pin: 50 mA

Flash Memory: 32 KB of which 0.5 KB used by [bootloader](#)

SRAM: 2 KB

EEPROM: 1 KB

Clock Speed: 16 MHz

Length: 68.6 mm

Width: 53.4 mm

Weight: 25 g

ICSP Header: Yes

Power Sources: DC Power Jack & USB Port

General pin functions

LED: Digital pin 13 powers the integrated LED. The LED is on when the pin's value is high; it is off when the pin's value is low.

VIN: The Arduino/Genuino board's input voltage when using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). This pin can be used to access voltage that has been supplied via the power jack or to feed voltage to it.

5V: The regulator on the board outputs a controlled 5V through this pin. The board's VIN pin, the USB connector (5V), or the DC power jack (7 to 20V) can all be used to supply power to it (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.

3.3 volt supply produced by the on-board regulator at 3V3. A 50 mA maximum current consumption is allowed.

Ground pins, or GND.

IOREF: The microcontroller uses this pin on the Arduino/Genuino board as its voltage reference. The IOREF pin voltage can be read by a properly constructed shield, which can then choose the proper power supply or enable voltage translators on the outputs to operate with 5V or 3.3V.

Shields that block the reset button on the board are frequently added with this feature.

Special pin functions

The Uno's 14 digital pins and 6 analogue pins can all be used as inputs or outputs when `pinMode()`, `digitalWrite()`, and `digitalRead()` methods are used in software. They use 5 volts to work. The suggested operating condition for each pin is 20 mA, and each pin also has a 20–50K ohm internal pull-up resistor that is unplugged by default. To prevent the microcontroller from becoming permanently damaged, no I/O pin should draw more current than 40mA at a time. The Uno includes six analogue inputs with the designations A0 through A5, each with a resolution of 10 bits (i.e. 1024 different values).

In addition, some pins have specialized functions:

Serial / [UART](#): pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.

External interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

[PWM](#) (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.

[SPI](#) (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.

TWI (two-wire interface) / [I²C](#): pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.

AREF (analog reference): Reference voltage for the analog inputs.[\[7\]](#)

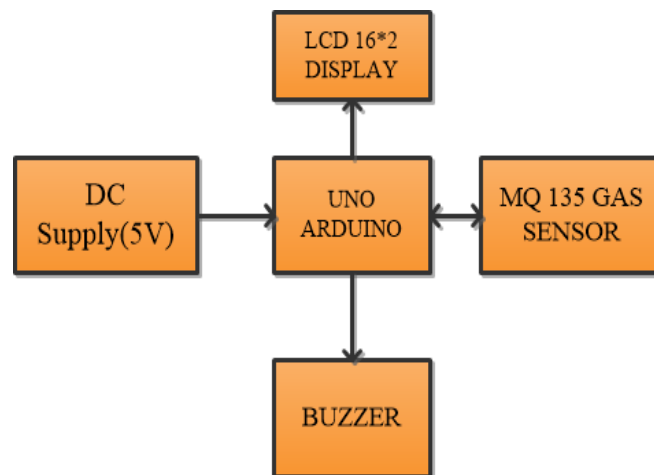
Communication

A computer, other Arduino/Genuino boards, or other microcontrollers can all be communicated with using the Arduino/Genuino Uno's many communication features. On digital pins 0 (RX) and 1, the ATmega328 provides UART TTL (5V) serial connection (TX). This serial communication is routed through USB by an ATmega16U2 on the board, which is seen by computer software as a virtual com port. There is no external driver required because the 16U2 firmware works with the built-in USB COM drivers. On Windows, however, a.inf file is necessary. A serial monitor is included in the Arduino Software (IDE) and allows straightforward textual data to be delivered to and received from the device.. When data is transmitted using the USB-to-serial chip and USB connection to the computer, the RX and TX LEDs on the board will flash (but not for serial communication on pins 0 and 1). Any digital pin on the Uno can support serial communication thanks to the Software Serial library.

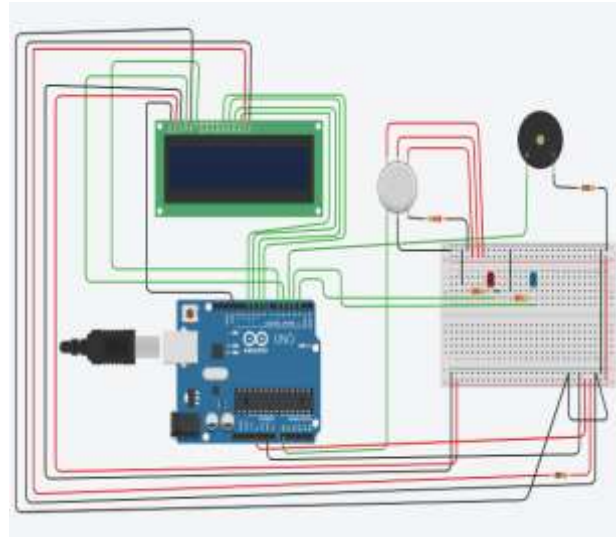
Automatic (software) reset

The Arduino/Genuino Uno board is made in such a way that it may be reset by software running on a connected computer, eliminating the need for a physical click of the reset button prior to an upload. A 100 nanofarad capacitor is used to connect one of the hardware flow control lines (DTR) of the ATmega8U2/16U2 to the ATmega328's reset line. The reset line lowers for a long enough period of time when this line is asserted (taken low) to reset the chip..

This configuration has additional effects. Each time a connection is made to the Uno from software while it is attached to a computer running Mac OS X or Linux, the Uno resets (via USB). The boot loader is active on the Uno for the next half-second or so. The initial few bytes of data transmitted to the board after a connection is established will be intercepted, despite the fact that it is configured to disregard invalid data (i.e., anything other than an upload of new code).



Block diagram



SCHEMATIC DIAGRAM

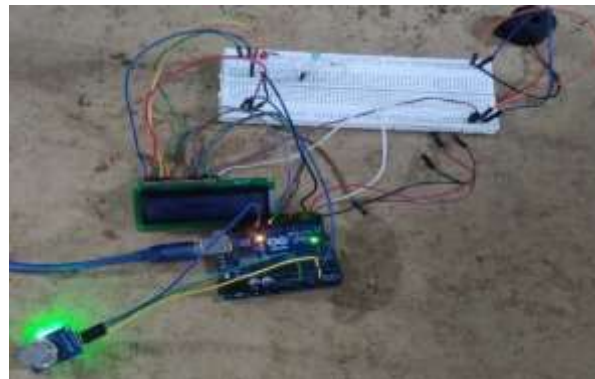


Fig.4

IV. CONCLUSION

used in enterprises to keep an eye on the levels of dangerous gases. used in homes to identify emergency situations. used to measure the concentration of gases emitted at oil rig locations. used in hotels to discourage smoking by guests. used to check the air quality in offices. used to measure CO2 levels in air conditioners. used to find fires. used to measure the gas concentration in mines. breathe monitor.

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