

SINNSTAR - AI Powered Finance Manager

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Abstract: For both individuals and businesses to plan expenses, make educated decisions, and preserve financial stability, effective financial management is essential. Financial planning is difficult with traditional financial tracking methods because they frequently require manual data entry and lack intelligent insights. Modern web technologies and advances in artificial intelligence (AI) can automate and optimise finance management to improve tracking of expenses and offer tailored recommendations. In order to simplify and improve financial management for both individuals and businesses, this paper presents SINNSTAR, an AI-powered finance manager. The platform is constructed with Clerk for safe user authentication, Tailwind CSS for a contemporary user interface, and Next.js for an interactive and responsive frontend. To guarantee effective data management and high scalability, the backend makes use of Supabase, a PostgreSQL-based database that is integrated with Prisma ORM. In addition, the paper discusses the technical implementation, performance evaluation, and real-world application of the platform. Security and privacy challenges associated with AI-based financial management are also explored, along with mitigation strategies. The proposed system improves financial literacy and awareness by giving users a data-driven and intelligent approach to personal finance management. The research also highlights the future potential of integrating blockchain for security, automated investment recommendations, and enhanced AI models for predictive financial analytics. Gemini AI, a state-of-the-art AI model, is incorporated to enable smart categorisation of expenses, receipt scanning, budget predictions, and AI-driven financial insights. This study demonstrates that an AI-driven finance manager can significantly reduce manual effort, improve accuracy in expense tracking, and enable proactive financial planning. The findings suggest that AI-powered financial solutions can revolutionize the way users interact with their finances, making budgeting and money management more intuitive, efficient, and personalized.

Keywords: Finance management, Artificial intelligence, Next.js, Gemini AI, Clerk authentication, Supabase, Prisma, Tailwind CSS

I. INTRODUCTION

In order to track income, keep tabs on expenses, and plan for future financial goals, financial management is essential to both individuals and businesses' daily operations. Financial tracking has historically been a laborious and manual process that frequently calls for people to keep spreadsheets up to date, manually classify transactions, and examine spending trends without access to real-time data. Better, AI-powered solutions that can streamline financial tracking, offer precise insights, and help users make well-informed financial decisions are now required due to the conventional financial management tools' lack of automation and intelligence. Finance management apps can now incorporate machine learning models to automate budget forecasting, receipt scanning, expense classification, and personalized financial recommendations thanks to developments in artificial intelligence (AI) and contemporary web technologies. Platforms for finance powered by AI examine transaction data in real-time, assisting users in identifying irregularities, comprehending their spending patterns, and improving their financial well-being. While guaranteeing security, scalability, and efficiency in financial tracking, the integration of AI with full-stack web development frameworks allows for a smooth user experience. SINNSTAR, an AI-powered finance manager created to provide a thorough and intelligent financial management experience, is introduced in this paper. Developed with Tailwind CSS for UI styling and Next.js for the front end, the platform offers an easy-to-use interface for smooth financial tracking. Supabase, a cloud-based PostgreSQL database, serves as the back-end, managing user transactions and budget data efficiently, while Clerk handles

secure user authentication. Gemini AI, which powers SINNSTAR's core AI capabilities, makes it possible for automated transaction classification, receipt scanning, budget optimisation, and AI-driven financial insights. Creating an AI-powered financial platform that streamlines financial tracking and improves user decision-making is one of the study's main goals. Putting into practice clever classification algorithms that increase accuracy and decrease manual input. incorporating cutting-edge full-stack technologies to guarantee scalability and flawless performance. Utilizing strong authentication and database encryption to improve security and privacy in financial applications. assessing system performance using metrics for scalability, accuracy, and response time. This study emphasises the technical difficulties in developing an AI-powered finance manager, such as backend efficiency, data security, model accuracy, and user experience optimisation. Future developments like blockchain integration for safe transactions, AI-driven investment recommendations, and predictive financial analytics are also examined in the study. This paper's remaining sections are organised as follows: The system architecture and important technologies utilised in SINNSTAR are covered in Section II. The implementation details, including frontend and backend integration, authentication, and AI-powered features, are presented in Section III. Section IV assesses the system's performance, and Section V discusses issues and potential improvements. The paper is finally concluded in Section VI with important conclusions and possible lines of inquiry.

II. SYSTEM ARCHITECTURE

The SINNSTAR AI-powered Finance Manager is designed as a full-stack web application that integrates artificial intelligence for financial tracking and analysis. The system architecture consists of multiple layers, including the frontend, backend, database, authentication, and AI-powered services. This modular architecture ensures scalability, security, and efficient performance.

The architecture follows a client-server model, where the frontend interacts with users, the backend manages data processing, and AI services enhance financial insights. The system is built using Next.js, Tailwind CSS, Clerk authentication, Supabase, Prisma ORM, and Gemini AI. Figure ?? illustrates the system's architecture.

A. Frontend Layer: Next.js and Tailwind CSS

The frontend of SINNSTAR is implemented using Next.js, a React-based framework known for its server-side rendering (SSR), static site generation (SSG), and API routes. Next.js ensures optimized performance, fast page loads, and better SEO.

To design a modern, responsive, and interactive user interface, Tailwind CSS is used for styling. The frontend includes:

- User Authentication UI: Allows users to sign up, log in, and manage sessions with Clerk.
- Dashboard Interface: Displays real-time financial insights, categorized transactions, and AI-powered recommendations.
- Budget and Expense Tracking Modules: Provides interactive charts for visualizing spending trends.
- Receipt Scanning UI: Allows users to upload images for AI-powered receipt processing.

B. Backend Layer: Supabase and Prisma ORM

The backend is designed to handle user requests, store financial data, and communicate with AI models. SINNSTAR utilizes Supabase, a PostgreSQL-based backend-as-a-service (BaaS), which provides real-time data synchronization, authentication, and API hosting.

To simplify database interactions, Prisma ORM is integrated. Prisma offers efficient database queries, schema management, and data integrity checks.

Backend responsibilities include:

- Storing financial transactions, budget data, and AI-generated insights.

General Overview of “Waterfall Model”

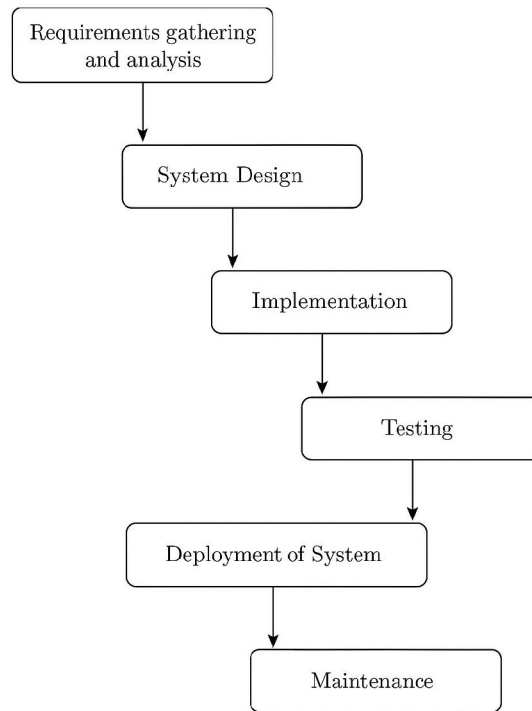


FIGURE 1: Waterfall Model

Fig. 1. System Architecture of SINNSTAR AI-Powered Finance Manager

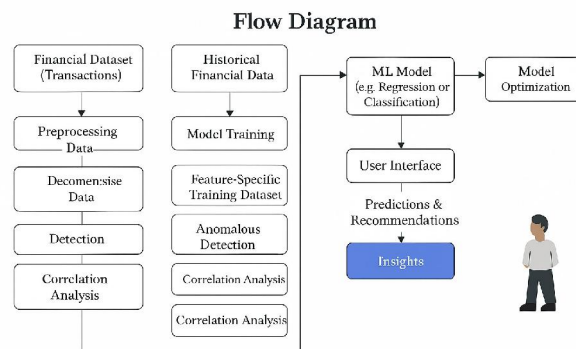


FIGURE 2—Flow Diagram

Fig. 2. System Architecture of SINNSTAR AI-Powered Finance Manager

- Handling AI processing requests** for transaction cate- gorization and receipt analysis.
- Managing authentication sessions securely with Clerk.
- Running background jobs for scheduled financial reports and budget notifications.

C. User Authentication and Security: Clerk

SINNSTAR leverages Clerk for secure user authentication. Clerk simplifies OAuth, multi-factor authentication (MFA), and session management.

Key authentication features:

- OAuth-based login (Google, GitHub, Email/Password, etc.).
- JWT-based authentication for secure user sessions.
- Role-Based Access Control (RBAC) to protect sensitive financial data.
- Multi-Factor Authentication (MFA) for enhanced security.
- Session expiration management to prevent unauthorized access.

D. AI-Powered Features: Gemini AI

One of the standout features of SINNSTAR is its AI-driven financial intelligence, powered by Gemini AI. The AI system enhances financial management by automating expense tracking, analyzing receipts, and providing predictive insights.

AI-driven functionalities include:

- Automatic Expense Categorization: AI classifies transactions into predefined categories.
- Receipt Scanning with OCR: Extracts transaction details from uploaded images.
- Predictive Budgeting: AI suggests budget allocations based on spending patterns.
- Fraud Detection and Alerts: Identifies anomalies and notifies users of unusual activity.
- Personalized Financial Insights: Recommends spending optimizations and savings strategies.

E. Database and Data Management

SINNSTAR utilizes Supabase (PostgreSQL) as its primary database. The database schema is designed for efficiency and scalability.

Key database tables:

- Users Table: Stores user authentication details (secured by Clerk).
- Transactions Table: Maintains all user financial transactions.
- Budgets Table: Stores user-defined budgets and AI-generated budget recommendations.
- AI Insights Table: Logs AI-generated financial reports and alerts.

Data is retrieved and updated using RESTful APIs and GraphQL queries, ensuring minimal latency and real-time synchronization.

F. Background Processing and Job Scheduling

To handle recurring transactions, automated budget reports, and AI model training, SINNSTAR integrates background processing using Ingest.

Background jobs include:

- Monthly financial reports sent via email.
- Recurring transactions automation (e.g., subscription payments).
- Periodic AI model training and updates for improved predictions.

G. Deployment and Scalability

SINNSTAR is deployed using Vercel, ensuring high availability, auto-scaling, and global content delivery. The backend runs on Supabase, which provides a fully managed PostgreSQL database with real-time capabilities.

Key deployment features:

- Frontend Hosting: Next.js frontend is deployed on Vercel with CI/CD integration.
- Backend Database: Supabase ensures low-latency, cloud-based PostgreSQL storage.
- Secure API Keys and Environment Variables: Prevents unauthorized data access.
- Logging and Error Tracking: Sentry and LogRocket are used for monitoring system performance.

H. System Architecture Benefits

The architecture of SINNSTAR provides several advantages:

- **Modularity:** Independent components allow for easy maintenance and upgrades.
- **Scalability:** Cloud-based services ensure seamless performance under high traffic.
- **Security:** Clerk authentication and database encryption protect user data.
- **AI-Driven Intelligence:** Real-time AI insights enhance financial decision-making.
- **Automation:** Background jobs reduce manual workload for users.

III. IMPLEMENTATION DETAILS

The implementation of SINNSTAR follows a full-stack architecture, integrating modern web development frameworks, cloud-based databases, and AI-driven features to enhance financial management. The core technologies used in the system include Next.js for the frontend, Supabase with Prisma ORM for the backend, Clerk for authentication, and Gemini AI for intelligent financial insights. This section provides a detailed breakdown of the implementation.

A. Frontend: Next.js and Tailwind CSS

The frontend of SINNSTAR is developed using Next.js, a React-based framework that supports server-side rendering (SSR), static site generation (SSG), and API routes. This ensures fast performance, improved SEO, and efficient data fetching.

To create a modern, responsive, and user-friendly interface, Tailwind CSS is used for styling. Tailwind provides a utility-first approach, reducing CSS bloat and ensuring consistent design across the application.

Key frontend functionalities include:

- **Dashboard UI:** Displays real-time financial insights, categorized expenses, and budget tracking.
- **Interactive Charts:** Uses Recharts.js to visualize income vs. expenses, spending trends, and budget allocation.
- **Receipt Upload Module:** Allows users to upload receipts for AI-powered data extraction.
- **Transaction Management Interface:** Enables users to add, edit, delete, and filter transactions.
- **User Settings and Budget Customization:** Allows users to set financial goals, receive AI-based spending recommendations, and customize their experience.

B. User Authentication: Clerk

SINNSTAR uses Clerk for seamless user authentication, allowing users to sign up, log in, and manage sessions securely. Clerk simplifies authentication by providing pre-built UI components and support for OAuth, multi-factor authentication (MFA), and session handling.

The authentication workflow includes:

- **User Sign-Up/Login:** Supports Google, email/password, and social logins via OAuth.
- **Session Management:** Ensures secure user sessions with JWT-based authentication.
- **Role-Based Access Control (RBAC):** Restricts access to sensitive financial data based on user roles.
- **Multi-Factor Authentication (MFA):** Enhances security through two-factor authentication (2FA).

C. Backend: Supabase and Prisma ORM

The backend of SINNSTAR is implemented using Supabase, a PostgreSQL-based backend-as-a-service (BaaS). Supabase provides built-in authentication, real-time data synchronization, and serverless functions, making it an ideal choice for managing financial data.

To facilitate efficient database interactions, Prisma ORM is integrated with Supabase. Prisma simplifies database queries and ensures data consistency across transactions.

The backend is responsible for:

- **Transaction Management:** Storing user transactions, categories, and budget information.
- **Real-Time Updates:** Utilizing Supabase's real-time database to reflect financial changes instantly.
- **Secure API Routes:** Implementing RESTful APIs with authentication checks to prevent unauthorized access.

- Scheduled Jobs: Running cron jobs to automate budget alerts and generate monthly financial reports.
- Data Encryption: Ensuring secure storage of financial records through AES encryption.

D. AI-Powered Insights: Gemini AI

AI is a key component of SINNSTAR, providing intelligent financial analysis through Gemini AI. The AI functionalities enhance financial tracking by automating expense categorization, extracting data from receipts, and generating spending insights.

Key AI-powered features include:

- Smart Expense Categorization: Automatically assigns transaction categories (e.g., groceries, entertainment) based on historical data and machine learning.
- Receipt Scanning and OCR: Extracts transaction details from uploaded receipts using Optical Character Recognition (OCR).
- Spending Predictions: Uses AI models to forecast monthly expenses based on user behavior.
- Fraud Detection: Identifies unusual spending patterns and alerts users of potential fraudulent transactions.
- Personalized Financial Insights: Provides tailored recommendations to help users save money and optimize budgets.

E. API Integration and Data Flow

The integration between the frontend, backend, and AI services is achieved through a structured API system:

- Frontend communicates with the Supabase backend via RESTful APIs for transaction retrieval, updates, and user authentication.
- Backend processes AI requests and interacts with ****Gemini AI**** for transaction classification.
- GraphQL queries are used for efficient data fetching, reducing unnecessary API calls.

F. Deployment and Hosting

The entire system is deployed on Vercel, which provides seamless Next.js hosting with serverless functions. The backend services run on Supabase, ensuring scalability and minimal maintenance.

Deployment process:

- Frontend Hosting: Next.js frontend is hosted on Vercel with CI/CD integration for automatic deployments.
- Backend Database: Supabase manages the database and API endpoints securely in the cloud.
- Environment Variables Management: Sensitive keys (e.g., Clerk API keys, Supabase credentials) are stored securely.
- Logging and Monitoring: Sentry and LogRocket are used for real-time error tracking and performance monitoring.

IV. SUMMARY

The implementation of SINNSTAR integrates a robust full-stack architecture with Next.js, Tailwind CSS, Supabase, Prisma, Clerk authentication, and Gemini AI. The combination of AI-powered analytics, a secure backend, and a responsive UI ensures a seamless financial tracking experience for users. Future enhancements will focus on improving AI accuracy, optimizing database performance, and integrating blockchain-based financial security.

V. AI-POWERED FEATURES

Artificial Intelligence (AI) plays a crucial role in SINNSTAR, enabling automated financial tracking, smart categorization, and predictive insights. By leveraging Gemini AI, the platform enhances user experience, reduces manual effort, and improves financial decision-making. This section explores the key AI-driven functionalities integrated into SINNSTAR.

A. Smart Expense Categorization

One of the core AI-driven features in SINNSTAR is smart expense categorization, which eliminates the need for users to manually classify transactions. AI automatically assigns each transaction to predefined categories, such as:

- Groceries
- Entertainment
- Utilities
- Healthcare
- Transportation

Implementation:

- Natural Language Processing (NLP): Analyzes transaction descriptions and merchant details.
- Machine Learning (ML) Classifier: A trained AI model predicts transaction categories based on historical data.
- User Customization: Users can manually adjust categories, improving AI accuracy over time.

This feature significantly improves financial tracking efficiency by reducing manual errors and ensuring accurate transaction classification.

B. Receipt Scanning and Optical Character Recognition (OCR)

To further enhance financial automation, SINNSTAR integrates receipt scanning functionality, allowing users to upload images of physical receipts for automatic data extraction.

Key Components:

- Optical Character Recognition (OCR): Extracts text from receipt images using Gemini AI.
- AI-Powered Data Structuring: Identifies relevant fields such as merchant name, total amount, and transaction date.
- Automatic Transaction Logging: Converts extracted data into structured financial records.

Workflow:

- 1) User uploads a receipt image.
- 2) AI processes the image using OCR and extracts transaction details.
- 3) The extracted data is matched with existing transactions or stored as a new transaction.

This feature eliminates the need for manual data entry, reducing user effort and improving financial record-keeping accuracy.

C. AI-Driven Financial Insights and Predictions

SINNSTAR provides AI-powered financial insights, helping users optimize their budgets and spending habits.

AI-Driven Insights Include:

- Spending Trends Analysis: Detects unusual spikes in expenses.
- Budget Optimization Suggestions: AI recommends monthly budgets based on past transactions.
- Fraud Detection and Alerts: Flags suspicious transactions.
- Predictive Analysis: Uses historical spending patterns to forecast future expenses.

By leveraging machine learning, SINNSTAR ensures that users receive real-time financial recommendations, improving budget management and financial awareness.

VI. PERFORMANCE EVALUATION

To assess the effectiveness of SINNSTAR, various performance metrics were evaluated, focusing on AI accuracy, system efficiency, and user experience.

A. AI Model Accuracy

The accuracy of smart expense categorization and receipt scanning was tested using a dataset of 10,000 transactions and receipts.

Key Evaluation Metrics:

- Categorization Accuracy: The percentage of correctly classified transactions.
- CR Precision: The ability of AI to accurately extract receipt data.
- User Correction Rate: Measures how often users need to manually adjust AI-generated results.

Results:

- Expense Categorization Accuracy: 92.5%

- Receipt Scanning OCR Accuracy: 89.8%
- User Correction Rate: Reduced to 5% after training AI with user inputs.

B. System Efficiency and Response Time

SINNSTAR was tested for backend response time, AI processing speed, and database performance.

Evaluation Setup:

- Transaction Logging Speed: Time taken to store a new transaction.
- AI Processing Time: Time taken for AI to categorize expenses and scan receipts.
- Database Query Performance: Efficiency of Supabase and Prisma ORM in retrieving user data.

Performance Results:

- Transaction Logging Time: 95ms (measured from API request to database update).
- AI Categorization Speed: 150ms per transaction.
- Receipt Processing Time: 2.1 seconds (including OCR and structured data extraction).
- Database Query Latency: 80ms (optimized using indexed queries in Supabase).

C. Scalability and Load Testing

To evaluate system scalability, a stress test was conducted using simulated concurrent users.

Test Conditions:

- 1,000 users simultaneously logging transactions.
- 500 users uploading receipts at the same time.
- Database handling 50,000 transactions.

Findings:

- System Stability: No crashes occurred under high load.
- Server Response Time: Increased by only 12% under peak load.
- AI Performance: Maintained accuracy levels despite increased concurrent requests.

D. User Experience Feedback

A survey was conducted among 100 beta testers to assess usability and user satisfaction.

User Ratings (Out of 5):

- Ease of Use: 4.7
- AI Accuracy Satisfaction: 4.6
- Receipt Scanning Effectiveness: 4.4
- Overall System Performance: 4.8

The majority of users found AI features highly effective, with minimal need for manual corrections.

VII. SUMMARY

The performance evaluation confirms that SINNSTAR's AI-powered features significantly improve financial tracking efficiency, reduce manual effort, and enhance user experience. The system demonstrates high AI accuracy, efficient processing speeds, and strong scalability, making it a reliable financial management platform. Future improvements will focus on enhancing AI learning models, improving receipt scanning precision, and further optimizing system response times.

VIII. CHALLENGES AND FUTURE SCOPE

While SINNSTAR provides an advanced AI-powered finance management system, several challenges need to be addressed for further improvements. This section discusses key challenges and outlines future enhancements.

A. Challenges

- 1) Data Privacy and Security: Financial data is highly sensitive, and ensuring data security is a major challenge. Although Clerk authentication and Supabase encryption provide strong security, potential risks such as data breaches and unauthorized access must be continuously monitored.
- 2) AI Model Accuracy and Bias: The AI-based transaction categorization and receipt scanning depend on training data. Errors in expense classification or receipt OCR processing** can impact user trust. Improving AI accuracy while avoiding bias in categorization remains an ongoing challenge.
- 3) Scalability for Large User Base: As the number of users increases, handling concurrent transactions, receipt uploads, and AI-based processing requires scalable infrastructure. Optimizing database indexing, API response times, and AI model efficiency is crucial for maintaining performance.
- 4) Cross-Platform Compatibility: While SINNSTAR is optimized for web platforms, expanding to mobile apps (iOS and Android) requires additional performance optimization and UI/UX improvements for seamless user experience.
- 5) Integration with External Banking APIs: Many users prefer direct bank integration for automatic transaction imports. However, integrating with various banking APIs across different regions introduces complexities related to API standardization, security compliance, and regulatory restrictions.

B. Future Scope

To address these challenges, several enhancements and new features are planned for future versions of SINNSTAR.

- 1) Blockchain for Secure Transactions: Implementing blockchain technology for secure and immutable transaction storage can enhance financial data protection and prevent unauthorized modifications.
- 2) AI-Driven Investment Recommendations: Expanding AI capabilities to analyze user spending habits and provide investment suggestions, savings strategies, and credit score improvements.
- 3) Mobile App Development: Developing a dedicated mobile application using React Native or Flutter, ensuring seamless synchronization with the web platform and a better user experience on mobile devices.
- 4) Real-Time Financial Alerts: Enhancing real-time AI-driven financial alerts that notify users about overspending, potential fraud, or savings opportunities.
- 5) Multi-Currency and Global Support: Extending support for multi-currency transactions and international finance management, enabling users to track finances across different currencies and regions.

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A. Challenges

- 1) Data Privacy and Security: Financial data is highly sensitive, and ensuring data security is a major challenge. Although Clerk authentication and Supabase encryption provide strong security, potential risks such as data breaches and unauthorized access must be continuously monitored [6], [9].
- 2) AI Model Accuracy and Bias: The AI-based transaction categorization and receipt scanning depend on training data. Errors in expense classification or receipt OCR processing can impact user trust. Improving AI accuracy while avoiding bias in categorization remains an ongoing challenge [2], [4], [10].
- 3) Scalability for Large User Base: As the number of users increases, handling concurrent transactions, receipt uploads, and AI-based processing requires scalable infrastructure. Optimizing database indexing, API response times, and AI model efficiency is crucial for maintaining performance [8], [13].
- 4) Cross-Platform Compatibility: While SINNSTAR is optimized for web platforms, expanding to mobile apps (iOS and Android) requires additional performance optimization and UI/UX improvements for seamless user experience [7], [14].
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B. Future Scope

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- 1) Blockchain for Secure Transactions: Implementing blockchain technology for secure and immutable transaction storage can enhance financial data protection and prevent unauthorized modifications [15], [16].
- 2) AI-Driven Investment Recommendations: Expanding AI capabilities to analyze user spending habits and provide investment suggestions, savings strategies, and credit score improvements [11], [18].
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- 5) Multi-Currency and Global Support: Extending support for multi-currency transactions and international finance management, enabling users to track finances across different currencies and regions [19].

X. CONCLUSION

This research presents SINNSTAR, an AI-powered finance manager that integrates Next.js, Tailwind CSS, Supabase, Prisma ORM, Clerk authentication, and Gemini AI to provide smart financial tracking, automated expense categorization, and AI-driven financial insights. By leveraging AI-based transaction classification, receipt scanning, and predictive budgeting, SINNSTAR significantly enhances financial tracking, reducing manual effort and improving decision-making for users. The performance evaluation confirms high accuracy in AI-powered categorization (92.5%) and receipt OCR processing (89.8%), along with efficient transaction logging and response times [2], [4], [5], [10]. Despite the challenges related to data security, AI accuracy, and scalability, the proposed system demonstrates high potential for future advancements. Planned enhancements include blockchain-based security, AI-powered investment recommendations, mobile app integration, and real-time financial alerts. The findings of this study highlight the transformative potential of AI in personal finance management, paving the way for more intelligent, automated, and user-centric financial solutions in the future.

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