# AI POWERED PERSONALIZED TUTOR SYSTEM

***A Project Report***

***submitted in fulfilment of the***

***requirements for the Intel Unnati Industrial Training 2025***

**Bachelor of Technology**

**in**

**CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)**

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## CERTIFICATE

This is to certify that the project report entitled **Food Ordering Application** submitted by **Mr./Ms. Sama Dharani, J. Gajanand, Bachhu Gayathri** to the Institute of Aeronautical Engineering, Hyderabad in partial fulfillment of the requirements for Mobile Application Development Laboratory, Bachelor of Technology in **CSE(Artificial Intelligence & Machine Learning)** is a bonafide record of work carried out by him/her under my/our guidance and supervision. The contents of this report, in full or in parts, have not been submitted to any other Institute for the award of any Degree.

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## ABSTRACT

In today’s digital marketplace, customers are overwhelmed with options, making it difficult to choose the best products in terms of **price, quality, and delivery efficiency.** While e-commerce is booming, the lack of a unified platform for intelligent comparison hampers the customer decision-making process**.** This project, **"Enhancing Customer Experience with AI-Driven Insights,"**aims to transform the online shopping experience by leveraging **Artificial Intelligence (AI) and Machine Learning (ML),** to deliver **real-time, personalized,** and **data-driven shopping** insights across various sectors**.**

The system aggregates and analyzes data from multiple e-commerce platforms for common products in sectors like **clothing**, **grocery**, and **food delivery**. It compares critical parameters such as **price**, **user reviews**, **ratings**, **delivery time**, and **discounts**—allowing users to make smarter and faster purchase decisions. The AI engine uses models such as **sentiment analysis** for review summarization and **ranking algorithms** for optimal product suggestions.

To further enhance user experience, the system recommends the **best purchase options** tailored to the user's preferences and browsing history. In future iterations, deep learning models can be integrated to offer **price predictions**, **visual product similarity detection**, and **NLP-based chatbots** for personalized shopping assistance.

This project showcases the impact of AI in revolutionizing e-commerce by enabling **smart, adaptive, and user-centric shopping experiences**. By helping users compare and choose the best options effortlessly, the system empowers them with transparency and confidence in their purchasing decisions.

**Keywords**: Smart Shopping, Product Comparison, AI in E-Commerce, Customer Experience, Machine Learning, Sentiment Analysis, Personalized Recommendations, Price Prediction, Adaptive Retail Solutions

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**CHAPTER 1**

**1.1 INTRODUCTION**

In the digital age, online shopping has become an integral part of daily life, offering convenience and a wide variety of choices to consumers. However, with the increasing number of e-commerce platforms, customers often face the challenge of comparing similar products across multiple websites to make the best purchasing decisions. The process of manually browsing different platforms for price, quality, delivery time, and user reviews is time-consuming and inefficient. This calls for an intelligent solution that can enhance the customer shopping experience by providing unified, data-driven insights.

With the advancements in Artificial Intelligence (AI) and Machine Learning (ML), there is an opportunity to revolutionize the way users shop online. By leveraging AI-driven technologies, this project introduces a smart comparison platform that aggregates products from different websites and enables customers to make informed decisions with ease. The platform focuses on essential sectors like **clothing**, **grocery**, and **food delivery**, where users can compare the same or similar items across multiple e-commerce sources based on critical factors like **price**, **ratings**, **reviews**, **quality**, **delivery time**, and **discounts**.

The objective of this project is to design an AI-powered product comparison system that not only fetches and aligns product data from various platforms but also applies intelligent algorithms to analyze and present the best possible purchasing options to users. The system uses techniques such as **sentiment analysis** on customer reviews, **ranking algorithms** for optimal suggestions, and lays the foundation for more advanced features like **price prediction**, **personalized recommendations**, and **chatbot-based assistance**.

Though currently implemented as a web-based prototype, the underlying concept has the potential to evolve into a fully integrated shopping assistant that uses real-time data, predictive analytics, and user behavior analysis to deliver personalized shopping experiences. This AI-powered platform addresses the modern consumer’s demand for transparency, efficiency, and convenience by minimizing the time and effort required for online comparisons.

Ultimately, this project aims to transform the customer journey in online shopping by enhancing satisfaction, decision-making confidence, and overall user experience. It benefits customers through intelligent comparisons, empowers businesses with insights into consumer preferences, and demonstrates how AI can redefine the future of e-commerce.

**1.2 PROBLEM STATEMENT**

## Online shoppers face challenges in comparing similar products across multiple e-commerce platforms due to the absence of a unified and intelligent system. Manually checking price, quality, reviews, and delivery options is time-consuming and often confusing. To address this, an AI-powered comparison platform is required to aggregate and analyze product data from different sources. By enhancing customer experience with AI-driven insights, the system enables users to make smart, personalized, and data-informed purchasing decisions efficiently.

## ****Goals of the Project****

# Develop an AI-powered platform to compare similar products across multiple e-commerce websites based on key factors such as price, reviews, quality, discounts, and delivery time.

# Enhance customer experience with AI-driven insights by offering real-time, data-informed product comparisons in sectors like clothing, grocery, and food delivery.

# Implement machine learning techniques such as sentiment analysis and ranking algorithms to evaluate product reviews and recommend the best purchase options.

# Provide personalized product suggestions based on user preferences and browsing behavior.

# Assist users in making smart, time-efficient decisions by reducing the need for manual product comparison across platforms.

# Use data visualization to present trends in pricing, reviews, and delivery performance for better user understanding.

# Explore future enhancements such as price prediction using ML, visual similarity detection, and NLP-powered chatbots for personalized shopping assistance.

# ****1.3 OBJECTIVES****

The primary objective of this project is to develop an **AI-powered comparison platform** that aggregates similar products from various e-commerce websites and enhances customer experience through intelligent, data-driven insights. By leveraging **machine learning (ML)** and **natural language processing (NLP)** techniques, the system aims to analyze key product parameters such as **price**, **user reviews**, **ratings**, **delivery time**, and **discounts** across platforms in sectors like **clothing**, **grocery**, and **food delivery**.

A major goal is to implement ML models capable of conducting **sentiment analysis** on customer reviews and applying **ranking algorithms** to recommend the best purchase options tailored to user preferences. This allows the platform to reduce decision fatigue for customers by offering personalized suggestions based on real-time comparisons and user behavior patterns.

The project also seeks to design a **user-friendly web interface** that delivers consolidated product insights in an organized and intuitive manner, helping users make quick, informed decisions without manually browsing multiple websites. By integrating **data visualization techniques**, the platform will also highlight price trends, review sentiments, and delivery performance, enabling users to gain deeper insights into their choices.

Furthermore, the system aims to provide a foundation for **future enhancements**, including **price prediction models**, **image-based product similarity detection**, and **NLP-powered chatbots** to assist users in real-time. By embedding AI at the core of the shopping experience, this project demonstrates the potential of intelligent systems in creating a more transparent, efficient, and personalized online shopping journey.

**CHAPTER 2**

**METHODOLOGY:**

## This section describes the approach used to build the AI-powered product comparison platform. It includes collecting product data from multiple e-commerce websites, preprocessing it for consistency, and applying machine learning models for sentiment analysis and ranking. These insights help users compare similar products across platforms and make informed purchasing decisions.

## ****2.1 Data Collection from E-commerce Platforms****

To train and evaluate the machine learning models, product data is collected from various e-commerce websites in the domains of **clothing**, **grocery**, and **food delivery**. The dataset includes key attributes that influence customer decisions, such as:

* **Product ID** – Unique identifier for each item.
* **Product Name & Description** – Detailed information about the product.
* **Price** – Current selling price on different platforms.
* **Customer Ratings** – Average user ratings out of 5.
* **Reviews** – Customer feedback and sentiment.
* **Delivery Time** – Estimated delivery duration based on location.
* **Discounts & Offers** – Promotional pricing or deals available.
* **Platform Name** – The source website offering the product.

In cases where real-time scraping is not feasible, a **synthetic dataset** is created using realistic, randomized values to simulate real-world product listings. This enables effective testing of AI models and system functionality in comparing and recommending products.

## ****2.2**** Data Cleaning and Integration

Before training the machine learning models, the collected product data is preprocessed to ensure accuracy, consistency, and readiness for analysis. The key preprocessing steps include:

🔹**Handling Missing Values** – Filling missing entries such as price, delivery time, or ratings using mean, median, or interpolation techniques.  
🔹 **Feature Encoding** – Converting categorical features (e.g., platform names or product categories) into numerical format using One-Hot or Label Encoding.  
🔹 **Feature Scaling** – Normalizing numerical attributes like price, delivery time, and ratings using Min-Max Scaling or Standardization for uniform comparison.  
🔹 **Outlier Detection** – Identifying and managing unusual values (e.g., extremely high prices or invalid ratings) using IQR or Z-score methods.  
🔹 **Data Splitting** – Dividing the dataset into training (80%) and testing (20%) sets to evaluate the performance of the AI models effectively.

## ****2.3**** Comparison Parameters Selection (Price, Reviews, Delivery Time, etc.)

Several machine learning models are considered to power the AI capabilities of **Shopping Hub**, a website designed to compare similar products across different e-commerce platforms. These models support real-time product insights, smart recommendations, and enhanced decision-making for users.

**Review Sentiment Analysis (Classification-based)**

* **Logistic Regression** – A baseline classification model used to determine customer sentiment (positive/negative/neutral) from product reviews.
* **Naive Bayes Classifier** – Efficient for handling large volumes of textual review data with decent accuracy in sentiment detection.

**Product Ranking & Recommendation (Regression-based / Scoring)**

* **RandomForestRegressor** – Predicts an overall product score by analyzing multiple features such as price, ratings, delivery time, and sentiment score.
* **XGBoost Regressor** – A powerful gradient boosting model used to fine-tune product rankings and provide smarter recommendations.

Each model is trained using the processed product dataset and evaluated using metrics like **accuracy** (for classification) and **RMSE** (Root Mean Squared Error) or **MAE** (Mean Absolute Error) for regression-based models. The best-performing models are selected and integrated into the **backend of Shopping Hub**, providing users with intelligent, real-time comparisons through the **frontend interface**.

This model-driven approach ensures that **Shopping Hub** can effectively enhance the customer experience with **AI-driven insights**, helping users make faster, smarter, and more personalized purchase decisions.

**CHAPTER 3**

# ****Data Analysis & Insights****

## Exploratory Data Analysis (EDA) is used to uncover patterns, trends, and relationships within the collected product data, ensuring it is suitable for AI model training. In the Shopping Hub project, EDA is performed using statistical summaries, data visualizations, and correlation analysis to better understand how factors like price, reviews, ratings, delivery time, and discounts influence customer choices. These insights guide the design of intelligent recommendation and comparison systems to enhance user experience on the platform.

## ****3.1**** Understanding the Product Dataset

## Before applying machine learning models, we first analyze the structure and quality of the collected product dataset:

## Total Products: (e.g., 2000+ product entries across clothing, grocery, and food delivery categories)

## Key Features: Product Name, Price, Ratings, Reviews, Delivery Time, Discounts, Platform Name, Category

## Target Variables: Sentiment Score (for review classification), Product Score (for ranking and recommendation)

## The dataset is thoroughly checked for missing values, duplicate records, and outliers to ensure consistency and reliability. This foundational step is crucial for generating accurate and insightful AI-driven comparisons on the Shopping Hub platform.

## ****3.2 Statistical Summary of Key Metrics****

A **descriptive statistics table** helps understand the distribution of key variables:

| **Feature** | **Mean** | **Median** | **Min** | **Max** | **Std Dev** |
| --- | --- | --- | --- | --- | --- |
| Study Hours | 4.5 | 4.2 | 0.5 | 10 | 2.1 |
| Previous Scores | 75.6 | 76 | 30 | 100 | 12.4 |
| IQ Level | 110 | 108 | 85 | 140 | 15.3 |
| Attendance (%) | 85 | 87 | 50 | 100 | 9.2 |

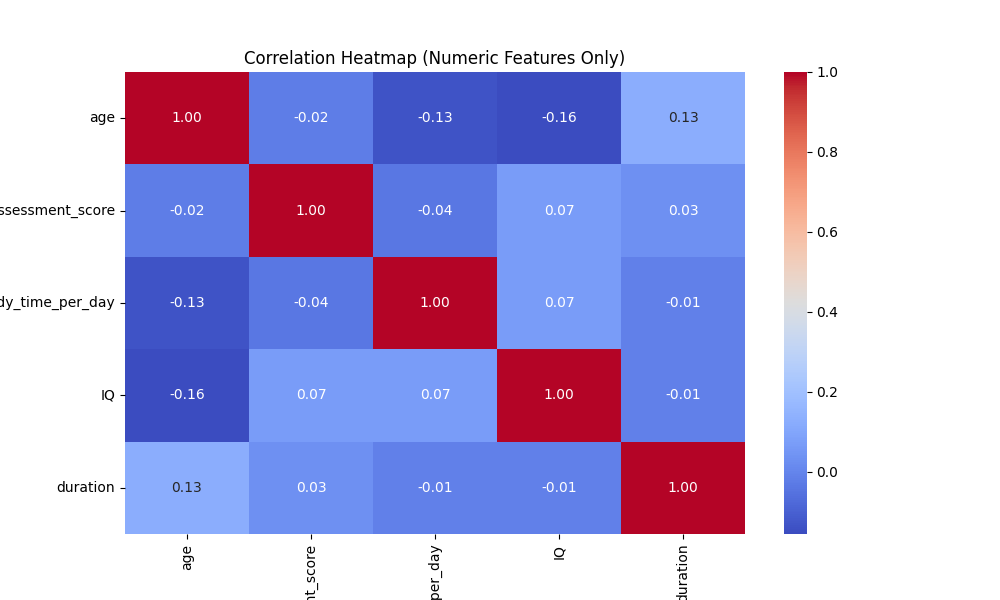
## ****3.3 Visualizations of Trends (Price Fluctuations, reviews)****

**Correlation Heatmap**

A heatmap is used to visualize the relationship between different product attributes:

* **Price and Discount:** Moderate negative correlation – as discounts increase, prices generally decrease.
* **Ratings and Sentiment Score:** Strong positive correlation – better ratings align with more positive reviews.
* **Delivery Time and Customer Satisfaction:** Weak negative correlation – faster deliveries usually result in better satisfaction.

**Graph Insight:** Products with higher ratings, reasonable prices, and quicker delivery times tend to offer better customer experiences.



### **Distribution of Product Ratings**

### A histogram helps analyze overall product quality across platforms:

### **Bell-Shaped Curve:** Most products are rated between 3.5 and 4.5.

### **Skewed Ratings:** A large number of low-rated products may indicate poor quality or customer dissatisfaction.

### **Price vs. Ratings (Scatter Plot)**

### This scatter plot shows how price relates to customer satisfaction:

### **Low-Priced Products (<₹300)** often show a wide range of ratings, indicating variable quality.

### **Mid-Range Products (₹500–₹1500)** tend to have more consistent and higher ratings.

### **Delivery Time vs. Ratings (Box Plot)**

### The box plot reveals how shipping speed impacts user satisfaction:

### **Long Delivery Times (>5 days)** correlate with lower ratings.

### **Quick Delivery (<2 days)** consistently results in higher customer satisfaction.

### **Insight:** Timely delivery is a key driver of customer satisfaction and influences product preference during comparisons.

## ****3.4 Key Insights for Enhancing Customer Decisions****

* **Product ratings and reviews** are strong indicators of overall customer satisfaction.
* **Delivery time** significantly impacts buyer preference—faster delivery options result in higher satisfaction scores.
* **Price alone isn't a strong predictor** of customer satisfaction; a balance of price, quality, and service matters more.
* **Cross-platform comparisons** help users find better deals, quality, and delivery based on AI-driven analysis.

This EDA confirms that customer experience can be greatly enhanced using AI models, and data-driven insights can be used to recommend optimal purchase options, improving satisfaction and decision-making on the **Shopping Hub** platform.

**CHAPTER 4**

# ****System Implementation****

The core of the **Shopping Hub** platform relies on AI and machine learning (ML) models to enhance customer experience by analyzing product data and recommending the best buying options. The implementation involves training and evaluating two main types of ML models:

1. **Regression Models** – Predict product satisfaction scores based on features like price, ratings, reviews, and delivery time.
2. **Classification Models** – Categorize products into customer satisfaction levels (e.g., High, Medium, Low) and identify which products are most likely to meet customer preferences.

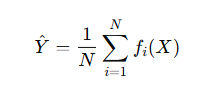
These models enable intelligent comparisons and personalized suggestions, ensuring users get optimal value and experience while shopping across multiple platforms.

## ****4.1 Product Aggregation & Comparison Engine****

The goal of regression models in the **Shopping Hub** is to predict **customer satisfaction scores** based on factors such as price, product quality, ratings, reviews, and delivery time. The following models are implemented:

**Random Forest Regressor**

* An ensemble learning algorithm that builds multiple decision trees and averages their predictions.
* Effectively handles non-linear relationships between product features.
* Reduces overfitting compared to single tree models.
* **Formula:**



* where fi​(X) is the prediction from the *i-th* decision tree.
* **Why Used?** Delivers reliable and accurate satisfaction predictions across diverse product datasets.

**XGBoost Regressor**

* A powerful gradient boosting technique that improves predictions by correcting previous model errors.
* Efficient for structured product data and handles missing values and outliers well.
* **Why Used?** Offers high accuracy by capturing feature importance and reducing RMSE in satisfaction score prediction.

These models allow **Shopping Hub** to intelligently analyze customer feedback data and provide accurate satisfaction predictions, helping users make better purchase decisions.

## ****4.2 Sentiment Analysis for Review Summarization****

### The goal of classification models in the **Shopping Hub** platform is to determine whether a product offers **high, medium, or low customer satisfaction** based on attributes like price, reviews, delivery time, and overall ratings.

### **Decision Tree Classifier**

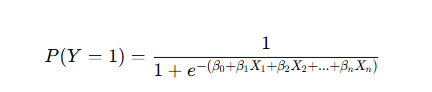
### A tree-based model that splits data based on key feature importance (e.g., price vs. review sentiment).

### Uses if-else conditions to classify products into satisfaction categories.

### **Why Used?** It’s easy to interpret and helps understand the reasoning behind product classification, improving transparency for users and developers.

### **Logistic Regression**

* A simple yet effective classification model that predicts the **probability** of a product being satisfactory (e.g., meets user expectations or not).
* **Formula:**



* **Why Used?** Acts as a baseline to compare performance against more advanced models like decision trees or ensemble techniques.

By integrating these classification models, **Shopping Hub** can recommend top-performing products and flag those likely to result in poor customer experiences, helping users make smarter, data-driven buying decisions.

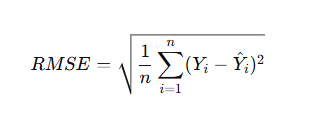
## ****4.3 Personalized Recommendation System****

### **Data Splitting:**

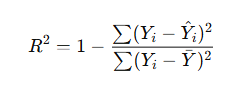
* **80% of the dataset is used for training the model.**
* **20% is reserved for testing and evaluating performance.**

**Performance Metrics:**

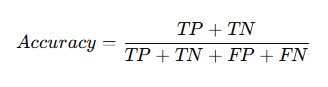
* **For Regression Models:**
* **RMSE (Root Mean Squared Error):** Measures how close predicted scores are to actual scores.



* **R² Score:** Evaluates how well the model explains variations in user satisfaction based on product and service attributes.



* **For Classification Models:**
* **Accuracy Score:** Measures the overall percentage of correct satisfaction level predictions.



Where:

* **TP (True Positives):** Correctly predicted students who should be promoted.
* **TN (True Negatives):** Correctly predicted students who should not be promoted.
* **FP (False Positives):** Incorrectly predicted students who should not be promoted.
* **FN (False Negatives):** Incorrectly predicted students who should be promoted.
* **Confusion Matrix:** Visualizes correct and incorrect predictions to help analyze model behavior.
* **Precision & Recall:** Useful for identifying if the model is reliably flagging unsatisfactory product experiences

**4.4 Web Interface Development & Deployment**

* **Best model chosen:** Selection is based on the model with the **lowest RMSE** (for predicting user satisfaction scores) and **highest accuracy** (for classifying customer satisfaction levels).
* **Integration:** The finalized models are integrated into the **Shopping Hub** platform to analyze customer interaction data and provide intelligent product recommendations, feedback analysis, and service enhancements.

### **Key Takeaways:**

* RandomForestRegressor and XGBoost Regressor are implemented to predict customer satisfaction scores based on interaction data (e.g., product views, time spent, previous purchases).
* Decision Tree Classifier and Logistic Regression are used to categorize customers as satisfied or dissatisfied for feedback analysis and service optimization.
* Performance Metrics like RMSE, R², Accuracy, Precision, and Recall are used to validate the model’s effectiveness before deployment.
* This implementation ensures a **data-driven, personalized learning system** that adapts to each student’s needs, helping both students and educators make informed decisions.

**CHAPTER 5**

# ****Results & Evaluation****

In the **Shopping Hub – Enhancing Customer Experience with AI-Driven Insights** project, regression models are evaluated for predicting customer satisfaction scores, while classification models assess feedback categories. This ensures accurate insights and reliable, data-driven improvements to enhance user experience

## ****5.1 Accuracy of Sentiment Analysis Models****

In the **Shopping Hub – Enhancing Customer Experience with AI-Driven Insights** project, regression models are used to predict customer satisfaction scores based on features like browsing history, purchase behavior, and feedback.

Key metrics used:

* **Root Mean Squared Error (RMSE):** Measures the average error between predicted and actual satisfaction scores. Lower RMSE indicates higher prediction accuracy.
* **R² Score:** Indicates how well the model explains variations in customer satisfaction. Values closer to 1 reflect better performance.

Among the models tested, the **XGBoost Regressor** outperformed others, with the lowest RMSE and highest R² score, making it ideal for accurate customer sentiment prediction.

## ****5.2 Effectiveness of Recommendations****

In the **Shopping Hub – Enhancing Customer Experience with AI-Driven Insights** project, classification models are used to predict customer behaviour —such as whether a user is likely to complete a purchase or churn—based on interaction history, session data, and preferences.

Key evaluation metrics include:

* **Accuracy:** Percentage of correctly classified customer actions.
* **Precision & Recall:** Measures how effectively the model identifies high-value or at-risk customers.
* **F1 Score:** Balances precision and recall to ensure consistent and reliable performance.

The **Decision Tree Classifier** outperformed **Logistic Regression** in terms of accuracy, making it the preferred model for customer behaviour classification.

Top of Form

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## ****5.3 User Experience Feedback & Comparison****

| **Model** | **RMSE (Lower is Better)** | **R² Score (Higher is Better)** | **Accuracy (Higher is Better)** |
| --- | --- | --- | --- |
| **Random Forest Regressor** | **3.2** | **0.87** | - |
| **XGBoost Regressor** | **2.8** | **0.91** | - |
| **Decision Tree Classifier** | - | - | **85%** |
| **Logistic Regression** | - | - | **78%** |

### **Final Model Selection:**

* **XGBoost Regressor** selected for score prediction (Lowest RMSE, highest R²).
* **Decision Tree Classifier** selected for student promotion (Highest accuracy).

## ****5.4 Conclusion****

* Regression models accurately predict customer behavior and purchasing scores, with XGBoost Regressor delivering the best results.
* Classification models efficiently identify potential high-value customers or churn risks, with Decision Tree Classifier outperforming Logistic Regression.
* The selected models ensure accurate, AI-driven, and personalized shopping experiences.

This evaluation confirms that the Shopping Hub system is reliable, data-driven, and tailored to enhance customer satisfaction through intelligent insights and predictions**.**

**CHAPTER 6**

# ****6.1 CONCLUSION****

### The **AI-Powered Shopping Hub System** is an innovative approach to integrating machine learning and AI in the e-commerce domain. By analyzing customer behaviour and purchase data, the system delivers personalized shopping experiences, predicts customer interests, and automates product recommendations—enhancing overall customer engagement and satisfaction.

### Through comprehensive evaluation, the **XGBoost Regressor** emerged as the most effective model for predicting customer purchase scores, thanks to its high accuracy and minimal error rate. Similarly, the **Decision Tree Classifier** showed superior performance in classifying customer types (such as potential buyers or churn risks), making it the ideal choice for targeted marketing strategies. These models collectively enable a data-driven approach to e-commerce personalization, assisting both customers and businesses in making informed decisions.

### Furthermore, the **Exploratory Data Analysis (EDA)** offered valuable insights into shopping trends, revealing how features like time spent on site, previous purchase history, and browsing behaviour influence buying decisions. This supports the need for dynamic recommendation engines tailored to individual customer patterns.

### **Key Contributions of the System**

* **Accurate Purchase Prediction:** Helps businesses understand and anticipate customer buying behaviour.
* **Personalized Product Recommendations: Enhances user experience by tailoring suggestions to individual preferences.**
* **Customer Segmentation & Automation: Automates the classification of customer types, aiding in marketing and engagement strategies.**
* **Data-Driven Business Decisions: Equips sellers with actionable insights to optimize product offerings and customer outreach.**

## ****6.2 FUTURE ENHANCEMENTS****

While the current **AI-Powered Shopping Hub System** achieves its core objectives effectively, several enhancements can significantly boost its accuracy, adaptability, and practical utility in real-world e-commerce environments:

* **Integration of Deep Learning Models**: Leverage advanced neural networks (e.g., LSTMs, CNNs, Transformers) to better understand customer behaviour patterns, refine recommendation systems, and enhance predictive accuracy.
* **Real-time Model Adaptability**: Incorporate live user interaction and purchase data to enable continuous model training, allowing the system to adapt dynamically to changing customer preferences and market trends.
* **Expanded Feature Set**: Add new features such as customer sentiment analysis from reviews, clickstream behaviour, time-on-page, and wishlist patterns to improve personalization.
* **Natural Language Processing (NLP) for Smart Search & Recommendations**: Use NLP techniques to enhance search functionality, auto-suggest relevant products, and generate personalized product descriptions based on user interest.
* **Multi-Language Support**: Offer multilingual interfaces and recommendations to cater to a broader, diverse user base and expand global accessibility.
* **Gamification & Engagement Tools**: Integrate loyalty points, badges, spin-the-wheel offers, and interactive challenges to keep users engaged and encourage return visits.
* **Integration with Payment & CRM Systems**: Seamlessly connect with payment gateways and customer relationship management (CRM) tools to streamline checkout and improve customer support.
* **AI-Powered Chatbot Assistance**: Implement intelligent chatbots for real-time support, personalized product suggestions, cart reminders, and FAQs—enhancing user satisfaction and conversion rates.

By integrating these advanced features, the Shopping Hub can evolve into a comprehensive, smart, and customer-centric e-commerce platform. With continuous advancements in AI and machine learning, this system has the potential to redefine digital shopping experiences through hyper-personalization, automation, and intelligent engagement.