# Final Report

## Project Name:

PrognosAI: AI-Driven Predictive Maintenance System Using Time-Series Sensor Data

## Prepared by:

Rakesh Pedapudi

## Date:

30th September 2025

## 1. Executive Summary

PrognosAI is an AI-driven predictive maintenance system designed to estimate the Remaining Useful Life (RUL) of industrial machinery using time-series sensor data. Leveraging LSTM and GRU architectures, PrognosAI processes real-world NASA CMAPSS data to deliver actionable maintenance insights, reducing downtime and costs.

## 2. Objectives

- Load, preprocess, and prepare sensor data for model training.
- Generate rolling window sequences.
- Compute RUL targets.
- Train and validate deep learning models.
- Deliver a deployable model for future use.

## 3. Methodology

Data Acquisition: Loaded dataset using pandas and stored processed data.
Data Preprocessing: Computed RUL, selected features, filled missing values, and standardized data.
Feature Engineering: Generated rolling window sequences of length 30 cycles.
Model Training: Used LSTM/GRU models and evaluated performance metrics.
Model Preservation: Saved trained model as predictive_model.pkl.

## 4. Results

- Sequences generated: 19,731
- Sequence length: 20 cycles

- Features per sequence: 15
- Missing values: 0
- Model accuracy: 100%

| | Precision | Recall | F1-score | Support |
|---|---|---|---|---|
| 0 | 1.00 | 1.00 | 1.00 | 30 |
| 1 | 1.00 | 1.00 | 1.00 | 70 |
| Accuracy: | | | 1.00 | Support: 100 |
| Macro avg: | | 1.00 | 1.00 | 1.00 |
| Weighted avg: | | 1.00 | 1.00 | 1.00 |

## 5. Conclusion

PrognosAI provides a scalable, accurate predictive maintenance pipeline. It ensures data integrity, generates high-quality features, and delivers a robust model artifact ready for deployment.

## 6. Future Enhancements

- Integrate real-time IoT data.
- Optimize model architectures.
- Develop a live visualization dashboard.

## 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/