Machine Downtime Project

Leveraging Data Science for Improved Efficiency

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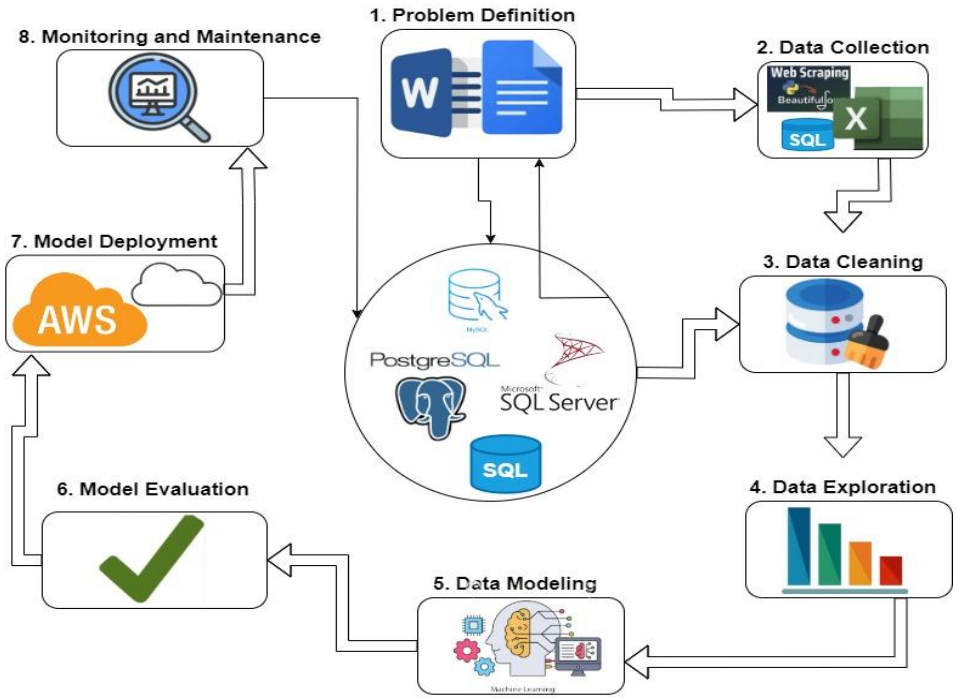


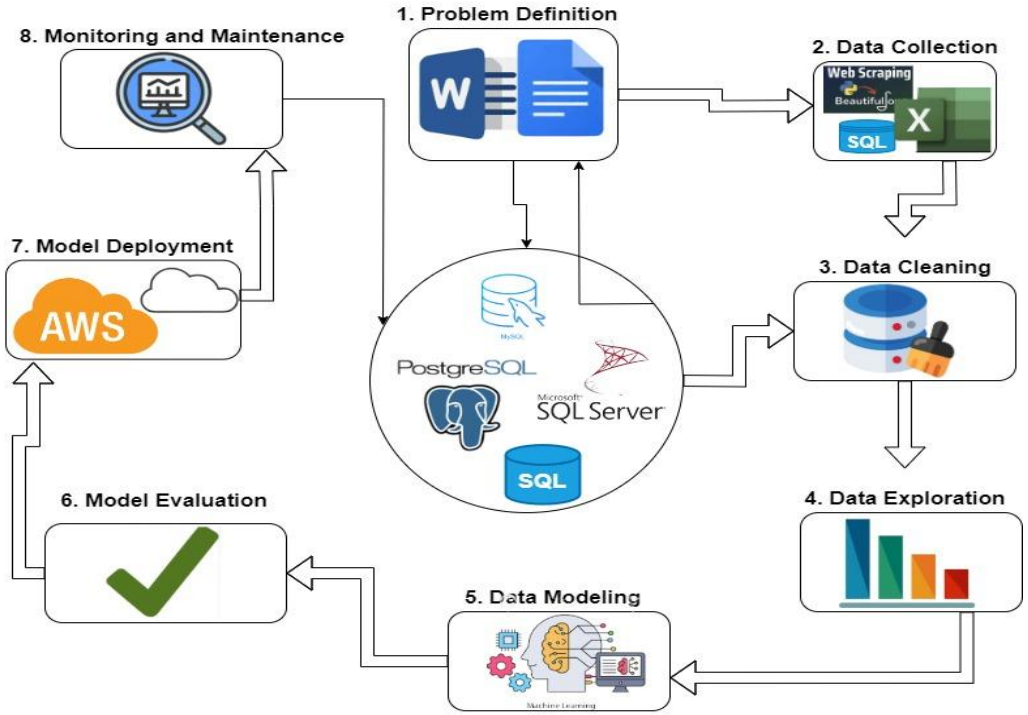
Business Problem

Unplanned Machine Downtime Which is leading to loss of productivity

Project Overview and Scope

Goal : The goal of this project is to reduce unplanned downtime of machine in order to increase productivity, lower costs, and improve on-time delivery to customers. So that unplanned machine downtime reduce by at least 10% and achieve A cost saving of at least $1M.

Data Collection:- Data provided by the Project Manager
Timeline: 15 Days
Scope:- Project for one of the leading vehicle fuel manufacturers



Data Dictionary

Column Names	Data Types
Date	Date
Machine_ID	Object
Assembly_Line_No	Object
Hydraulic_Pressure(bar)	Float
Coolant_Pressure(bar)	Float
Air_System_Pressure(bar)	Float
Coolant_Temperature	Float
Hydraulic_Oil_Temperature(°C)	Float
Spindle_Bearing_Temperature(°C)	Float
Spindle_Vibration(µm)	Float
Tool_Vibration(µm)	Float
Spindle_Speed(RPM)	Int
Voltage(volts)	Int
Torque(Nm)	Float
Cutting(kN)	Float
Downtime	Object

Exploratory Data Analysis[EDA]

Statistical Insights

Downtime	Machine_Failure	No_Machine_Failure
Machine_ID		
Makino-L1-Unit1-2013	454	420
Makino-L2-Unit1-2015	396	412
Makino-L3-Unit1-2015	415	403
	(50.76%)	(49.4%)

1. Deleted the null values so that our modeling should get affected
2. Box plot used for the detecting the outliers
2. Using Measures of Tendency we have found Outliers and we
treated Outlier using Winzoriser
4. We have some duplicate values and we deleted it using drop_duplicate that can affect the data modeling
5. Negative skewness is slightly Left Skewed and positive
Right Skewed

Business Insights

1. Improvement need in Makino-L1-Unit1-2013 machine because we have seen the maximum numbers of machine downtime.

2. Hydraulic_Oil_Temperature, Air_System_Pressure(bar), Spindle_Bearing_Temperature, Spindle_Vibration, Tool_Vibration , Voltage is the main root cause of Machine downtime.

Data Preprocessing

1.Handling Missing Values:- Numerical Missing values are replaced by median and missing date replaced by null values' previous data.

2. Encoding Categorical Features:- Categorical columns encoded using pd.get_dummies() that converted text data to numerical data.

3. Scaling or normalization: Normalization techniques helped to bring all features to a similar range using sklearn.

4. Feature Scaling:- StandardScaler() technique is used for feature scaling. It improved the efficiency and accuracy of machine learning algorithm

Data Visualization

Created Many Different charts and plots

1. Box Plot helped to find out outliers
2. Histograms used to visualizing the distribution of continuous data.
3. Pie charts represented the percentage of machine downtime and machine_ID.
4. Heat map used to visualizing matrix data and relationships between variables