Industrial Sensor Data Analysis - Report

Overall Idea of the Project

This project focuses on industrial sensor data analysis, where we analyze engine performance over time using various sensors. The main goal is to clean the data, detect anomalies, and visualize trends that help in predictive maintenance and failure detection.

Sensor Trends for a Single Engine

This plot tracks sensor readings over time for a specific engine.
Key insight: It helps in detecting gradual performance degradation or sudden sensor spikes that may indicate failures.

Sensor Correlation Heatmap

A heatmap that displays correlations between different sensors.
Key insight: If two sensors are highly correlated, one may be redundant; if they have negative correlation, they might be inversely related.

Distribution of a Single Sensor

A histogram of values for one sensor across all engines.
Key insight: Helps detect abnormal readings and understand whether the sensor data follows a normal distribution.

Boxplot for Sensor Readings

A boxplot that summarizes the distribution of sensor values.
Key insight: Identifies outliers and shows the spread of data.

Rolling Average of Sensor Readings

A smoothed version of the sensor values using a moving average.
Key insight: Helps track long-term trends without noise.

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How Python Was Used

1. Data Loading & Cleaning: Used pandas to read the dataset, handle missing values, and remove outliers using the Interquartile Range (IQR) method.

2. Data Visualization: Used matplotlib and seaborn to create meaningful plots and heatmaps. Highlighted sensor trends, correlations, and anomalies.

3. Data Saving: Stored the cleaned dataset in a CSV file for future use.

Final Thoughts

This project is a great example of data-driven decision-making in industrial settings. By cleaning, analyzing, and visualizing sensor data, we can predict failures and optimize machine performance, which is essential in Industry 4.0 and smart manufacturing.