9506 EINSTEIN COLLEGE OF ENGINEERING

AIR QUALITY MONITORING SYSTEM

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PROJECT OBJECTIVES:

INTRODUCTION

Air is getting polluted because of release of toxic gases by industries, vehicle emissions and increased concentration of harmful gases and particulate matter in the atmosphere. The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. Particulate matter is one of the most important parameter having the significant contribution to the increase in air pollution [2]. This creates a need for measurement and analysis of real-time air quality monitoring so that appropriate decisions can be taken in a timely period. This paper presents a real-time standalone air quality monitoring. Internet of Things is nowadays finding profound use in each and every sector, plays a key role in our air

There might be different objectives for the development of the environmental monitoring and surveillance system. Normally, the system will have to provide on-line data and information transfer with a direct /automatically/ on-line quality control of the collected data. Several monitors, sensors and data collection systems may be applied to make on-line data transfer and control possible [3].

The main objectives stated for the development of an air quality measurement and surveillance programme might be to:

— facilitate the background concentration(s) measurements,
— monitor current levels as a baseline for assessment,
— check the air quality relative to standards or limit values,
— detect the importance of individual sources,
— enable comparison of the air quality data from different areas and countries,
— collect data for the air quality management, traffic and land-use planning purposes,
— observe trends (related to emissions),
— develop abatement strategies,
— determine the exposure and assess the effects of air pollution on health, vegetation or building materials,
— inform the public about the air quality and raise the awareness,
— develop warning systems for the prevention of undesired air pollution episodes,
— facilitate the source apportionment and identification,
— supply data for research investigations,
— develop/validate management tools (such as models),
— develop and test analytical instruments and
— to support legislation in relation to the air quality limit values and guidelines.

The relationships between the data collected and the information to be derived from them must be taken into account when a monitoring programme is planned, executed and reported. This emphasizes the need for users and potential users of the data to be involved in planning surveys, not only to ensure that the surveys are appropriate to their needs but also to justify committing the resources.

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vestigation, often referred to as a screening study. This may consist of some simple inexpensive measurements (*e.g.* using passive samplers) and simple dispersion models. The data will give some information on the expected air pollution levels, high impacted areas and the general background air pollution in the area.

The number of monitoring stations and the indicators to be measured at each station in the final permanent network may then be decided upon as based on the results of the screening study as well as on the knowledge of the sources and prevailing winds.

Once the objective of air sampling is well-defined and some preliminary results of the screening study are available, a certain operational sequence has to be followed. The best possible definition of the air pollution problem, together with the analysis of the personnel, budget and equipment available, represent the basis for the decision on the following questions:

1. What spatial density of sampling stations is required?
2. How many sampling stations are needed?
3. Where should the stations be located?
4. What kind of equipment should be used?
5. How many samples are needed and during what period?
6. What should the sampling (averaging) time and frequency be?
7. What additional background information is needed?
   - meteorology;
   - topography;
   - population density;
   - emission sources and emission rates;
   - effects and impacts.
8. What is the best way to obtain the data (configuration of sensors and stations)?
9. How will the data be accessible, communicated, processed and used?

The answers to these questions will vary according to the particular need in each case. Most of the questions will have to be addressed in the site studies and in the selection of sites as addressed below.

Air quality indicators

Air quality indicators have been selected for different environmental issues and challenges. Not all indicators are specific enough to address only one issue. The nature of the air pollution involves some indicators addressing several issues. Some of the issues that have to be addressed are:

- climate change,
- ozone layer depletion,
- acidification,
- toxic contamination,
- urban air quality and
- traffic air pollution.

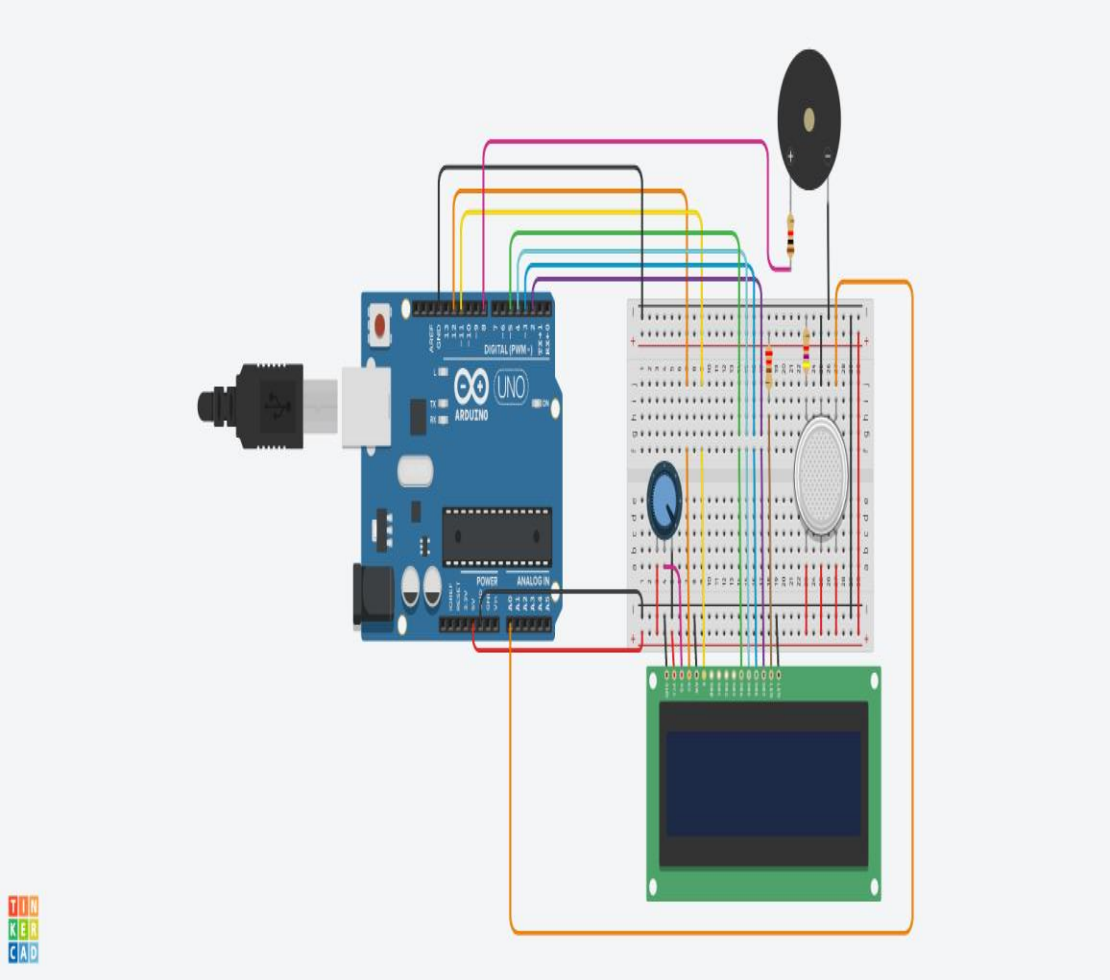
As it can be seen from the list, the indicators have to cover all scales of the air pollution problems (in space and time) to address different type of impacts and effects [7].

The most commonly selected air quality indicators for urban and industrial air pollution are:

- nitrogen dioxide (NO_2),
- sulphur dioxide (SO_2),
- carbon monoxide (CO),
- particles with aerodynamic diameter less than 10 μm (and 2,5 μm), PM10 (and PM2,5) and
- ozone (O_3).

The US EPA refers to the compounds listed above as the priority pollutants [5]. They are also given in the Air Quality Daughter Directives of the European Union with specific limit values for the protec-

IOT DEVICE SET UP:


DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN


Good
Everything looks good
24.5°C
Temperature
41.5%
Humidity
1014.0hPa
Atmospheric Pressure
463ppm
CO_2
9ppb
TVOC
9.4µg/m³
PM 2.5
12.8µg/m³
PM 10


choudharyss
Dashboards
Air Quality Index
AQI
64
ug/m3
PM2.5
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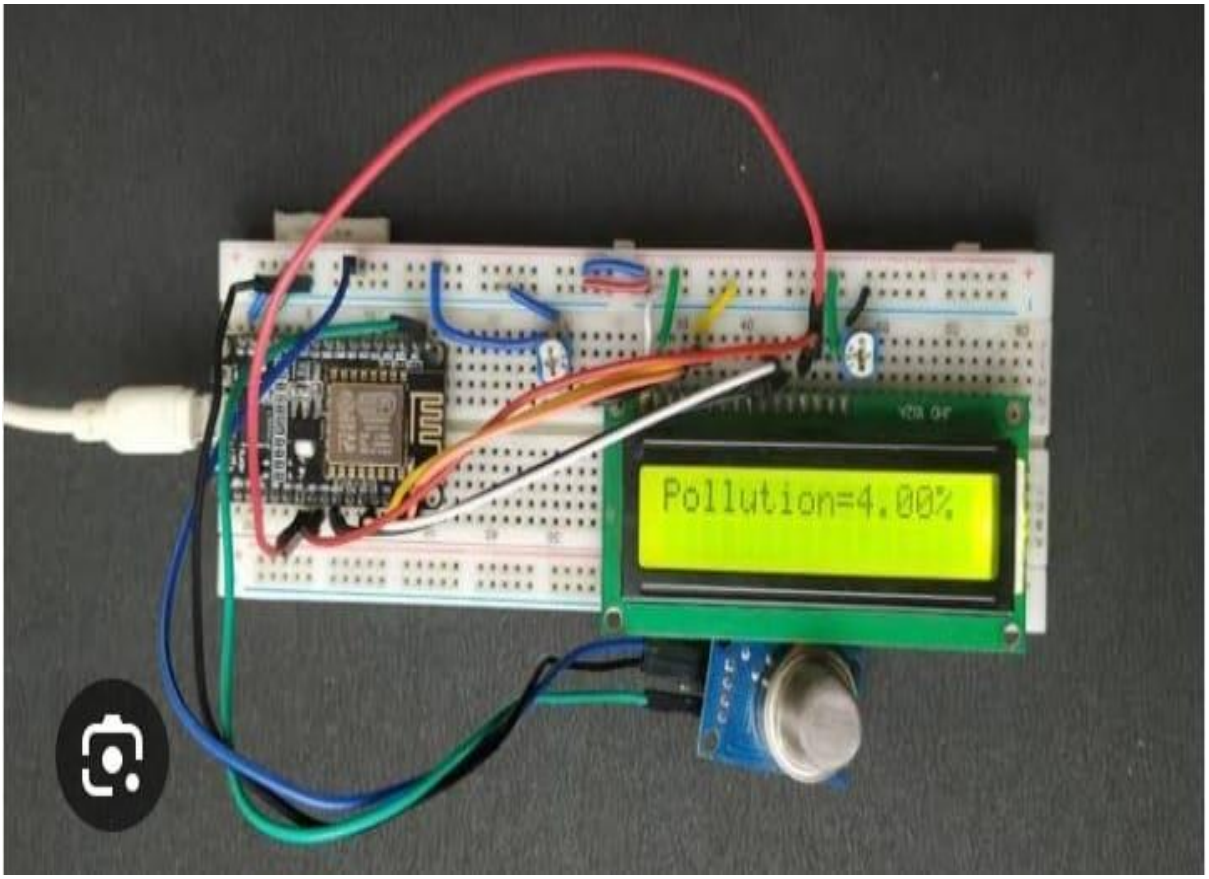
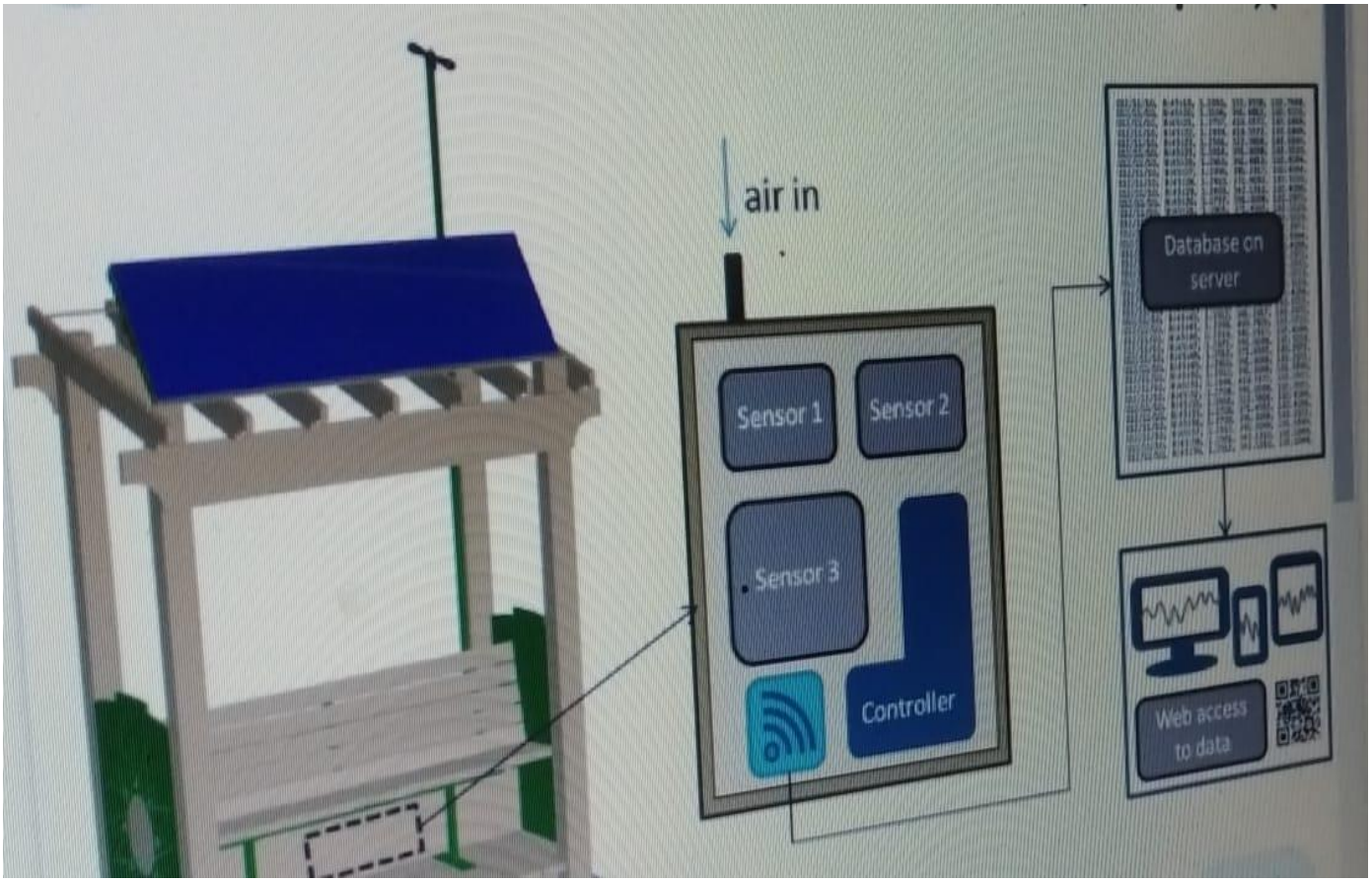
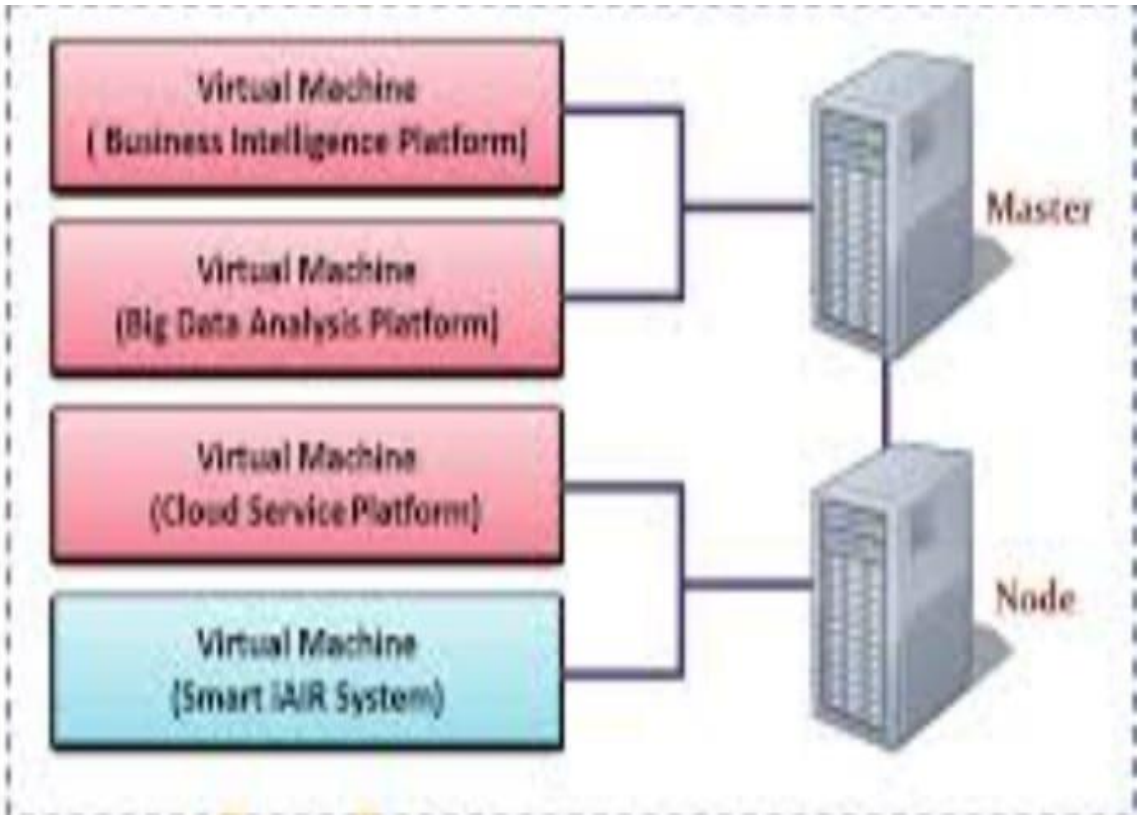
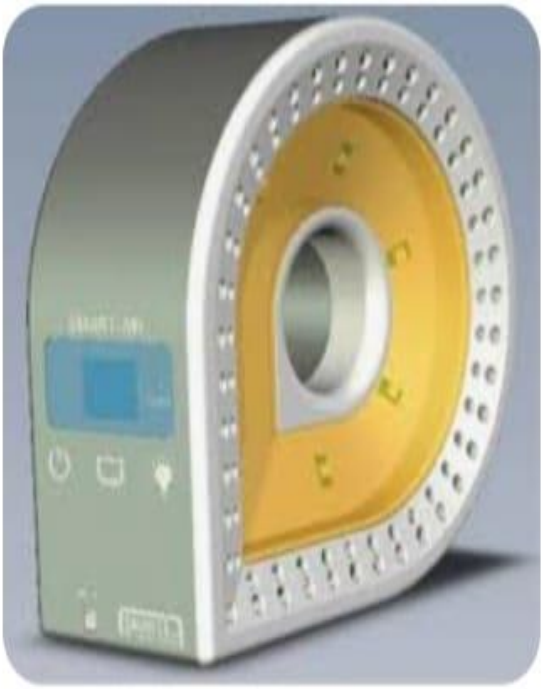
CO
65 mg/m3
Temperature
24
Humidity
15
PM10
64 ug/m3
Air Quality

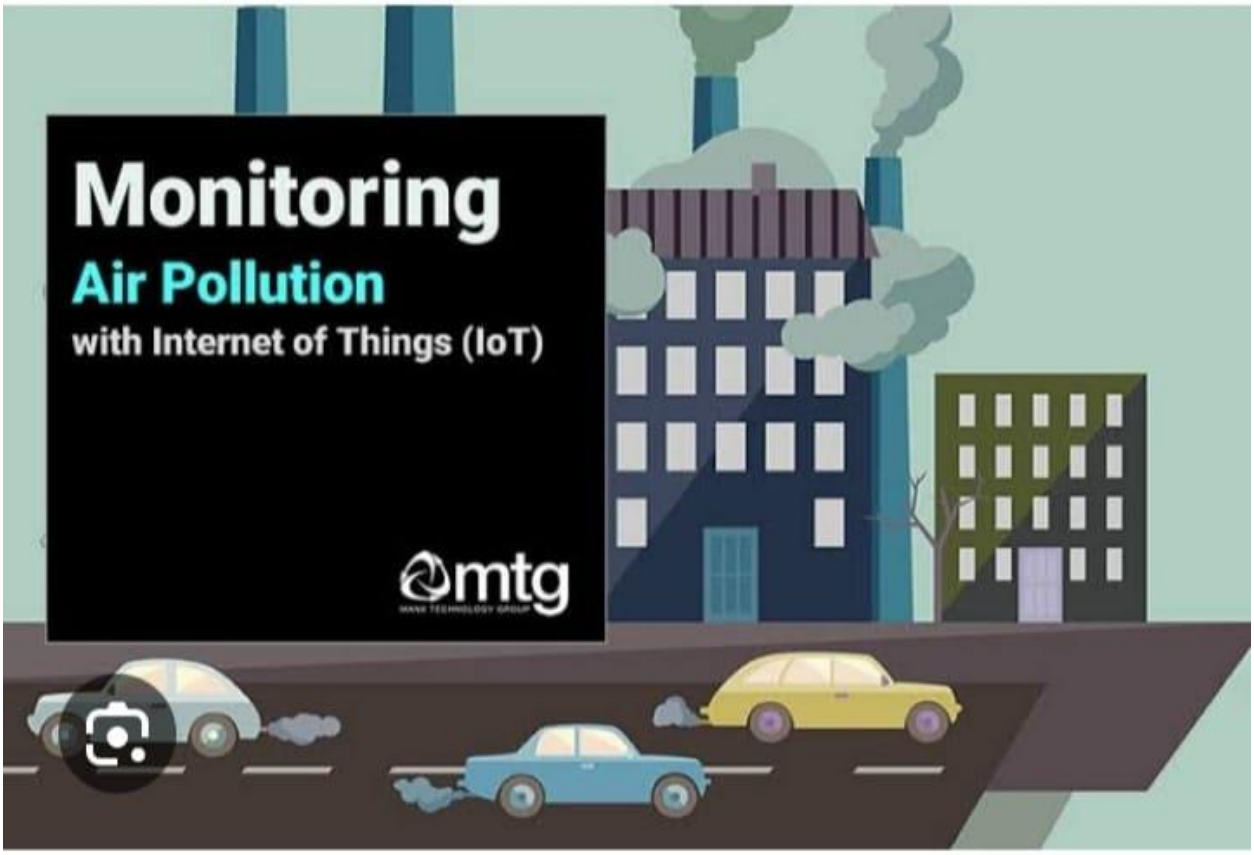

Pollution=4.00%

PLAT FORM DEVELOPMENT:




Virtual Machine
(Business Intelligence Platform)
Virtual Machine
(Big Data Analysis Platform)
Virtual Machine
(Cloud Service Platform)
Virtual Machine
(Smart iAIR System)
Master
Node



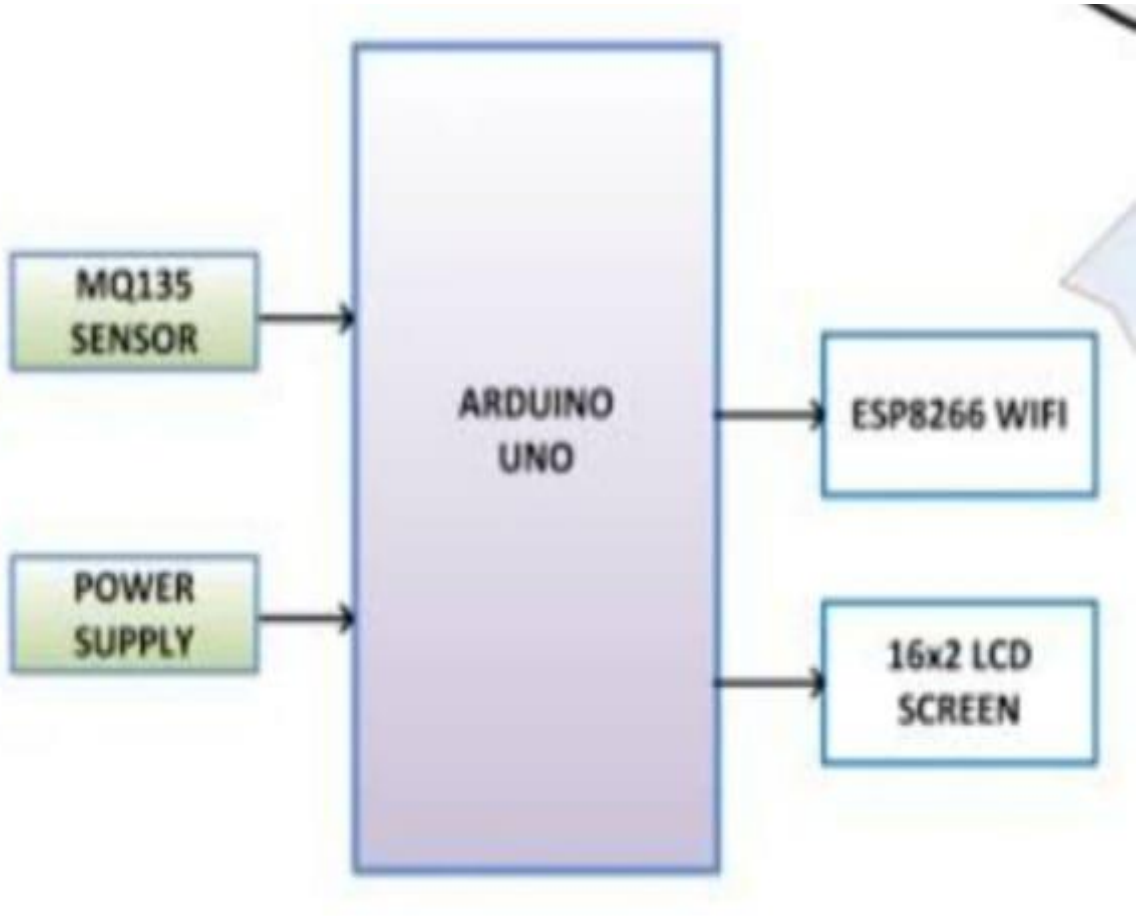


CODE IMPLEMENTATION:

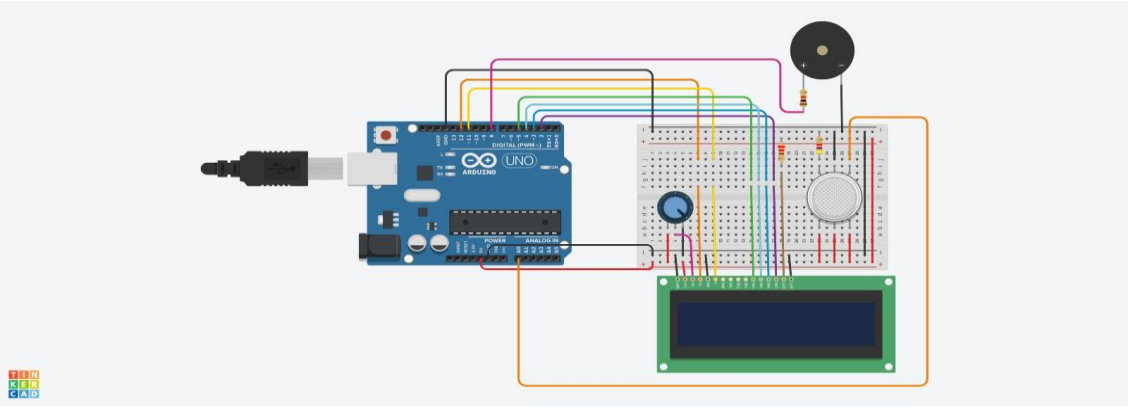
```
import time
import random


class AirQualitySensor:
    def _init_(self):
        # Initialize sensor parameters
        self.sensor_id = "AQ-123"
        self.location = "Living Room"

    def measure_air_quality(self):
        # Simulate air quality measurement (replace with actual sensor data)
        pm_concentration = random.uniform(0, 100)
```

```
        return pm_concentration


class IoTPlatform:
    def send_data(self, sensor_id, location, data):
        # Simulate sending data to an IoT platform (replace with actual IoT platform code)
        print(f"Sending data to IoT platform: Sensor ID - {sensor_id}, Location - {location}, Data - {data}")


def main():
    air_quality_sensor = AirQualitySensor()
    iot_platform = IoTPlatform()


    try:
        while True:
            # Measure air quality
            pm_concentration = air_quality_sensor.measure_air_quality()


            # Send data to IoT platform
            iot_platform.send_data(air_quality_sensor.sensor_id, air_quality_sensor.location,
pm_concentration)


            # Wait for a specified interval (e.g., 1 hour)
            time.sleep(3600)


    except KeyboardInterrupt:
        print("Monitoring stopped.")


if _name_ == "_main_":
    main()
```

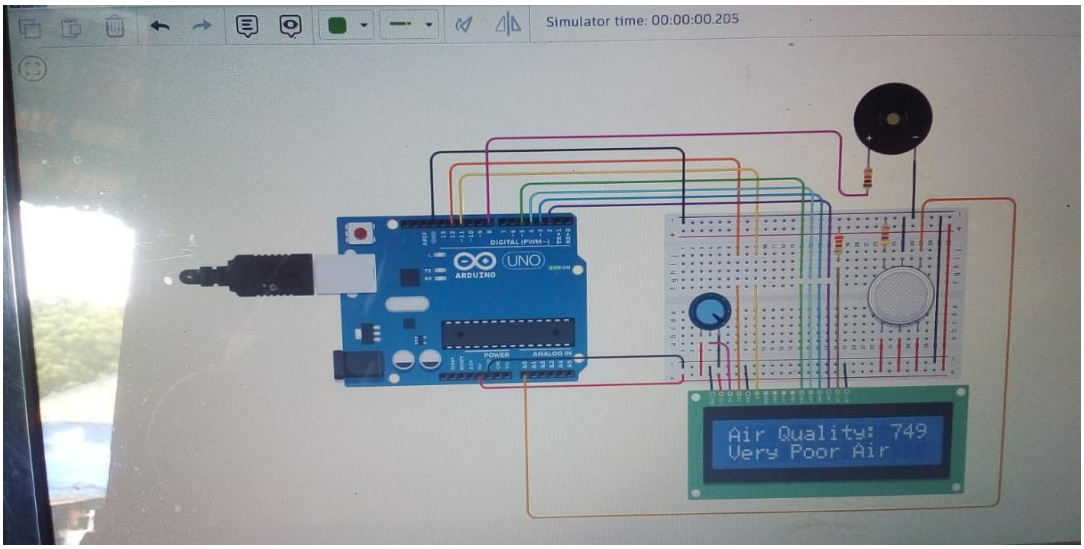
DIAGRRAMS:

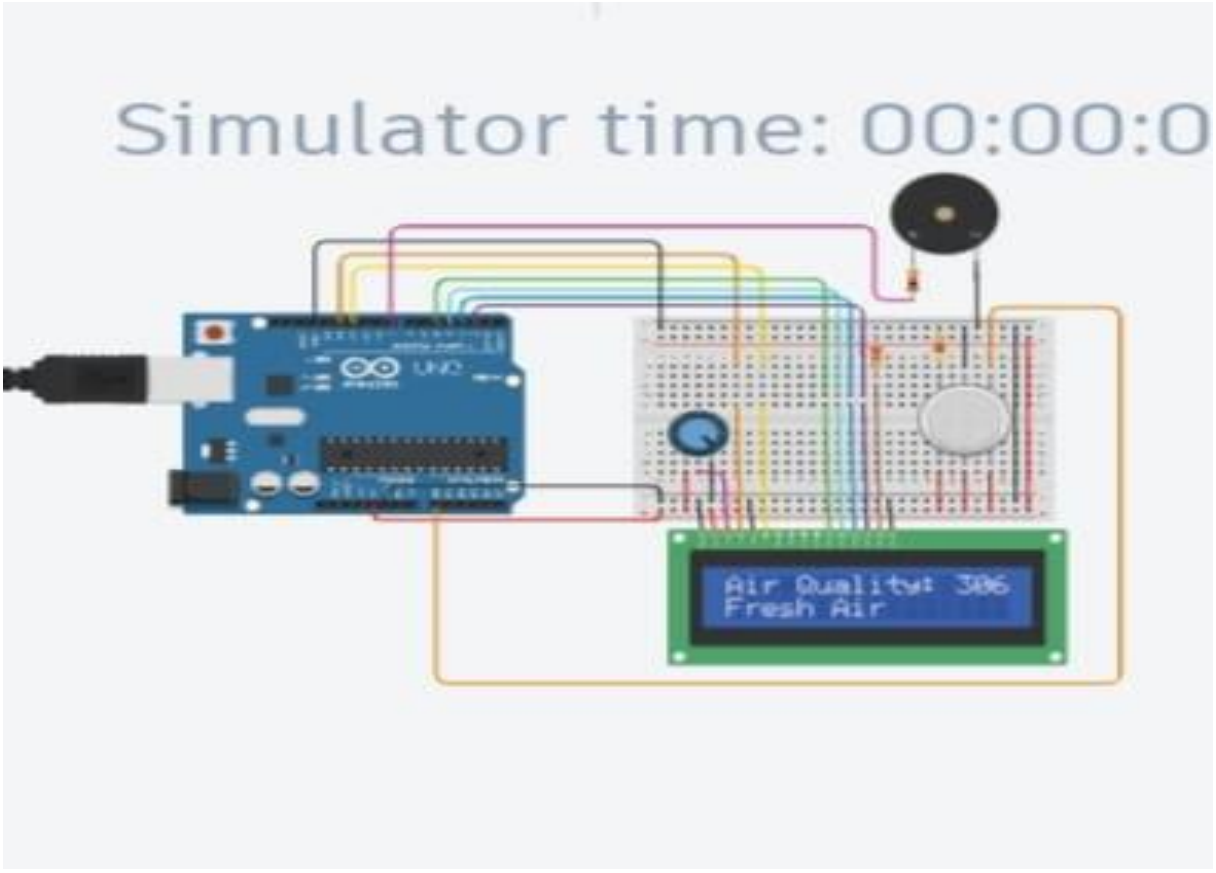


SCREENSHOT OF IOT DEVICES:

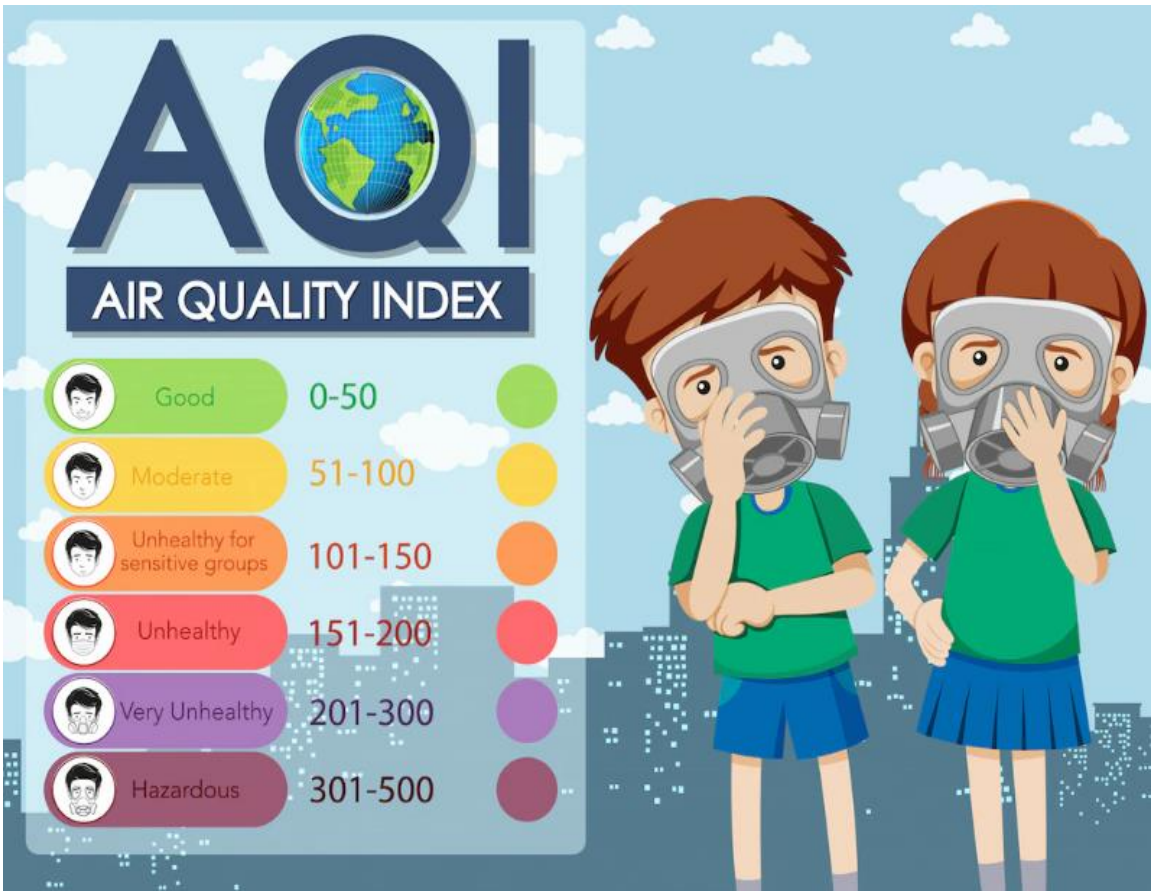


OUTPUT OF AIR QUALITY MONITORING SYSTEM:





PUBL,IC AWARENESS OF AIR QUALITY MONITORING AND HEALTH IMPACTS:



1. Introduction

Air pollution is produced from a wide range of sources, such as automobiles (e.g., diesel-powered vehicles), power generation facilities (e.g., fossil fuel power plants), industrial processes (e.g., factories and cement kilns), agricultural and residential emissions (e.g., use of fertilizers and heating), natural sources (e.g., volcano, wildfires, and dust storms), and transboundary transports [1–4]. At high concentrations, air pollution poses a significant threat to public health and well-being [5–8]. Researchers have shown the risks associated with ambient air pollution, particularly the adverse health consequences of exposure to PM_{10} (i.e., particulate matter with a diameter of 10 micrometers or less), including mortality [9,10], respiratory ailments [9,11,12], cardiovascular disease [13,14], stroke [15], and early menarche [16].

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SENSORS OF AIR QUALITY MONITORING SYSTEM

CONCLUSION:

IoT (Internet of Things) has become an integral part of our lives and it has already made an impact in various sectors, including the environment. Air pollution is a severe problem that has been affecting our planet for years. Therefore, there is a need for a reliable and efficient air pollution monitoring system to protect ourselves from its hazardous effects. An IoT-based air pollution monitoring system is an ideal solution that can provide real-time data and insights about the air quality in a particular area.

IoT based Air Pollution Monitoring System – Perfect Pollucon Services

The IoT-based air pollution monitoring system provides several benefits over traditional air pollution monitoring systems. It can collect real-time data from multiple locations, which then analyzed to identify the sources of pollution. It helps to take necessary measures to reduce it.