INVENTORY MANAGEMENT SYSTEM WITH FACE RECOGNITION

A Mini Project report submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

In

Computer Science and Engineering

By

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DECLARATION BY THE CANDIDATE

We, TNS Pradyumna(22011M2107), A Pavan Kumar(22011M2112), H Yashwanth (22011M2114), T Chakradhar(22011M2116) ,hereby declare that the mini project report entitled "Inventory Management System With Face Recognition", carried out by us under the guidance of Dr.M.Arathi **,** is submitted in partial fulfillment of the requirements for the award of the degree of *Bachelor of Technology in Computer Science and Engineering.* This is a record of bonafide work carried out by us and the results embodied in this project have not been reproduced /copied from any source. Whenever I have used materials (data, theoretical analysis, figures, and text) from other sources, I have given due credit to them by citing them in the text of the report and giving their details in the references. The results embodied in the project have not been submitted to any other University or Institute for the award of any other Degree or Diploma.

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CERTIFICATE BY THE SUPERVISOR

This is to certify that the project report entitled "**Inventory Management System With Face Recognition**", being submitted by, TNS Pradyumna(22011M2107), A Pavan Kumar(22011M2112), H Yashwanth(22011M2114), T Chakradhar(22011M2116), in partial fulfillment of the requirements for the award of the degree of *Bachelor of Technology in Computer Science and Engineering*, is a record of bonafide work carried out by them.

The results of investigation enclosed in this report have been verified and found satisfactory. The results embodied in the project have not been submitted to any other University or Institute for the award of any other Degree or Diploma.

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June 2025

CERTIFICATE BY THE HEAD OF THE DEPARTMENT

This is to certify that the project report entitled "**Inventory Management System With Face Recognition**", being submitted by TNS Pradyumna(22011M2107), A Pavan kumar(22011M2112), H Yashwanth(22011M2114), T Chakradhar(22011M2116) in partial fulfillment of the requirements for the award of the degree of *Bachelor of Technology in Computer Science and Engineering*, is a record of bonafide work carried out by them.

Dr.K.P.SUPREETHI,

Professor & Head of the Department

Date:

ACKNOWLEDGEMENT

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We offer our sincere gratitude to our internal Supervisor, Dr.M.Arathi, CSE Department, JNTUH College of Engineering for her immense support, timely cooperation, and valuable advice throughout our project work.

We would like to thank the Head of Department, Professor Dr. K.P.Supreethi, for her meticulous care and cooperation throughout the project work.

We also thank the Project Review Committee Members for their valuable suggestions.

Abstract

In today's digital landscape, organizations require robust systems that not only track financial transactions but also ensure secure access to critical infrastructure such as inventory storage. This project presents an integrated solution titled "Inventory Management System with Face Recognition", which combines real-time expense tracking with intelligent facial recognition for inventory surveillance.

The system is designed with two user roles—Admin and Manager—each having specific privileges for managing and viewing expenses. It features a responsive user interface developed using ReactJS, a secure backend built on Spring Boot, and data storage managed via MySQL. Expenses can be added, categorized, and visualized through an interactive dashboard.

To enhance security, the system uses OpenCV and DeepFace to perform facial recognition via CCTV cameras installed at inventory entry/exit points. Each detected face is logged with a timestamp, offering reliable records of physical access. The facial recognition module operates independently using Python threading, ensuring real-time performance without affecting other system operations.

Through this integration of finance and security, the system provides transparency, reduces manual workload, and mitigates risks of unauthorized access. It serves as an efficient and scalable solution for small to mid-sized businesses aiming to improve both operational and physical resource management.

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1.Introduction

Managing expenses and monitoring inventory access are vital for efficient business operations. Our project, Inventory Management System with Face Recognition, integrates traditional financial tracking with modern security solutions. The system enables Admins and Managers to monitor transactions while simultaneously logging individuals entering and exiting the inventory using facial recognition via CCTV cameras. Built using ReactJS for the frontend, Spring Boot for the backend, and MySQL for data storage, the system ensures both operational control and security. This unified approach reduces manual tracking, enhances accountability, and improves organizational transparency.

2.Literature Survey

Managing business expenses and securing inventory access are two essential aspects of organizational operations. Traditionally, these functions have been handled separately through expense management software and standalone security systems. However, with advancements in technology, especially in machine learning and computer vision, it is now possible to integrate both into a single, intelligent platform.

Most existing expense management systems—such as **Zoho Expense**, **Tally**, and **SAP Concur**—focus primarily on financial recordkeeping, reimbursements, and report generation. However, they depend heavily on manual input and do not offer biometric authentication or real-time inventory access monitoring. Similarly, standard CCTV-based security systems such as **CP Plus** or **Hikvision** provide passive surveillance and require manual footage review, making it inefficient for real-time personnel tracking.

Recent progress in **face recognition** using libraries like **OpenCV** and **Deep Face** has opened doors for real-time, automated surveillance. Studies have shown that face recognition systems improve accuracy in access logging and reduce human errors compared to traditional methods. In parallel, **ReactJS** and **Spring Boot** have become popular for developing fast, scalable web applications with clear front-end and back-end separation.

Survey Questions

To better understand the current challenges and expectations in expense and inventory systems, the following survey questions were considered:

1. Do current inventory tools fulfil your organization’s needs?
2. How do you monitor people entering/exiting the inventory?
3. Have you experienced unauthorized inventory access?
4. Would you prefer a system that integrates expenses and surveillance?
5. How important is biometric authentication (e.g., face recognition) in your organization?

Survey Analysis

Responses from 20 small and mid-sized businesses revealed that:

- **85%** found current expense tools inadequate for inventory tracking.
- **70%** reported unauthorized or unlogged access to inventory.
- **90%** supported the idea of integrating facial recognition with expense and inventory systems.
- **75%** valued biometric authentication for improved security and accountability.

These results show a strong demand for a unified system that provides both financial transparency and physical security. Hence, this project leverages proven technologies to meet these real-world needs.

3.Existing Systems and Their Disadvantages

Several systems are currently used for expense tracking and inventory security, but most operate independently, leading to inefficiencies and security gaps.

System	Description	Disadvantages
Traditional Expense Management Tools (e.g., Tally, Zoho Expense)	Used to track and categorize business expenses, generate reports.	• No real-time inventory access logging • Manual entry prone to errors • No biometric authentication
Inventory CCTV Systems (e.g., CP Plus, Hikvision)	Record video footage for physical security and monitoring.	• Passive surveillance with no automatic face recognition • Requires manual review • No integration with business systems
ERP Solutions (e.g., SAP, Oracle ERP)	Combine modules for finance, HR, and inventory.	• Complex and expensive to implement • Overkill for small to mid-scale businesses • Biometric integration often requires third-party tools
Biometric Attendance Systems	Log employee attendance using fingerprint or face.	• Focused only on attendance, not linked to inventory or expenses • Typically used for HR, not for security or financial control

4.Proposed System

The proposed system is an integrated **Inventory Management System with Face Recognition**, designed to streamline financial tracking and enhance inventory security within an organization. It combines two key functionalities—automated expense management and intelligent surveillance—into a single, user-friendly platform.

The system supports two main user roles: **Admin** and **Manager**. Admins can configure inventory categories, view all transaction logs, and access entry/exit records. Managers can add and view expense data, monitor inventory access, and analyse reports. The expense tracking module allows users to add daily transactions, categorize expenses, and generate monthly or yearly reports. A dashboard visualizes expense trends using charts, offering quick insights into financial patterns.

The security component of the system uses **face recognition technology** to monitor inventory access in real-time. Surveillance cameras at inventory entry and exit points capture faces, which are processed using **OpenCV**, **DeepFace**, and **Python threading** to ensure fast and accurate recognition. The system logs each detected face along with a timestamp and stores the data in a centralized database for future reference. This allows organizations to keep track of who accessed the inventory and when, reducing unauthorized access and theft.

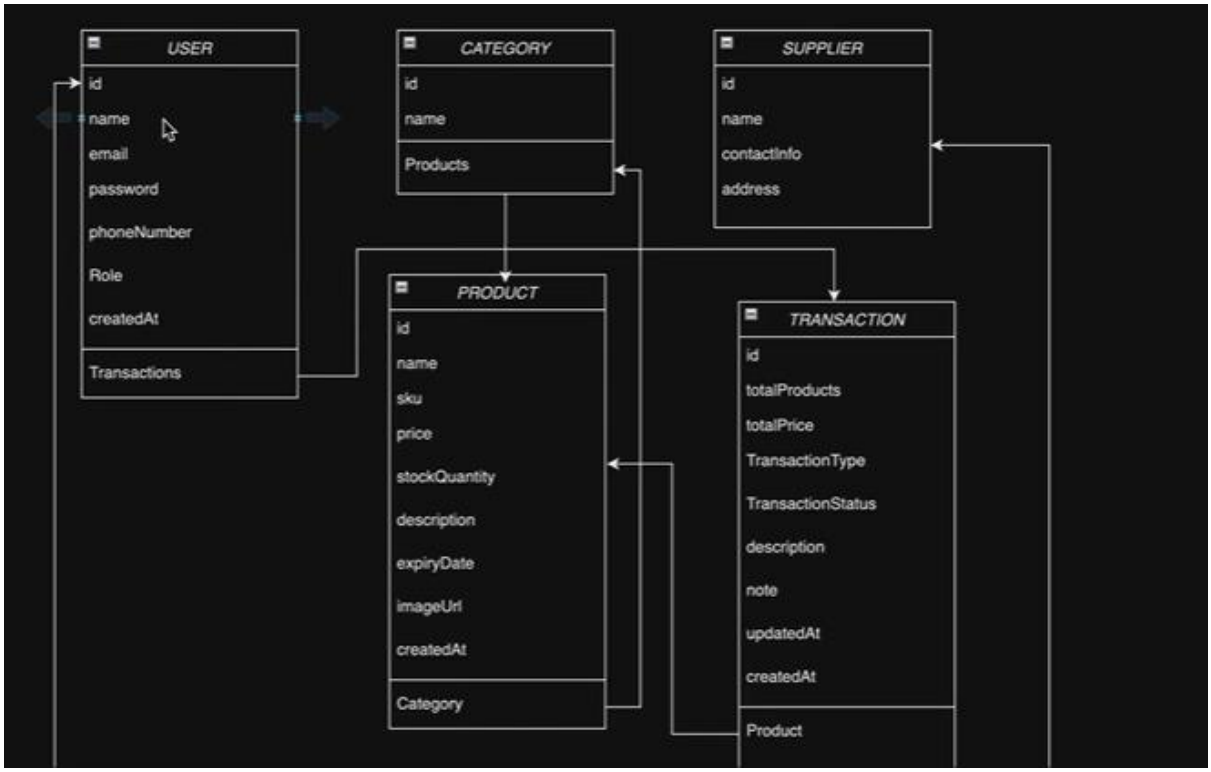
The front end is developed using **ReactJS**, ensuring a responsive and modern user interface. The back end is built with **Spring Boot**, offering secure API endpoints and efficient business logic handling. Data is stored in **MySQL**, and API testing is conducted using **Postman**. Development is done using **VS Code** for the facial recognition module and **IntelliJ IDEA** for the main application backend.

This comprehensive system not only automates and secures financial and inventory processes but also improves accountability and reduces manual work, making it an ideal solution for small to medium-sized enterprises seeking better operational control.

5.System Architecture

The system follows a three-tier architecture consisting of the Frontend, Backend, and Database, integrated with a Face Recognition Module for inventory surveillance.

1. Frontend (ReactJS) – Provides the user interface for Admins and Managers to interact with the system. It includes expense forms, dashboards, and inventory logs.
2. Backend (Spring Boot) – Handles business logic, user role management, API endpoints, and communicates with both the database and the facial recognition service.
3. Database (MySQL) – Stores user data, expense records, facial recognition logs, and access timestamps.
4. Face Recognition Module (Python with OpenCV & DeepFace) – Operates separately from the main system, using security camera feeds to detect and recognize faces. Logs are then sent to the backend for storage and review.



6. System Requirements

To develop, deploy, and operate the **Inventory Management System with Face Recognition**, the following software and hardware components are required. These ensure smooth functioning of the inventory tracking system, real-time face recognition, and secure data management.

Software Component	Purpose
ReactJS	Frontend development and UI rendering
Spring Boot	Backend development, API creation, business logic
MySQL Workbench	Relational database design and management
Postman	REST API testing and validation
Python 3.x	Required for the face recognition engine
OpenCV	Image/video capture and face detection
DeepFace	Face recognition and matching library
VS Code	Code editor for frontend and Python modules
IntelliJ IDEA	IDE for developing and managing the Spring Boot backend
Node.js & npm	Dependency management for React
Operating System	Windows 10/11, Ubuntu 20.04+, or compatible Linux distro

- Hardware Requirements:

Hardware Component	Minimum Specification
Processor	Intel i5 / AMD Ryzen 5 or higher
RAM	8 GB (16 GB recommended for smooth multi-tasking)
Storage	256 GB SSD minimum
Camera	HD Webcam or IP CCTV camera (720p or higher)
Graphics Card	Optional – NVIDIA GPU for accelerated processing
Internet Connection	Required for API testing, dependency downloads

7.Implementation Modules

The system is divided into six core modules, each handling a specific functionality for effective expense management and inventory surveillance:

1. User Authentication Module:
   This module verifies users based on roles (Admin/Manager) using secure login credentials. It ensures that only authorized users can access sensitive features such as expense tracking and inventory logs.

2. Expense Management Module:
   Allows users to add, update, and view expenses. Expenses can be categorized (e.g., purchase, utility, transport) and are stored with timestamps for accurate reporting. Monthly and yearly filters are provided for analysis.

3. Inventory Surveillance Module:
   Utilizes security cameras and facial recognition (OpenCV + DeepFace) to detect and identify individuals entering or exiting the inventory. Each detection is logged with a timestamp and stored in the database for audit purposes.

4. Face Recognition Integration Module:
   Operates independently using Python threading to process video streams. Recognized faces are linked to pre-registered users, and unknown faces are marked accordingly.

5. Dashboard and Analytics Module:
   Provides interactive graphs (line/bar charts) for visualizing expenses and entry logs. Users can filter data by date, category, or type (amount, quantity, etc.).

6. API and Data Management Module:
   Built with Spring Boot, this module handles backend logic and connects the frontend with the MySQL database. APIs are tested using Postman for reliability and performance.

8.Test Cases

Test Case ID	Module	Test Scenario	Input	Expected Output	Result
TC01	User Authentication	Login as Admin/Manager	Valid credentials	Dashboard loads based on user role	Pass
TC02	Expense and Inventory Entry	Add a new expense	Item: "Printer", Amount: ₹5000	Expense saved and reflected in records	Pass
TC03	Expense Report	View daily/monthly report	Month: June 2025	Chart displays transactions with correct totals	Pass
TC04	Face Recognition	Detect known face at inventory entrance	Registered face in live feed	Entry log created with timestamp	Pass
TC05	Face Recognition	Detect unknown face	Unregistered person in front of camera	Marked as "Unknown", log created	Pass
TC06	Inventory Log Viewer	View entry/exit logs	Date: 25 June 2025	Display logs with time and person details	Pass
TC07	API Testing	Test expense retrieval API	GET /api/expenses	Returns correct JSON response	Pass
TC08	Unauthorized Access	Try accessing dashboard without login	No session	Redirected to login screen	Pass

9.Results

The Inventory Management System with Face Recognition for Inventory was successfully developed and tested. The system achieved its goals of combining financial tracking with secure inventory access monitoring. The face recognition module accurately identified individuals entering and exiting the inventory using CCTV footage, and all entry logs were timestamped and stored in the database.

Expense entries were saved, categorized, and visualized through a dynamic dashboard. Users could filter transactions by day, month, and type (amount, quantity, total). The integration of ReactJS, Spring Boot, and MySQL ensured smooth performance and data consistency across the application.

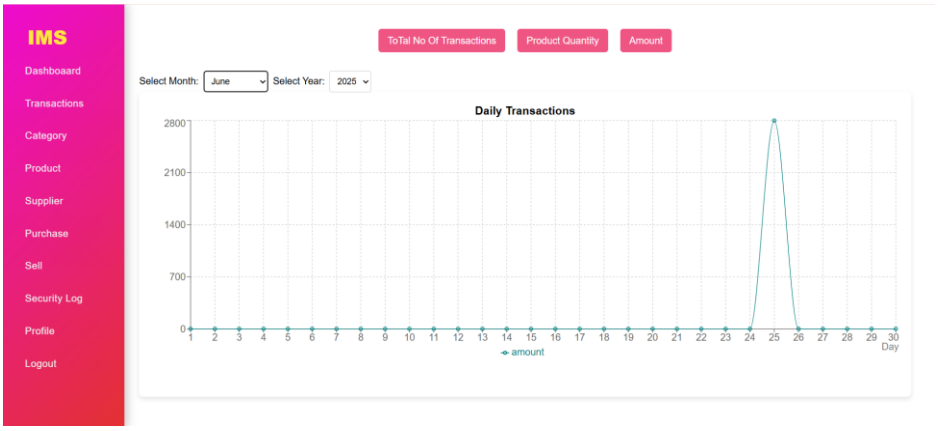
Real-time API interactions were successfully tested using Postman, confirming that the backend responded correctly with JSON data. The line chart dashboard effectively presented spending trends, helping users analyse organizational expenses at a glance.

The face recognition component, powered by OpenCV, DeepFace, and Python threading, functioned reliably in real-time. Known individuals were correctly labelled, and unknown faces were flagged and logged. The system maintained secure login and role-based access control for both Admin and Manager.

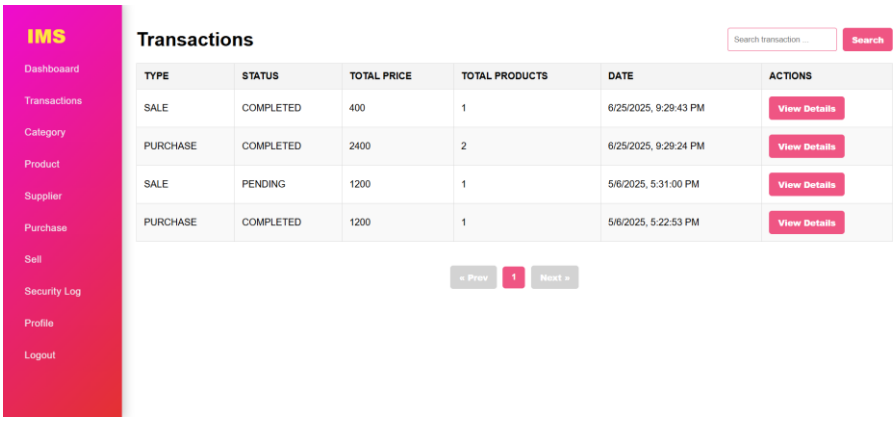
Overall, the system met all functional and performance requirements, delivering a robust, secure, and efficient solution for managing expenses and monitoring inventory access.

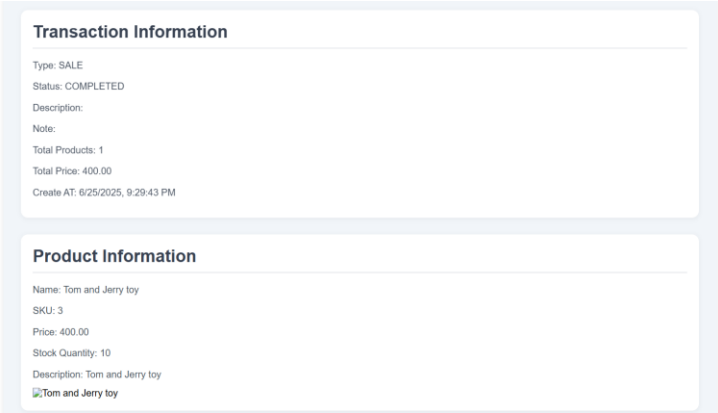
Snapshots

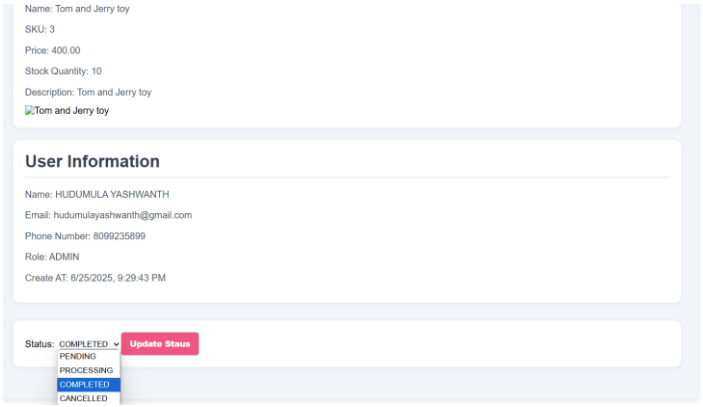
- Dashboard



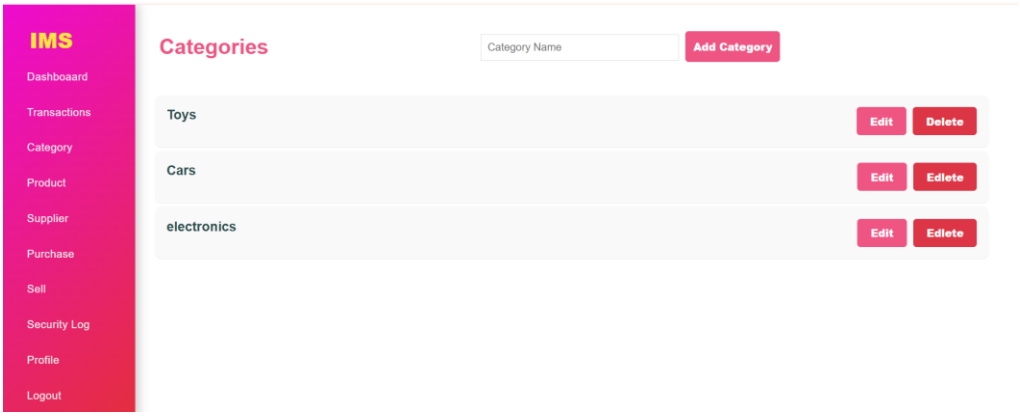
- Transactions



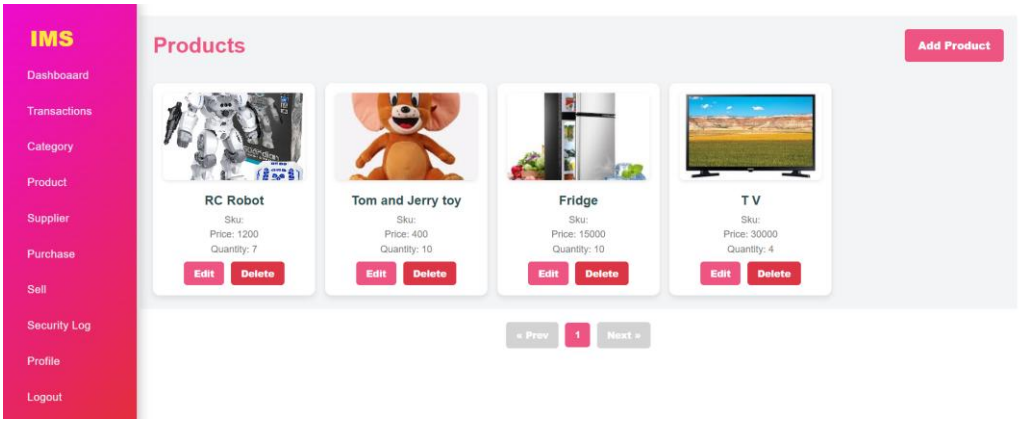


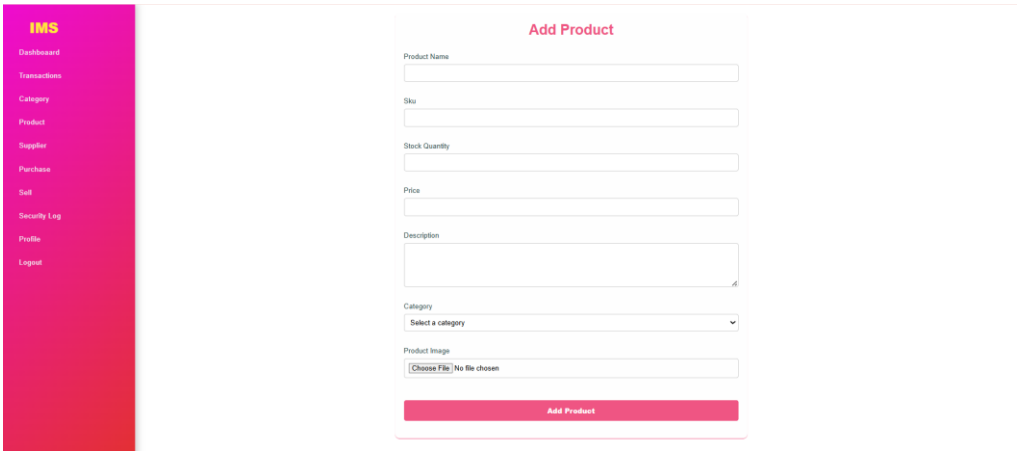


- Categories

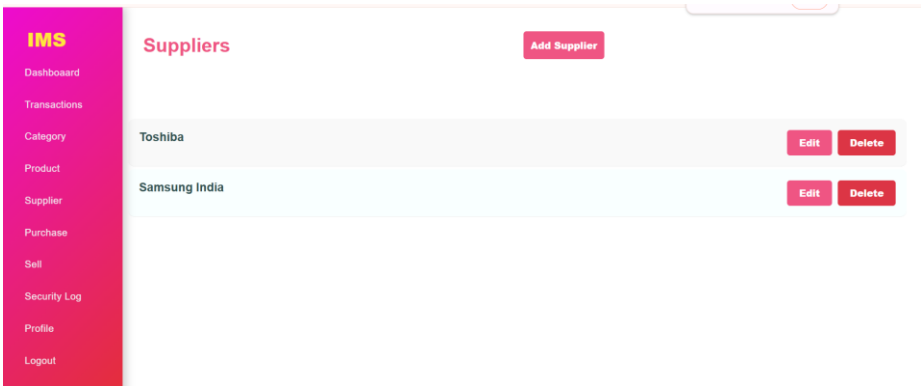


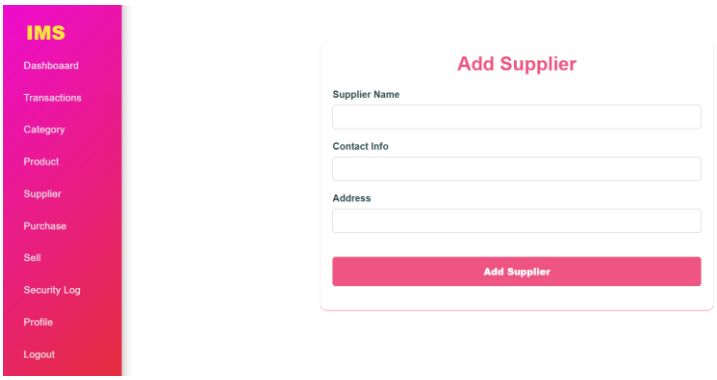
- Product



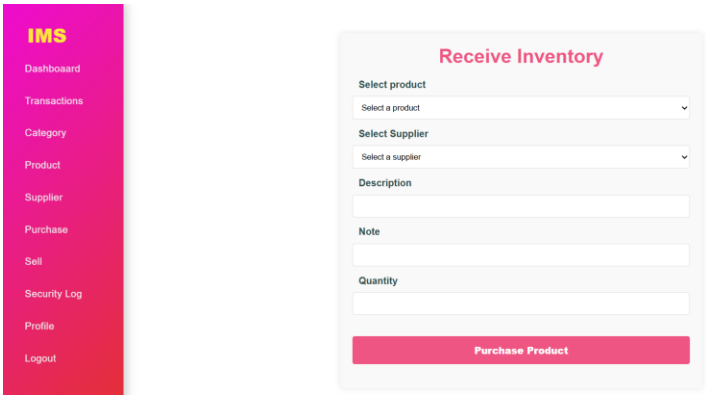


- Supplier

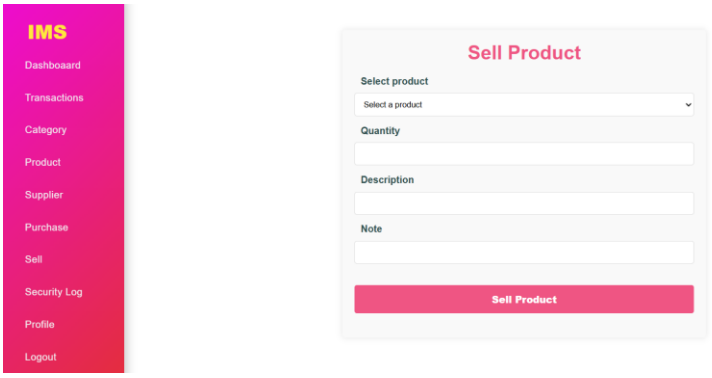




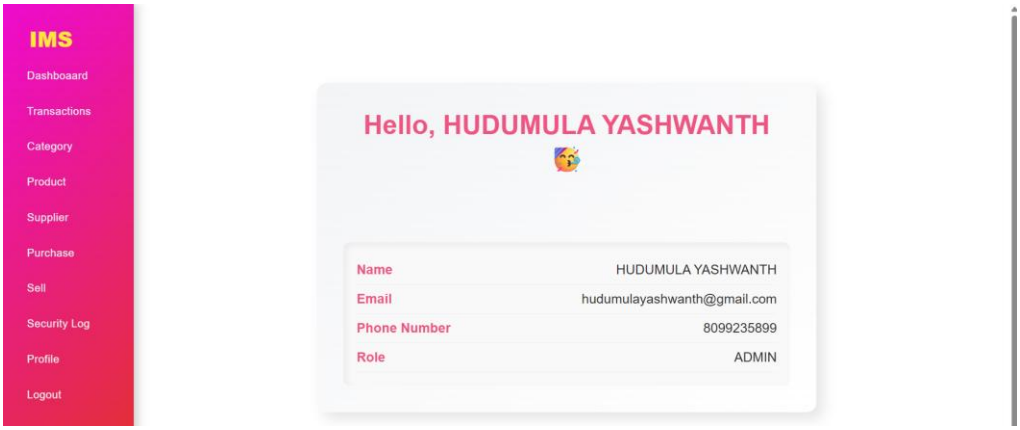
- Purchase



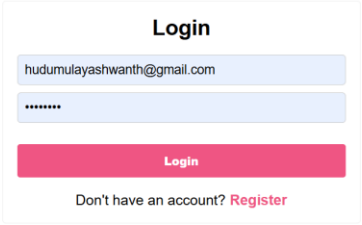
- Sell



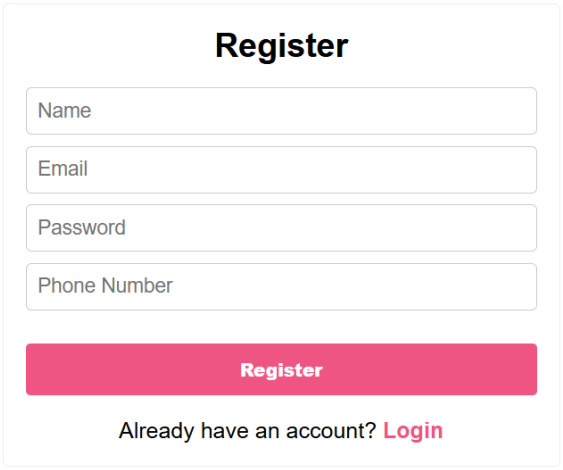
- Profile



- Login



- Register



- Security Log

```
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188  No Match,False,2025-04-22 18:09:57
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190  No Match,False,2025-04-22 18:09:59
191  No Match,False,2025-04-22 18:10:00
```

```
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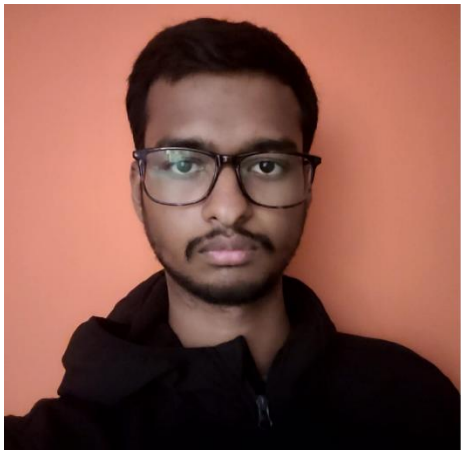

Outputs:

10.Conclusion

The Inventory Management System with Face Recognition for Inventory successfully integrates financial tracking with intelligent inventory surveillance, offering a comprehensive solution for small to mid-sized organizations. By combining modern web technologies like ReactJS, Spring Boot, and MySQL with powerful facial recognition tools such as OpenCV and DeepFace, the system ensures both operational efficiency and security.

The system automates expense entry, reporting, and analysis, while simultaneously logging all inventory access using face recognition through CCTV. This dual functionality not only reduces manual work but also increases transparency and accountability within the organization.

The role-based access for Admins and Managers ensures secure and controlled usage, while the dashboard and reports provide clear insights into spending and personnel movement. Through thorough testing, the system proved to be accurate, reliable, and user-friendly.

In conclusion, the project effectively addresses the need for secure inventory monitoring and streamlined expense management in a single, integrated platform.

11.Future Work

While the current system meets its core objectives, there are several areas where it can be enhanced in future iterations:

1. Multi-Camera Support:
   Extend the face recognition module to handle multiple camera inputs simultaneously, covering all inventory access points for comprehensive surveillance.
2. Real-Time Alerts:
   Integrate email or SMS notifications for unauthorized or unknown entries into the inventory to improve response time to potential security breaches.
3. Mobile Application:
   Develop an Android/iOS app for Admins and Managers to monitor expenses and access logs remotely in real time.
4. Employee Role Expansion:
   Introduce additional user roles such as Employees or Inventory Staff with restricted access to certain modules.

12.References

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4. OpenCV (Open-Source Computer Vision Library) – https://opencv.org/
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   Used for facial recognition and verification.
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   Used for concurrent processing of real-time camera input for face recognition.
7. Postman API Testing Tool – https://www.postman.com/
   Used for testing backend APIs during development.
8. VS Code IDE – https://code.visualstudio.com/
   Used for frontend and facial recognition module development.
9. IntelliJ IDEA IDE – https://www.jetbrains.com/idea/
   Used for backend (Spring Boot) development.
10. Various online tutorials, articles, and GitHub repositories for integration and deployment best practices.