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# Retraction

# **Retraction: Improved Air Quality Testing Using Kalman Filter Based on IoT Data Fusion for Smart Cities (***J. Phys.: Conf. Ser.* **1916** 012114)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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# Improved Air Quality Testing Using Kalman Filter Based on **IoT Data Fusion for Smart Cities**

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Abstract. Monitoring the amount of gases in air in smart cities provides immature gas emissions, polluting concentrations and filtering are examined in this paper. Air contamination is a worry in numerous metropolitan territories and is a critical reason for respiratory issues for some individuals . Monitoring the quality of air aids in the prevention of emission of gases and also the reduction of disease caused by pollution . A System has been developed to measure the values of CO2, NH3, and CH4 gases and therefore the parameters are sent via the ESP8266 Wi-Fi module through which we can monitor the concentration of the gases by tracking the IP address via IoT and also implemented a Kalman filter which purify the polluted air.

Keywords: IoT,kalman filter, esp8266, toxic gases,Pollution Monitoring

#### 1. Introduction

Air contamination is the serious issue of each country, regardless of whether it is created or creating. Medical conditions are developing at quicker rate in metropolitan zones where industrialization and a more noteworthy number of vehicles prompts arrival of parcel of vaporous poisons. Unsafe impacts brought about by the vaporous toxins are gentle unfavourably susceptible responses like inflammation of the mouth, watery eyes and runny nose, further as serious complications like lung cancer, stroke, COPD. The IoT enabled air monitoring system tracks the gases present in air via internet and stimulates a signal when the gases in air exceeds the specific value, demonstrating that there are satisfactory measures of hurtful gases noticeable all around like, smoke, CO2, CH<sub>4</sub>, and NH<sub>3</sub>.LCD will display the values of gases in ppm and the framework is actualized in manufacturing plants, homes and high contaminated city.

#### 2. Literature Survey

Air pollution has become a global environmental problem due to industrialization and urbanization and can cause serious diseases. In this case, air quality monitoring provides significant benefits in air pollution control. AvijoyChakma analyzed the use of image-based air quality analysis for Particles with diameter less than 2.5 mm are measured. This approach uses the in-depth Convolutional Neural Network (CNN)

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which is an in-depth learning method used to classify natural images into different categories according to their PM2.5 focus [1].

Rohan Kumar Jha has built a IoT based real time air monitoring system based. To track the air quality, this project uses an IoT platform called Thing Speak, to link this tool with the hardware ESP8266 Wi-Fi module is used. It integrates real-time data into our mobile phone app, which was created specifically with Android Studio particularly for this purpose [2].

Pollution control and control are given priority in urban areas because of their significant impact on human illness and death. The construction of the system is designed to detect intelligent pollution and predict future pollution by including pollution levels and weather parameters. A pollution model that uses spatial design has been developed and adds climate limits to indicate the emergence of a pollution field and the location of potential sources of air pollution. Using in-depth learning strategies, the program provides predictions of future levels of pollution and timing of alarming limits. The whole system is integrated with a fast, easy-to-use web service and a client that seems to provide system responses. The plan was developed and tested in the details of the city of Skopjen [3].

Of the present world, the nonstop ascent in air and sound contamination has become a genuine concern. Controlling and appropriately checking the circumstance has gotten vital to take the important measures to ease the circumstance. An IOT-based framework for checking the AQI and intensity level of noise has been developed. To begin, the AQI is calculated based on the existence of five unique air toxins. The intensity of the sound is then determined using the appropriate sensor. From that point onwards, Module for cloud-based monitoring guarantees information assortment measure with the guide of the Raspberry Pi's Wi-Fi module, accomplishing the objective of information preparing consistently. At long last, the Anomaly Notification Module tells the client if there is an issue [4].

#### 3. Proposed System

Here it is proposed that, the system uses sensors to detect gas levels and the signals from the sensors are fed into the microcontroller .The parameters are sent via the ESP8266 Wi-Fi module through which we can monitor it remotely via wifi and we implement Kalman filter to purify the air. By which the quality of air will be improved Figure 1.



Figure 1. Proposed Model

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The proposed model of Air quality enhancement system is shown in Figure 1. The data of various gases are recognized by Co2 sensor, NH3 sensor, Smoke sensor, and methane sensor. These sensors are connected to the Microcontroller .When the microcontroller is powered up, it starts to detect all gases, and the emission level is shown on the LCD in PPM (parts per million). If the sensor returns a value of 90 PPM, there isn't a problem. 250 PPM is the highest condition for air quality. When it reaches 500 PPM, it induces nausea, headaches, and respiratory problems [5]. It can cause a variety of diseases if it exceeds 1000 PPM. The LCD will show the PPM values for CO2, NH3, Methane gases, and smoke. The buzzer will sound when the value reaches the preset limit and the kalman filter will activate. We can monitor the gas concentration by tracking the IP address in any wireless device via IoT. The four sensors act as input devices, transmitting data to determine which gas is present. The output devices connected to the microcontroller are LCD and buzzer. The buzzer is triggered when the PPM exceeds a preset limit and the Kalman filter is used to filter.

### 4. Module Description

4.1 LCD



LCD is an electronic device that uses a liquid crystal to display the visible image. In DIY projects and circuits, a simple 16x2 LCD is employed [6]. The 16x2 converts to a two line display of 16 characters per line. The characters within the LCD are represented by 5x7 byte arrays Figure 2.

4.2. ATMEGA8 Microcontroller



Figure 3. ATMEGA8 Microcontroller.

The ATMEGA8 microcontroller is a 8 bit RISC architecture that is primarily used in embedded systems and industrial automation projects [7]. It is available in three packages namely PDIP, MLF, and TQFP.

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The PDIP package consists of 28 pins and both MLF and TQFP consists of 32 pins per module. The programme memory can store 8K while the RAM and EEPROM can store 1K and 512 Bytes Figure 3.

4.3. CO2 Sensor



The carbon dioxide gas sensor detects the amount of IR radiation absorbed by carbon dioxide molecules to determine the amount of gaseous carbon dioxide present. To produce IR radiation, the sensor uses a hot metal filament that functions as an IR source Figure 4.

4.4. NH3 Sensor



The electrochemical theory is used to operate the ammonia detector. Electrochemical sensors are electrochemical sensing transducers that are used to measure the partial pressure of gases in the atmosphere [8]. The sensor's liquid electrolyte is filled with ambient air that diffuses through a membrane. It detects NH3 and generates an emf signal proportional to the logarithms of the NH3 concentration in the engine exhaust Figure 5.

4.5. CH4 Sensor



Figure 6.CH4 Sensor.

CH4 Sensor is a type of hydrocarbon sensor used to measure the amount of methane in the atmospheric air. This sensor has good accuracy, stability, durability and it is oxygen independent Figure 6.

4.6. Smoke Sensor

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Figure 7. Smoke Sensor.

A smoke detector is an electronic fire-protection system that detects the presence of smoke, which is a key indicator of fire, and alerts building occupants. Photoelectric alarms target a light source at an angle away from the sensor to the closed counter. Once the Smoke gets into the counter it reflects the light to the sensor that activates/triggers the buzzer [9]. In certain fire cases, the benefit it offers can be vital to life protection Figure 7.

4.7. Buzzer



Figure 8. Buzzer.

A buzzer or beeper is a mechanical, electromechanical, or piezoelectric audio signaling system. Alarm clocks, timers, and confirmation by pressing keyboard keys and clicking mouse buttons Figure 8.

4.8. ESP8266



### Figure 9. ESP8266

ESP8266 is an IC chip which works on full TCP/IP protocols that allows any microcontroller to access the Wi-Fi network. ESP8266 serve as a host or a networking offloader. It is a low-cost device with large, and rapidly increasingly user base Figure 9.

4.9. Kalman filter



Figure 10. Kalman Filter.

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A particulate air filter is a system that eliminates solid particulates from the air, such as dust, pollen, mould, and bacteria, using fibrous or porous materials. Filters that contain an adsorbent or catalyst, such as charcoal (carbon), can also eliminate odours and gaseous emissions like Volatile organic compounds and ozone as shown in figure 10.

#### 5. Flow Chart



The emissions that give the ratio of methane, CO2 and CO to indoor air and these emissions are transmitted to mobile users as a message via IoT in figure 11 and 12. When the amount of these gases in the air exceeds the limit it gives an alarm to indicate an imbalance in the air. The Kalman filter is attached to this system which cleans the dirt and toxic gases in the air and is free from toxic gases. Here we use the Kalman filter with a partial order for a home indoor air quality model that captures lost and incorrect data collected from the structural sensors.

#### 8. Application

- 1) Industries that operate in confined spaces
- 2) Cities with higher pollution levels, such as Delhi and Kanpur

#### 9. Conclusion

In this paper we have suggested an effective way to improve the accuracy of predicting indoor air pollutants. In addition to the sensors, we have used a filtering technique called kalman filtering to purify the air with more amount of accuracy. Tracking and controlling real time air quality on smart gadgets can be implemented through wireless mode to sensor networks with the help of IoT. This paper offers a solution to the increase in air pollution in smart industries and buildings or cities.

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