AIR QUALITY MONITORING SYSTEM USING IOT

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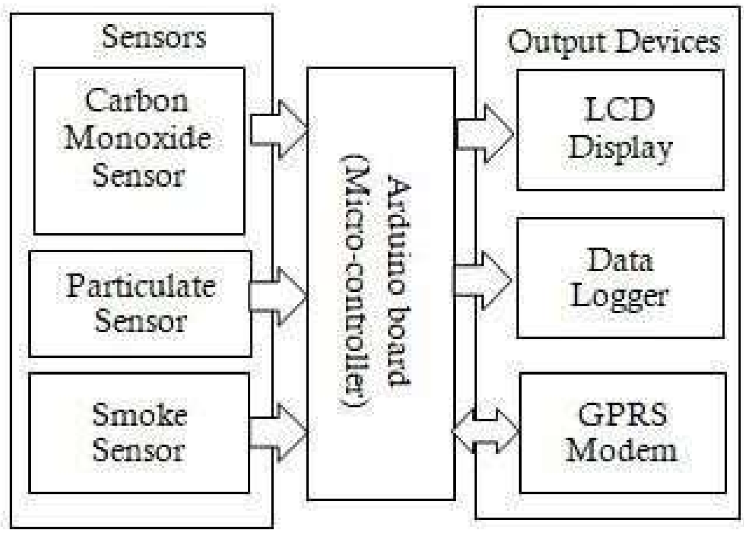
BLOCK DIAGRAM:



Carbon Monoxide Sensor :

When carbon monoxide enters the gas-permeable compartment that houses the sensor, a chemical reaction occurs that causes the electrical current passing through the electrolyte to surge. The specific amount by which the current increases tells the detector the concentration of the carbon monoxide molecules. **Particulate sensor** :

A particulate matter sensor measures the quantity of (fine) dust particles in the air, expressed in PM(Particulate Matter). Particulate matter are (dust) particles smaller than 10 micrometers (μm). The more particulate matter in the air, the unhealthier the air.

Smoke Sensor :

A smoke detector is an electronic fire-protection device that automatically senses the presence of smoke, as a key indication of fire, and sounds a warning to building occupants.

Arduino Board :

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button, or a twitter message-and turn it into an output-activating a motor, turning on an LED, publishing something online

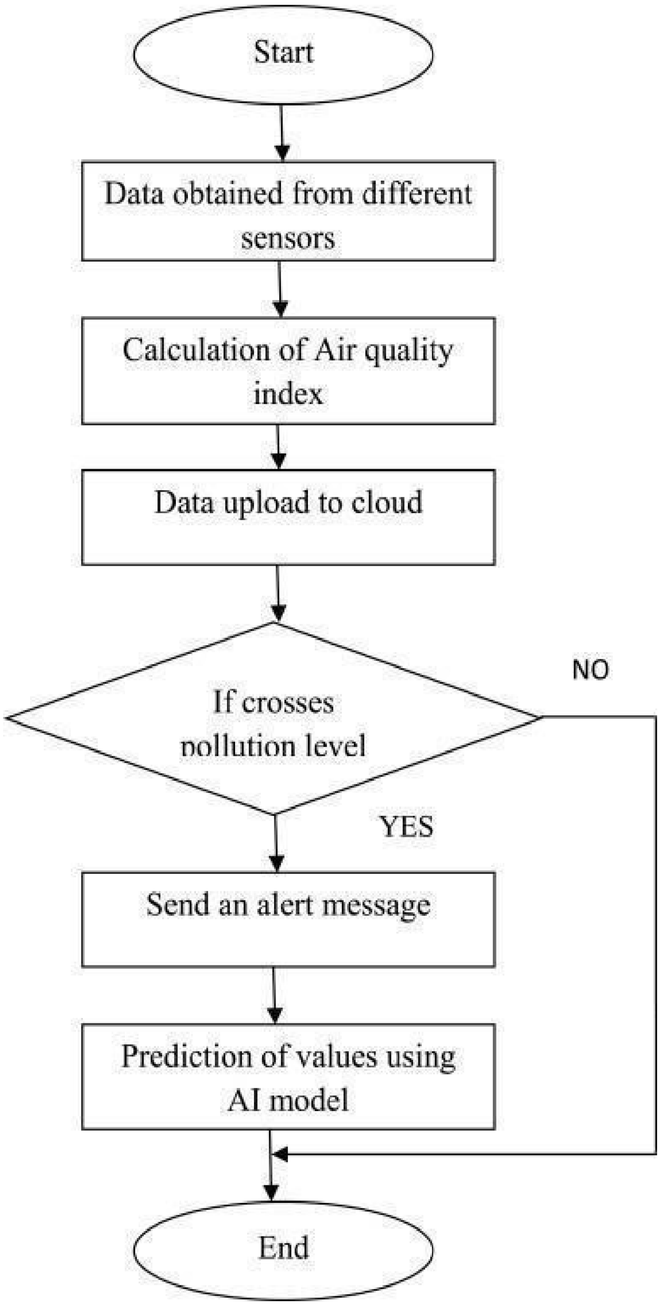
Data Logger :

Data loggers are electronic devices which automatically monitor and record environmental parameters over time, allowing conditions to be measured, documented, analysed and validated.

GPRS Modem :

A GSM/GPRS modem is a class of wireless modems, designed for communication over the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network

Flow Chart :



Air Quality Index :

The Air Quality Index (AQI) is a scale of air pollution that gives Canberrans an indication of how clean the air is so we can change our outdoor activities if pollution levels are high.

The AQI is calculated from air quality data relating to the five pollutants that are monitored in the ACT. For each pollutant, the AQI is the data value expressed as a percentage of the level specified by the National Environment Protection Measure for Ambient Air (NEPM) standard.

AQI is not used for the purpose of providing health advice. For detailed health advice on air quality and pollen please go to the Air Quality Health Advice Portal .

There are six AQI categories ranging from ‘Very good’ to ‘Hazardous’. Each category is shown in a different colour.

A lower value indicates better air quality, and a higher value indicates poorer air quality.

When a pollutant AQI is poor, very poor and hazardous, this means the pollutant has exceeded its corresponding air quality standard.

When a pollutant AQI is poor, very poor and hazardous, this means the pollutant has exceeded its corresponding air quality standard.

Very Good	Good	Fair	Poor	Very Poor	Hazardous
0-33	34-66	67-99	100-149	150-200	200+

You can see the latest data readings on our Air Quality in the ACT Page.

Air Quality Index Calculations :

Monitoring and reporting air quality starts with data from a network of air quality sensors and instruments that we manage at three sites across the ACT.

Data readings are actual measurements—numbers with measurement units, from scientific instruments for each air pollutant. Data is collected on five major pollutants.

The Air Quality Index (AQI) is a scale of air pollution over a designated time period that gives Canberrans an indication of how clean the air is so we can change our outdoor activities if pollution levels are high.

NEPM air quality standards used to calculate the AQI

Pollutant	**Averaging period**	**Air NEPM Standard**
$PM_{2.5}$	24 hours	25 micrograms per cubic meter(µg/m3)
PM_{10}	24 hours	50 micrograms per cubic meter(µg/m3)
Carbon monoxide	8 hours	9.0 parts per million (ppm)
Nitrogen dioxide	1 hour	0.08 parts per million (ppm)
Ozone	8 hours	0.065 parts per million (ppm)

Calculating the AQI

To calculate the index (AQI) values for each pollutant, the data reading is divided by the national standard and multiplied by 100 to get the AQI for the pollutant.

The formula is:

$$AQIpollutant = \frac{pollutantdatareading}{standard} \times 100$$

Alert Message :

Alert messages can be used to notify the user about something special: danger, success, information or warning.

```
# Import necessary libraries
 import pandas as pd
 import numpy as np
 import matplotlib.pyplot as plt
 import seaborn as sns
 from sklearn.linear_model
 import LinearRegression
 from sklearn.metrics
 import mean_squared_error, r2_score
 from sklearn.model _selection
 import train_test_split
 # Load the air quality dataset
 df = pd.read_csv('air_quality_data.csv')
 # Explore the data
 print(df.head())
 # Split the data into training and testing sets
 X = df[['Temperature', 'Humidity', 'Wind Speed']]
 y = df['Air Quality']
 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_
state=42)
 # Train a linear regression model
 model = LinearRegression()
 model.fit(X_train, y_train)
 # Evaluate the model on the test set y_pred = model.predict(X_test)
 mse = mean_squared_error(y_test, y_pred)
 rmse = np.sqrt(mse) r2 = r2_score(y_test, y_pred)
 print("Mean Squared Error: ", mse)
 print("Root Mean Squared Error: ", rmse)
 print("R-squared: ", r2)
 # Visualize the predicted vs actual values
 plt.scatter(y_test, y_pred)
 plt.xlabel('Actual Air Quality')
 plt.ylabel('Predicted Air Quality')
 plt.title('Air Quality Prediction')
 plt.show()
```

This Python code is an example of a linear regression model for air quality prediction using a dataset. Let's break down the code and its purpose:

Import Necessary Libraries:
pandas for data manipulation.
numpy for numerical operations.
matplotlib for data visualization.
seaborn for enhanced data visualization.
scikit-learn for machine learning tools.
Load the Air Quality Dataset:
It loads a dataset named 'air_quality_data.csv' into a pandas DataFrame called 'df'.
Explore the Data:
The code prints the first five rows of the dataset using df.head() to give you an initial view of the data.
Split the Data into Training and Testing Sets:
The features (independent variables) are defined as 'Temperature', 'Humidity', and 'Wind Speed' in 'X'. The target (dependent variable) is 'Air Quality' in 'y'.
The data is split into training and testing sets using train_test_split from scikit-learn. Here, 80% of the data is used for training and 20% for testing.
It creates a scatter plot showing the actual air quality values on the x-axis and the predicted values on the y-axis to visually assess the model's performance.
Train a Linear Regression Model: A linear regression model is created using LinearRegression() from scikit-learn.
The model is trained on the training data with model.fit(X_train, y_train).
Evaluate the Model on the Test Set:
The model makes predictions on the test data using model.predict(X_test) . It calculates Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and R-squared (R2) as evaluation metrics .
Visualize the Predicted vs Actual Values:
In summary, this code loads an air quality dataset, splits it into training and testing sets, trains a linear regression model, evaluates its performance using various metrics, and visualizes how well the model's predictions match the actual air quality values.
It's a simple example of a regression analysis in machine learning to predict air quality based on given features