

## Project Proposal: AI-Driven Equipment Maintenance

### Project Summary

This project aims to leverage machine learning techniques to predict when repair or maintenance is needed for equipment. By accurately predicting maintenance needs, we can reduce downtime, prevent costly repairs, and improve overall operational efficiency. The project will involve data collection, preprocessing, model training, and validation to build a predictive model that identifies equipment likely to require maintenance. The expected outcome is a predictive maintenance system that can be integrated into existing workflows to optimize maintenance schedules and reduce unexpected equipment failures.

### Problem Statement

Maintaining equipment in optimal working conditions is crucial for ensuring the smooth operation of industrial processes. Unexpected equipment failures can lead to significant downtime, increased operational costs, and safety hazards. Traditional maintenance strategies, such as reactive maintenance (repairing equipment after it fails) and preventive maintenance (regularly scheduled maintenance regardless of condition), can be inefficient and costly. The challenge lies in predicting when equipment will need repair or maintenance before a failure occurs. This requires analyzing large volumes of equipment data to identify patterns and indicators of potential issues. By developing a predictive maintenance model, we aim to accurately forecast maintenance needs, allowing for timely interventions that prevent unexpected failures and optimize maintenance schedules.

### Data Description & Evaluation

The data set consists of 10,000 data points stored as rows with 8 features, 1 target and 1 column with additional context, providing a robust number of samples for training and testing. The project will evaluate the predictive maintenance model using accuracy, precision, recall, and F1 score to comprehensively measure its performance in identifying equipment maintenance needs.

#### Dataset:

UDI	Product ID	Type	Air temperature [K]	Process temperature [K]	Rotational speed [rpm]	Torque [Nm]	Tool wear [min]	Target	Failure Type
1	M14860	M	298.1	308.6	1551	42.8	0	0	No Failure
2	L47181	L	298.2	308.7	1408	46.3	3	0	No Failure
3	L47182	L	298.1	308.5	1498	49.4	5	0	No Failure

### Expected Outcome and Impact

Development of a machine learning model capable of accurately predicting when equipment will need maintenance or repair. This model will analyze data from various equipment sensors to identify patterns and indicators of potential issues. The implementation of a predictive maintenance system will enhance overall operational efficiency by minimizing disruptions and optimizing maintenance activities.