SCHOOL OF COMPUTING
Faculty of Engineering

Project Proposal Form MCST1043
Sem: 2 Session: 2024/25

SECTION A: Project Information.

Program Name:	**Masters of Science (Data Science)**
Subject Name:	**Project 1 (MCST1043)**
Student Name:	Nurhafizah binti Mohd. Yunos
Metric Number:	MSC241048
Student Email & Phone:	nurhafizah99@graduate.utm.my & 60143680885
Project Title:	Air Quality Prediction: Forecasting Pollutant Levels for Improved Environmental Monitoring
Supervisor 1:	
Supervisor 2 / Industry Advisor(if any):	

SECTION B: Project Proposal

Introduction:

Air quality is a significant concern worldwide due to its direct impact on public health, the environment, and climate change. Poor air quality can lead to respiratory diseases, cardiovascular problems, and exacerbate pre-existing conditions like asthma. This project will focus on building a machine learning-based air quality prediction system that leverages historical air quality data, meteorological features (such as temperature, humidity, and wind speed), and environmental data to predict the levels of pollutants in the air in future time periods.

Problem Background:

Air pollution is one of the leading environmental risk factors to human health worldwide. The World Health Organization (WHO) estimates that air pollution is responsible for millions of premature deaths annually, with a significant portion of these deaths due to diseases such as respiratory infections, cardiovascular diseases, and lung cancer. The most dangerous pollutants, such as fine particulate matter (PM2.5), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), and ozone (O3), can have immediate and long-term detrimental effects on public health, especially in urban areas where population density and industrial activities are high.

In many cities around the world, air quality is compromised due to factors like vehicular emissions, industrial activities, deforestation, and unfavorable weather patterns. In cities with rapid industrialization and heavy traffic, poor air quality can become a daily problem, particularly during certain seasons or events (e.g., high traffic periods, industrial accidents, or wildfires). As a result, it's crucial to develop tools and systems that help forecast and predict air quality levels, allowing

individuals, businesses, and governments to take proactive measures to mitigate the effects of air pollution.

Problem Statement:

The primary challenge is to create an accurate and reliable predictive model that forecasts air quality levels in real-time or for future periods based on historical pollution data, weather conditions, and other environmental variables. This model should be capable of forecasting air pollutant concentrations (such as PM2.5, NO2, O3, CO) for the next few hours or days, enabling proactive actions to protect public health and reduce the impact of poor air quality.

Aim of the Project:

The aim of this project is to develop a predictive model that forecasts air quality levels, specifically focusing on key pollutants such as PM2.5, NO2, O3, CO, and SO2, based on historical data and meteorological conditions. The model will provide insights into future air quality trends, allowing for better planning, early warnings, and informed decision-making to mitigate the health risks associated with poor air quality.

Objectives of the Project:

The objectives of the research are:

1. To develop a predictive model to forecast air quality based on historical data and meteorological factors.
2. To analyze the correlation between different meteorological features (temperature, humidity, wind speed) and air quality indicators (PM2.5, O3, NO2).
3. To evaluate model's performance using multiple metrics (RMSE, MAE, R-squared).
4. To visualize the predicted air quality levels based on the collected data.

Scopes of the Project:

This project will focus on forecasting the air quality levels for specific pollutants in a given geographical region, which could be a city or a monitoring station. The geographical coverage of the project will depend on the available dataset. For instance, datasets like the UCI Machine Learning Repository's Air Quality dataset or the Kaggle Air Quality Data can be used to train the model for specific cities (e.g., Rome, Delhi, or New York).

The key pollutants that the project will focus on including PM2.5 (Particulate Matter less than 2.5 microns in diameter), NO2 (Nitrogen Dioxide), CO (Carbon Monoxide), O3 (Ozone), SO2 (Sulfur Dioxide).

Additionally, the project will take into account weather and environmental conditions like temperature, humidity, wind speed, rainfall and pressure.

Expected Contribution of the Project:

The expected contribution of the project is a machine learning model capable of predicting air quality levels (PM2.5, NO2, O3, CO, etc.) for future time periods based on historical data and meteorological features. The project will also provide insights into the impact of weather conditions on air quality.

Project Requirements:

Software: Python, Pandas, Matplotlib, Scikit-learn, Keras

Hardware: Computer with 8GB RAM and 4GB GPU/Google Colab

Technology/Technique/ Methodology/Algorithm: Data Collection, Data Preprocessing, Exploratory Data Analysis (EDA), Model Development, Model Evaluation.

Type of Project (Focusing on Data Science):

[/] Data Preparation and Modeling

[/] Data Analysis and Visualization

[ ] Business Intelligence and Analytics

[/] Machine Learning and Prediction

[ ] Data Science Application in Business Domain

Status of Project:

[/] New

[ ] Continued

If continued, what is the previous title?

SECTION C: Declaration

I declare that this project is proposed by:

[/] Myself

[ ] Supervisor/Industry Advisor ( )

Student Name: NURHAFIZAH BINTI MOHD YUNOS

Hafizah 7/4/2025

Signature **Date**

SECTION D: Supervisor Acknowledgement

The Supervisor(s) shall complete this section.

I/We agree to become the supervisor(s) for this student under aforesaid proposed title.

Name of Supervisor 1:

Signature **Date**

Name of Supervisor 2 (if any):

Signature **Date**

SECTION E: Evaluation Panel Approval

The Evaluator(s) shall complete this section.

Result:

[ ] FULL APPROVAL

[ ] CONDITIONAL APPROVAL (Minor)

[ ] CONDITIONAL APPROVAL (Major)*

[ ] FAIL*

***** Student has to submit new proposal form considering the evaluators' comments.

Comments:

Name of Evaluator 1: .....

Signature **Date**

Name of Evaluator 2: .....

Signature **Date**