

STEM Fair Project Plan

Predicting Air Quality Using Artificial Intelligence

Project Question

Can we use artificial intelligence and weather data to predict air quality?

Background

Air pollution affects health, especially for people with asthma or heart disease. Air quality depends on weather conditions like temperature, wind, and humidity. Artificial Intelligence (AI) can learn patterns from data and make predictions.

Hypothesis

If we use past air quality data and weather data, then an AI model will be able to predict future air pollution levels with reasonable accuracy.

Data Collection

Team will use real, public data:

Air Quality Data

- PM2.5 or AQI values
- Collected from a government air quality database

Weather Data

- Temperature
- Humidity
- Wind speed

Data will be collected for the same city and same time period.

Data Preparation

Students will:

- Remove missing or incorrect data
- Organize data into a table
- Make sure dates and times match
- Normalize values if needed

AI Model Used

Students will train a **machine learning model** such as:

- Linear Regression **or**
- Random Forest

Inputs (features):

- Temperature
- Humidity
- Wind speed

Output (prediction):

- PM2.5 or AQI level

Training the Model

1. Split data into:
 - 70% training data
 - 30% testing data
2. Train the AI model using the training data
3. Test the model using unseen data

Evaluation

Students will compare:

- **Predicted air quality**
- **Actual measured air quality**

Accuracy will be measured using:

- Mean Absolute Error (MAE)

Graphs will include:

- Predicted vs actual values
- Error over time

Results

Students will record:

- How accurate the predictions were
- Which weather variable affected air quality the most
- When predictions were most and least accurate

Conclusion

Students will explain:

- Whether the hypothesis was supported
- What the AI model did well
- What could be improved

Limitations

Possible limitations:

- Limited data
- Sudden pollution events (fires, traffic spikes)
- AI does not understand physical laws

Real-World Applications

This type of AI model could be used to:

- Warn people about poor air quality
- Help cities plan traffic control
- Improve public health responses

Future Improvements

- Use more data
- Try a different AI model
- Add satellite or traffic data
- Predict air quality several days ahead

Student Roles (Optional)

- Data Manager
- AI Model Builder
- Graph & Visualization Designer
- Presenter / Writer

Safety and Ethics

- Only public data is used
- No personal information collected
- AI predictions should support, not replace, human decisions