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OCR in Finance: A Web-Based Approach for Personalized Expense Tracking and Budget Monitoring

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Abstract: *Managing personal finances is a critical challenge in today's fast-paced world, as individuals often struggle to track daily expenditures and maintain a balanced budget. The complexity of manually recording expenses and adhering to financial goals without proper tools leads to inefficiencies and financial mismanagement. This paper presents the OCR in Finance: A Web-Based Approach for Personalized Expense Tracking and Budget Monitoring to address these challenges. The proposed system simplifies the process of expense tracking by integrating Optical Character Recognition (OCR) for automatic bill scanning and manual logging options. Users can categorize their spending into custom-defined categories, such as food, petrol, and clothing, and set monthly budget limits for each category. The system proactively monitors spending and sends real-time e-mail alerts when a budget limit is exceeded or when expenses surpass a user-defined percentage of their salary, ensuring timely oversight. Additionally, the platform generates periodic visual reports (graphs and charts) summarizing spending patterns and sends them via email for informed decision-making. A key feature of the system is an AI chatbot, which offers personalized financial advice, further enhancing user experience. The application utilizes modern web technologies, including HTML, CSS, JavaScript, and MySQL for backend data management. By providing an intuitive, user-centric approach, the project empowers individuals to better manage their finances, optimize spending, and work towards achieving their financial goals.*

Keywords: Expense Tracking, OCR, Chatbot, Passbook Digitization, Budget Alerts, MySQL

I. INTRODUCTION

In India, managing personal finances has become a significant challenge for a large section of the population. With rising living costs, fluctuating incomes, and the growing complexity of financial products, many individuals struggle to efficiently manage their daily expenses and long-term financial goals. Traditional methods of budget management, such as manual logging of expenses, often fail to provide accurate, real-time insights and are prone to human error. Furthermore, most individuals lack the financial literacy necessary to make informed decisions, leading to poor financial management and unnecessary financial stress.

The lack of effective tools for personal finance management is particularly concerning, as it hampers the ability of individuals to plan their budgets, track expenditures, and stay on top of their financial health. While financial literacy plays a crucial role in effective money management, studies have shown that a significant portion of the Indian population lacks proper financial education. In fact, a report by the National Center for Financial Education (NCFE) reveals that only 27% of Indians are financially literate. Despite the rapid growth of the personal finance software market globally, existing solutions often fail to address the unique needs of individuals with low financial literacy, making it harder for them to manage their finances effectively.

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This paper presents OCR in Finance: A Web-Based Approach for Personalized Expense Tracking and Budget Monitoring, a solution aimed at bridging the gap between the lack of financial literacy and the need for efficient financial management tools. The project focuses on creating a web-based platform that simplifies the process of tracking and managing personal expenses. By integrating Optical Character Recognition (OCR) technology, users can easily scan and extract data from their bills, minimizing manual data entry and reducing the risk of errors. The system automatically categorizes expenses, enabling users to gain real-time insights into their spending habits without complex manual tracking.

Moreover, the application empowers users to set customizable budget limits for various categories such as food, transport, and entertainment. The system sends email alerts when users approach or exceed their set limits, promoting timely financial decisions and helping them avoid overspending. Visual reports, including graphs and charts, are generated and sent periodically to the users, offering valuable insights into their financial behavior. An integrated AI-powered chatbot further enhances the user experience by providing personalized advice based on individual financial goals.

By leveraging advanced technologies such as Optical Character Recognition (OCR) for seamless bill scanning and categorization, along with an AI-powered chatbot that provides personalized financial advice, this project offers an intuitive and accessible solution.

II. RELATED WORK

A. OCR in Finance Applications

In the paper by Koo et al. [2], an expense tracking mobile application was developed using Tesseract OCR v5, achieving an average Character Error Rate (CER) of 9.36% for item text recognition and a System Usability Scale (SUS) score of 71.5%. The study demonstrated that OCR could automate manual entry of expenses, although challenges remained when dealing with blurred or low-quality images. Similarly, Garcia and Claour [3] proposed the Mobile Bookkeeper application, emphasizing automatic digitization of receipts via OCR to generate personal expense reports. They highlighted key technical issues such as lighting conditions, skewness, and typography variance that affect OCR accuracy. Nawinna et al. [1] extended the application of OCR beyond printed receipts to include handwritten financial documents by employing specialized pre-processing techniques and neural models to improve extraction accuracy. Moreover, researchers have investigated the integration of advanced OCR models for banking forms [12], but generic user-focused expense tracking through passbook or multi-format receipt scanning still poses difficulties. These studies collectively indicate that while OCR has successfully reduced manual expense recording efforts, its performance is sensitive to the quality and structure of input documents.

B. Chatbot Integration in Expense Tracking

Integrating chatbot functionalities into financial management applications has emerged as a promising approach to enhance user interaction and automate expense tracking. Uyanahewa et al. [1] presented the WONGA system, which utilizes Natural Language Processing (NLP) models and Artificial Neural Networks (ANNs) to extract and categorize financial data from SMS messages. The system automates transaction recognition and uses chatbots for user communication, significantly reducing manual input and enhancing user engagement. The study demonstrated that combining text extraction and chatbot interfaces improves the usability and appeal of personal finance apps. In a related study, Shao et al. [5] reviewed conversational agents for finance management, noting that while many banking apps offer basic chatbot functionalities, the integration of personalized financial guidance through conversational systems remains limited. Overall, these findings suggest that intelligent chatbot integration can streamline expense tracking and provide real-time financial insights to users, although there is still scope for deeper personalization based on individual spending patterns.

C. Passbook Scanning Innovations

Passbook scanning and digitization have gained attention as a method for automating financial recordkeeping. Although much work has been done in extracting structured data from printed banking forms, passbook scanning for personal

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finance tracking is relatively underexplored. Nawinna et al. [1] introduced techniques for extracting transaction details from SMS and financial documents but did not directly address passbook scanning. Recent studies on mobile OCR for banking documents [12] have shown that high-accuracy text extraction is achievable on structured forms using advanced deep learning models. However, most such solutions are tailored for specific institutional formats and are not generalized for consumer applications. The variability in passbook layouts, print quality, and handwritten annotations presents unique challenges for OCR systems. These studies reveal a gap in developing flexible, user-friendly solutions for personal passbook digitization, suggesting opportunities for further research and system development.

D. Budget Monitoring Techniques

Effective budget monitoring remains a critical aspect of personal finance management. Garcia and Claour [3] implemented a budget tracking feature in Mobile Bookkeeper that utilized OCR-extracted receipt data to generate cumulative spending reports, thereby enhancing users' financial awareness. Meanwhile, the WONGA application proposed by Uyanahewa et al. [1] extended traditional budget monitoring by employing machine learning algorithms to generate personalized budget plans. Their system analyzed past spending patterns using time-series forecasting models such as ARIMA and integrated future expense predictions based on calendar events. Additionally, Kumar [15] reviewed AI-based budgeting systems and emphasized the importance of dynamic budget adaptations based on predictive analytics rather than static historical data. While existing applications such as Mint and YNAB offer manual tracking and visualization features, they often lack predictive budget adjustments. The reviewed literature indicates that combining automated data extraction, behavioral analysis, and machine learning forecasting can significantly enhance the accuracy and relevance of budget plans, thus supporting more informed financial decisions.

III. METHODOLOGY

A. Smart Expense Tracker

This component of the research focuses on automating the extraction of expense details from receipts and passbook images through Optical Character Recognition (OCR). The system uses Tesseract.js, an open-source OCR engine, integrated within a web-based interface to process uploaded images securely on the client side. To enhance recognition accuracy, uploaded images undergo several pre-processing techniques such as gray-scaling, sharpening, noise reduction, resizing, and binarization. After pre-processing, Tesseract OCR extracts transaction-related information including merchant names, transaction dates, and transaction amounts. The parsed data are mapped to structured fields, and users are given the opportunity to review and manually correct extracted values before final submission. All validated expense records are securely stored in a MySQL database, ensuring efficient data retrieval and offline access for further analysis.

B. Data Visualization

After organizing the extracted financial data, the system provides dynamic and interactive visualizations to offer users valuable insights into their spending patterns. Bar graphs are used to illustrate year-over-year comparisons, helping users observe variations in annual spending across different categories. Pie charts display the proportional distribution of expenses among key categories such as Food, Transport, Housing, Healthcare, and Entertainment. The visualization engine is powered by the Chart.js JavaScript library, which allows responsive and real-time updates based on user activity. This graphical representation of financial behavior enables users to identify overspending trends and make informed decisions regarding budgeting and savings optimization.

C. Budget Monitoring and Email Alerts

A critical feature of the system is budget monitoring, which aids users in maintaining spending discipline. Users can define monthly budget limits for each expense category through the application's settings module. The system continuously monitors real-time expense accumulation across categories and compares them to the user-defined limits. When spending in any category exceeds the assigned threshold, an automated email alert is triggered and sent to the user via the Simple Mail Transfer Protocol (SMTP). This mechanism ensures that users are promptly

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notified of potential overspending, enabling corrective financial actions without delay. Email alerts are securely configured using SMTP libraries and integrated seamlessly with the application's backend logic

D. Chatbot Integration for User Queries

To improve usability and enhance user engagement, the system integrates a chatbot that provides an interactive interface for users to access general assistance and guidance. The chatbot serves as a first-level support tool, offering users real-time responses to common queries related to the application's features. The chatbot assists users with tasks such as setting up new budgets, understanding visualizations, or navigating through the application's functionalities. By providing automated, conversational assistance, the chatbot helps users efficiently interact with the system without the need for extensive manual navigation or technical knowledge. This feature contributes to a more user-friendly experience, allowing users to quickly receive help and suggestions.

IV. RESULTS AND DISCUSSION

The Personalized Daily Expense Tracker demonstrated robust performance across all key metrics. OCR-based bill data extraction achieved an accuracy of 95 %, while the system delivered Telegram alerts with 98 % reliability. Beta testers rated overall satisfaction at 4.6 out of 5, and stress testing confirmed a 99.2 % system uptime, indicating both user approval and operational stability.

Table I: Key System Performance Metrics

Metric	Result
OCR-based bill data extraction accuracy	95 %
Email alert delivery reliability	98 %
System uptime (stress testing)	%

Expense entry became significantly more efficient compared to traditional methods. Whereas manual entry previously required around three minutes per record, our streamlined form interface reduced that to 45 seconds. Incorporating OCR further cut data entry time by 70 %, averaging just 15 seconds per scanned bill. Users also valued the flexibility to define between 5 and 15 custom spending categories, tailoring the tracker to their individual needs.

Table II: Comparison of Manual and OCR-Based Expense Entry Methods

Method	Time-per Entry	Error Rate	User Preference
Manual Input	45 s	2 %	40 %
OCR Automation	15 s	5 %*	60 %

* Errors were primarily due to low-quality bill scans (e.g., blurred or poorly lit images).

Budget monitoring proved equally effective: email alerts triggered via SMTP reached users in under two seconds upon exceeding category thresholds, and customizable alert levels (e.g., 40 %, 50 % of budget) helped prevent notification fatigue. The combination of rapid alerting and intuitive visual feedback empowered users to correct spending behavior proactively rather than reactively.

Despite these strengths, the OCR module's 5 % error rate on low-quality scans highlights an opportunity for improvement—specifically through enhanced pre-processing or machine-learning–based post-correction. Future work will explore these avenues as well as the addition of push notifications and deeper in-app insights to further boost user engagement. Overall, the system delivers a lightweight, modular solution that effectively automates expense tracking, tightens budget adherence, and provides clear, actionable financial insights.

V. CONCLUSION AND FUTURE SCOPE

The OCR in Finance: A Web-Based Approach for Personalized Expense Tracking and Budget Monitoring project has demonstrated that a lightweight web technology stack—comprising HTML, CSS, JavaScript, and MySQL—can deliver robust, enterprise-grade financial management capabilities. By seamlessly integrating OCR-based invoice and receipt

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processing with real-time budget-breach alerts via Telegram, the application unites the ease of manual tracking apps with the power of sophisticated accounting software. As a result, advanced financial oversight becomes accessible to everyday users without imposing significant technical or resource requirements.

Looking ahead, the system will evolve to include more advanced OCR capabilities—such as handwriting recognition powered by CNN-LSTM hybrid models and support for multiple languages—to further reduce manual corrections. User experience enhancements like voice-activated expense logging will improve accessibility and battery efficiency. On the analytical front, incorporating LSTM-based predictive models will enable proactive spending forecasts and automated budget rebalancing. Broader ecosystem integrations—linking digital payment networks and generating tax-compliant reports—will streamline end-to-end financial workflows. To support these features, the data architecture will adopt real-time streaming pipelines, and the system will adhere to emerging data localization and privacy standards. In the long term, a decentralized architecture leveraging blockchain for expense verification and issuing NFT-based digital receipts will enhance security, auditability, and user trust, positioning the application at the forefront of next-generation personal finance management.

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