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Abstract

The sneaker resale market has expanded to a multi-billion-dollar business with hype, rarity, social media trends, and cultural demand being definitive factors that generate the buzz around this phenomenon. Nevertheless, sneaker collectors and resellers are not able to make any informed decisions due to the high-rate turnover and lack of unified data sources. The proposed project will develop a web-based analytics and prediction algorithm that will allow users observe the historical prices, popularity tendencies, and get AI-based predictions of the sneaker resale values in the future.

It will combine StockX and eBay data through which users will be able to search sneakers, visualize their historic trend, and monitor the market buzz. The Python models of machine learning will have predicted future values. Web interface will be developed with MERN and enable users to make accounts, add favorites, and get dashboards.

Agile Scrum approach will be applied in the development of the project over a period of 5 months. The end system will equip the collectors and resellers with a data-driven and dependable means of making decisions and making it through the ever-changing sneaker market.

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1. Introduction

1.1. Introduction to Topic

The culture of sneaker is one of the biggest trends in the world. Athlete partnerships, rare releases and hype on the brand have turned sneakers into an investment item. Stock market-like marketplace: According to platforms such as StockX and eBay, a type of marketplace has been possible in which prices increase and decrease as per the real-time demand.

Nevertheless, it is hard to forecast sneaker resold value as it is sensitive to:

- scarcity and restocks
- influence by the side of a celebrity or an influencer.
- cultural trends
- social media hype
- collector demand

The old ones present previous prices but fail to deliver projections. Thus, collectors and resellers tend to use their intuition and not facts.

1.2. Problem Scenario

The sneaker resale business encounters a number of issues:

Price volatility: it is highly volatile, and the values fluctuate randomly following a drop, restock and viral moment.

None of the prediction charts: StockX, eBay, and GOAT reveal the past, but not the future.

Scattered data: trend messages are received on Instagram, Twitter, Google Trends, Reddit, and so on.

Delays in research: users spend time doing comparisons of platforms.

Making wrong choices: bad decision making that causes people to acquire shoes that eventually depreciate.

All these complicate how sneaker lovers can know when to make a lucrative purchase and when to lose money.

1.3. The Project as a Solution

The current project will suggest a Sneaker Price Prediction Platform, a combination of machine learning, real-time data, and trend analytics that would provide users with:

- Past and most recent price records.

The platform will show historical price changes from multiple marketplaces like stockx and eBay. This help user to understand long-term pattern.

- Artificial intelligence forecasting.

A major component of the platform is its machine learning-based price prediction model. Using historical data, market indicators, brand popularity, rarity, and release dates, the system will train various ML algorithms such as Linear Regression, Random Forest, or LSTM networks.

- Popularity trends

Sneaker popularity changes rapidly, influenced by social media hype, celebrity endorsements, limited releases, and community demand. The platform will track these signals using metrics such as search frequency, number of users monitoring a shoe, marketplace activity, and trending hashtags.

- Interactive dashboards

To ensure a seamless user experience, the platform will include interactive dashboards created using modern front-end frameworks and visualization libraries. These dashboards will present data in a clear and engaging manner through charts, graphs, tables, and heatmaps.

- Sneaker search.

The sneaker search feature enables users to quickly find information about any sneaker model by entering keywords, model numbers, or brand names. The system will return detailed results including pricing history, prediction graphs, popularity indicators, and related sneakers.

- User authentication with two factor authentication

The platform includes a robust authentication system integrated with two-factor authentication. Users must verify their identity not only with a password but also through a secondary method such as an email or mobile OTP code.

2. Aim and Objectives

2.1. Aim

To create and build a complete web application predicting sneaker resale prices with the help of machine learning and offering its users searchable sneaker data, historical charts, and market trends.

2.2. Objectives

The objectives behind developing this product are as follows:

- Develop a secure authentication and user management system.
- Integrate sneaker data from Stockx, eBay and datasets.
- Build a sneaker search engine with brand and model filtering.
- Create a data pipeline for collecting and storing historical sneaker prices.
- Train machine-learning models (Regression/Time-Series) to forecast prices.
- Visualize predictions and price history on an interactive dashboard.
- Allow users to save favorites and search history.

3. Expected Outcomes and Deliverables

At the end of the project, the following outcomes and deliverables are expected:

3.1. User and Profile Management:

1. User Authentication & Account Module

Registration & login

JWT-based secure authentication

User profile

Saved favorites & search history

2. Sneaker Search Module

Search by brand/model/name

Sneaker details (release date, retail price, images, colorway)

Filtering & sorting options

3. Machine Learning Prediction Module

Data cleaning & feature engineering

Trained ML models (Random Forest, Linear Regression, Prophet, etc.)

Prediction API endpoint

Confidence scores and future price projections

4. Historical Price Visualization

Time-series charts (daily/weekly/monthly)

Price comparison across platforms

Trend change indicators

5. Trend Analytics

Social media hype scoring model (optional)

Trend dashboard visualization

6. Real-Time Market Data

StockX/eBay price updates

Scheduled data refresh

7. Dashboard

Predictions

Trends

Charts

User saved items

3.2. Technical Documentation:

- SRS documentation
- ER diagram
- System architecture diagram
- ML model documentation
- API documentation

3.3. Testing Reports:

- Backend API test results
- ML model evaluation (RMSE, MAPE, R²)
- UI/UX usability testing

4. Project Risks, Threats and Contingency Plans

Table 1 Project Risks, Threat and Contingency Plans

Risk Type	Risk Description	Severity	Mitigation Plan
Development	Limited historical data	High	Build custom dataset; collect weekly data manually
Technical	API restrictions or blocking	High	Use backup scraping + cached datasets
Maintenance and Scalability	Deployment issues	Moderate	Use Docker/Vercel/Render for smooth hosting

External	Social media data complexity	Low	Make it optional or lightweight
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5. Methodology

This project will follow Agile Scrum methodology because the system involves iterative development, machine-learning experimentation, and evolving requirements.

Scrum Structure

- Sprint Length: 2 weeks
- Sprint Activities: Planning to Development to Testing to Review
- Total Sprints: 10 over 5 months

Why Scrum Works Here

- ML requires experimentation & frequent improvements
- Data collection evolves over time
- Incremental features like dashboards, search, and trends
- Reduces risk of last-minute failures

6. Resources Requirements

6.1 Hardware

Laptop with 8–16 GB RAM

RTX 4070 Graphics card

6.2 Software

Frontend: React.js, Next.js

Backend: Node.js, Express.js

Database: PostgreSQL

Machine Learning: Python (pandas, scikit-learn, Prophet, NumPy)

Dev Tools: GitHub, Postman, Docker

APIs: StockX, eBay

7. Work breakdown structure

One of the productivity strategies that are being applied to make the work manageable and approachable is breaking the work into smaller segments. In the case of projects, the tool that employs this technique and is among the most valuable project management documents is the Work Breakdown Structure (WBS). It also combines scope, cost and schedule bases at the same time such that the project plans are aligned. (workbreakdownstructure.com, 2025)

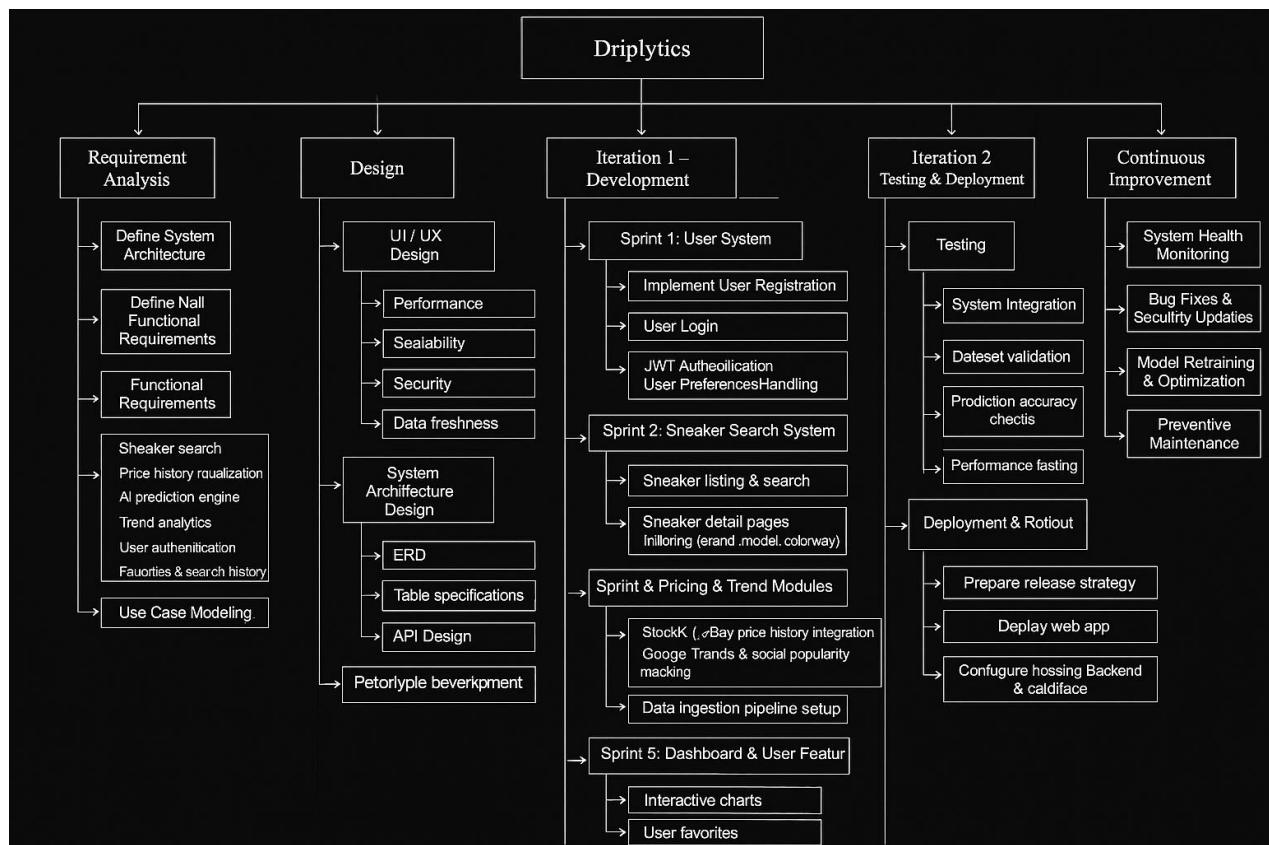


Figure 1 Work Breakdown Structure

8. Milestones Chart

A milestone is an important point or achievement within a project, such as completing a deliverable, moving to a new phase, or accomplishing a key task. These milestones help track progress, measure success, and align expectations between clients and team members. Identifying and agreeing on them at the start of a project ensures that everyone clearly understands the project's direction, reducing the risk of misunderstandings, changes, or revisions later on. Milestones also help establish project timelines by indicating when major goals or outputs should be completed. Examples include design approval, completion of requirements gathering, delivery of a prototype, completion of a testing phase, or completion of user acceptance testing. Overall, milestones act as checkpoints that confirm that a project is progressing as planned while motivating the team by showing visible achievements. (Niftypm, 2020)

Table 2 Milestone Chart

Milestone Code	Milestone Description
M1	Proposal Completion
M2	Architecture + Requirements
M3	Data Collection Pipeline
M4	Machine Learning Model
M5	Backend API

M6	Frontend Implementation
M7	Dashboard + Trends
M8	System Integration
M9	Testing
M10	Final Report & Submission

9. Project Gantt chart

Gantt chart is project management tool that helps in project planning and scheduling of projects of all sizes; they would help in visualizing projects. A Gantt chart can be said to be a graphical depiction of time-activity; this assists the project professionals to track progress.

Scheduling tools Gantt charts are simply the scheduling tools of projects: the tasks and project management bars are translated into horizontal bars (also known as Gantt bars) to create a bar chart. These Gantt bars include start and end dates, dependencies, scheduling and deadlines, percentage of the task done, per stage and the task owner. The Gantt charts indicate scheduled activity over the time depth; these charts are commonly employed across projects, programme and portfolios, having identified tasks which have been determined with the help of a work breakdown structure.

When there is a high number of stakeholders and a large number of people, a timeline, such as Gantt chart comes in handy to ensure things are done in time. They provide an effective time keeping and progress report tool - one can also use Gantt charts to seek the longest path between project start and project completion that is also called the critical path. (Association For the Project Management, 2018)



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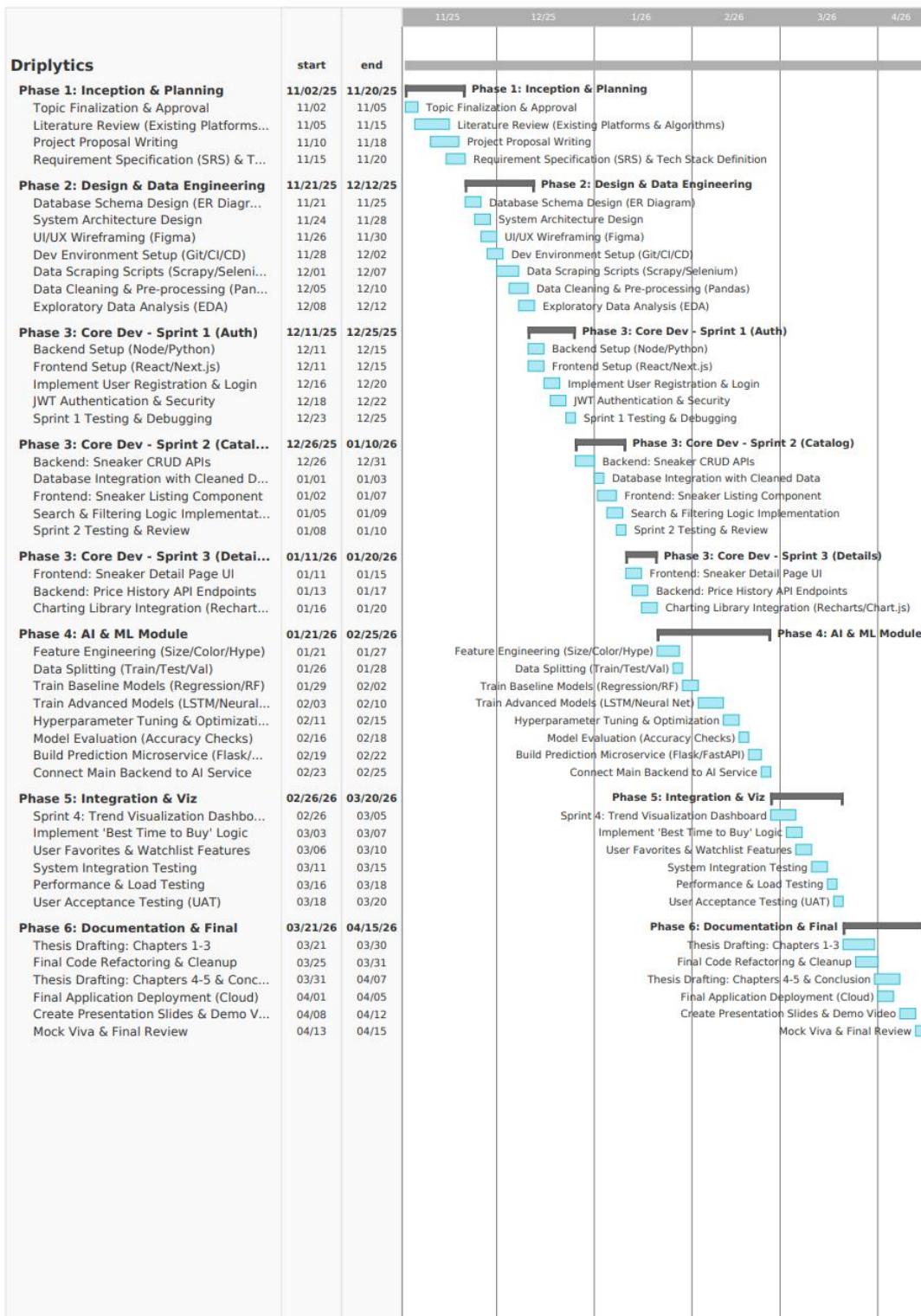


Figure 2 Gantt Chart

10. Conclusion

The current project will be full-scale web-based sneaker analytics that will utilize machine learning to forecast the prices in the resale market. The platform is able to arrange historical information, trend analysis, and AI-grounded predictions together, which withstands the insight of sneaker collectors that cannot be found in the current marketplaces.

The system will be functional, scalable, and academic with the help of the MERN stack and Python ML. The project will provide a complete predictive analytics tool within 5 months that will show the ability to work with full-stack development, machine learning, data engineering, and design of user interfaces.

11. References

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Appendix

Software Requirements Specification (SRS)

1. Introduction

1.1 Purpose

The purpose of this project is to build a web-based platform that predicts sneaker resale prices using AI and real-time data from sneaker marketplaces such as StockX and eBay. The system will help collectors, resellers, and enthusiasts make informed buying and selling decisions.

1.2 Scope

The system will allow users to:

Search sneakers by brand, name, or model.

View historical and current resale prices.

Analyze popularity trends via Google and social media data.

Predict future resale prices using AI models.

Visualize data through interactive charts and dashboards.

Create user accounts to save favorites and view history.

This system combines AI prediction, data analytics, and user interactivity into a single web application.

1.3 Objectives

Provide accurate sneaker price predictions.

Offer interactive data visualization.

Centralize sneaker data from multiple sources.

Assist users in making smart investment decisions in the sneaker resale market.

2. Overall Description

2.1 Product Perspective

The project is a standalone web application. It interacts with external APIs such as StockX, eBay, and Google Trends to fetch live data. It uses a machine learning model for predicting future prices and displays insights on an interactive dashboard.

Architecture:

Frontend: React.js

Backend: Node.js + Express.js

- Database: MongoDB
- ML Model: Python (Flask API or TensorFlow-based prediction service)

2.2 Product Features

User Authentication: Secure login/registration system.

Sneaker Search: Search by name, model, or brand.

Price Prediction: Predict future sneaker resale value using historical trends.

Data Visualization: Interactive charts showing price fluctuations.

Trend Analytics: Monitor sneaker popularity trends.

User Dashboard: Save favorites, view history, and personal insights.

Real-Time Data Integration: Fetch updated sneaker data from marketplaces.

2.3 User Characteristics

Sneaker Collectors: Track and compare sneaker values.

Resellers: Predict profitable sneaker flips.

General Users: Explore market trends and sneaker data.

2.4 Constraints

API rate limits and possible access restrictions.

Time required for model training and data cleaning.

Real-time data dependency on third-party APIs.

2.5 Assumptions and Dependencies

Users have internet access.

APIs like StockX or eBay are accessible during runtime.

Datasets will be pre-cleaned before training.

Functional Requirements

Req ID	Description
FR01	User shall register and log in securely.
FR02	User shall search sneakers by name, brand, or model.
FR03	System shall fetch live sneaker data from StockX and eBay APIs.
FR04	System shall store sneaker data in MongoDB.
FR05	System shall predict sneaker resale prices using a trained ML model.
FR06	System shall visualize data trends and predictions using interactive charts.
FR07	User shall be able to save favorites and view search history.
FR08	Admin shall manage users and maintain datasets.

Non-Functional Requirements

Req ID	Description
Performance	The system should return search results within 3 seconds.
Security	Passwords must be encrypted using bcrypt or JWT.
Availability	System should have 99% uptime.
Usability	UI should be responsive and mobile-friendly.
Scalability	Should handle at least 1000 concurrent users.

3.3 External Interface Requirements

User Interface: Modern, clean dashboard UI with charts and filters.

API Interfaces: Integration with StockX, eBay, and Google Trends.

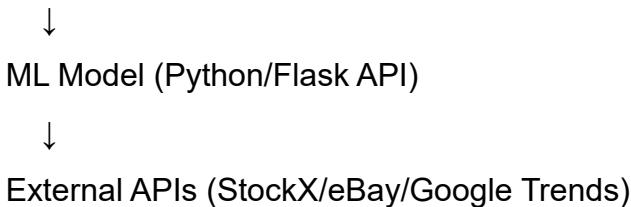
Hardware Interfaces: Works on standard desktops and laptops.

Software Interfaces: Web browsers (Chrome, Edge, Firefox).

4. System Design

4.1 Proposed Architecture Diagram

Frontend (React) → Backend (Node/Express) → Database (MongoDB)



5. Future Enhancements (if possible)

- Add payment integration for sneaker trading.
- Include mobile app version.
- Expand to clothing and accessories market.
- Add notification system for price drops or new releases.

6. Appendix

Tools & Technologies:

- Frontend: React.js, Tailwind CSS
- Backend: Node.js, Express.js
- Database: MongoDB
- ML Model: Python, Scikit-learn
- Visualization: Chart.js / Plotly
- Deployment: Vercel / Render / AWS