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AI-POWERED E-COMMERCE INTELLIGENCE TOOL

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ABSTRACT
The AI-Powered E-Commerce Intelligence Tool is a web-based application designed to help buyers and sellers analyse competitor prices, discounts, and promotional strategies more efficiently. In today's fast-growing e-commerce environment, manually comparing products across multiple platforms is time-consuming and often inaccurate. To solve this problem, the system uses web scraping techniques to automatically collect competitor pricing and discount data whenever requested by the user.
The tool also includes an AI-powered analytics module that analyses market trends and customer sentiment to generate valuable business insights. These insights help sellers make better decisions regarding pricing, discounts, and promotional planning, while buyers can easily compare products and identify better deals across different e-commerce platforms.
The system is implemented using Selenium for data extraction, ARIMA for time-series forecasting, and transformer-based NLP models for sentiment analysis. The analysed data and insights are presented through an interactive Streamlit dashboard for easier visualization and decision-making. Overall, the project improves competitive analysis, market awareness, and pricing optimization in dynamic online marketplaces.

Keywords:
E-Commerce Analytics, Artificial Intelligence, Web Scraping, Competitor Analysis, Price Forecasting, Sentiment Analysis, Natural Language Processing (NLP), ARIMA, BERT, Large Language Model (LLM), Streamlit, Selenium, Data Visualization, Pricing Strategy, Market Intelligence.

INTRODUCTION
The e-commerce industry has grown rapidly with the increase in internet usage, digital payments, and online shopping platforms such as Amazon and Flipkart. As competition among sellers increases, tracking competitor prices, discounts, customer feedback, and promotional strategies has become essential for effective business decisions. Buyers also compare products across multiple platforms to identify better deals and reliable products. However, manual comparison and analysis are time-consuming, inefficient, and often inaccurate.
To overcome these challenges, the proposed **AI-Powered E-Commerce Intelligence Tool** provides an automated platform for competitor analysis and market intelligence. The system uses Selenium-based web scraping to collect product prices, discounts, ratings, and customer reviews from multiple e-commerce platforms. The collected data is analysed using AI and data analytics techniques to generate meaningful insights and evaluate competitor strategies.
The system applies ARIMA for forecasting future discount trends and transformer-based NLP models such as BERT for sentiment analysis of customer reviews. It also generates pricing and promotional recommendations using AI-driven analytics. All outputs are presented through an interactive Streamlit dashboard with graphs, charts, and comparative insights for easier decision-making.
The proposed system helps sellers improve pricing strategies and market competitiveness while enabling buyers to identify better products and discounts efficiently. It reduces manual effort, improves accuracy, and supports faster data-driven decision-making in the dynamic e-commerce environment. Future enhancements may include real-time monitoring, automated alerts, and integration with additional e-commerce platforms.

OBJECTIVES
The primary objective of the **AI-Powered E-Commerce Intelligence Tool** is to develop an intelligent and automated platform for competitor analysis in e-commerce marketplaces. The project aims to assist both sellers

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and buyers by providing data-driven insights into pricing trends, discount behaviour, and customer sentiment. The specific objectives of the project are:

- To develop a web-based system that extracts competitor prices and discount details through automated web scraping.
- To preprocess and organise collected data for efficient storage, analysis, and historical tracking.
- To forecast future discount trends using ARIMA-based time-series analysis for proactive pricing decisions.
- To analyse customer reviews using transformer-based Natural Language Processing models for sentiment classification.
- To evaluate competitor pricing and discount patterns for comparative market analysis and to generate pricing and strategic recommendations using a Large Language Model based on market trends and sentiment insights.
- To provide an interactive dashboard for visualizing forecasts, trends, sentiment analysis, and recommendations.
- To reduce manual effort and improve the accuracy of competitor monitoring and pricing strategy formulation.

METHODOLOGY

The proposed AI-Powered E-Commerce Intelligence Tool follows a systematic workflow to automate competitor analysis and generate intelligent insights for e-commerce decision-making. The methodology includes multiple stages such as data collection, preprocessing, analysis, forecasting, recommendation generation, and visualization of results.

1. **Product Selection and User Input:** The methodology begins with the product selection stage, where the user enters a product name or query through the dashboard interface. The system accepts user input and initiates the competitor analysis process based on the selected product.
2. **Data Collection:** In this stage, Selenium-based web scraping techniques are used to collect competitor product details such as prices, discounts, ratings, and customer reviews from e-commerce platforms like Amazon and Flipkart. The automated scraping process ensures real-time and accurate data collection without manual effort.
3. **Data Preprocessing:** The collected raw data is processed using Python libraries such as Pandas and NumPy. This stage includes cleaning the data, removing duplicate records, handling missing values, and organizing the extracted information into a structured format suitable for further analysis.
4. **Data Analysis:** The processed data is analysed to perform competitor price comparison, trend analysis, and sentiment analysis. Historical pricing and discount data are analysed using the ARIMA forecasting model to predict future discount trends. At the same time, customer reviews are analysed using transformer-based NLP models such as BERT to determine customer sentiment and product perception.
5. **AI-Based Insights and Recommendations:** The analysed results are further processed using a Large Language Model (LLM) integrated through the Groq API. Based on competitor pricing, forecasted trends, and customer sentiment, the system generates intelligent pricing strategies, promotional suggestions, and business recommendations.
6. **Output Visualization and Dashboard:** Finally, all outputs including price comparisons, forecast graphs, sentiment analysis results, and AI-generated recommendations are displayed through an interactive Streamlit dashboard. The dashboard presents results using charts, graphs, and visual insights to support effective decision-making for buyers and sellers.

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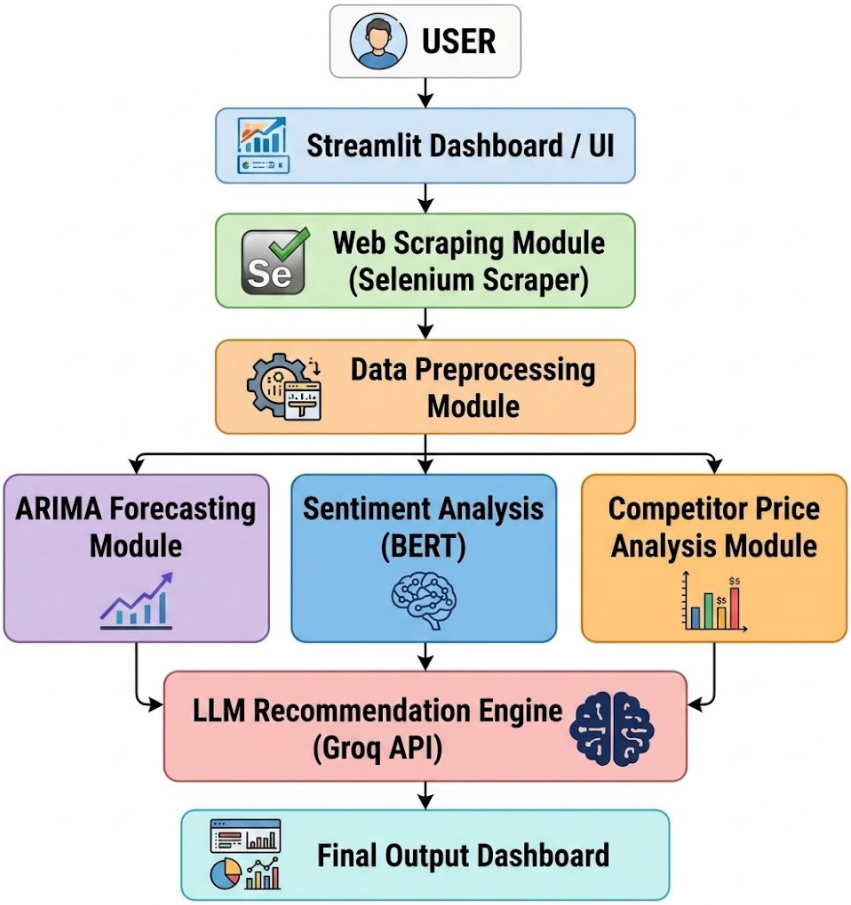

Figure 1 Overall System Architecture Diagram of the Project

RESULTS AND DISCUSSION

The proposed AI-Powered E-Commerce Intelligence Tool was successfully implemented and tested using product data collected from e-commerce platforms such as Amazon and Flipkart. The system effectively performed competitor price comparison, discount forecasting, sentiment analysis, and AI-based recommendation generation. The results demonstrate that the system can provide meaningful insights and support informed decision-making for both buyers and sellers.

The Selenium-based web scraping module successfully extracted product details such as prices, discounts, ratings, and customer reviews from multiple e-commerce websites. The collected data was processed and displayed through the interactive dashboard in both tabular and graphical formats, allowing users to compare competitor products and identify better pricing opportunities.

The ARIMA forecasting model analysed historical pricing and discount trends and generated short-term predictions of future discounts. These forecast results helped in understanding market behaviour and supported proactive pricing and promotional planning. In addition, customer reviews were analysed using transformer-based NLP models such as BERT, which effectively classified sentiments and provided insights into customer satisfaction and product perception.

The Large Language Model (LLM) integrated through the Groq API generated intelligent pricing strategies and recommendation insights based on competitor analysis, forecasting outputs, and sentiment results. All analytical outputs including price comparisons, forecast graphs, sentiment charts, and AI-generated recommendations were visualized through an interactive Streamlit dashboard. Overall, the results indicate that the proposed system reduces manual effort, improves market awareness, and supports efficient data-driven decision-making in the e-commerce environment.

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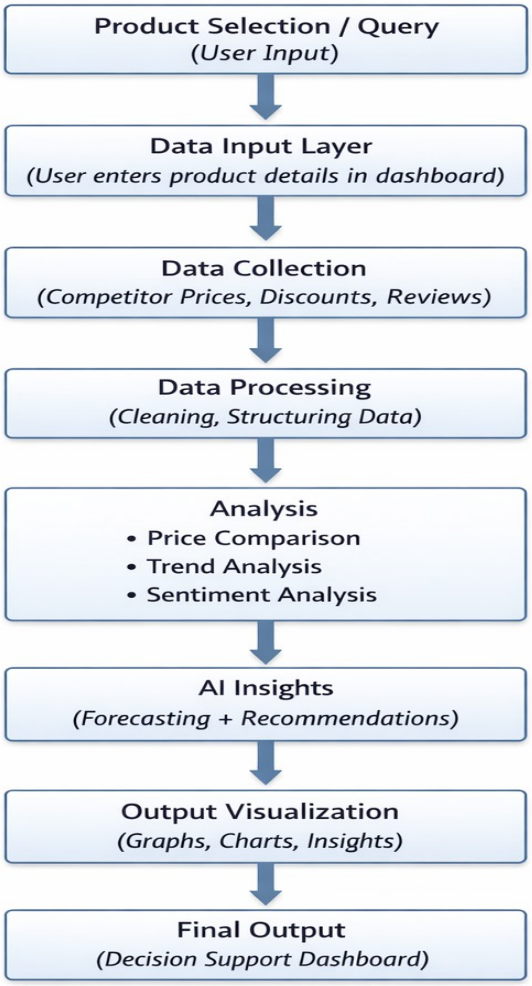

Figure 2 Workflow of the Project

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CONCLUSION

The proposed AI-Powered E-Commerce Intelligence Tool successfully provides an intelligent and automated solution for competitor analysis in the e-commerce domain. The system integrates web scraping, forecasting, sentiment analysis, and AI-driven recommendation generation into a unified platform that supports effective decision-making for both buyers and sellers.

The Selenium-based web scraping module efficiently collects competitor prices, discounts, and customer reviews from multiple e-commerce platforms, reducing the need for manual comparison. The ARIMA forecasting model helps predict future discount trends, while transformer-based NLP models such as BERT analyse customer sentiment to provide insights into product perception and customer satisfaction. In addition, the integration of a Large Language Model (LLM) enables the generation of intelligent pricing strategies and promotional recommendations.

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The analysed results are visualized through an interactive Streamlit dashboard that presents price comparisons, forecast graphs, sentiment analysis, and AI-generated insights in a user-friendly format. Overall, the proposed system improves market awareness, supports pricing optimization, reduces manual effort, and enables efficient data-driven decision-making in dynamic e-commerce marketplaces. The project also provides a strong foundation for future enhancements such as real-time monitoring, automated alerts, and integration with additional e-commerce platforms.

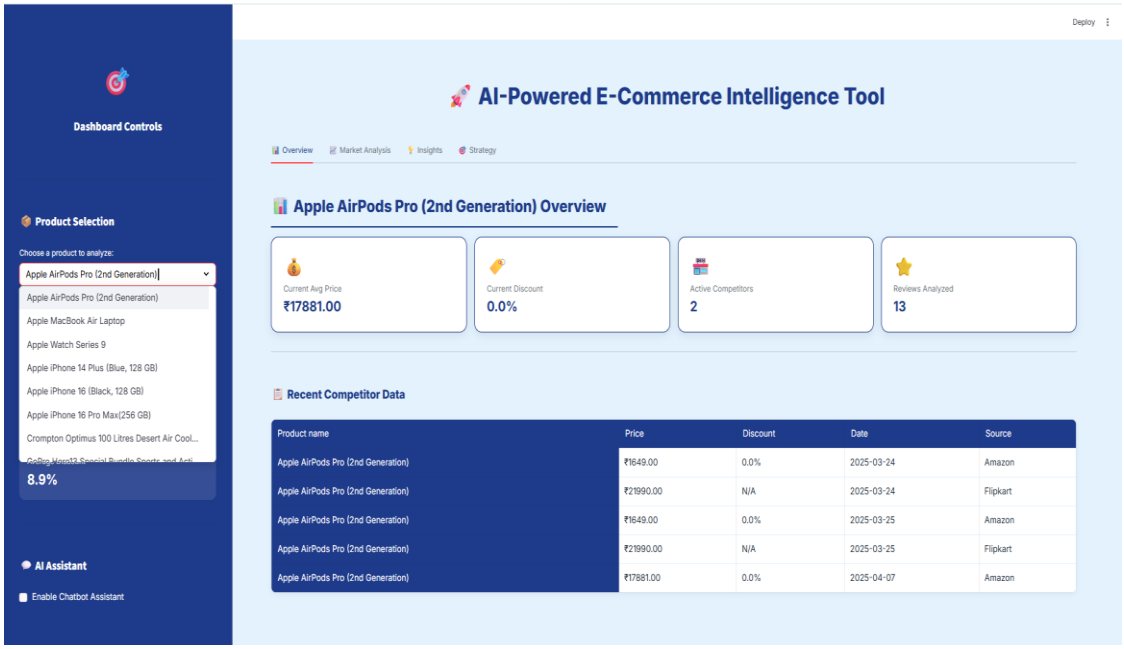

Figure 3 User Interface of the Project

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