

# Under Ground Mine Air Quality Pollution Based On Iot Technology

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## Abstract

The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health.

IOT Based Air Pollution Monitoring System is used to monitor the Air Quality over a web server using the Internet. It will trigger an alarm when the air quality goes down beyond a certain level, means when there are enough harmful gases present in the air like CO<sub>2</sub>, smoke, alcohol, benzene, NH<sub>3</sub> and NO<sub>x</sub>. It will show the air quality in PPM on the LCD and as well as on webpage so that air pollution can be monitored very easily. The system uses MQ135 and MQ6 sensor for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.

*Keywords: Arduino, Underground coal mines, Internet of things, Mine environment index, Principal component analysis*

## Introduction

The harsh and confined working conditions in underground coal mines (UCMs) have led to the listing of the mining industry as the most dangerous profession. In recent years, the adoption of sophisticated regulations has occurred; yet hundreds of miners lose their lives every year. According to the Mine Safety and Health Administration (MSHA), faulty equipment, negligence of labor towards explosions, structure failure, and gas accumulation are the most common causes of underground mine accidents. During the economic year of 2014, in the salt range coal mine in Punjab, Pakistan, more than 35% of accidents occurred due to the accumulation of toxic gases. Therefore, for the safety of workers and the mine itself, it is extremely important to monitor the mine environment continuously and accurately.

In recent years, advancements in the fields of wireless sensor network (WSNs), radio

frequency identification (RFID), and cloud computing have led the way toward the development of internet of things (IoT) in the areas of Smart Grids, e-health services, home automation, and environment monitoring.

### Literature Survey:

In recent decades, various scientific studies have used multivariate statistical approaches, such as cluster analysis (CA), PCA, factor analysis (FA), and discriminant analysis for solving environmental and air quality issues. However, based on the eigenvalue's solution, PCA is the most prevailing and simplest technique. Specifically, in air quality problems, it has been used alone or in combination with other approaches.

For instance, used PCA and CA to figure out the seasonal variations and spatial distribution in the open air. Similarly analyzed by concentrations all over Malaysia using rotated PCA. Moreover, PCA, in combination with an enrichment factor, has successfully been implemented in the assessment of the air quality of an indoor charcoal cooking restaurant; it identified the particle fraction of PM<sub>2.5</sub> as a source of pollution. Therefore, in the present study, PCA is used to identify major pollutant sources present in the mine environment. The drawbacks of conventional

monitoring instruments are their enormous size, heavy weight, and extraordinary expensiveness. monitoring stations. To be effective, IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are number of harmful gases present in the air like CO<sub>2</sub>, smoke, alcohol, benzene, NH<sub>3</sub>, NO<sub>x</sub> and LPG. The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.

### Proposed Methodology:

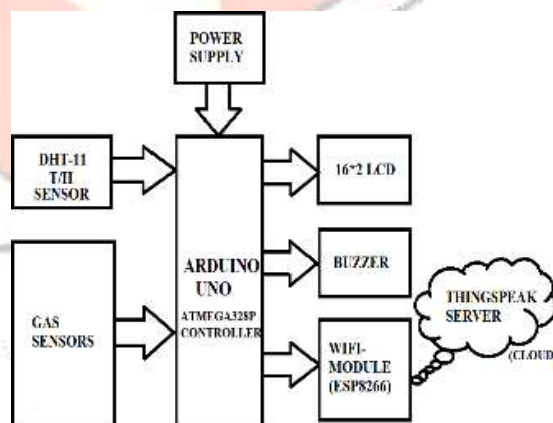


Figure1: Proposed Block Diagram

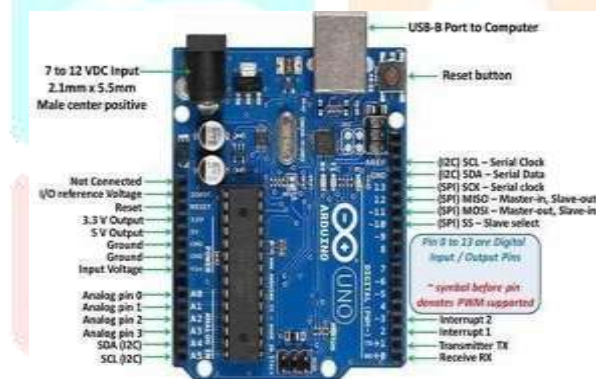
### List of components used

1. Arduino
- uno2. Gas
- sensors
3. Buzzer

- 4.Wifi Module
- 5.Power supply
- 6.LCD

## Arduino UNO

An open-source electronics platform called Arduino is built on simple hardware and software. A motor can be started, an LED can be turned on, and something may be published online by using an Arduino board to receive inputs like light on a sensor, instructions to the board's microcontroller will instruct your board what to do. You achieve this by using the Arduino Software(IDE), which is based on Processing, and the Wiring-based Arduino Programming Language.



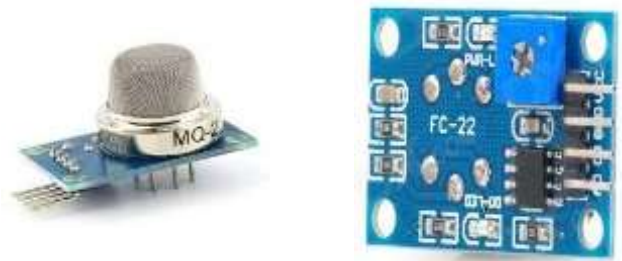
**Figure 2: Labelled Arduino UNO**

The one in Italian is called as Arduino UNO. It is from the ATMEL Family. Here we used ATMEGA328P microcontroller.

## Gas sensors

Gas Sensor module detects gas leakage in homes and industry. The MQ series of gas sensors use a small heater inside with an

electrochemical sensor. They are sensitive to a range of gases and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of Arduino.



**Figure 3: Gas Sensors**

## Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, trains, and confirmation of user input such as a mouse click. A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.



**Figure 4: Buzzer**

### Wi-Fi Module

The ESP8285 is a similar chip with a built-in 1 MiB flash memory, allowing the design single-chip devices capable of connecting via Wi-Fi. These microcontroller chips have been succeeded by the ESP32 family of devices.



**Figure 5: Wi-Fi module**

### Power Supply

A regulated power supply which maintains the output voltage constant irrespective of a.c. mains fluctuations or load variations is known as regulated power supply. A

voltage remains constant whether the load current changes or there are fluctuations in the input a.c. voltage.



**Figure 6: Power supply**

### LCD (Liquid Crystal Display):

The liquid crystal display (LCD) panel is designed to project on-screen information of a microcomputer onto a larger screen with the aid of a standard overhead projector, so that large audiences may view on-screen information without having to crowd around the TV monitor.

### Working:



**Figure 7: LCD**

regulated power supply consists of an ordinary power supply and voltage regulating device. The output of ordinary power supply is fed to the voltage regulator which produces the final output. The output

A system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air. The use of IOT technology enhances the process of monitoring various aspects of

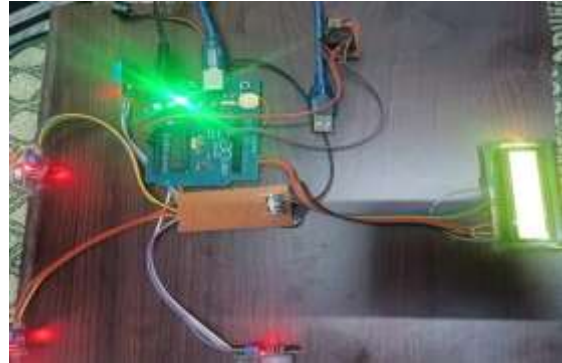


environment such as air quality monitoring issue proposed in this paper. Here, using the MQ135 and MQ6 gas sensor gives the sense of different type of dangerous gas and Arduino is the heart of this project which control the entire process. Wi-Fi module connects the entire process to internet and LCD is used for the visual Output. We tested out the project in a highly polluted and highly crowded closed environment in the metropolitan city, and results suggested that the air there is unhealthy. Data was sent to ThingSpeak by the nodeMCU; it was then collected by the web application that we created, the comparison was made against the range of pollution levels stored, and then it was declared whether the air was healthy, unhealthy, or hazardous. We were able to acquire data from all the sensors but are discussing the findings of some of them in the subsequent paragraphs.

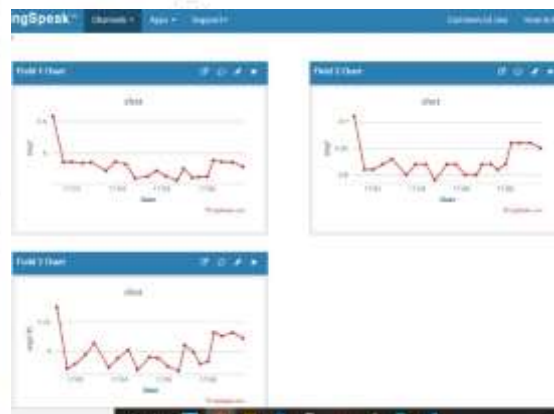
### Result:

The temperature, humidity, and air quality monitoring system in the room to be built is a system that can monitor or see the state of the temperature, humidity and air quality in the room in real time and can be accessed using the web which is equipped with sensors, MQ-135 sensors, DHT11 sensor and module ESP8266. In this case the temperature sensor that functions as a temperature detector, the DHT11 sensor as a humidity sensor, and the MQ-135 sensor

as an air quality detector and then the measurement results will be calibrated by the ESP8266 microcontroller system, and the results will be sent to Thingspeak via a Wi-Fi signal using the Wi-Fi module contained in module ESP8266.



**Figure 8:**  
**Result**



**Figure 9: ThingSpeak**  
**Results**

### Conclusion:

In this project IoT based on measurement and display of Air Quality Index (AQI), Humidity and Temperature of the atmosphere have been performed. From the information obtained from the project, it is possible to calculate Air Quality in PPM. The disadvantage of the MQ135 sensor is that specifically it can't tell the Carbon Monoxide or Carbon Dioxide level in the

atmosphere, but the advantage of MQ135 is that it is able to detect smoke, CO, CO<sub>2</sub>, NH<sub>4</sub>, etc. harmful gases. After performing several experiments, it can be easily concluded that the setup is able to measure the air quality in ppm, the temperature in Celsius and humidity in percentage with considerable accuracy. The results obtained from the experiments are verified through Google data. Moreover, the led indicators help us to detect the air quality level around setup.

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