Project 8 - Rotary Platform for Predictive Maintenance

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Background & Motivation:

- Autonomous manufacturing relies on complex data analysis for customization, presenting the critical challenge of maintaining machine longevity and performance.
- Predictive maintenance is essential for operational efficiency, targeting components like bearings to significantly reduce downtime and costs.
- Thus, experiments with novel features are needed to explore different predictive maintenance solutions.

Objective:

- To develop an automated rotary platform equipped with advanced sensors.
- Aimed at conducting future experiments regarding proactive monitoring and predictive analytics of bearing health. Future results will facilitate timely maintenance actions and enhance component lifespan.

Novelty:

- Incorporates sound sensors to compliment vibrations in detecting failure.
- Employs high RPM range to accelerate bearing degradation, producing faster data recording sessions.

Methodology

Component Selection:

Selected a compatible motor and bearing for the core of the platform, ensuring the correct operating conditions.

Physical Assembly:

By integrating the selected mechanical and electrical components for data capture.

AI Model Development:

By using pre-existing datasets to recognize patterns and predict bearing health.

System Integration:

By combining the mechanical assembly, sensor systems, and AI analytics into a cohesive platform. Further failure methods (poor lubrication, debris) introduced to further accelerate testing.

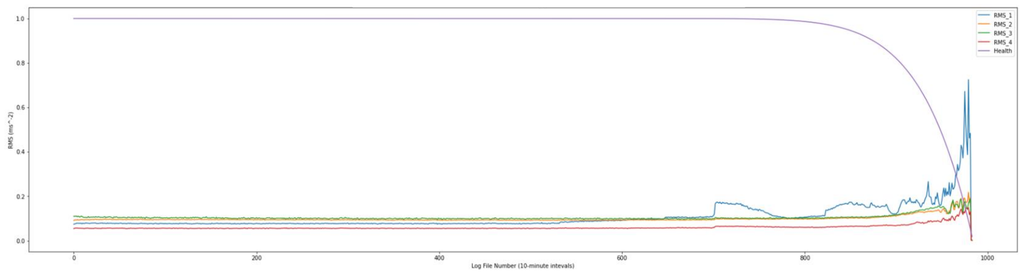
Applications

- Improved machinery uptime and reduced operational costs
- Proactive monitoring and predictive analytics of bearing health

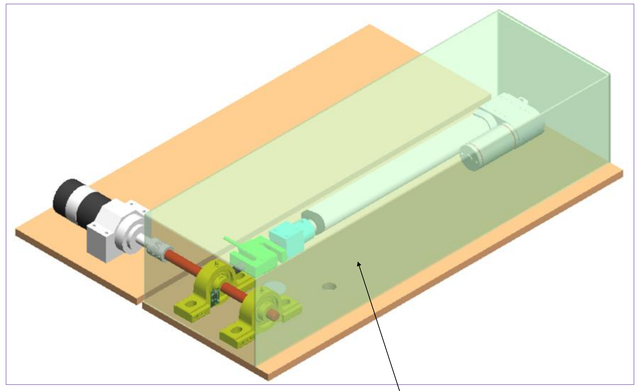
Framework

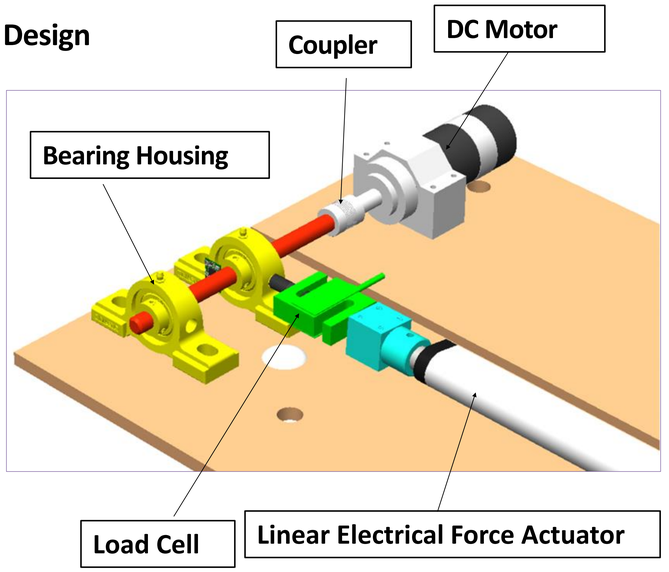
- LabView: For capturing data from sound sensors and a load cell, and for platform control.
- Control Lookup Table: For actuator force adjustment.
- AI Model: Receives sensor data for analysis and processing. Built using multivariable linear regression. Time domain features determined to be most important.

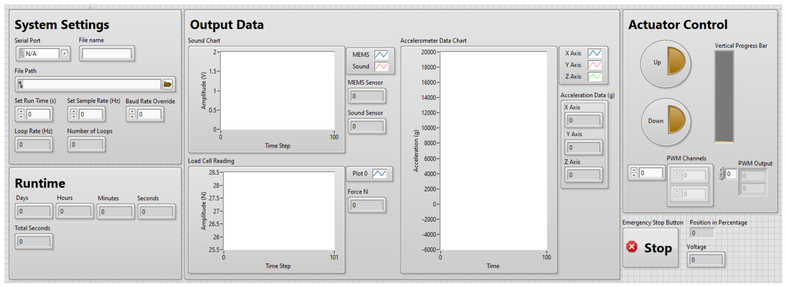
Data Trends (Vibrations)



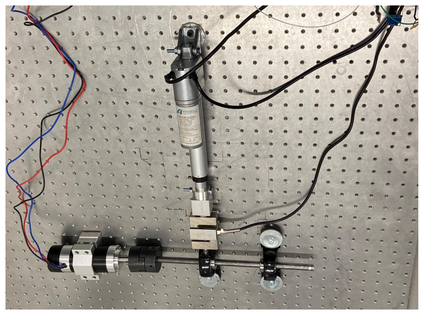
Platform Design





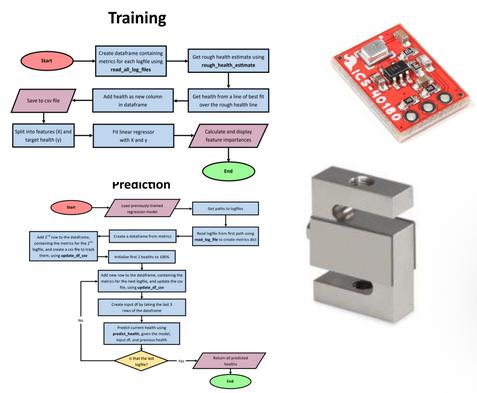


LabView Interface



Actual Platform

- Integrates a bearing-shaft-motor assembly with an actuator for precise load application on the bearing
- Utilizes an S-type load cell for accurate force measurement, complemented by a durable polycarbonate casing to enhance safety and durability of the platform.
- Features a custom-developed LabVIEW script for efficient electronics control and processing of output data, facilitating user-friendly operation and analysis.



What's Next?

- Additional data must be collected to refine the AI model.
- Multiple bearings will be tested in different conditions (RPM, Actuator Force, Failure Methods)
- Confirm data trends in sound.