

# Air Quality Monitoring System based on ISO/IEC/IEEE 21451 Standards

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**Abstract:** Although the role of environment has long been recognized, much work has focused on host and parasite genetic effects. However, the last few years have seen a surge of studies revealing a great diversity of ways in which non-genetic factors can interfere with pathogen interactions. Here, we review the current evidence for such environmentally mediated effects, including ambient temperature, particulate matter and gas composition. This paper introduces research oriented security access for pathogen. Depending on the atmospheric parameters like temperature, wind, pressure etc., in this project we are going find the atmospheric temperature and humidity using DHT11 sensor. Wind speed is also calculated using flow sensor. Whenever the sensors detects the signal then the values will be started calculating the value of the sensor and those values are transmitted using Zigbee. In the receiver side the values are received in PC and uploaded in server. Hence we can see the value by logging in the internet.

**Keywords:** Atmospheric Parameters, DHT11 sensor, Particulate matter, Zigbee

## 1. Introduction

Air, an inevitable condition for the survival of an organism, which is being compensated by number of environmental factors nowadays. The environmental conditions today leads to various diseases without the consent of the individual. These factors not only aim the adults but also the children who are subjected to such ill threats caused by the former generation. Various diseases such as respiratory failure, Chronic obstructive pulmonary disease are caused by increasing pollutants and toxic substances in air. The various toxic substances such as carbon monoxide ,particulate matter are harmful to the survival of living organisms .These substances are emitted by various ways such as automobiles ,thermal plants, electricity plants ,fuel extraction and so on .Such processes increase day by day as the human consumption increases .One of the main reason why such environments threats are created is that individual awareness about the air we take has been reduced beyond a critical level .This has to be stressed in every individual that the air we take is becoming poisonous without our knowledge .Due to this, the ambient temperature, wind flow speed, pathogen content in an environment increases drastically when compared to the past observations .If such conditions prevails for another 20 years

than the air we breathe in becomes a poisonous gas with heavy toxicity.

## 2. Objective

The main objective of our project is to create individual awareness to make people understand the air we take is inevitable. We provide a system that gives an overall observation about the gas we breath in. It mentions and highlights the factors of measuring the most important toxic gas levels and particulate matter.

## 3. Literature survey

Hong He, Yaqing Hou, Zhihong Zhang designed Research on Indoor Environment Monitoring System Based on ZigBee. The system real-time monitoring of indoor air quality in a number of physical quantities .Mainly CC2530 chip as the core processor .Through the Zigbee wireless communication module to form a wireless data communication network ,upload the collected information .Using LabView designed PC monitoring software, according to the set value to effectively monitor and alarm .This system has raised people's concern for the indoor living environment quality and to consider the impact of the environment on our own health ,which provides a new monitoring framework for indoor environment comfort system.

Somansh kumar,Ashish jashuja came up with Air quality monitoring system based on IoT using Raspberry Pi.This paper presents an air quality monitoring system which includes various parameters: carbon monoxide, carbon dioxide, temperature, humidity . The various sensors included in the system detects the various gases and send the through an IoT module. The values collected through the sensors are shown in tabular form and presented in IBM Blue mix cloudmix method.

ZaemAslam, Waqas Khalid, TallalAhmed ,Daniyal Marghoob developed the system in which the hazardous gases like liquid petroleum gas(LPG), Methane, Carbon-Monoxide, Propane and Smoke, in addition to over temperature, were sensed and displayed continuously on the LCD and a popup alarm will be generated if any of the said elements cross specified ranges. Central HVAC systems required certain level of air changes as the loss of chilled air is directly related to the loss of energy in building.

Hong hi, Zhihong zhang designed the system of real-time monitoring of indoor air quality in a number of physical quantities. Mainly CC2530 chip as the core processor. Through the Zigbee wireless communication module to form a wireless data communication network, upload the collected information. Using LabView designed PC monitoring software, according to the set value to effectively monitor and alarm.

Sumanth Reddy Enigla, Hamid shanasseer developed Real Time Air Quality Monitoring. In this paper, a real-time crowd sensing based air quality monitoring system is presented. The proposed system uses gas sensors to capture the air quality index from the atmosphere. Raw sensor data collected from the gas sensors sent to the cloud using an android application. In cloud, the data is stored and processed. The processed data is visualized in real time on a map using an open-source geospatial data visualization framework such as Leaflet using R programming.

#### 4. Block diagram

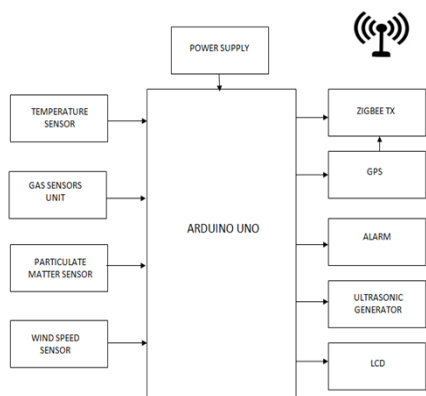


Fig. 1. Transmitter section

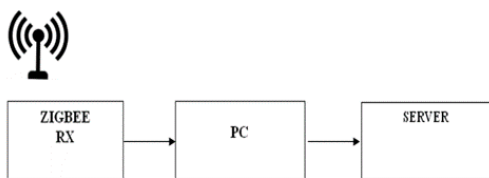


Fig. 2. Receiver section

#### 5. Methodology

The device consists of gas sensor module comprising various gas sensors such as co, MQ6 to detect the gas composition in the air. It also contains PM 2.5 sensor to detect particulate and wind speed is calculated using wind speed sensor. The DHT11 sensor is used to calculate the ambient temperature. All the measured values are transmitted through the zigbee module to the PC server. An alarm is set to provide a basic alert to user when the gas level crosses the threshold. In addition to this set up an Ultrasonic wave generator is fixed to reduce the pathogen survival since the basic pathogen cannot bear the ultrasound frequency level.

#### 6. Components

**ARDUINO UNO:** The Arduino UNO is an open-source microcontroller Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

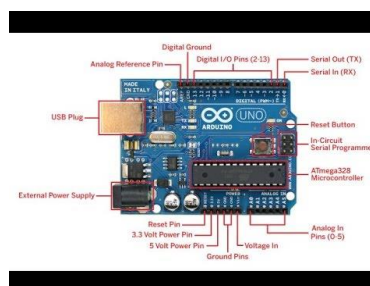


Fig. 3. Arduino UNO board

- **DHT11 humidity sensor:** DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability.
- **MQ-6 gas sensor:** This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.



Fig. 4. Mq6 sensor

- **PM 2.5 sensor:** PM2.5 and PM10 refer to particulate matter with particle diameter up to 2.5 microns and 10 microns, respectively, and are among the most dangerous air pollutants. Due to their small size, PM2.5 particles can travel deep into the human lung and cause a variety of health issues; for instance, by triggering asthma attacks or contributing to cardiovascular disease. The PM 2.5 will enable the implementation of innovative air quality monitoring devices that prevent air pollution damage.



Fig. 5. PM 2.5 sensor

- Ultrasonic module(hcsr04):** In ultrasonic module HCSR04, we have to give trigger pulse, so that it will generate ultrasound of frequency 40 kHz., HC-SR04 can measure up to range from 2 cm - 400 cm,  $V_{CC}=+5$  V supply.



Fig. 6. Ultrasonic sensor

**Zigbee:** It is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.



Fig. 7. Zigbee module

- Global positioning system (GPS):** It is a satellite-based system that uses satellites and ground stations to measure and compute its position on Earth. GPS is also known as Navigation System with Time and Ranging (NAVSTAR) GPS. ... This GPS receiver is used in many applications like smartphones, Cabs, Fleet management etc.



Fig. 8. GPS module

### 7. Advantages

- The proposed system gives a stand-alone performance in measuring most of the parameters of the air including fine particles.
- Location identification and remote sensing can also be implemented which makes monitoring much easier than previous methods.
- Alert and automatic ultrasonic wave generation for pest prevention is also given.
- More individual awareness is created through this system.

### 8. Disadvantages

- The system proposed here involves number of components that makes the device scale a bit large.
- Accuracy level may be decreased as the parameters keep on changing.

### 9. Applications

- Can be implemented as an individual device to safely monitor the indoor space.
- It can be used in industries and factories involving gas components.
- In the automobile verification and emission department to control and track air pollution.

### 10. Future enhancements

This device is highly suitable to be attached as an additional device to various other device units as vehicles, indoor space, children bags to track the air they are being exposed to. This helps to create an awareness amongst people and give a better exposure about the environment.

### 11. Conclusion

By using this system, it has been proven that the system can measure the gas composition, particulate matter content, Ambient temperature and provide an all-round awareness about the air quality. It also allows the user to view value by logging in the internet and thus provides remote access. Thus the project proposed here increase the individual awareness thereby increases the chances to protect the air quality as soon as possible and to create a better future for the coming generation.

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