📘 Sales Forecasting System – Project Manual

💻 Project Overview

The *Sales Forecasting System* aims to predict product sales based on store and item codes using machine learning and provide real-time recommendations to support inventory and discount strategies.

🛠️ Technologies Used

Frontend:

- HTML5
- CSS3
- JavaScript

Backend:

- Java (Servlets)
- Apache Tomcat

Database:

- MySQL

ML Libraries (via Java ML Integration):

- Weka or custom Java-based model

🔎 Introduction to Java

✨ History of Java

Java is a high-level, object-oriented programming language that was originally developed by **James Gosling** and his team at **Sun Microsystems**. The project initially began in **1991** as a part of a research initiative called *"Green Project"*. Its primary aim was to develop software for consumer electronics like set-top boxes and televisions.

Java was officially released in **1995** with the slogan **"Write Once, Run Anywhere" (WORA)**, which signifies its key strength—**platform independence**. In 2010, Sun Microsystems was acquired by **Oracle Corporation**, which has since been the official steward of Java.

Over the years, Java has evolved from a basic programming language into a robust and versatile ecosystem. Today, it powers not only desktop applications but also large-scale enterprise systems, mobile apps, and even embedded devices.

💡 Real-time Applications of Java

Java's versatility makes it one of the most widely-used programming languages in the world. Some key real-world applications include:

💼 Enterprise Applications

Java is extensively used in **banking, finance, e-commerce**, and **CRM software** development. Its robust frameworks like **Spring** and **Hibernate** make it the go-to choice for building secure and scalable enterprise-level solutions.

📱 Android Applications

Java was the primary language used for developing Android applications before Kotlin gained popularity. Most Android apps still use Java libraries or are hybrid applications that incorporate Java in the backend.

🌐 Web Applications

With the help of **JSP (JavaServer Pages)**, **Servlets**, and **Spring Boot**, Java is a solid choice for building dynamic web apps and RESTful APIs.

🧪 Scientific and Research Applications

Java's portability, performance, and support for multithreading make it suitable for simulations, scientific calculations, and natural language processing applications.

⚙️ Embedded Systems and IoT

Due to its low memory footprint and stability, Java is widely used in embedded systems, smart cards, and IoT devices.

✅ Advantages of Java

Java stands out due to the following significant advantages:

- **Platform Independent**: Java programs are compiled into bytecode, which runs on the Java Virtual Machine (JVM) and can be executed on any operating system without modification.
- **Object-Oriented**: It follows core OOP principles like encapsulation, inheritance, polymorphism, and abstraction, which make code reusable and scalable.
- **Secure**: Java provides a secure runtime environment with features like bytecode verification, sandboxing, and cryptographic libraries.
- **Multithreaded**: Java supports multithreading, allowing developers to write programs that perform several tasks simultaneously, increasing performance.
- **Rich Standard Library**: Java provides an extensive collection of APIs and libraries for tasks ranging from networking to GUI development.
- **Strong Community Support**: Java has been around for decades and has a vast developer community, tons of libraries, frameworks, and documentation available.

⚠️ Disadvantages of Java

Despite its strengths, Java has certain limitations:

- **Performance Overhead**: Java applications tend to be slower compared to programs written in compiled languages like C or C++ because of the abstraction layer (JVM).
- **Verbose Syntax**: Writing code in Java often requires more boilerplate code, making development slightly more time-consuming.
- **UI Development Complexity**: While Java provides **Swing** and **JavaFX** for building user interfaces, these tools are considered less modern and flexible compared to frameworks like React, Flutter, or native Swift/Android UI toolkits.
- **Memory Consumption**: The JVM consumes more memory, which may be a concern in low-resource environments.

📈 Project Details

🏷️ Project Title

Sales Forecasting System: A Real-Time Intelligent Dashboard for Business Insights

🎯 Objective

The primary objective of this project is to develop a **Sales Forecasting System** that leverages real-time data to:

- **Predict sales volume** for specific store-item combinations.
- **Recommend business actions**, such as optimal stock levels or promotional strategies.
- Provide a **user-friendly interface** for interacting with predictions and viewing actionable insights.
- Enable businesses to make **data-driven decisions** to improve profitability, reduce overstock or understock situations, and plan logistics efficiently.

🛠️ Tools & Technologies Used

Category	Tools/Technologies
Frontend	HTML, CSS, JavaScript
Backend	Java (JDK 21), REST APIs
Machine Learning	Custom Java implementation using Regression
Database	MySQL
IDE	IntelliJ IDEA
Other Tools	Notion, Canva, Postman

🗂️ Features of the System

- 🔍 **Sales Prediction**: Predict future sales for selected items using historical patterns.
- 📊 **Real-Time Dashboard**: Live UI that displays predictions instantly.
- 🧠 **Recommendation Engine**: Suggests actions like discount offers or reordering items.
- 📁 **Data Upload & Processing**: Upload CSV data files to train or test the model.
- 🔐 **Login System (Optional)**: Ensures secure access to dashboard functionalities.

🧱 Architecture Overview

The system is designed with **three main layers**:

1. **Presentation Layer**
   - User interface developed using HTML, CSS, and JavaScript.
   - Responsive UI with an interactive prediction form and dynamic display.
2. **Business Logic Layer (Backend)**
   - Built in Java, handling data input, model prediction logic, and API communication.
   - Uses RESTful services for frontend-backend interaction.
3. **Data Layer (Database & Model)**
   - MySQL database stores historical sales data, item-store mapping.
   - Custom Java regression model to compute predictions based on trained datasets.

📁 Input & Output

Type	Description
Input	Store Code, Item Code
Process	ML-based prediction using trained model

Output	Estimated Sales Volume and Recommended Action

Example Output:

> Estimated Sales: 57 units

🌐 Real-World Impact

By predicting demand accurately, this system can help:

- Optimize **inventory management**.
- Enhance **supply chain efficiency**.
- Reduce **losses from overstocking or understocking**.
- Improve **customer satisfaction** with timely availability of products.

🔧 Software Requirements

Component	Description
OS	Windows/Linux
Editor	IntelliJ IDEA
Backend	Java 17
Server	Apache Tomcat 9
Database	MySQL 8.0
Browser	Chrome, Firefox

🚀 Hardware Requirements

Component	Specification
Processor	Intel i5 or above
RAM	8GB or more
Hard Disk	256GB SSD

🔍 Modules

1. 🖥️ User Interface (Frontend)

- Built using **HTML, CSS, and JavaScript**
- Clean and responsive UI for seamless interaction
- Sidebar navigation for easy access to Dashboard, Upload, Predictions, Reports, and Logout
- Dynamic display for prediction results and data tables

2. 📊 Sales Prediction Logic

- Implemented using **Java** (without Spring Boot)
- Predicts future sales based on historical data
- Accepts Store Code and Item Code as input
- Utilizes a machine learning model (implemented in Java) trained on preprocessed data
- Handles edge cases and ensures accuracy in predictions

3. 🎯 Recommendation Engine

- Analyzes predicted sales and suggests:
  - Optimal stock levels
  - Discount strategies
  - Restocking schedules
- Helps businesses make data-driven decisions to boost sales and minimize losses

4. 📝 Report Generation

- Generates visual and textual reports based on sales trends and predictions
- Uses **Chart.js** for plotting prediction graphs

- Can export and display recent predictions for business analysis
- Modular design allows addition of custom reports in future

5. 🗃️ Database Integration

- Uses **MySQL** for data storage and management
- Stores product details, historical sales data, and prediction logs
- Ensures data consistency and supports real-time data access
- Connected through standard JDBC configuration in Java

6. 🧠 Data Handling & File Processing

- Accepts CSV file uploads for training and testing
- Preprocessing includes handling missing values, duplicates, and outliers
- Generates sample data using custom scripts
- Ensures files are clean, structured, and ready for model training

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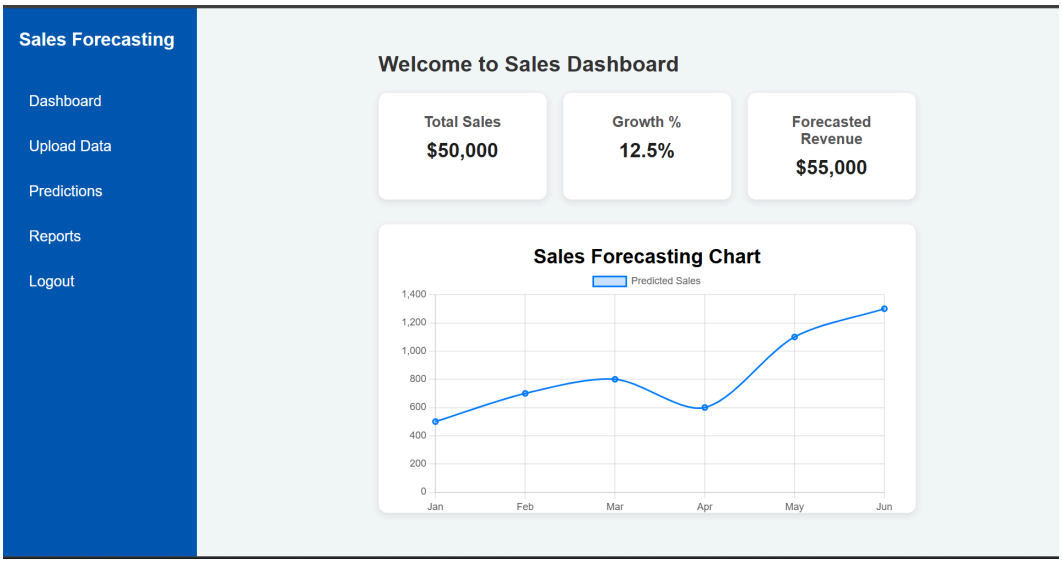
👨‍💻 Input Code Example

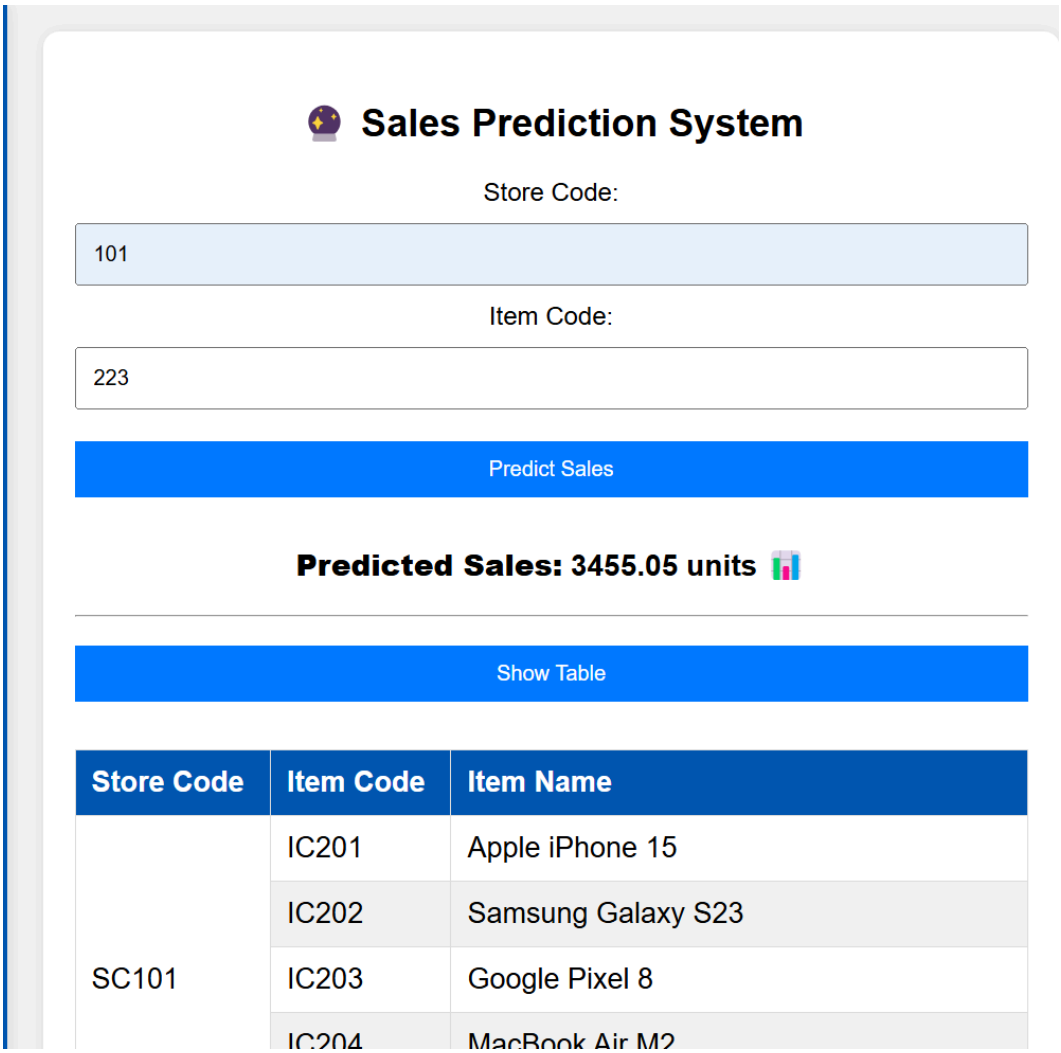
```
public class SalesInput {
    private String storeCode;
    private String itemCode;

    public SalesInput(String storeCode, String itemCode) {
        this.storeCode = storeCode;
        this.itemCode = itemCode;
    }
}
```

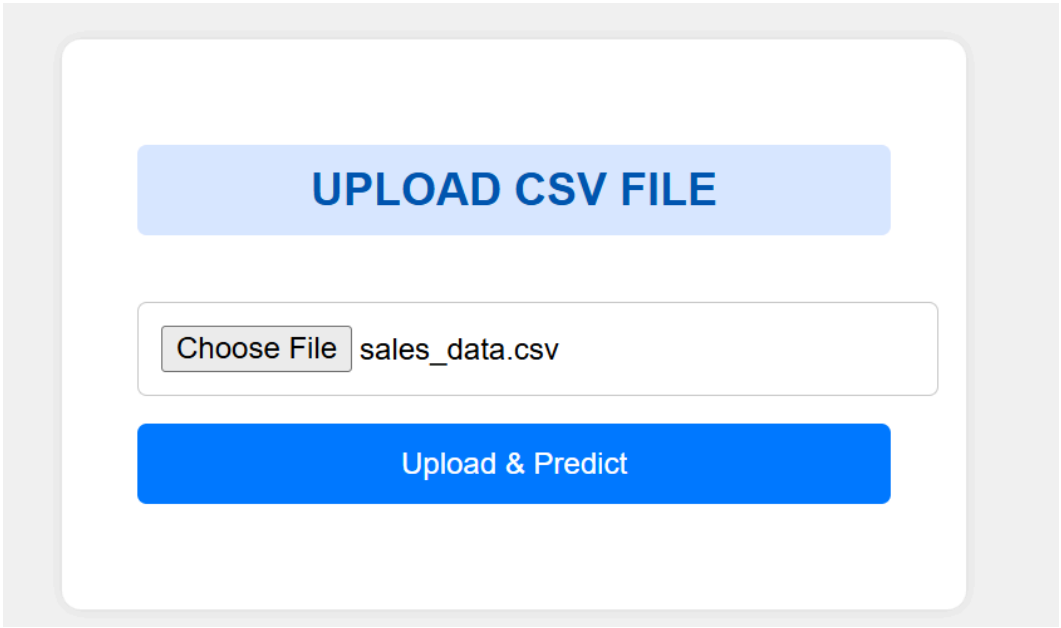
📤 Output Example

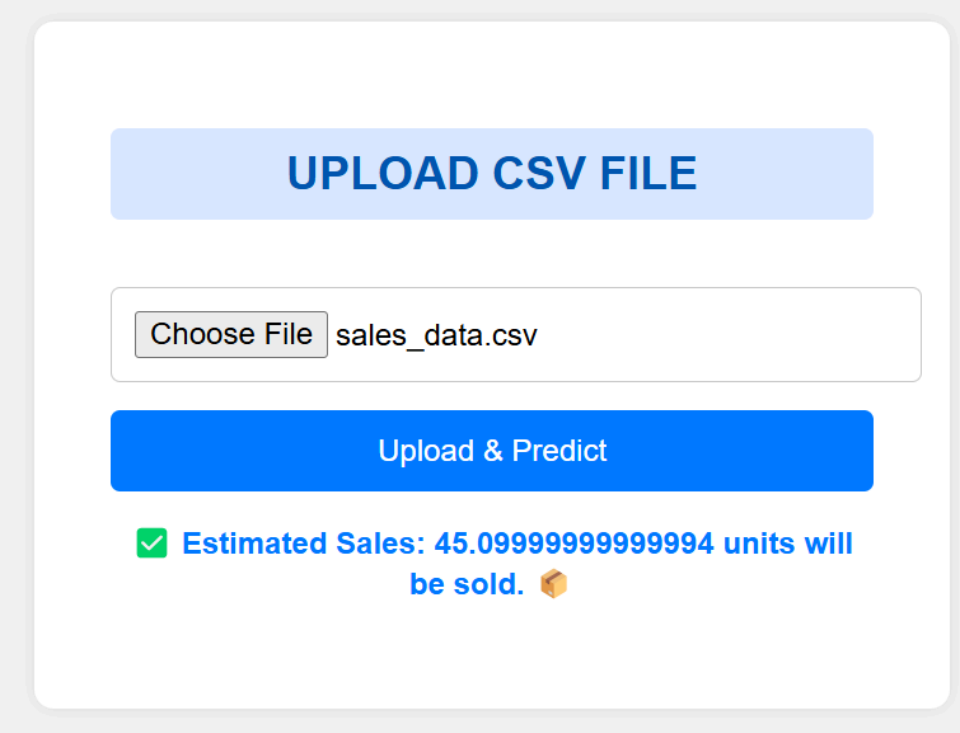
Predicted Sales: 320 units 📊
Recommended: Offer 10% discount next week

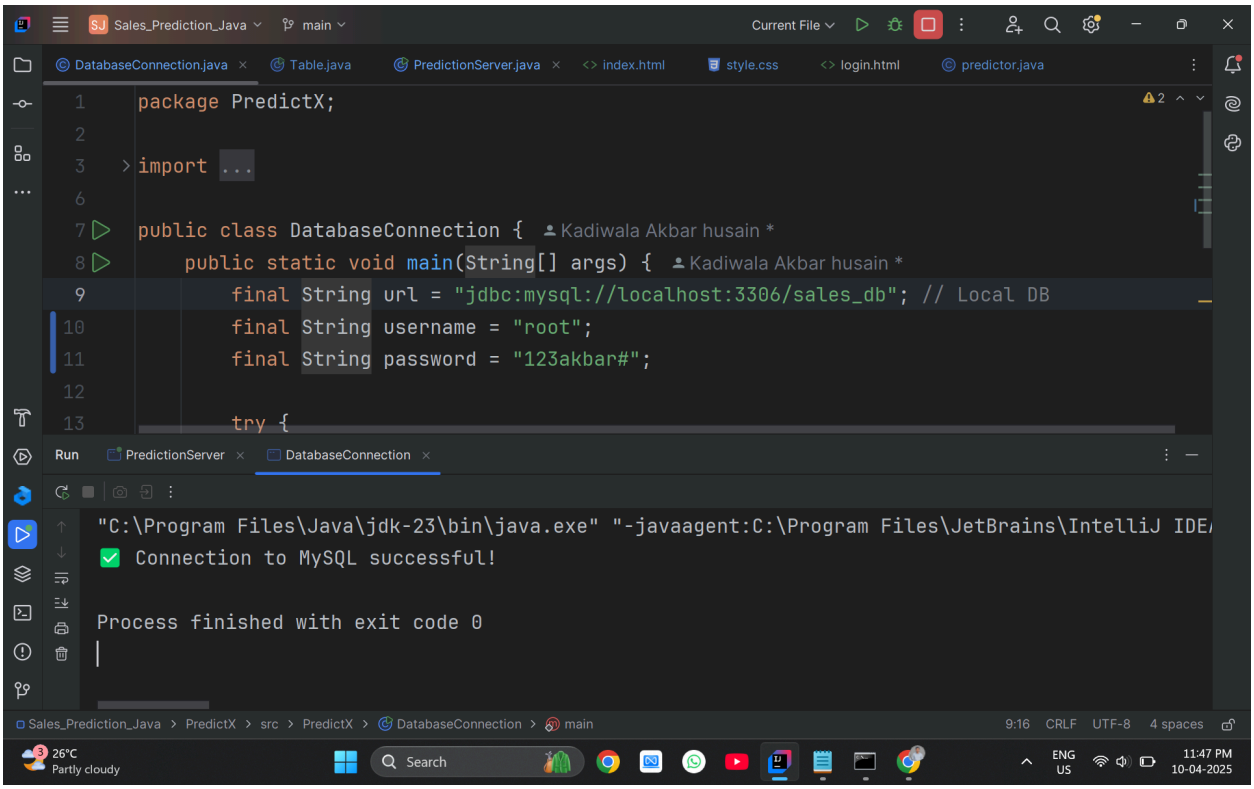
📊 Output Screenshots

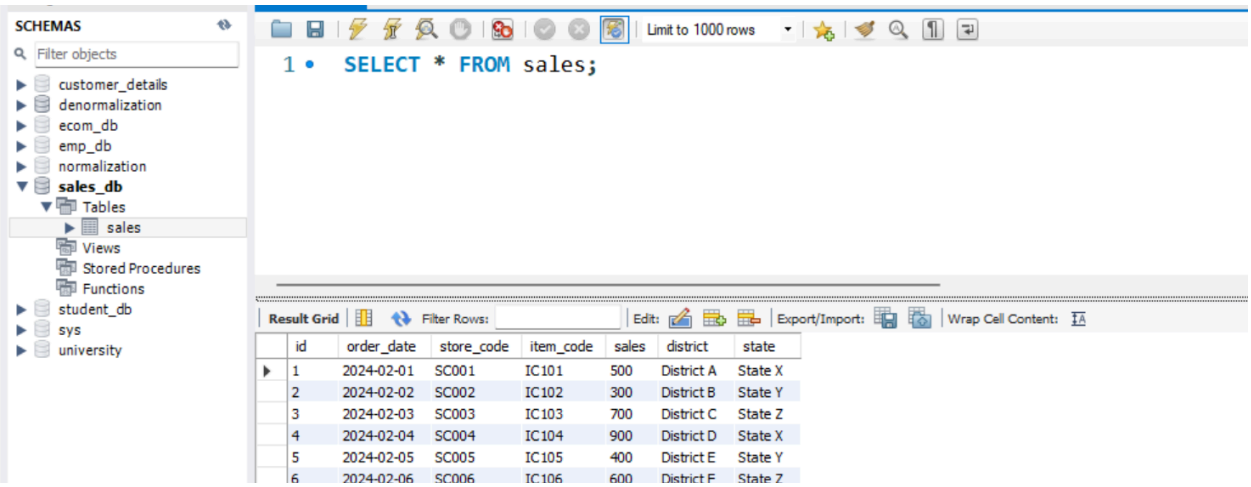



Sales Prediction System
Store Code:
101
Item Code:
223
Predict Sales
Predicted Sales: 3455.05 units
Show Table
Store Code
Item Code
Item Name
SC101
IC201
Apple iPhone 15
IC202
Samsung Galaxy S23
IC203
Google Pixel 8
IC204
MacBook Air M2

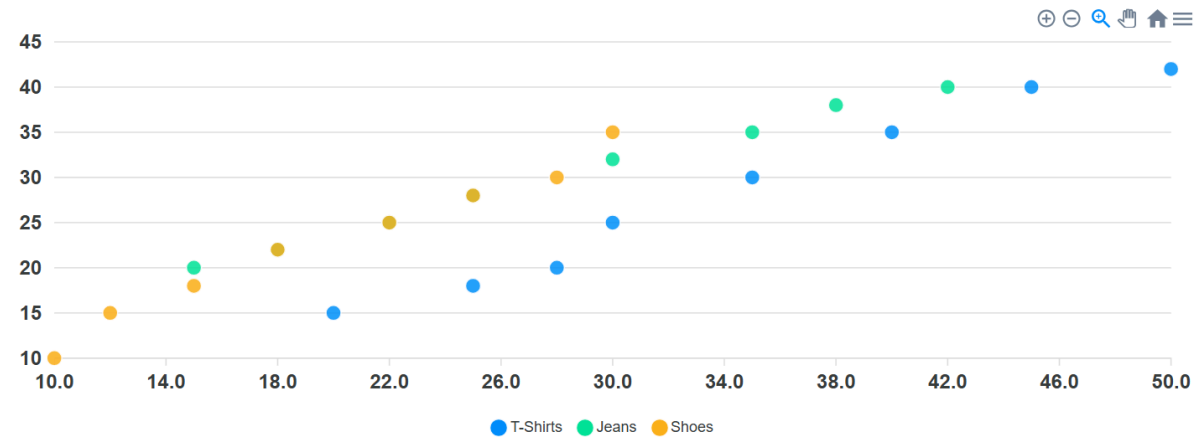

UPLOAD CSV FILE
Choose File
sales_data.csv
Upload & Predict


UPLOAD CSV FILE
Choose File
sales_data.csv
Upload & Predict
Estimated Sales: 45.09999999999994 units will be sold.

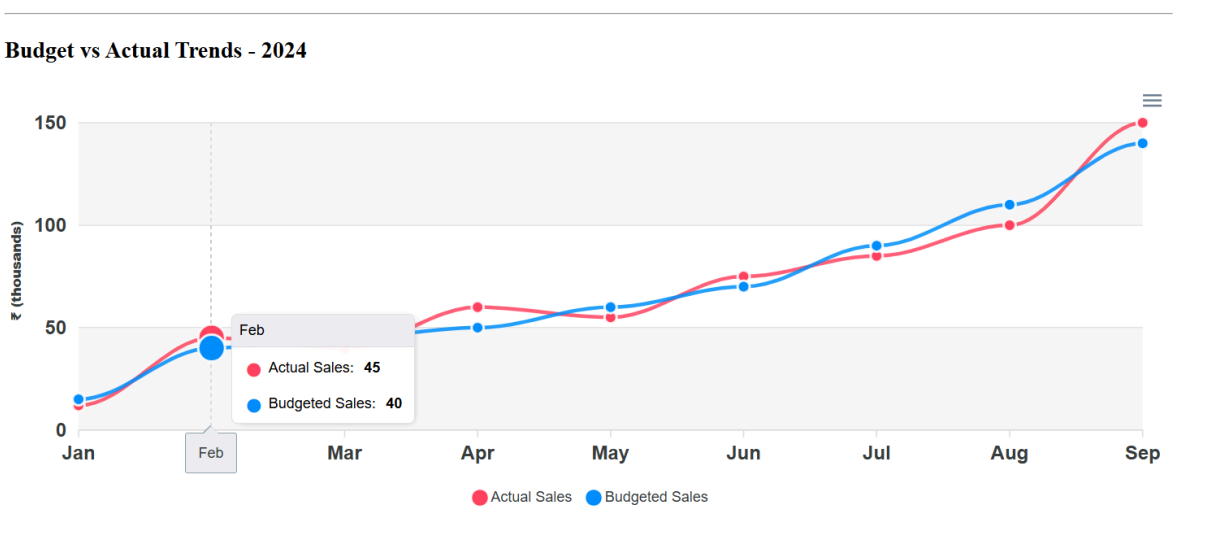

Sales_Prediction_Java
main
Current File
DatabaseConnection.java
Table.java
PredictionServer.java
index.html
style.css
login.html
predictor.java
package PredictX;
import ...
public class DatabaseConnection {
Kadiwala Akbar husain *
public static void main(String[] args) {
Kadiwala Akbar husain *
final String url = "jdbc:mysql://localhost:3306/sales_db"; // Local DB
final String username = "root";
final String password = "123akbar#";
try {
Run
PredictionServer
DatabaseConnection
"C:\Program Files\Java\jdk-23\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDE
Connection to MySQL successful!
Process finished with exit code 0
Sales_Prediction_Java > PredictX > src > PredictX > DatabaseConnection > main
9:16
CRLF
UTF-8
4 spaces
26°C
Partly cloudy
Search
ENG
US
11:47 PM
10-04-2025

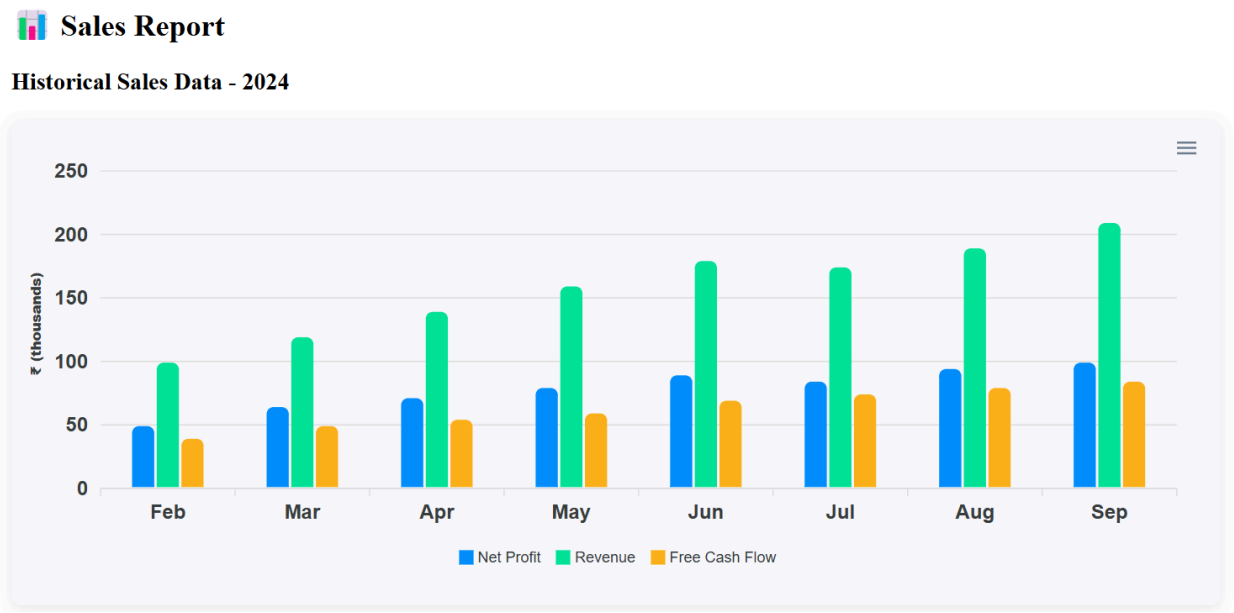


Product Sales vs Customer Demand



Budget vs Actual Trends - 2024





🧠 Algorithm Explanation

📥 1. Data Input & Fetching

- User inputs `Store Code` and `Item Code` through the UI.
- These inputs are sent to the backend Java service via a REST API.
- Corresponding historical sales data is fetched from the **MySQL** database.

🧹 2. Data Preprocessing

- Raw data is cleaned by:
  - Removing null or missing values
  - Filtering out anomalies and outliers
  - Normalizing data for consistent scale
- Ensures higher model accuracy and stability during predictions.

🧠 3. Machine Learning Model

- A **Linear Regression model** is implemented in **Java**.
- Model is trained on features such as:

    - Previous sales trends
    - Seasonal data
    - Item and store patterns
- The model is optimized to minimize prediction error (MSE/RMSE).

📈 4. Prediction Process

- Given the current input, the model predicts future sales.
- The predicted value is rounded and formatted to show expected units.
- The backend sends the result to the frontend.

🧾 5. Output & Recommendations

- The UI displays:
    - **Predicted Sales** (e.g., "Estimated Sales: 25 units 📦")
    - Smart suggestions like:
        - Stock up inventory if sales are high
        - Offer discounts if predicted sales are low
        - Trigger alerts for stockouts
- Enhances decision-making and helps optimize business strategy

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📁 Project Folder Structure: PredictX

```
📁 PredictX/
├── 📁 .idea/
├── 📁 out/
├── 📁 src/
│   ├── 📄 DatabaseConnection.java
│   ├── 📄 PredictionServer.java
│   ├── 📄 predictor.java
│   ├── 📄 Table.java
```

```
├── 📄 .gitignore
├── 📄 dashboard.css
├── 📄 dashboard.html
├── 📄 index.html
├── 📄 login.html
├── 📄 PredictX.iml
├── 📄 report.css
├── 📄 report.html
├── 📄 report.js
├── 📄 script.js
├── 📄 script_1.js
├── 📄 signup.html
├── 📄 style.css
├── 📄 upload.css
├── 📄 upload.html
└── 📄 upload.js
```

🔷 Root Directory

```
📁 PredictX/
```

This is the main project directory that contains all configuration files, source code, styling, HTML pages, and backend logic.

📂 `.idea/`

- Stores **IntelliJ IDEA project settings** and configurations.
- Not directly involved in your code execution.

📂 `out/`

- This folder holds **compiled Java bytecode** (e.g., `.class` files).

📂 src/

Contains all **Java source code files** responsible for backend operations and prediction logic.

File Name	Description
DatabaseConnection.java	Manages database connectivity using JDBC. Connects to MySQL to fetch/store data.
PredictionServer.java	Acts as a server-side handler that receives requests and returns predictions.
predictor.java	The core Java-based ML logic used to train and predict sales data.
Table.java	Handles dynamic table creation and rendering, possibly for report generation.

📄 .gitignore

Specifies files/folders to be ignored by Git (e.g., `.class`, `.idea/`, logs, etc.).

🌐 Frontend Files (HTML + CSS + JS)

File Name	Type	Description
index.html	HTML	Homepage with links to features or login.
login.html	HTML	Login page for user authentication.
signup.html	HTML	Sign-up/registration page.
dashboard.html	HTML	Main dashboard UI displaying predictions, reports, etc.
upload.html	HTML	Page for uploading sales data (CSV or manual entry).
report.html	HTML	Report viewer showing predicted results.

🎨 CSS Files

File Name	Description
`style.css`	General site-wide styling.
`dashboard.css`	Specific styling for dashboard elements and layouts.
`upload.css`	Custom styles for upload section (buttons, input fields, etc.).
`report.css`	Styling for the reports section, tables, and result cards.

⚙️ JavaScript Files

File Name	Description
`script.js`	Handles core interactivity like form submission, validation, etc.
`script_1.js`	Possibly older or alternative script handling smaller modules.
`upload.js`	Controls the file upload process and data previewing.
`report.js`	Generates tables/charts based on prediction results or historical data.

✅ Description of Key Files

- `index.html`: Entry point of the application.
- `login.html` / `signup.html`: Authentication screens.
- `dashboard.html`: Displays predictions and insights.
- `report.html`: Shows detailed reports and trends.
- `upload.html`: Allows CSV upload for batch predictions.
- `style.css` / `dashboard.css`: Contains global and module-specific CSS.
- `script.js` / `upload.js`: JavaScript logic to power front-end functionality.
- `src/`: Backend Java source files and ML logic.

🔚 Conclusion

Through the development of the **Sales Forecasting System – PredictX**, I have gained valuable insights into building a complete, end-to-end software

application. This project has served as a bridge between theoretical knowledge and practical implementation, helping me strengthen my skills across multiple domains.

Key Learnings:

- 🖥️ **Java Backend Integration**:

  I learned how to efficiently connect frontend interfaces (HTML, CSS, JavaScript) with the Java backend using servlets and handlers. This gave me practical exposure to creating dynamic and responsive systems using a structured programming approach.

- 📊 **Machine Learning in Java**:

  I explored how to implement a basic regression-based machine learning model purely in Java without using external libraries like Python. This included data preprocessing, model training, and real-time prediction generation using custom algorithms.

- ⚙️ **Real-time Data Handling**:

  Working with real-time data inputs, validating sales data, and generating predictions on-the-fly was a core aspect. I also focused on creating a system that processes new data from uploads or databases and instantly reflects changes on the dashboard.

- 📦 **Database Connectivity & CRUD**:

  Establishing a stable and secure connection with MySQL helped me understand JDBC operations and how to perform CRUD (Create, Read, Update, Delete) functionalities, which are essential for data-driven applications.

- 📈 **Dashboard & Reporting**:

  I learned to design clean and intuitive dashboards that showcase sales insights and recommendations in an easily digestible format. Report generation and visualization added a layer of clarity for end users.

- 🌐 **Frontend Design & UX**:

Through the development of user-friendly pages like login, signup, upload, and reports, I gained a deeper understanding of layout structuring, styling, and user experience (UX) design principles.

- 🔐 **Security & Data Validation**:

  Implementing basic input validations and secure interactions between frontend and backend taught me the importance of safe coding practices and user data integrity.

Final Thoughts:

This project not only tested my knowledge of Java and web development but also introduced me to real-world problem-solving using predictive analytics. It has built my confidence in integrating multiple technologies into one cohesive system. I now feel more prepared to take on complex development tasks and contribute to practical, data-driven solutions in the industry.

📂 GitHub Repository

You can find the complete source code, project files, and documentation at the GitHub repository below:

🔗 **GitHub Link**: