AIR QUALITY MONITORING_USING IOT

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Introduction :

Air pollution has been causing serious problems in our modern society and the regulations on the emission standards of pollutants are becoming more severe year by year. It is well-known that carbon monoxide and nitrogen oxides are a prominent part of the polluting agents of the atmosphere and they are among the most dangerous chemical species for human health present in the atmosphere. Their detection is therefore of great interest in various fields like air quality control, combustion processes and engine emissions. This is the reason why increasing requirements are being made for monitoring the gas pollution in urban area, fixing the concentration alarm threshold at about 13 ppm for CO and about 0.1 ppm for NO_2. Moreover, in the last years SnO_2 gas sensors have been subjected to extensive research and development. It has been demonstrated that the sensing characteristics of a semiconductor gas sensor can be improved by several factors like the decreasing of crystallite size, the valency control of SnO_2 or the addition of noble metal catalysers [1]. In the last case Pd is often used as catalytic element; it is known to modify surface reactions which are responsible for the electrical signal of SnO_2. The objective of this paper is to find the best response to CO and NO_2 gases given by pure and Pd-modified SnO_2 sensors prepared by means of the sol–gel process and then report about the application of sol–gel technique for preparing integrated gas sensors.

Objectives :

Air quality monitoring aims to protect public health by tracking and managing harmful pollutants, enforce environmental regulations, inform policymaking, support research, provide early warnings during pollution events, and raise public awareness about air quality issues. It's crucial for ensuring clean air and a healthier environment.

Apparatus Requirments :

An air quality monitoring apparatus should be capable of accurately and continuously measuring various air pollutants such as particulate matter (PM2.5 and PM10), volatile organic compounds (VOCs), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and ozone (O_3). It should provide real-time data, have a wide detection range, and be equipped with sensors that can withstand varying environmental conditions. Additionally, data logging and remote connectivity features are essential for data analysis and sharing, making it a valuable tool for assessing and managing air quality in both indoor and outdoor environments.

Steps Involed In This Project :

1. Select Monitoring Locations:

Determine where to measure air quality. This may include urban areas, industrial zones, or specific sites near pollution sources.

2. Choose Monitoring Parameters:

Decide which air pollutants to measure. Common parameters include particulate matter (PM2.5 and PM10), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), ozone (O3), and volatile organic compounds (VOCs).

3. Select Monitoring Instruments:

Acquire the appropriate monitoring instruments for chosen parameters. This could include air quality sensors, samplers, and analyzers. Ensure they are calibrated regularly.

4. Data Collection:

Install monitoring equipment at selected locations. Collect data continuously or at regular intervals. Ensure data integrity and quality control.

5. Data Transmission:

If monitoring is remote, set up a system to transmit data in real-time to a central database. This can be done via the internet or other communication methods.

6. Data Storage and Management:

Store collected data securely. Use databases or software to manage and analyze the data.

7. Data Analysis:

Analyze air quality data to identify trends,patterns, and potential issues. Compare results to air quality standards and regulations.

8. Reporting:

Generate regular reports summarizing air quality measurements and any deviations from standards. Share this information with relevant authorities and the public.

9. Maintenance:

Regularly maintain and calibrate monitoring equipment to ensure accurate measurements. Replace sensors or parts as needed.

10.Interpretation:

Interpret the data to understand the impact on public health and the environment. Identify areas where air quality improvements are needed.

11.Action:

Based on data analysis, take corrective actions to mitigate air quality issues. This may involve implementing pollution control measures imposing regulations, or advising the public on reducing exposure.

12.Public Awareness:

Inform the public about air quality conditions through various channels, such as websites, apps, and public announcements.

13.Continuous Monitoring and Improvement:

Continue to monitor air quality over time and adjust monitoring strategies as needed. Strive for continuous improvement in air quality management.

Block diagram :

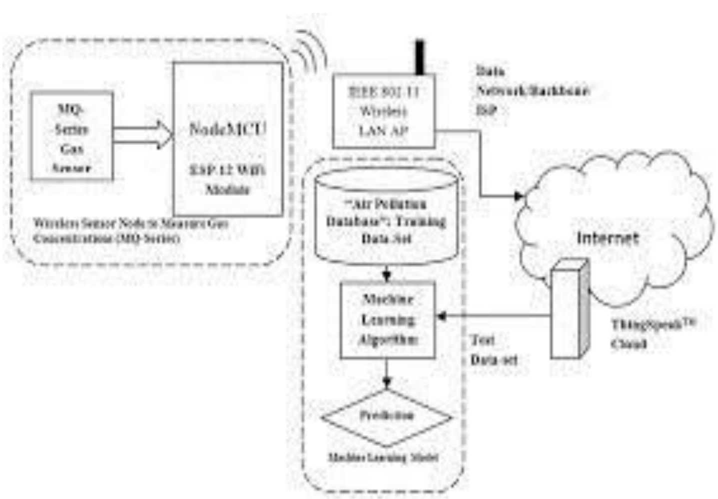

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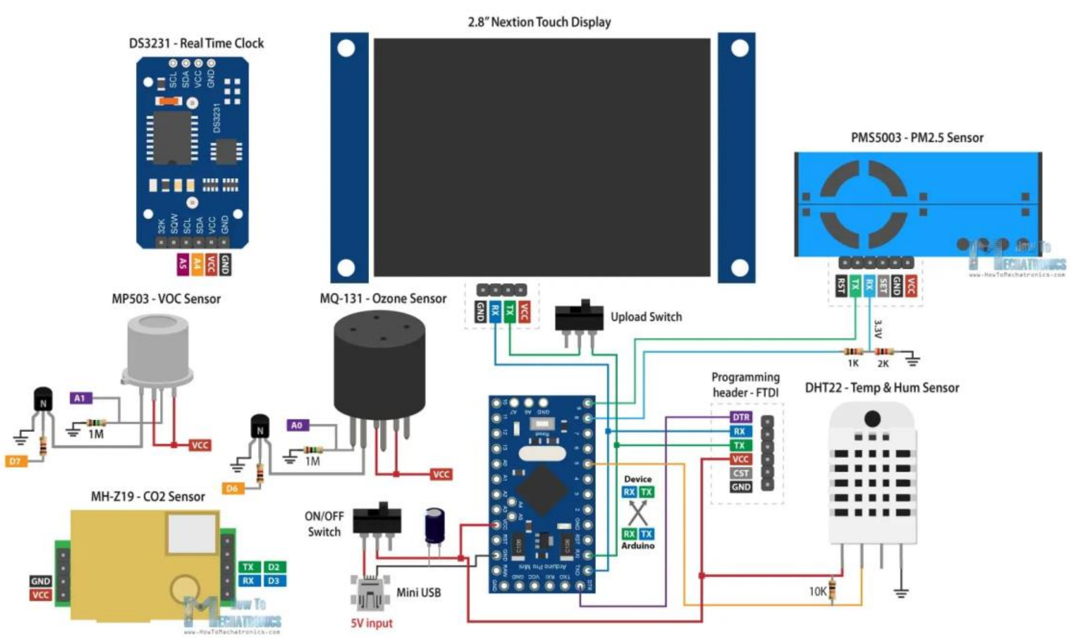
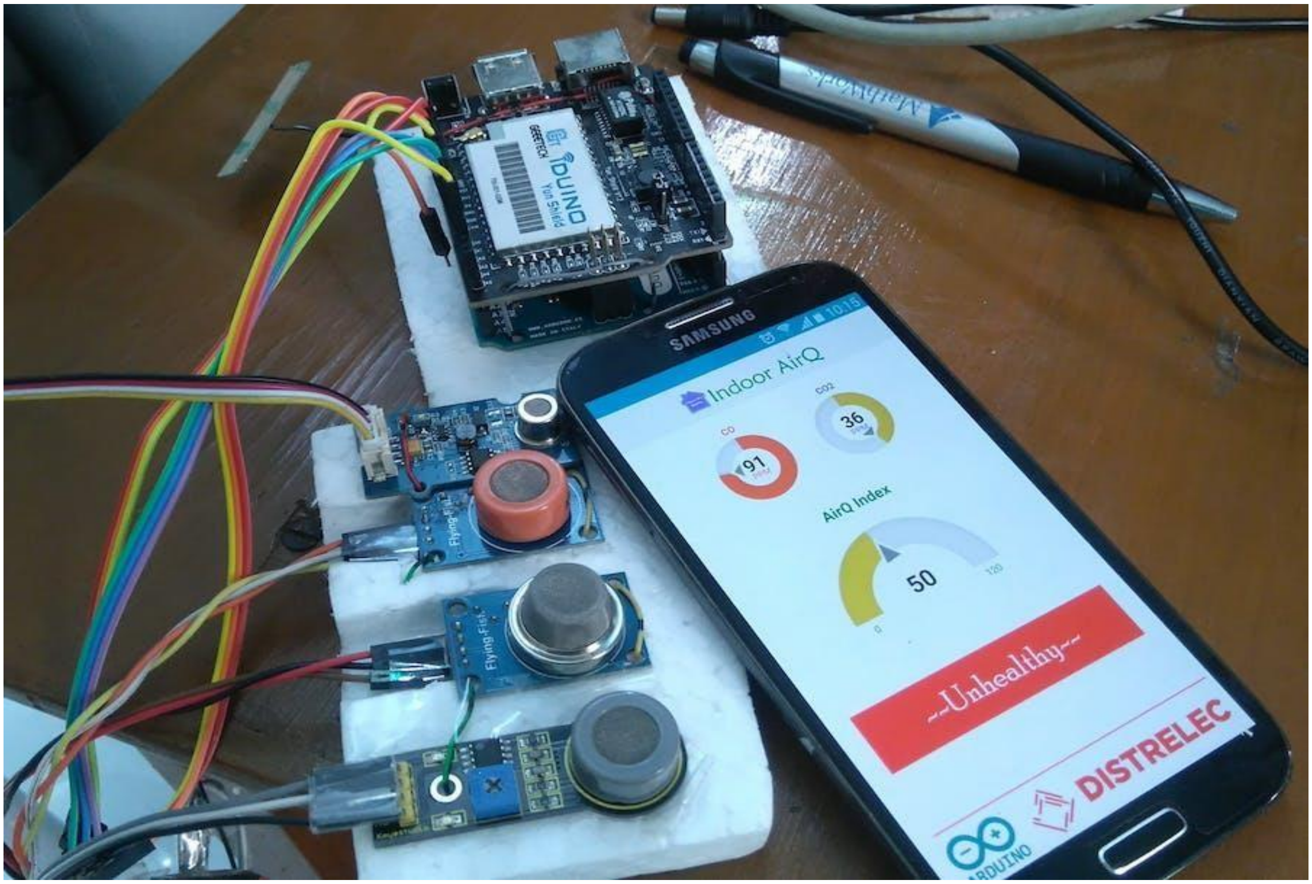
Diagram :

Circuit Diagram:



Model :



Program :

python import
requests

Replace these with your actual API endpoint and key

API_ENDPOINT = 'https://example.com/api/air-quality'

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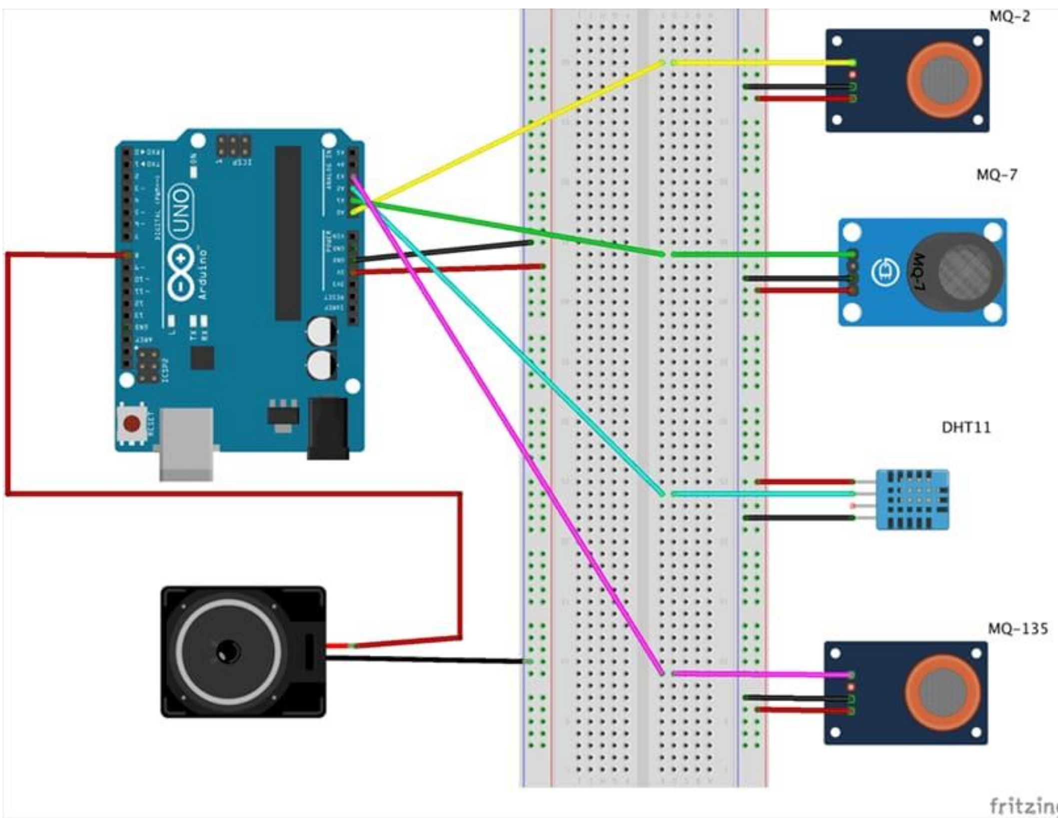
API_KEY = 'your_api_key_here'

def get_air_quality(location):
 headers = {'Authorization': f'Bearer {API_KEY}'}
 params = {'location': location}


try:
        response = requests.get(API_ENDPOINT,
headers=headers, params=params)
if
response.status_code == 200:
            data = response.json()
air_quality_index = data.get('air_quality_index')
pollutants = data.get('pollutants')
print(f'Air Quality Index for {location}:
{air_quality_index}')
            print('Pollutants:')
for pollutant,
 value in pollutants.items():
                print(f'{pollutant}: {value}')
 else:
            print(f'Error: Unable to fetch data. Status code
{response.status_code}')
except Exception as e:
        print(f'An error occurred: {e}')
```

```
if__name__== '__main__':
    location = input('Enter a location for air quality
monitoring: ')
get_air_quality(location)
```

Sample Output :



Conclusion :

Pure and palladium activated SnO_2 thin films for simultaneous detection of CO and NO_2 were prepared by means of the sol–gel technique. Good results were obtained, showing the possibility to use the sol–gel process in the fabrication of thin films on patterned interdigitated substrates and then in possible microsensors array. As regard the gas sensing properties it was shown that doping with palladium increases the sensitivity of the sensors and reduces the temperature corresponding to the best.