

AIR QUALITY MEASUREMENT

TEAM MEMBERS

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Phase 2 : Innovation

Using IoT (Internet of Things) devices in combination with predictive modeling to forecast air quality trends based on historical data is a powerful approach for monitoring and managing air quality. Here's a step-by-step guide on how to implement such a system:

1. Define Your Objectives:

- Determine the specific air quality parameters you want to monitor (e.g., PM2.5, PM10, CO2, NO2, O3, etc.).
- Identify the geographical area you want to cover with your IoT devices.

2. Select IoT Sensors:

- Choose the appropriate air quality sensors and IoT devices for your application. Consider factors like accuracy, durability, and connectivity options (Wi-Fi, LoRa, cellular).

3. Data Collection:

- Deploy the IoT sensors at strategic locations across your chosen area. Ensure that they are properly calibrated and maintained.
- Collect real-time air quality data, including both the primary pollutants and meteorological data (temperature, humidity, wind speed, etc.).

4. Data Storage:

- Store the collected data securely in a cloud-based database. Services like AWS, Azure, or Google Cloud can be used for this purpose.

5. Data Preprocessing:

- Clean the data by removing outliers and correcting for sensor errors.
- Aggregate the data into meaningful time intervals (e.g., hourly or daily averages).

6. Historical Data Analysis:

- Analyze historical data to identify patterns, seasonal trends, and correlations between air quality and meteorological variables.

7. Feature Engineering:

- Create relevant features that can help improve the predictive model. For example, lagged air quality values or weather conditions.

8. Choose a Predictive Model:

- Select a suitable predictive modeling technique, such as time series forecasting, regression analysis, or machine learning models like Random Forest, LSTM, or XGBoost.

9. Model Training:

- Split your historical data into training and testing datasets.
- Train the selected model using the training dataset, optimizing its hyperparameters to achieve the best performance.

10. Model Validation:

- Validate the model's accuracy using the testing dataset. Assess its performance using appropriate metrics (e.g., Mean Absolute Error, Root Mean Squared Error).

11. Real-Time Prediction:

- Implement the predictive model to make real-time air quality forecasts. This can be done either on the IoT devices themselves or on a central server.

12. Visualization and Alerts:

- Develop a user-friendly dashboard or interface to visualize the real-time and forecasted air quality data.
- Set up alerts and notifications to inform relevant stakeholders when air quality reaches critical levels.

13. Continuous Monitoring:

- Regularly update and retrain your predictive model with the latest data to ensure accuracy.

14. Feedback Loop:

- Consider implementing a feedback loop where corrective actions can be taken based on air quality forecasts, such as adjusting traffic patterns or activating air purifiers.

15. Compliance and Regulation:

- Ensure that your system complies with local regulations and standards for air quality monitoring.

16. Education and Outreach:

- Educate the community about the air quality data and forecasts, and provide actionable insights for individuals to protect their health during poor air quality days.

By implementing this system, you can proactively address air quality issues and help improve public health and environmental conditions. Additionally, you can contribute to data-driven policies and interventions to mitigate air pollution.