AI-Powered Smart *Expense Manager*

The domain of the Project

Financial Technology

Under the guidance of

Mr. Shrihari Poturaju

By

Mr. Hemal Dholakiya

Period of the project

August 2024 to February 2025

SURE TRUST

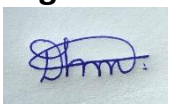
PUTTAPARTHI, ANDHRA PRADESH

DECLARATION

The project titled "***AI-Powered Smart Expense Manager***" has been mentored by **Mr. Srihari Poturaju**, organized by SURE Trust, from August 2023 to August 2023. The project aims to benefit educated unemployed rural youth by providing hands-on experience in industry-relevant projects to enhance employability skills. I, Hemal Dholakiya, declare that I have worked independently on this project under the guidance of my mentor and successfully gained practical knowledge in the domain.

I, **Mr. Hemal Dholakiya,** hereby declare that I have solely worked on this project under the guidance of my mentor. This project has significantly enhanced my practical knowledge and skills in the domain.

Name
Mr. Hemal Dholakiya

Signature


Mentor
Mr. Shrihari Poturaju
(IBM)

Signature

Seal & Signature

Prof.Radhakumari
Executive Director & Founder
SURE Trust

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Executive Summary

The AI-Powered Smart Expense Manager is an intelligent financial management tool that assists users in tracking and managing their expenses efficiently. The project leverages AI and machine learning to categorize expenses and predict future expenditures. The system is designed to offer actionable insights, helping users make informed financial decisions. Key findings from the project indicate improved financial awareness among users and enhanced budget planning capabilities.

Introduction

Background and Context

Financial management is a critical aspect of an individual's economic stability. Many people struggle to track expenses, leading to poor financial planning. This project addresses this issue by implementing an AI-driven solution to streamline expense tracking and budget management.

Problem Statement

The primary goal is to develop an AI-powered system that:

- Automatically categorizes expenses
- Predicts future expenses based on spending trends
- Provides budget recommendations
- Visualizes financial data through interactive dashboards
- Read the expense data from receipt

Scope

This project aims to develop a user-friendly expense management system with AI-based predictive analytics. The scope includes:

1. **Expense Tracking:** Users can input expenses manually or upload receipts/statements for automatic processing.
2. **Expense Prediction:** Predicts future spending based on past trends.
3. **Visualization:** Offers dashboards and real-time graphical insights.

Limitations

1. **Data Dependency:** Requires a sufficient amount of past data for accurate predictions.
2. **Accuracy Variations:** Expense categorization accuracy may vary based on receipt quality.
3. **Limited External API Support:** No real-time banking integration in the initial version.

Innovation

The project implements **AI-based financial planning** by integrating **machine learning for budget recommendations and future expense predictions**. It also provides **real-time visualization** to help users manage finances effectively.

Project Objectives

Project Objectives and Expected Outcomes

1. **Develop an AI-Powered Expense Management System**
    - **Expected Outcome:** A fully functional system for tracking and categorizing expenses.
2. **Implement AI-Based Expense Categorization**
    - **Expected Outcome:** Automatic classification of expenses into predefined categories.
3. **Integrate Budget Planning and Expense Prediction**
    - **Expected Outcome:** AI-powered budgeting assistance and future expense forecasting.
4. **Enhance User Experience with Interactive Dashboards**
    - **Expected Outcome:** Real-time financial insights and visual analytics.

Deliverables

1. Working AI-Powered Smart Expense Manager System
2. GitHub Repository with Complete Source Code
3. Detailed Project Report with Screenshots and Results

Methodology and Results

Methods/Technology Used

1. **FastAPI** for the back-end
2. **PostgreSQL** for database management
3. **Machine Learning (NLP-based models, SimpleExpSmoothing)** for predictive analytics
4. **HTML,CSS,JS** for the front-end
5. **Visualization Libraries (Plotly.js)** for dashboard analytics

Tools/Software Used

1. **FastAPI –** API development framework
2. **PostgreSQL –** Database for storing expenses and transactions
3. **Pandas,–** AI/ML libraries for predictions

Data Collection Approach

- Expense data collected from user inputs and receipts (processed using OCR)
- Machine learning models trained on past spending patterns
- Regular expression for category-based expense predictions

Project Architecture

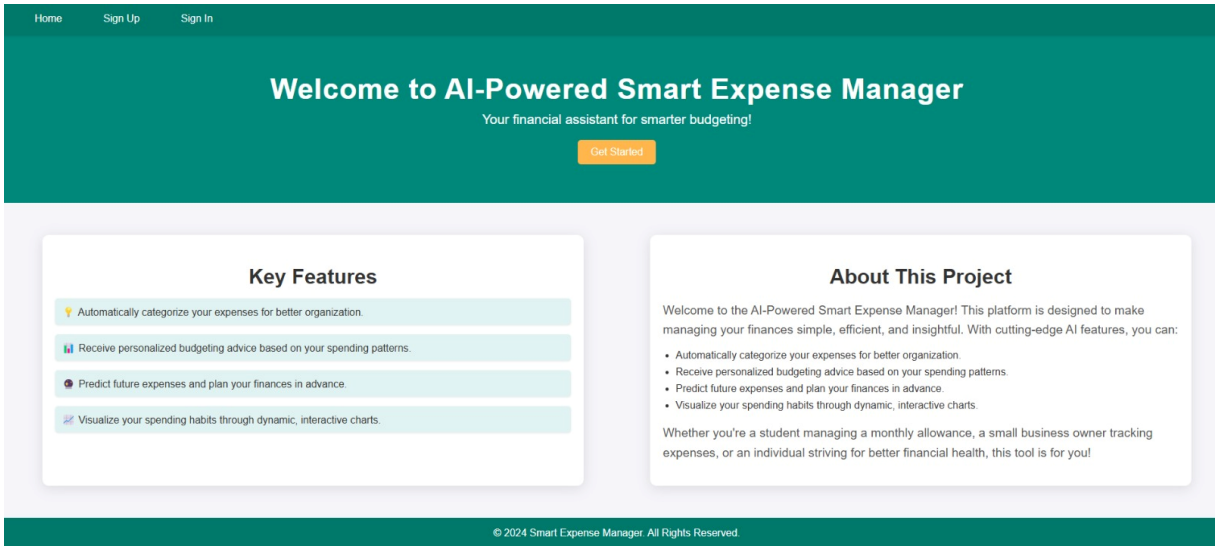
1. **User Inputs Expense Data** → Stored in PostgreSQL
2. **AI Categorizes Expenses** → NLP-based classification
3. **ML Predicts Future Expenses** → SimpleExpSmoothing trained on past data
4. **Data Visualized on Dashboards** → Real-time insight

Results

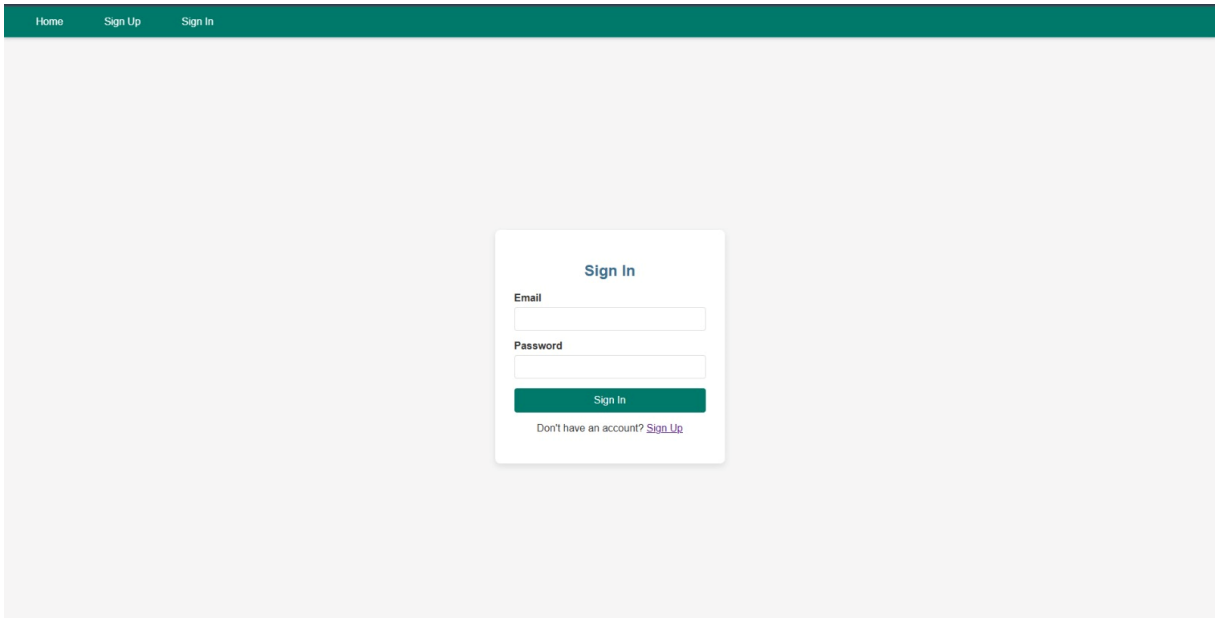
1. The AI-powered expense categorization demonstrated high accuracy, correctly classifying expenses based on past user data and NLP-based classification.
2. Achieved accurate budget recommendations based on historical spending trends, helping users manage finances more efficiently

Final Project Working Screenshots

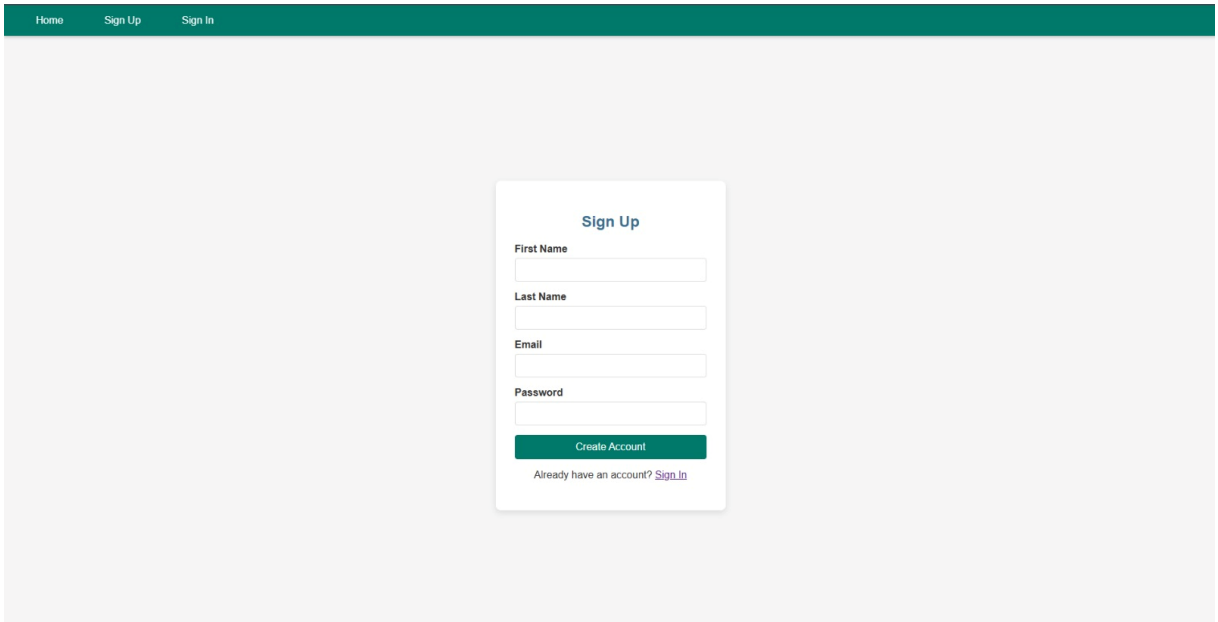
➢ Home Page:



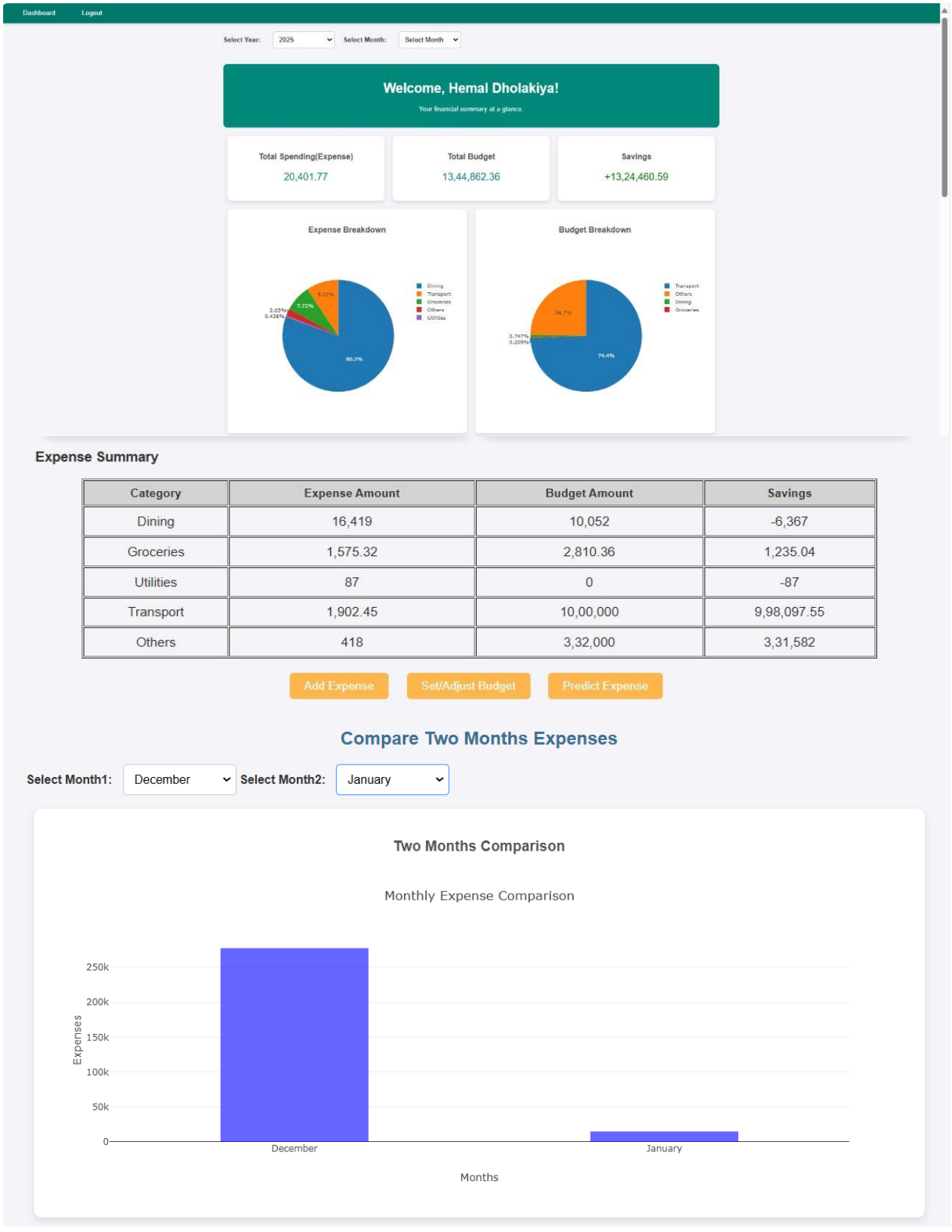
- **Signin Page:**



- **Signup Page:**



➢ Dashboard:


Dashboard
Logout
Select Year:
2025
Select Month:
Select Month
Welcome, Hemal Dholakiya!
Your financial summary at a glance
Total Spending(Expense)
20,401.77
Total Budget
13,44,862.36
Savings
+13,24,460.59
Expense Breakdown
Budget Breakdown
Expense Summary
Category
Expense Amount
Budget Amount
Savings
Dining
16,419
10,052
-6,367
Groceries
1,575.32
2,810.36
1,235.04
Utilities
87
0
-87
Transport
1,902.45
10,00,000
9,98,097.55
Others
418
3,32,000
3,31,582
Add Expense
Set/Adjust Budget
Predict Expense
Compare Two Months Expenses
Select Month1:
December
Select Month2:
January
Two Months Comparison
Monthly Expense Comparison
250k
200k
150k
100k
50k
0
Expenses
December
January
Months

GitHub Link

Frontend:

https://github.com/HemalDholakiya212/expense_manager_frontend

Backend:

https://github.com/HemalDholakiya212/expense-manager-backend

🚀 Live at:

https://ai-powered-smart-expense-manager-frontend.onrender.com/

Learning and Reflection

Learning and Reflection

New Learnings

1. **Impact of Data Preprocessing on Prediction Accuracy**
   I learned how data preprocessing, including handling missing values and outliers, significantly impacts the accuracy of expense prediction models. Cleaning and normalizing financial data helped improve the model's reliability.
2. **Importance of Transaction Categorization**
   Through experimentation, I discovered that accurate expense categorization using **NLP-based classification** and **rule-based filtering** enhances financial tracking. Proper classification improves budgeting insights and enables better decision-making.
3. **Effect of Feature Engineering on Expense Prediction**
   I learned that choosing the right features—such as past spending trends, seasonal variations, and income levels—affects the accuracy of **future expense prediction models**. Extracting relevant financial patterns improved model performance.
4. **Role of Database Optimization in Performance**
   Optimizing **PostgreSQL queries**, and structuring the **expense database schema** correctly significantly improved query performance. These optimizations made financial report generation and analytics faster and more efficient.
5. **Integration of OCR for Automated Expense Logging**
   Implementing **Tesseract OCR** for extracting transaction details from receipts and bank statements helped automate data entry, reducing manual effort and improving accuracy in expense tracking.
   a. **Handling Major Errors**
      a) **Mismatch in Expense Data Formats**
      Different bank statements and receipts use varied formats. I

addressed this by implementing **preprocessing scripts** that normalize data before feeding it into the system.

b. **Incorrect Expense Categorization Due to NLP Misclassification**
Initial NLP models misclassified certain transactions. I improved classification accuracy by refining the training dataset and adjusting **TF-IDF and word embeddings**.

c. **Memory and Performance Optimization in Large Data Handling**
Processing a large number of transactions caused performance bottlenecks. Optimizing **batch processing and indexing strategies** improved system efficiency.

Experience

This project reinforced my understanding of DSP concepts and their practical application in embedded systems. It also improved my problem-solving skills by addressing real-world constraints.

Conclusion and Future Scope

Objectives

The primary goals of this project were to:

1. **Develop an AI-powered expense management system** that allows users to log, categorize, and track expenses efficiently.
2. **Implement machine learning-based expense prediction** to help users forecast future spending patterns based on historical data.
3. **Enhance financial transparency** by visualizing expenses through dynamic graphs and budget reports.
4. **Automate expense entry** by integrating OCR for extracting data from receipts and bank statements.

Achievements

1. **Automated Expense Tracking**
   - Users can manually add expenses or upload receipts for automatic expense logging using **OCR (Tesseract)**.
2. **Expense Prediction and Budget Insights**
   - A **machine learning model** was successfully implemented to predict future expenses based on past spending trends.
3. **Real-Time Data Visualization**
   - Implemented **interactive charts and dashboards** for users to analyze spending habits.
   - Budget comparisons and category-wise breakdowns allow users to make informed financial decisions.

4. **Database Optimization and Performance Improvements**

    - Optimized **PostgreSQL queries** to handle large expense data efficiently.

Conclusion

The **AI-Powered Smart Expense Manager** successfully integrates **machine learning, NLP, and data visualization** to provide an intelligent and user-friendly financial management system. The system automates expense tracking, predicts future spending, and offers budget optimization insights while maintaining strong data security. This project proves that AI-driven solutions can significantly improve financial decision-making and simplify expense management for users.

Future Scope

1. **Integration with Banking APIs**
   - Connect with financial institutions for **real-time transaction updates** and **automatic expense tracking** from bank statements.
2. **Enhanced AI Accuracy with Larger Datasets**
   - Improve **ML model performance** by training on a more diverse and extensive dataset for better expense prediction.
3. **Voice-Based Financial Assistant**
   - Implement **AI-powered voice assistants** to allow hands-free interaction for adding expenses, checking budgets, and receiving financial insights.
4. **Advanced Financial Analytics**
   - Develop AI-driven **spending pattern analysis** and anomaly detection to alert users about unusual expenses.
5. **Smart Investment Recommendations**
   - Expand the system to suggest **investment opportunities** based on savings trends and financial goals.