PROJECT REPORT - REAL TIME AIR QUALITY MONITORING AND WEATHER FORECASTING

1.INTRODUCTION:

1.1 OVERVIEW :

As of recent outbreaks, the air around the living systems is being polluted in different possible lookouts. By predicting the gas percentage in the air, it is possible to variate the number of toxic gases present in the air. While considering weather forecasting, capturing the periodic patterns in previous data will yield results with future occurrences and precautions. A user Interface will be provided by our team as an implementation outcome confronting all the above-prescribed modules. On the account of previously present data's on-air quality, the fluctuations and concentration of other gases could be predicted using Machine learning. Different forms of gases present will help determine whether to plan a day in the out, if the gases that might be harmful are present in high amounts then we can use necessary precautions.

1.2 PURPOSE :

The prediction of gases present could provide information about when is a good time to get a little exposure to the surroundings, and when to avoid them, which keeps our health in check, by preventing exposing ourselves to harmful gases. The application can also be used in the website format when enhanced so that it can make the process further simple and reliable for people to use. Due to the sudden outbreak of floods much more loss occurs in farm fields. Hence predicting weather could lead to finding out the pattern of outbreaks that occur during a particular time interval, with which not a complete but still a good amount of assets could be saved. Predicting the weather in a quiet handy way will make regular work of people easier by avoiding unnecessary delays. When all the required information is injected on hand, it is more reliable. Capturing gases present, and weather monitoring detailed submissions are given at the capture to the customers using the user interface which makes the work more efficient.

2. LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

1. Wenhua,L et.al.,[1] Used IoT to predict air quality in five regions under a campus to analyze the quality.Modules include communication module , temperature and humidity sensor, laser dust sensor, voltage detection module, cloud server and mobile application program.Using

cloud server regular updates on air quality can be made.Using Pearson correlation coefficient the air quality for next 24 hours is been predicted.electricity monitoring helps in monitoring the power consumption.

2. Pallavi,A,summit,M et al.,[2] created an IOT-based air pollution observation framework to use sensors to assess air quality and use bolt to monitor air quality in real time.quality standards, then upload them to the cloud platform for processing and storing data.when the atmosphere when it is determined to be lower than the limit value.Set off an alarm

3. Niharika,VM et.al.,[3]Conventional methods have been used for many years to evaluate air quality. The conventional methods for predicting air quality rely on statistical and mathematical methods.These methods involve the initial creation of a physical model and the coding of data using mathematical formulae. These computations, however, need sophisticated mathematics. Additionally, the accuracy of these procedures is not perfect. Alternatives to conventional techniques have lately been put forth;

4. Zheng et al.[4]suggested a hybrid prediction technique that combines an ANN-based spatial prediction technique with a linear regression-based temporal prediction technique.A technique to anticipate the concentration of pollutants.

5. Huang and Kuo et al.,[5] suggested a network built on LSTMs to forecast urban air quality. The before mentioned techniques all employed the LSTM deep learning model to capture temporal features, but they all relied on past data (such as historical air quality data) and infrequently dealt with prediction data that had strong correlations.

6. Qin et al.,[6] proposed utilizing an a-priori pattern mining method to mine environmental spatial temporal connections. In order to produce high frequency candidates for rule creation, they moved one of the time sequences to create particular gaps in each time sequence. The resulting rules show that pollutants appear with delays in various places. His approach is time-consuming since it necessitates continually executing the rule generation process via various combinations.

2.2 PROPOSED SOLUTION:

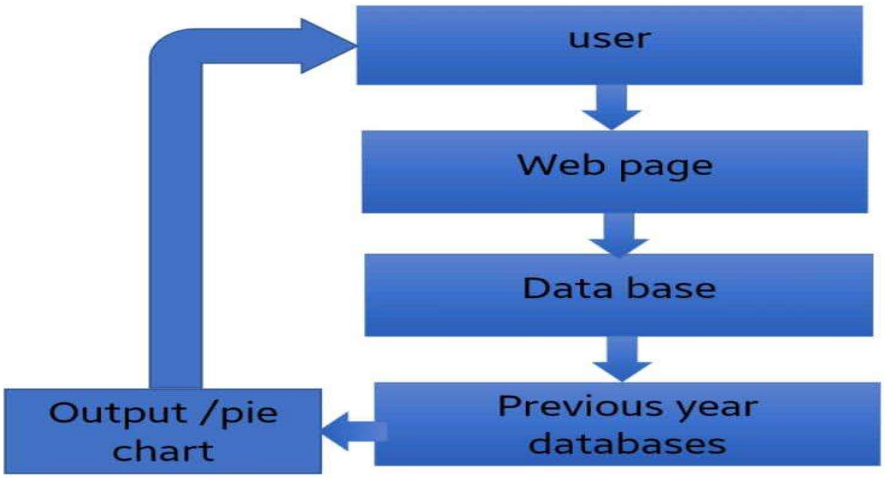
Our idea aims at the fact that it is feasible to vary the level of toxicity in the air by estimating the percentage of gases in the atmosphere. The variations and concentration of other gases could be anticipated using machine learning based on previously collected data on air quality. Capturing the periodic patterns in historical data will produce outcomes with future occurrences and precautions when considering weather forecasting. Our team will deliver a user interface as a result of the implementation, which will be used by all of the a fore mentioned modules.

The different modules involve,

user interface with various gases existing and their percentage on the current date.
The second one specifies,timely weather conditions and historical collapse patterns with the actual cure that lessened the impact of specific circumstances.
The project's conclusion provides information on when is a good time to travel. The result will be projected onto a dashboard that will include pie charts, bar charts, or other visual representations of the many types of gases that are present. Datasets are evaluated to identify any harmful gases that maybe present. To learn about prior occurrences of a certain event and tailor responses accordingly, patterns are observed. As a result, air exposure could benefit human health variables and help prevent mental disease. Asset losses could be avoided. Numerous lives might be saved.
Using many websites, including **kaggle**, we will gather the data sets about gas emissions and presence in the air. The many types of gas present and their hazardous characteristics are determined using machine learning. It allowed us to record the air's quality.
The weather patterns are obtained as advanced inputs from various databases, and future patterns are to be anticipated. Therefore, future preventative ideas and the current influence might be imagined.
Django is used to create the structure as the user interface because it is more practical.

3. THEORITICAL ANALYSIS:

3.1 BLOCK DIAGRAM:



3.2 HARDWARE REQUIREMENTS:

1. PC (laptop or personal computer)

SOFTWARE REQUIREMENTS:

1. Python
2. Django Framework
3. HTML
4. Java Script
5. Kaggle
6. CSS

4. EXPERIMENTAL INVESTIGATIONS:

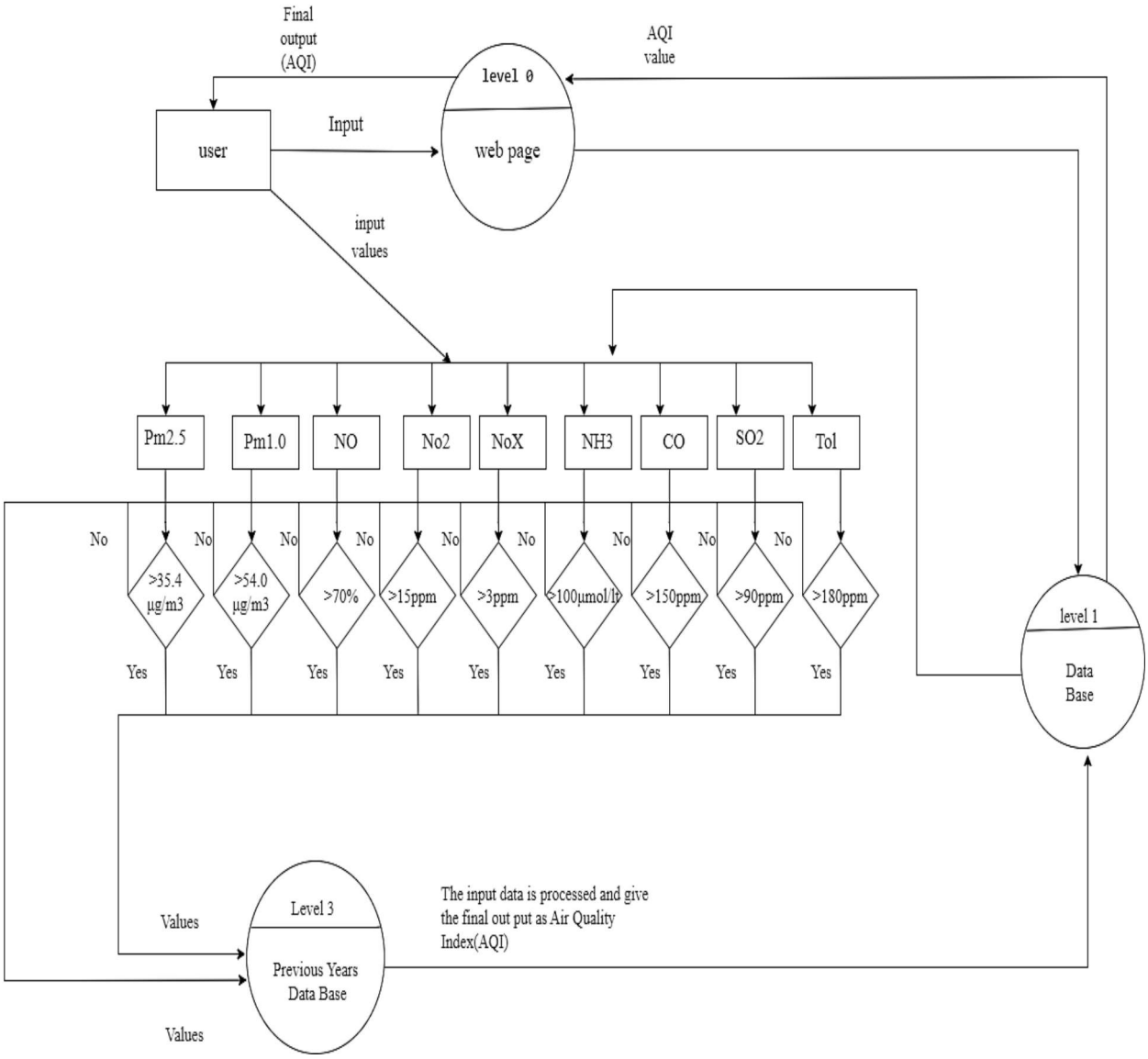
Referenced various websites regarding air quality and weather forecasting, to get an insight on what are the expectations, when it comes to air quality monitoring and also in predicting the weather. Some of the applications that are best reviewed are as follows,

1. **"Environmental Protection Agency's Air Now Mobile App"** an application - home-based indoor air quality monitoring used in both IOS and Android, used in small areas only to measure the local airborne particles and volatile organic compounds - gases such as vapor from paints, cleaners etc.

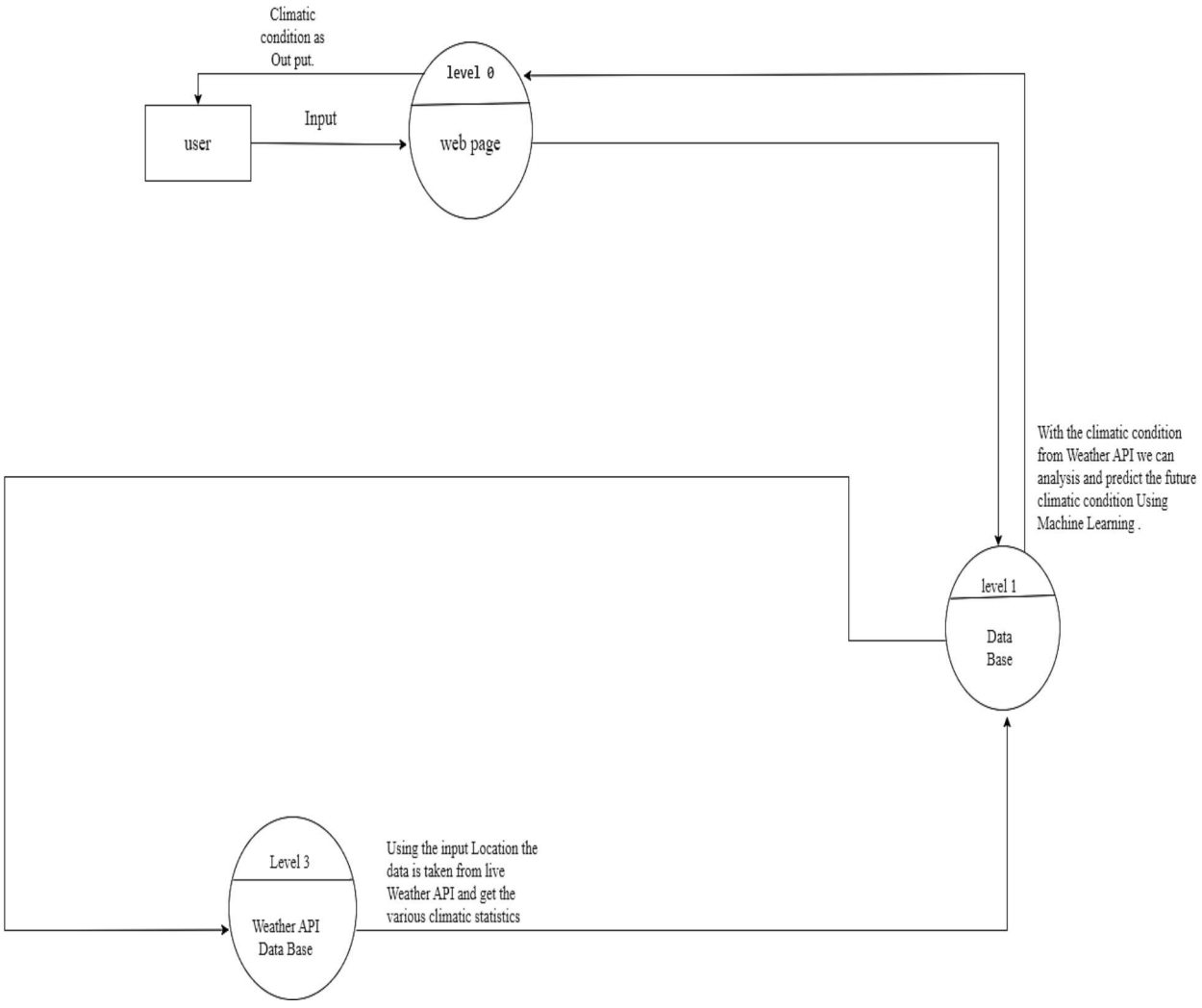
2. There are some hardware air quality sensor modules named "CUBIC", which have various products for control solutions, airflow regulation, air diffusion, air handling, air moving etc.

We have studied these above products on how they work, to get an idea of whether the solution we find should be hardware related or purely a software product. The main drawback that we identified in the above two products is that they are expensive products, and work within a particular space. The designing of an application proved more reliable and easy to access, and also we can enhance the application.

5. FLOWCHART:


Air Quality Monitoring data flow diagram
Final output (AQI)
AQI value
level 0
user
Input
web page
input values
Pm2.5
Pm1.0
NO
No2
NoX
NH3
CO
SO2
Tol
No
>35.4 µg/m3
>54.0 µg/m3
>70%
>15ppm
>3ppm
>100µmol/l
>150ppm
>90ppm
>180ppm
Yes
level 1
Data Base
Values
Level 3
Previous Years Data Base
The input data is processed and give the final out put as Air Quality Index(AQI)
Values

Weather Forecasting data flow diagram



6. RESULT:

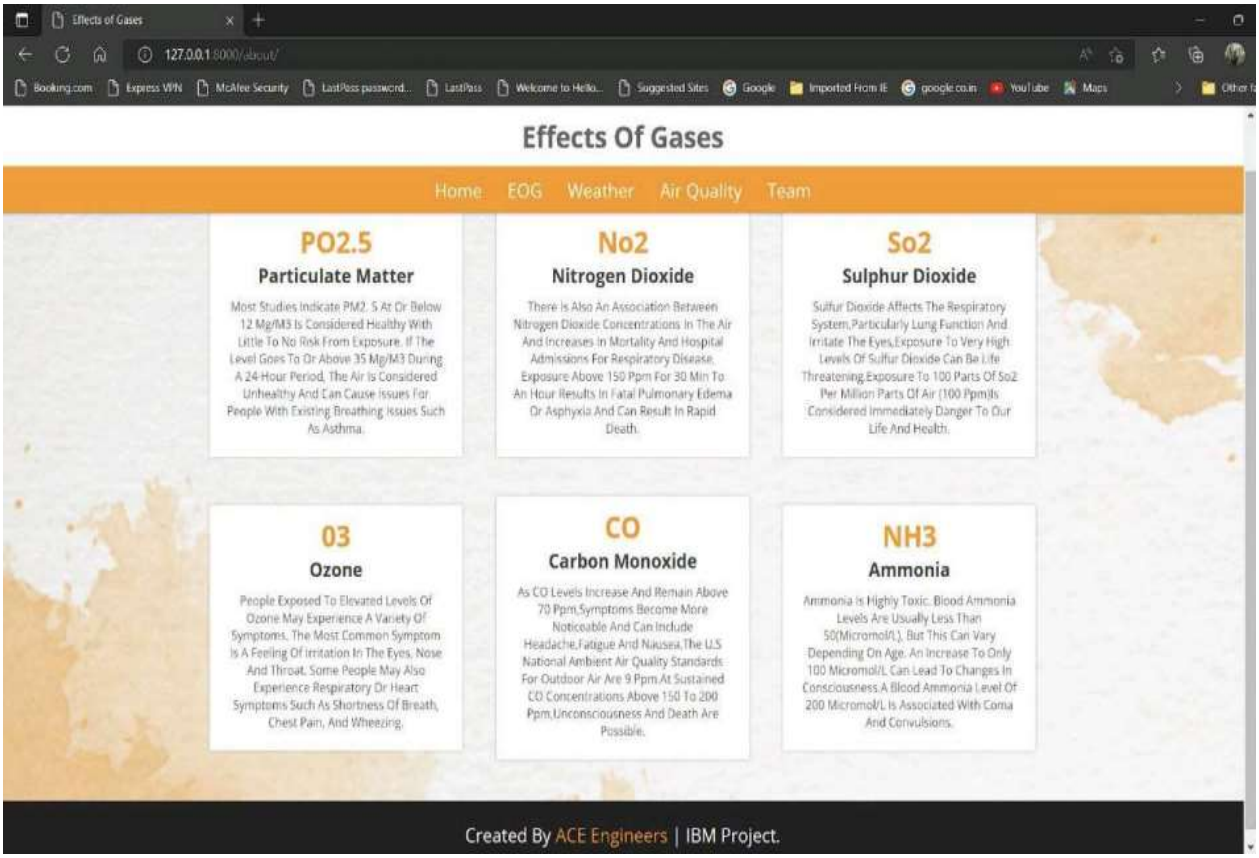
The output page consists of five options :

1. Home
2. EOG (Effects of Gases)
3. Weather
4. Air Quality
5. Team Details

HOME PAGE

The Home Page contains some introduction details on Real Time Air Quality Monitoring and Weather Forecasting, with a Learn More button where there is a Wikipedia link attached to get more insight on the concept.

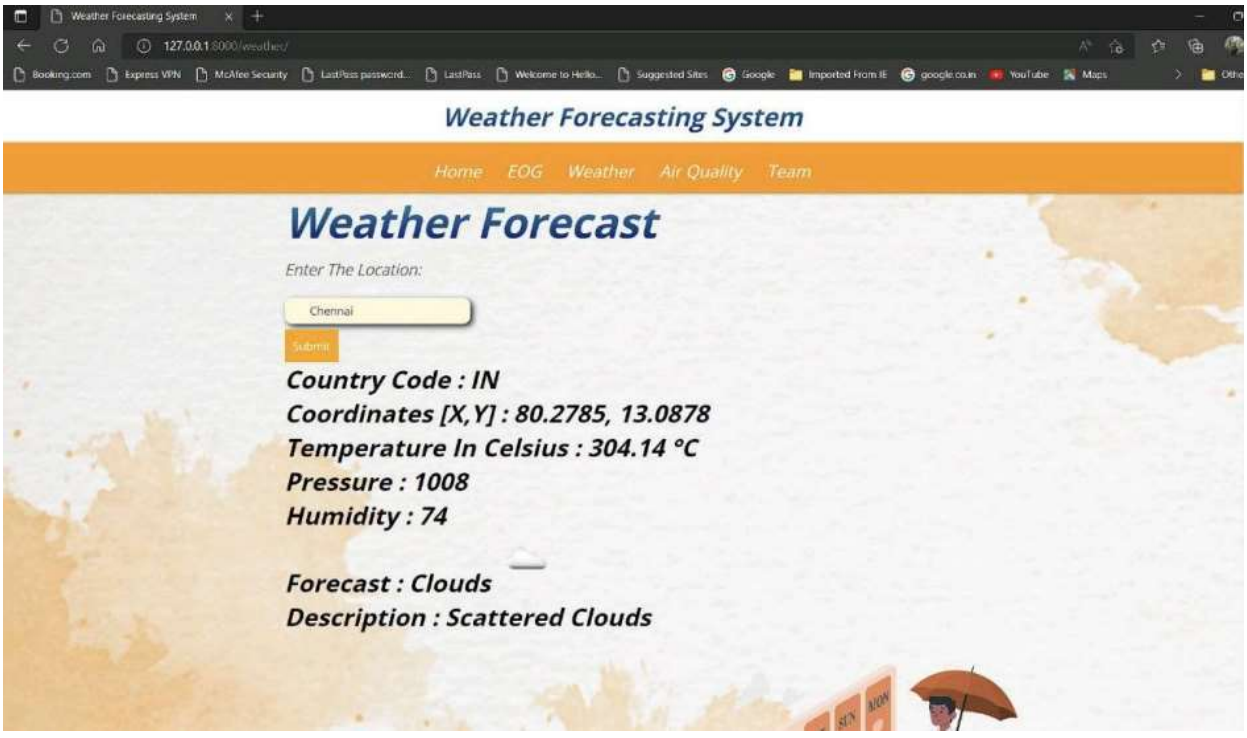
EOG PAGE



The EOG page contains information such as the levels from which they turn toxic and their supposed presence in the environment, what the mixture of gases they contain etc on six gases that the application monitors, that are considered harmful when inhaled. They are,

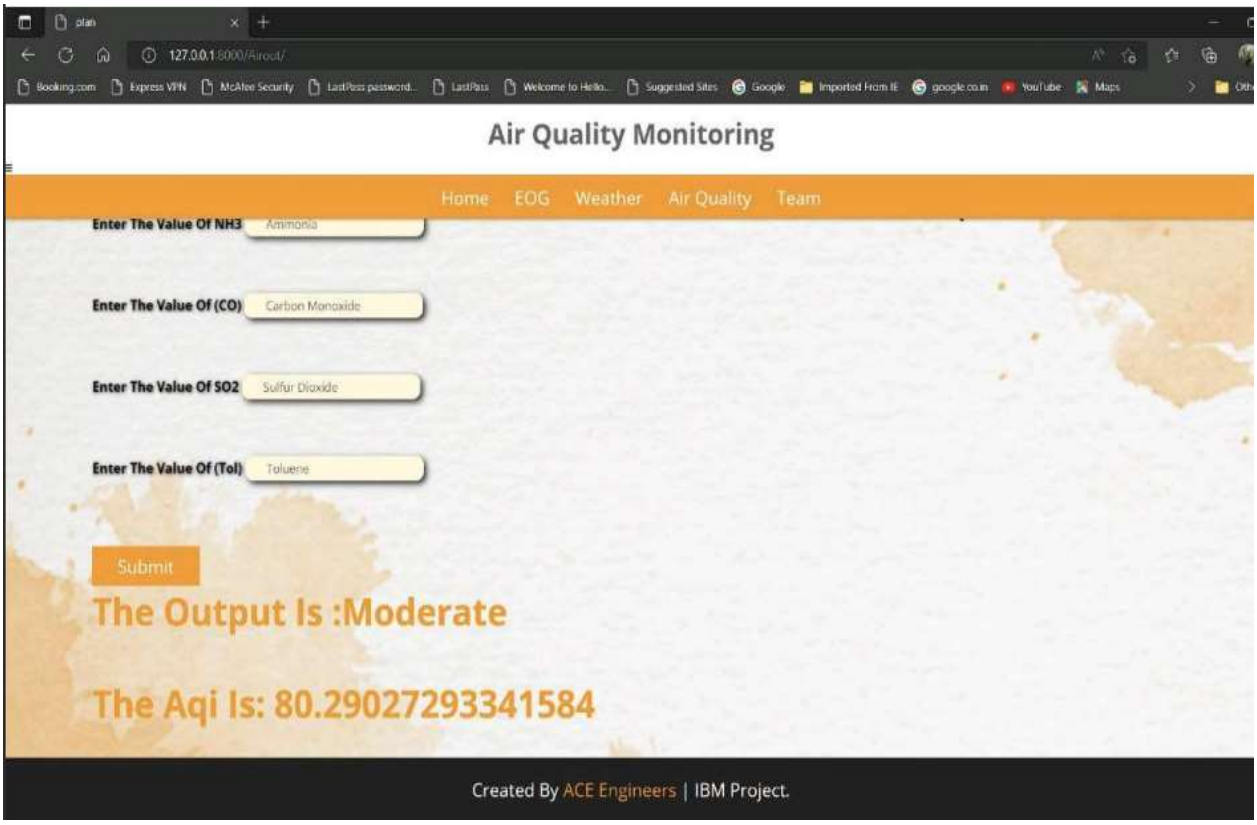
1. PO2.5
2. Nitrogen Oxide
3. Sulfur Dioxide
4. Ozone
5. Carbon Monoxide
6. Ammonia

WEATHER FORECASTING PAGE



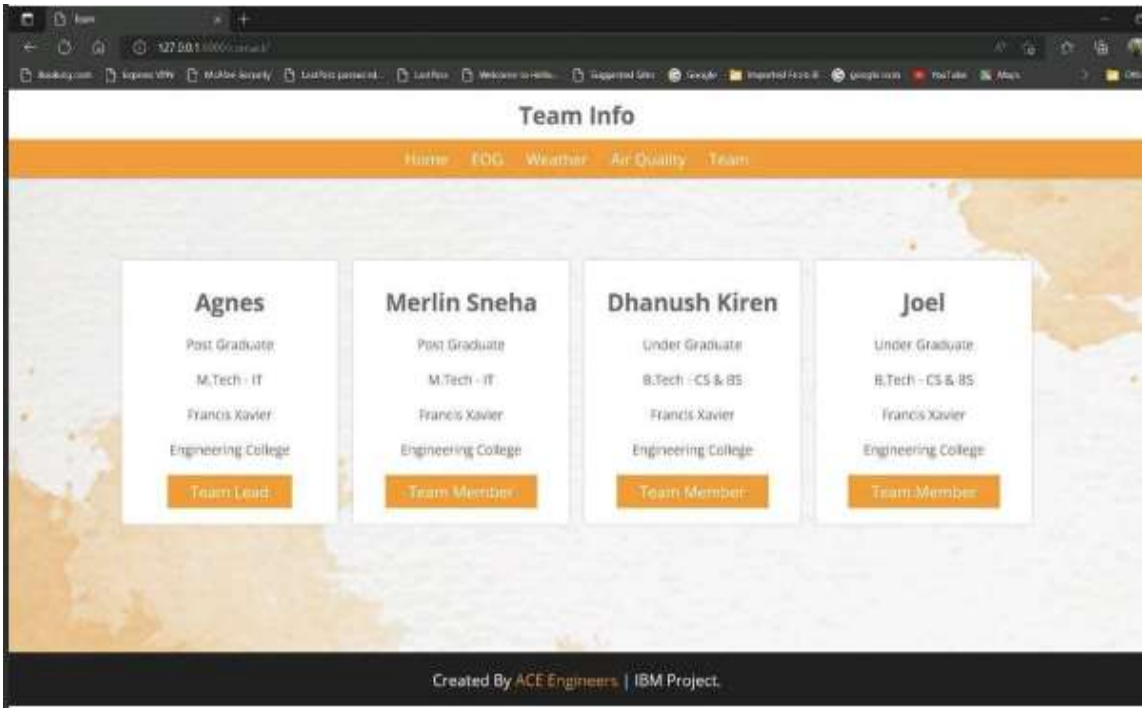
When entered the country name, the above details will be shown.

AIR QUALITY PAGE



The Air Quality Monitoring page, will give the accurate level, based on the following image,

TEAM INFO



7. ADVANTAGES AND DISADVANTAGES:

The pros include,

1. Identifying the pollution present and helps in avoiding disease caused by pollution.
2. Can identify the disasters happened by weather in earlier stages and be prepared for future occurrences.

The cons include,

1. Immediate reaction to particular weather condition cannot be captured even though the predictions are done accordingly.
2. Might affect people's exposure to surroundings frequently since their movement will be depending upon the toxic exposure.

8. APPLICATIONS:

1. This idea could be implemented in customized areas that are crowded with people so that people could know the amount of pollution and react accordingly.
2. It could be implemented in more sandy areas and more vehicle surrounded areas so that much pollution could be avoided.
3. It could be helpful in fields of agriculture where sudden climatic changes could create greater loss in crops and finance.

9. CONCLUSION:

We are trying to make it an app implemented along with plant monitoring system so that it covers major drawbacks faced by agri people in terms of crop production.Plant monitoring system that covers the temperature and humidity factors can help us combine with weather forecasting to yield perfect time for cultivation.If further we extend, we tend to add up factors like capturing the diseases in plants in terms of image processing which is already under study by us, and motion capturing of animals for preventing animal intrusion.

10. BIBILOGRAPHY:

[1]Wenhua,L,Lili,Y,Xiang,Y,"Real Time Air Monitoring, Analysis and Prediction System Based on Internet of Things and LSTM"The 12th International Conference on Wireless Communications and Signal Processing,pp:188

[2] P. Asthana and S. Mishra, “Iot enabled real time bolt based indoor air quality monitoring system,” in 2018 International Conference on Computational and Characterization Techniques in

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[3] V. M. Niharika and P. S. Rao, ‘‘A survey on air quality forecasting techniques,’’ Int. J. Comput. Sci. Inf. Technol., pp. 103–107, Jan. 2014
[4]Y. Zheng et al., ‘‘Forecasting fine-grained air quality based on big data,’’ Proc. ACM SIGKDD Int. Conf. Knowl. Discovery Data Mining. New York,2015, pp. 2267–2276.
[5]C. J. Huang and P.-H. Kuo, ‘‘A deep CNN-LSTM model for particulate matter (PM2.5) forecasting in smart cities,’’ Sensors, vol. 18, no. 7, p. 2220, 2018.
[6]S. Qin, F. Liu, C. Wang, Y. Song, and J. Qu, ‘‘Spatial-temporal analysis and projection of extreme particulate matter (PM10 and PM2.5) levels using association rules: A case study of the Jing-Jin-Ji region, China,’’ Atmos. Environ., vol. 120, pp. 339–350, Nov. 2015.

APPENDIX: