**Mechenance – Team 3**

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## Problem statement:

Companies spend millions of dollars in reactive maintenance (happens after failure) rather than predictive maintenance (happens before failure).

Companies lose time and productivity, or major accidents occur due to poorly maintained machines.

Manufacturing industries (or any other heavy industries) ignoring the environmental aspects of their business or unknowingly creating adverse effects on environment which leads to unsustainable way of growing business.

## Significance (Why this problem needs to be solved)

**Injury:** Facilities with poorly maintained equipment have been found to experience a higher rate of industrial accidents. For instance, OSHA highlights that proper maintenance can prevent up to 70% of machine-related accidents.

**Downtime and Efficiency:** A study by the Federal Emergency Management Agency (FEMA) indicates that predictive maintenance can reduce the probability of sudden equipment failures by up to 75%, consequently decreasing the risk of accidents associated with emergency breakdowns.

**Cost:** Research suggests that predictive maintenance can save companies 8% to 12% over preventive maintenance, and up to 40% over reactive maintenance strategies. This cost efficiency also helps allocate more resources to comprehensive safety measures.

## Solution

1. Dashboard indicating the probabilities of machine failures based on data collected from sensors.
2. Carbon footprint calculator for the users to run their business in sustainable way and in align with government policies.

**Why:** To save millions of dollars spent in reactive maintenance & increase productivity in manufacturing industries.

**How:**Leveraging the power of AI to analyze the sensor data and predict the probabilities of machine failures & predicting carbon footprint.

## Literature review:

Companies providing predictive maintenance services.

* Temeda – Industrial IoT Dashboards ([Link](https://about.temeda.com/solutions/maintenance/))
* Saviant – Predictive Analytics ([Link](https://www.saviantconsulting.com/predictive-analytics-company.aspx))
* KCF Technologies ([Link](https://kcftech.com/))
* Emprise Corp. ([Link](https://www.emprisecorporation.com/))

**Common Features in existing dashboards.**

* Machine / Tool Health Analytics
* Maintenance Logs
* Maintenance Intervals
* Automated Maintenance Assignments
* Inventory & Supply Chain Management

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## Model Training & Bench Marking

Steps for training:

* Gathering data (Kaggle)
* Loading the data in Notebook
* Pre-processing
  + Removed NaN values
  + Balanced the data
  + Removed columns – Machine ID
* Split the data into train-test (80-20)
* Trained with Neural Network with Dense Layers

## Model deployment.

* 2 Notebooks – Model 1 (Predictive Maintenance), Model-2 (Carbon Footprint Calculation)
* Converted into 2 Python Scripts
* Saved the models
* Created 1 Python script to load the models and take input data to print the predictions
* Converted into flask scripts, fast API script
* Tested with Postman (Local)
* Dockerization
* Deployed (Tested with Heroku (Flask), GCP (Flask), GCP (Fast API)

DEMO: <https://mechenance-900ac7459385.herokuapp.com/>

**Response for presentation feedback.**

The dataset which our models were trained on were specifically for multiclass classification. In practice the dataset would be built on gathering data about failures and figuring out relevant parameters including time to failure. Future scope of the project is to try integrating real-life sensor data with the nature of time-series data and retrain the model with ‘Survival Analysis’ techniques as suggested during the presentation.