Air Quality Monitoring

TEAM ID: NM2023TMID467

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1 | Introduction

1.1 | Overview

In our modern lives, air quality monitoring has assumed a prominent role due to growing concerns about environmental well-being and public health. With the convenience of smartphone apps and accessible low-cost sensors, people can effortlessly track air quality in their immediate surroundings, guiding daily decisions. Community engagement in monitoring initiatives has become a hallmark of current times, fostering local awareness and advocacy for cleaner air. Governments and industries face mounting pressure to adhere to air quality regulations, driven by the ever-increasing availability of monitoring data. This heightened awareness underscores the critical role of air quality monitoring in our contemporary society, impacting our daily choices and influencing policies and environmental stewardship.

1.2 | Purpose

Air quality monitoring is like a health checkup for the air we breathe. It helps us understand if the air is clean and safe or if it has pollution that can harm our health. The main purpose is to keep an eye on the air to make sure it meets certain cleanliness standards set by the government. By measuring things like dust, smoke, and harmful gases, we can spot problems and take action to keep our air clean. It's important because clean air is better for our lungs and the environment, so monitoring helps us live healthier lives and protect our planet.

2 | Ideation and Proposed Solution

This Phase Contain

- Problem Statement Definition
- Empathy Map
- Ideation and Brainstorming
- Proposed solution

2.1 | Problem Statement Definition

This statement defines who are the customer, what they trying to do, but what happens, Because of some reason, that situation how they feel.

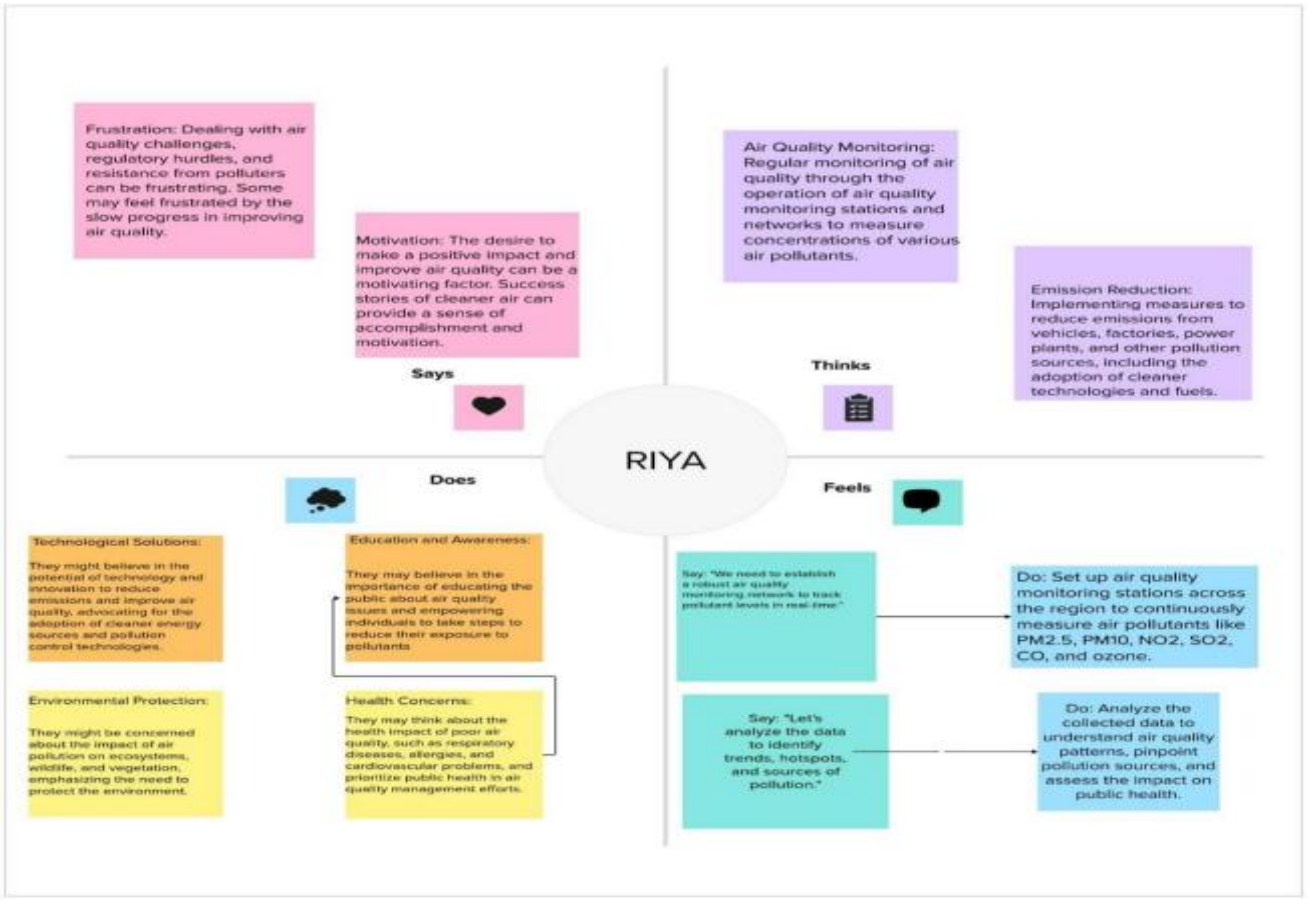
Problems statements

Problem statement (PS)	**I AM customer**	**IAM trying to**	**But**	**Because**	**Which makes me feel**
PS-1	Asthma Patient	Breath fresh air	In high pollution days	They struggle for breath	Indoor precautions
PS-2	Children	Play outdoor games	High pollution	Play Indoor games	Physical discomfort
PS-3	Outdoor workers	working	Air pollution	They use personal equipment	Anxiety And stress

Figure 2.1: I am an Asthma Patient, Trying to Breath Fresh Air, but in air pollution days They struggle for breathing, which makes me feel Indoor precautions

2.2 | Empathy Map

Empathy map talks about customer feelings, thoughts, what they say, and action did by the customer.



2.3 | Ideation & Brainstorming

Brainstorming combines an informal approach to problem-solving with lateral thinking, which is a method for developing new concepts to solve problems by looking at them in innovative ways. Some of these ideas can be built into original, creative solutions to a problem, while others can generate additional ideas. Prioritization was helpful to find immediate demands of customer.

This helps to figure out which demand must be solved immediately

2.4 | Proposed Solution

- **Problem Statement** Developing scalable and cost-effective monitoring solutions that can be deployed across different regions, from urban centers to rural areas, is a significant challenge.

- **Uniqueness** Users can access the drone data through mobile apps, receiving notifications and real-time air quality updates, helping them make informed decisions about outdoor activities.

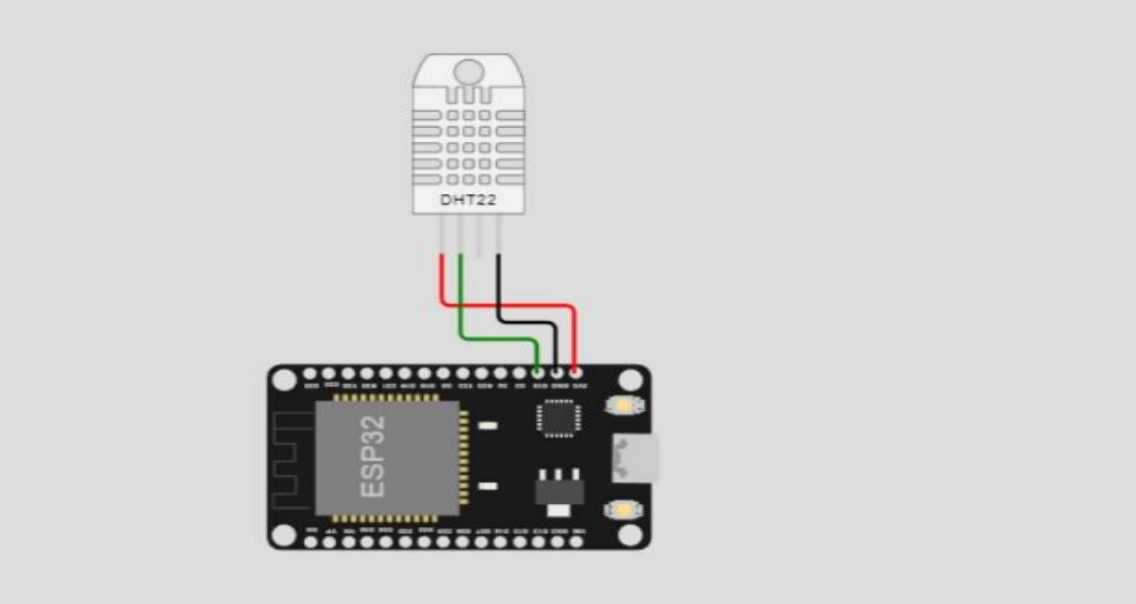
- **Scalability** the ability to make the solution work for a small area and then easily expand it to cover a larger area without a lot of extra effort or cost.

S.No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	Developing scalable and cost-effective monitoring solutions that can be deployed across different regions, from urban centers to rural areas, is a significant challenge.
2.	**Idea / Solution description**	By providing real-time information and educational content, these kiosks empower individuals and communities to take steps to protect their health
3.	**Novelty / Uniqueness**	Users can access the drone data through mobile apps, receiving notifications and real-time air quality updates, helping them make informed decisions about outdoor activities.
4.	**Social Impact / Customer Satisfaction**	People learn more about air pollution and its dangers, so they can protect themselves and their families.
5.	**Business Model (Revenue Model)**	The company makes and sells air quality sensors or monitoring devices to individuals, businesses, and government agencies.
6.	**Scalability of the Solution**	the ability to make the solution work for a small area and then easily expand it to cover a larger area without a lot of extra effort or cost.

Figure 2.2: Proposed Solution

3 | Project Design

3.1 | Circuit Diagram



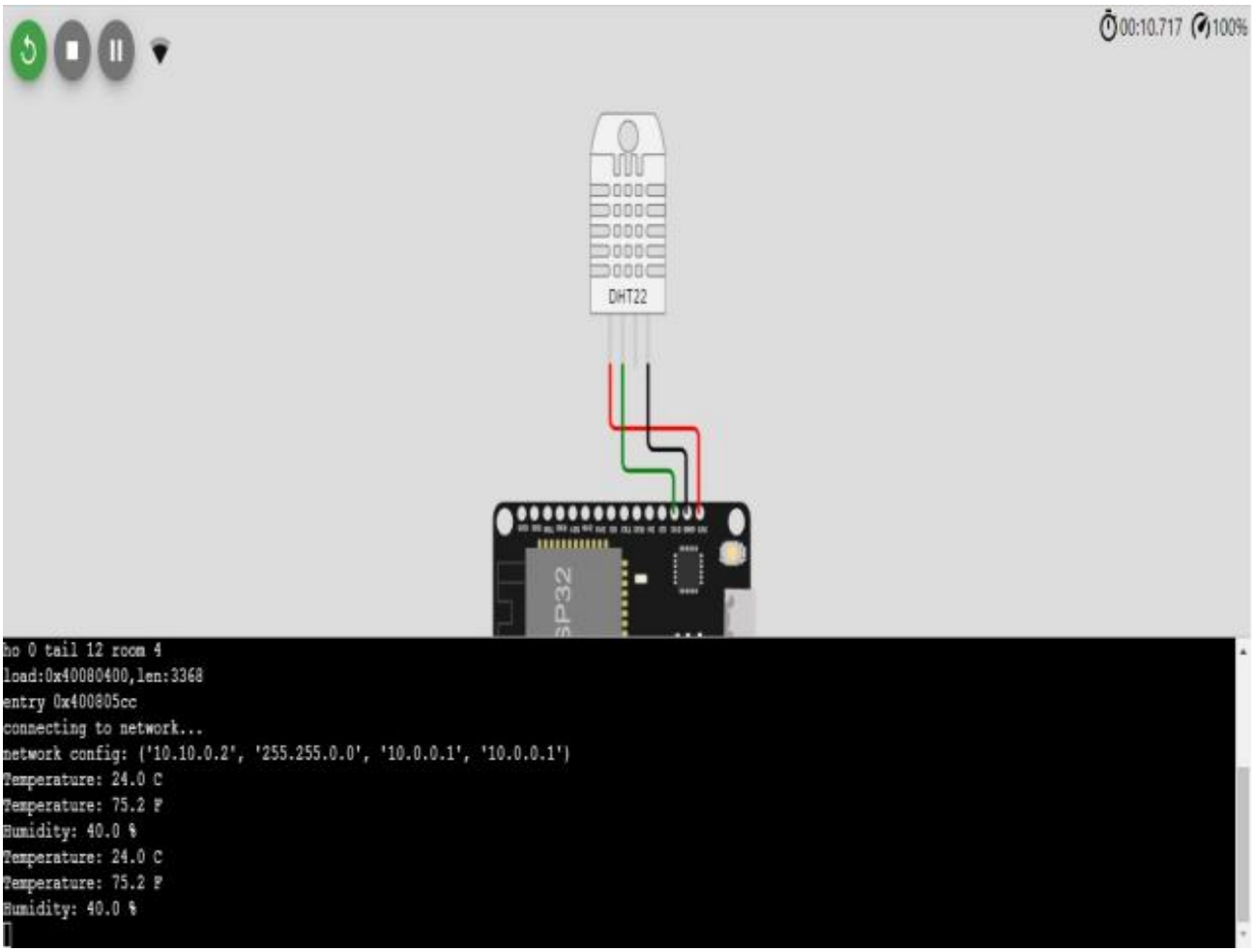
3.2 | Program code:

WOKWI SAVE SHARE Air quality monitoring

main.py diagram.json

```
from machine import Pin
from time import sleep
import dht
import network
sta_if = network.WLAN(network.STA_IF)
if not sta_if.isconnected():
    print('connecting to network...')
    sta_if.active(True)
    sta_if.connect('Wokwi-GUEST', "")
    while not sta_if.isconnected():
        pass
    print('network config:', sta_if.ifconfig())


sensor = dht.DHT22(Pin(15))
while True:
  try:
    sleep(2)
    sensor.measure()
    temp = sensor.temperature()
    hum = sensor.humidity()
    temp_f = temp * (9/5) + 32.0
    print('Temperature: %3.1f C' %temp)
    print('Temperature: %3.1f F' %temp_f)
    print('Humidity: %3.1f %%' %hum)
  except OSError as e:
    print('Failed to read sensor.')
```

3.3 | Output:



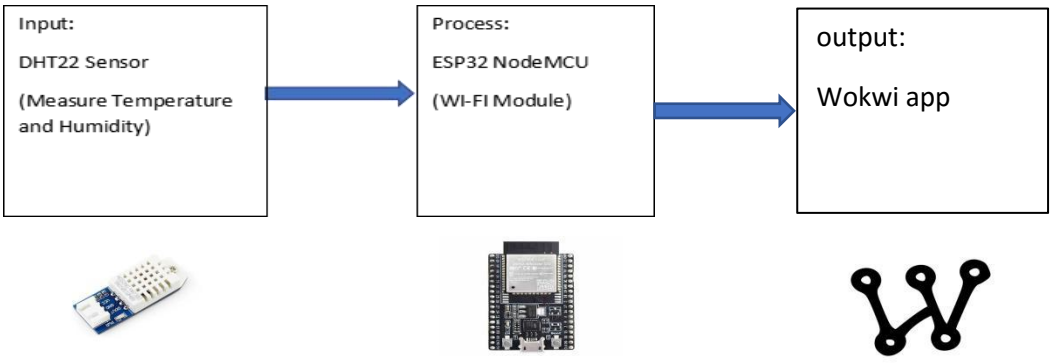
4 | Coding Solutioning

4.1 | Python Coding

```
from machine import Pin

from time import sleep

import dht
import network

sta_if = network.WLAN(network.STA_IF)

if not sta_if.isconnected():
    print('connecting to network...')
sta_if.active(True)
sta_if.connect('Wokwi-GUEST', "")
```

```
 while not sta_if.isconnected():
pass
print('network config:', sta_if.ifconfig())

sensor = dht. DHT22(Pin (15))
while True:
try:
sleep (2)

sensor. Measure ()
temp = sensor. Temperature ()
hum = sensor. Humidity ()
temp_f = temp * (9/5) + 32.0
  print ('Temperature: %3.1f C' %temp)
  print ('Temperature: %3.1f F' %temp_f)
  print ('Humidity: %3.1f %%' %hum)
  except OSError as e:
print('Failed to read sensor.')
```

4.2 | Block Diagram



4.3 | Output

```
Output:

   connecting to network...
network config: ('10.10.0.2', '255.255.0.0', '10.0.0.1', '10.0.0.1')

Temperature: 24.0 C
Temperature: 75.2F
Humidity: 40.0 %
```

5 | Results

5.1 | Performance Metrices

To present the results of an air quality monitoring project, you'll need to organize and share the data in a clear and informative way. Here's a basic outline of how you can structure the presentation of your project results:

- **Compliance with Air Quality Standards**
- **Pollutant Concentration Trends**
- **Health Impact Assessment**
- **Environmental Impact Assessment**
- **Hotspot Identification**
- **Spatial and Temporal Variability**
- **Public Awareness and Engagement**
- **Response Time to Pollution Events**
- **Cost-effectiveness**
- **Long-Term Sustainability**
- **Policy Impact**
- **Stakeholder Feedback**
- **Challenges and Lessons Learned**

5.1.1 | Hotspot Identification

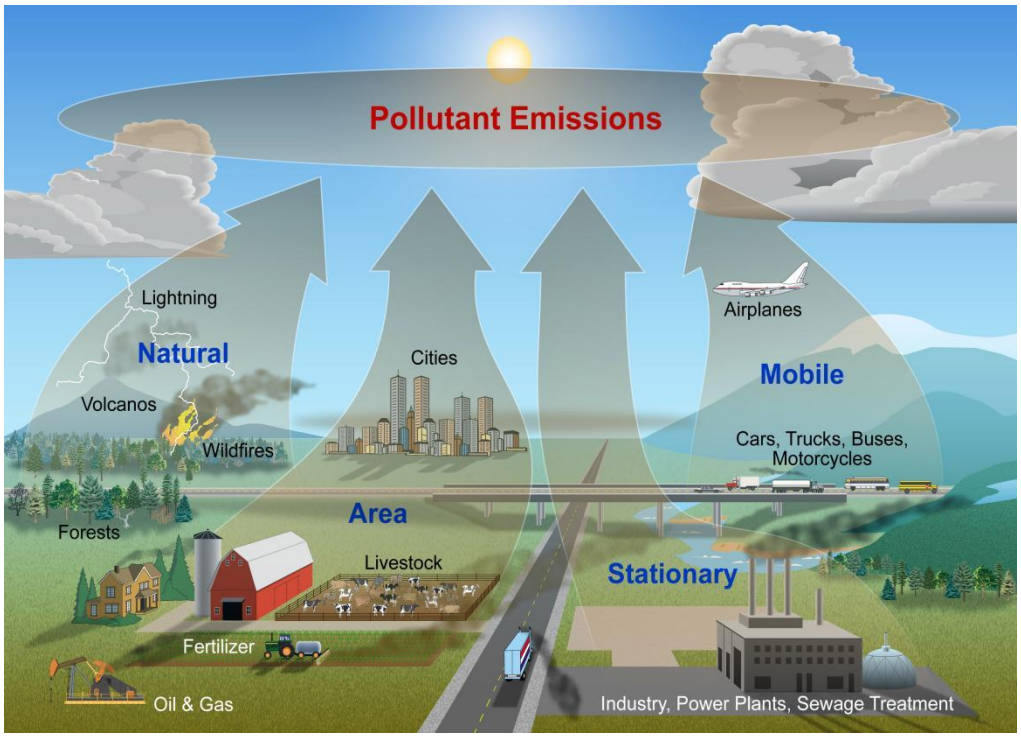
Identify pollution hotspots or areas with consistently poor air quality. Assess whether these areas are associated with specific pollution sources or geographic features.

5.1.2 | Public Awareness and Engagement

Measure the level of community engagement and awareness generated by the project. Evaluate whether the project contributed to increased public understanding of air quality issues.

5.1.3 | Challenges and Lessons Learned

Highlight any challenges encountered during the project and discuss lessons learned that can inform future air quality monitoring efforts.



6 | Advantages & Disadvantages

6.1 | Advantages

- **Health Protection**: Air quality monitoring helps protect people's health by providing early warnings about harmful pollutants in the air, allowing individuals to take precautions.
- **Environmental Protection**: It aids in preserving the environment by identifying pollution sources and assessing their impact on ecosystems, plants, and animals.
- **Regulatory Compliance**: Helps industries and governments ensure compliance with air quality standards and regulations, reducing the risk of fines and penalties.

6.2 | Disadvantages

- **Cost**: Setting up and maintaining monitoring systems can be expensive, which may limit the coverage and frequency of monitoring in some areas.
- **Limited Coverage**: Monitoring stations are typically concentrated in urban areas, leaving rural or remote regions with less access to air quality data.
- **Maintenance Challenges**: Sensors and monitoring equipment require regular maintenance to ensure accuracy, which can be a logistical challenge

7 | Conclusion

In conclusion, air quality monitoring is an essential tool for safeguarding public health, preserving the environment, and promoting informed decision-making. It offers valuable insights into the cleanliness of our air, enabling us to identify pollution sources, assess

compliance with air quality standards, and respond to emerging threats promptly. The information derived from monitoring is instrumental in guiding regulatory measures and shaping urban planning efforts, all with the overarching goal of achieving cleaner air for all.

Moreover, air quality monitoring contributes to heightened awareness within communities, empowering individuals to advocate for cleaner air and make choices that reduce their personal exposure to pollutants. It plays a pivotal role in scientific research, aiding our understanding of pollution patterns and their implications for human health and ecosystems. Furthermore, it assists in climate change mitigation by tracking greenhouse gas emissions and other contributors to global warming.

As we move forward, it is imperative to expand monitoring efforts to underserved regions, address the challenges associated with cost and maintenance, and enhance public education on interpreting air quality data. By doing so, we can leverage the power of air quality monitoring to foster healthier lives, protect the environment, and contribute to a sustainable and cleaner future.

8 | Future Scope

- **Internet of Things (IoT)**: The integration of air quality sensors with IoT networks will create a vast interconnected system that can provide real-time data from various locations, enhancing our ability to monitor and respond to pollution events.
- **Big Data and Artificial Intelligence**: Big data analytics and AI will enable better data interpretation, trend analysis, and prediction of air quality changes. This can help anticipate pollution events and guide policy and regulatory decisions.
- **Mobile Monitoring Stations**: Mobile monitoring stations mounted on vehicles or drones will allow for more flexible and targeted monitoring, particularly in areas with rapidly changing air quality conditions or those with limited access to fixed monitoring stations.

9 | Appendix

9.1 | GITHUB Links

Ramya: https://github.com/ramyaarasan199/Ramya.git

Santhoshkumar:

Phase-1: https://github.com/santhoshkumarsrec/Air-quality-monitoring-.git

Phase-2: https://github.com/santhoshkumarsrec/Air-quality-monitoring-phase2.git

Phase-3: https://github.com/santhoshkumarsrec/Air-quality-monitoring-phase-3.git

Phase-4: https://github.com/santhoshkumarsrec/Air-quality-monitoring-phase-4-.git

Parthasarathi: https://github.com/Sri1233/Parthasarathi-7.git

Pravin jagadeesh:

Phase-1:https://github.com/pravin-1904/Air-Quality-Monitoring-Ideation-.git

Phase-2: https://github.com/pravin-1904/Air-Quality-Monitoring-Innovation-git

Phase-3:https://github.com/pravin-1904/Air-Quality-Monitoring-Design-.git

Phase-4:https://github.com/pravin-1904/Air-Quality-Monitoring-Phase-4.git