Final Year Project Showcase Batch 2021
Year 2025

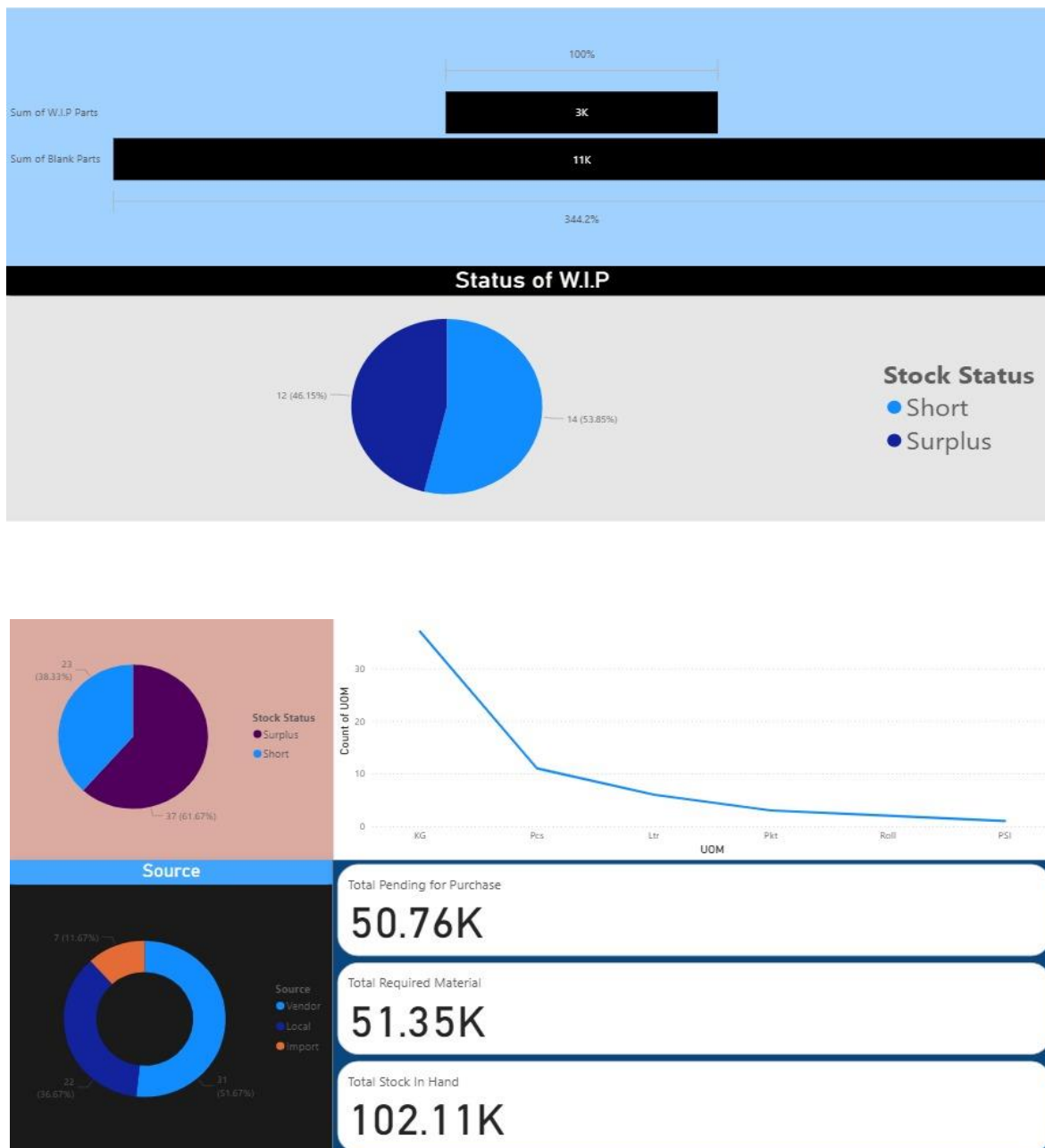|	**Department: Industrial & Manufacturing Engineering**
	Programme: Industrial & Manufacturing Engineering
1	**Project Title** Optimizing Supply Chain Efficiency Using Machine Learning Techniques
2	**Project Idea** The project aims to enhance the efficiency of supply chains by leveraging machine learning algorithms for accurate demand forecasting and procurement optimization. Traditional methods often lead to overstocking or stockouts, which increases operational costs. This project replaces those approaches with intelligent, data-driven solutions to align supply chain processes with real-time market demand.
3	**Process** The process included: • Collection of historical and real-time supply chain data (Kaggle & Metlink Steel Industry) • Preprocessing and analysis of datasets • Development and training of machine learning models (Random Forest, XGBoost, CNN) • Evaluation using metrics like R^2, MAE, MSE • Integration of best-performing models into a functional forecasting and procurement system
4	**Outcome** • Developed highly accurate models for both demand forecasting and procurement. • Random Forest achieved best performance: • **R^2 Score:** 0.989 for demand, 0.986 for procurement • Enabled cost reduction, improved inventory management, and responsiveness to market changes. • Provided a foundation for real-time decision-making and future scalability.
5	**Evidence (Theoretical Basis)** This project applies supervised machine learning techniques to solve inefficiencies in traditional supply chain management. It combines theoretical concepts from regression models, decision trees, and ensemble learning to develop high-accuracy predictive systems. Theoretical foundations include supply chain optimization, Industry 4.0 principles, and ML model evaluation metrics.
6	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** By optimizing procurement and reducing waste, this project contributes indirectly to SDG-11 by promoting efficient resource utilization, reducing environmental burden from overproduction, and supporting smarter urban industrial practices. Efficient supply chains reduce traffic congestion from excessive logistics and lower emissions from unnecessary manufacturing.

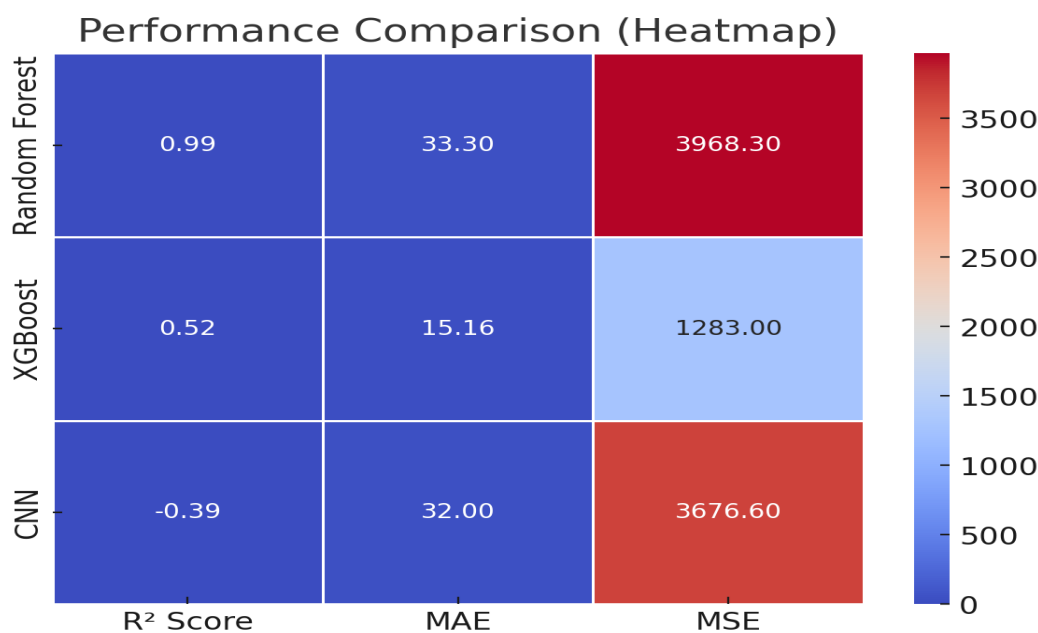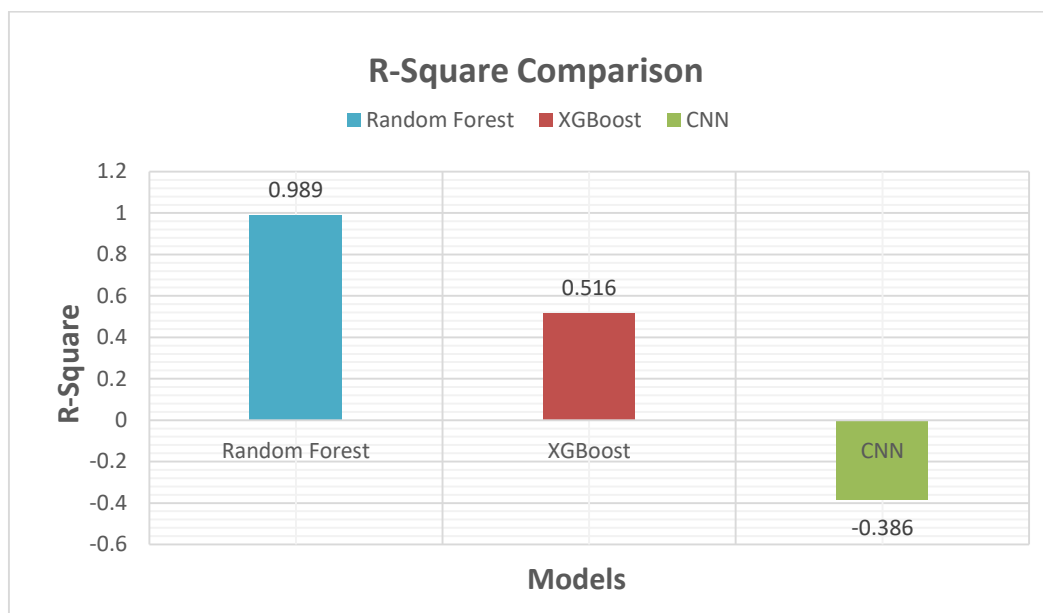| 7	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) Supports SDG-9 (Industry, Innovation & Infrastructure) and SDG-12 (Responsible Consumption & Production) by reducing waste, optimizing production, and improving efficiency.
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) Minimizes overproduction and unnecessary logistics, reducing carbon emissions and energy consumption.
c	**Cost Reduction of Existing Product** Accurate forecasts reduce inventory costs and financial losses from unsold products or missed sales due to stockouts.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Replaces outdated manual forecasting with intelligent automation, improving speed, accuracy, and responsiveness of supply chains.
8	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service • **Industries:** Manufacturing, Retail, Distribution, Logistics • **Groups:** Supply Chain Managers, Procurement Teams, Data Analysts • **Individuals:** Entrepreneurs and business owners aiming for smart supply chain solutions • **Application:** Particularly beneficial for SMEs and large-scale industries with high inventory turnover
9	**Team Members** (Names along with email address) Jaweria Jawed jaweriajawed9221@gmail.com Misbah misbahiqbal.0115@gmail.com Hamza Ahmed hamzaahmed4956@gmail.com Muhammad Areeb Shah areeblocker123@gmail.com
10	**Supervisor Name** (along with email address) Mr. Muhammad Danish Saleem mdanishsaleem@cloud.neduet.edu.pk
11	**Video (If any)** You may please provide the link of the video to be accessible

Pictures (If any)

Predicted vs Actual (Random Forest)

Actual vs Predicted Overlap Plot
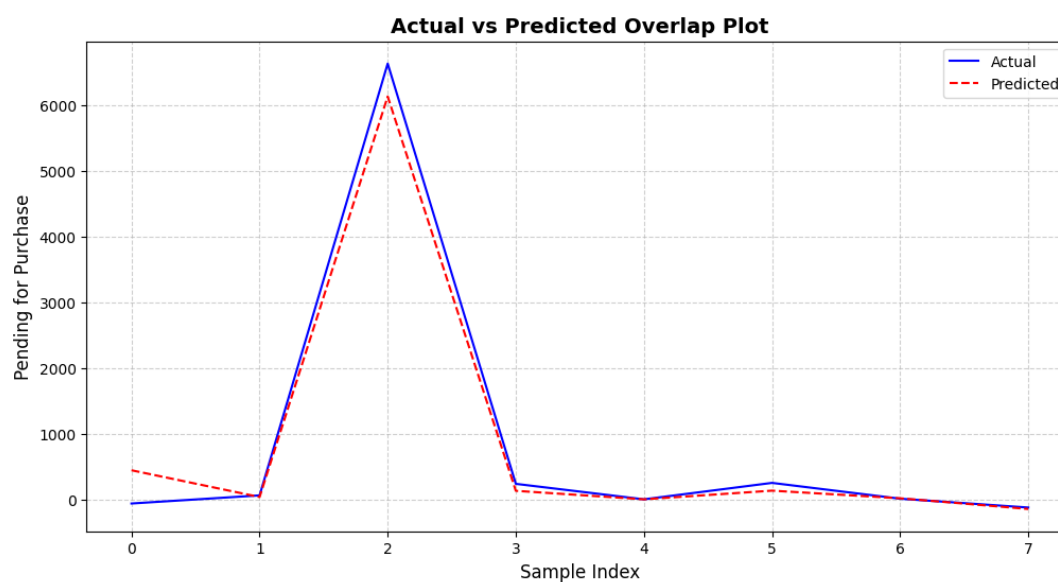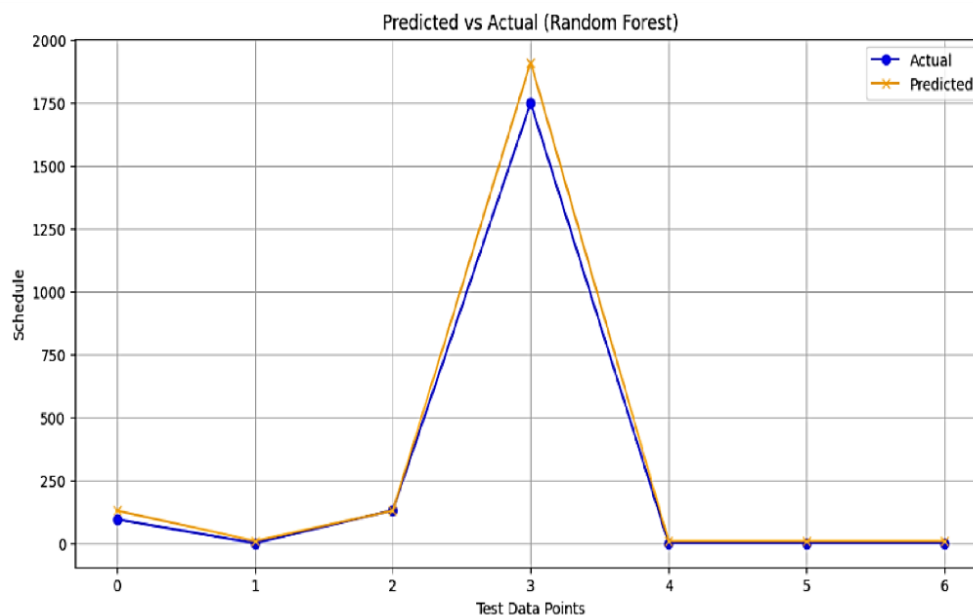
Dashboard

Comparative Analysis of Demand Forecasting Models:

R-Square Comparison

Legend: ■ Random Forest ■ XGBoost ■ CNN

Model	R-Square
Random Forest	0.989
XGBoost	0.516
CNN	-0.386

Y-axis: R-Square
X-axis: Models

Performance Comparison (Heatmap)

	R² Score	MAE	MSE
Random Forest	0.99	33.30	3968.30
XGBoost	0.52	15.16	1283.00
CNN	-0.39	32.00	3676.60

Comparative Analysis of Procurement Models:

R-Square Comparison

Model Performance Heatmap