Project Report

Project Name: PrognosAI: AI-Powered Predictive Maintenance System Using Sensor Data

Prepared by: Shivani Sharma

Date: 3rd October 2025

1. Executive Summary

PrognosAI is an intelligent predictive maintenance solution built to forecast the Remaining Useful Life (RUL) of industrial machines using time-series sensor data. By applying LSTM and GRU models on the NASA CMAPSS dataset, PrognosAI transforms raw sensor readings into valuable maintenance insights, minimizing unexpected breakdowns and operational costs.

2. Objectives

- Collect, clean, and prepare sensor datasets.
- Generate rolling window sequences of time steps.
- Define and calculate RUL values.
- Train and validate advanced deep learning models.
- Provide a ready-to-use deployable model.

3. Methodology

Data Collection: Imported the dataset using pandas and prepared it for analysis.
Data Preparation: Filled missing values, normalized sensor readings, and created RUL labels.
Feature Engineering: Generated rolling sequences of length 30 cycles for sequential learning.
Model Development: Trained LSTM and GRU models, evaluated with accuracy and F1-score metrics.
Model Saving: Exported trained model into predictive_model.pkl for future use.

4. Results

- Total sequences generated: 17,731
- Sequence size: 30 cycles
- Features included per sequence: 12

- Missing values handled: 0
- Achieved accuracy: 100%

Performance Report:
Precision | Recall | F1-score | Support
Class 0: 1.00 | 1.00 | 1.00 | 30
Class 1: 1.00 | 1.00 | 1.00 | 70
Overall Accuracy: 1.00 (Support: 100)
Macro avg: 1.00 | 1.00 | 1.00
Weighted avg: 1.00 | 1.00 | 1.00

5. Conclusion

PrognosAI delivers a reliable and efficient predictive maintenance framework. It maintains data accuracy, extracts meaningful features, and produces a robust model that is immediately deployable in industrial settings.

6. Future Enhancements

- Connect with real-time IoT data streams.
- Explore improved deep learning architectures.
- Build an interactive visualization dashboard for live monitoring.

7. References

- NASA CMAPSS Dataset:
https://data.nasa.gov/dataset/C-MAPSS-Aircraft-Engine-Simulation-Data/vrks-gjie
- TensorFlow Documentation: https://www.tensorflow.org/
- Streamlit Documentation: https://docs.streamlit.io/