Interactive Dashboard–Based Analysis of Personal Financial Transactions for Budget Control and Savings Enhancement

Anany Singh

Department of Electronics and Computer Engineering

J. B. Institute of Engineering and Technology, Hyderabad, India

Dr. Md. Asif

Assistant Professor

Department of Electronics and Computer Engineering

J. B. Institute of Engineering and Technology, Hyderabad, India

asif.ecm@jbiet.edu.in

Abstract

Personal financial management has become increasingly complex due to the rapid growth of digital payments and diverse spending channels. Individuals often struggle to track expenses, understand spending behaviour, and maintain consistent savings. This paper presents an interactive dashboard–based analytical framework for personal financial transaction analysis aimed at supporting effective budget control and savings enhancement. The proposed system integrates a relational database for structured data storage, spreadsheet-based preprocessing for data refinement and indicator computation, and a business intelligence platform for real-time interactive visualization. The framework enables users to explore category-wise expenses, payment mode patterns, monthly trends, and savings performance through intuitive dashboards. Experimental evaluation demonstrates that the proposed system significantly improves visibility of financial behaviour and supports informed decision-making for sustainable financial planning.

Keywords: Personal finance analytics, expense tracking, interactive dashboards, Power BI, financial decision support, data visualization.

1. Introduction

Digital transformation in banking and payment platforms has enabled individuals to perform a large number of daily financial transactions using mobile applications, cards and online services. Although transaction records are easily accessible, extracting meaningful insights from raw financial data remains a challenging task for most users. Traditional expense tracking methods rely on manual record keeping or static spreadsheet summaries. These approaches lack automated categorization, dynamic exploration and interactive analysis capabilities. Consequently, users fail to recognize spending patterns, seasonal variations and hidden leakage points in their budgets.

Recent advances in data analytics and business intelligence tools provide an opportunity to transform personal finance management into an interactive, data-driven activity. By integrating structured storage, data preprocessing and interactive visualization, individuals can gain real-time insights into their financial behaviour and make informed budgeting decisions.

This paper proposes an integrated analytical framework that combines SQL-based data storage, Excel-based preprocessing and indicator computation, and interactive dashboard visualization for personal financial transaction analysis.

The key contributions of this work are:

- design of an end-to-end analytical pipeline for personal finance data,
- development of interactive dashboards for expense and savings exploration,
- formulation of budget and savings indicators for financial awareness, and
- experimental validation of the proposed framework.

2. Related Work

Several studies have investigated personal finance applications and expense tracking platforms. Most commercial applications provide transaction summaries and static charts. However, limited flexibility is offered for custom exploration and deeper analytical insights.

Research on financial analytics has focused primarily on enterprise-level accounting systems and investment analysis. In contrast, personal-level financial decision support systems remain comparatively under-explored. Recent works highlight the importance of interactive visualization and self-service analytics for non-technical users.

Business intelligence platforms have demonstrated strong potential in financial reporting and operational analytics. Nevertheless, their application for individual-level budgeting and behavioural spending analysis has not been adequately studied. The proposed work bridges this gap by introducing a lightweight and user-centric dashboard framework specifically tailored for personal financial data.

3. Overall System Architecture
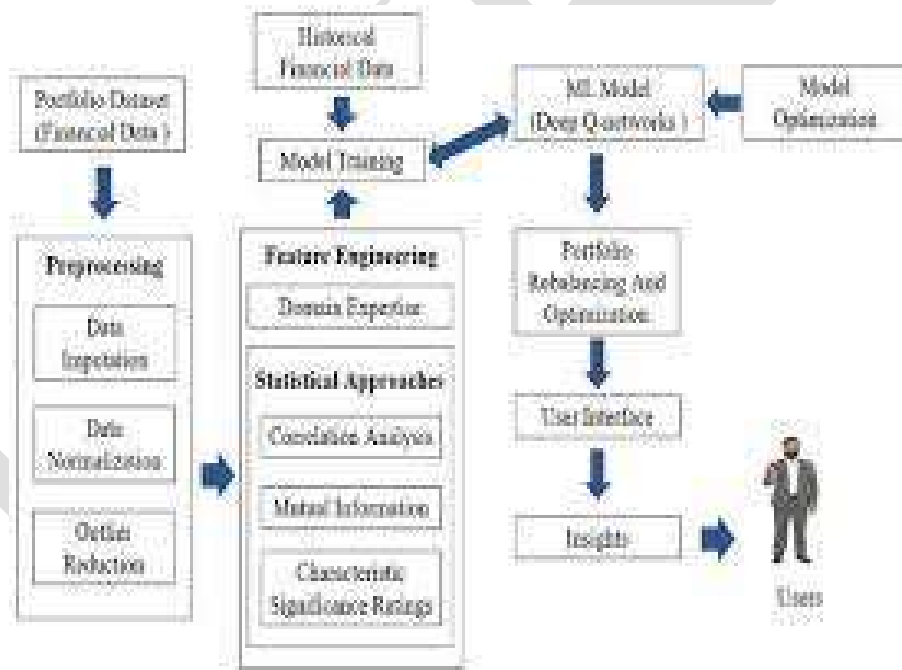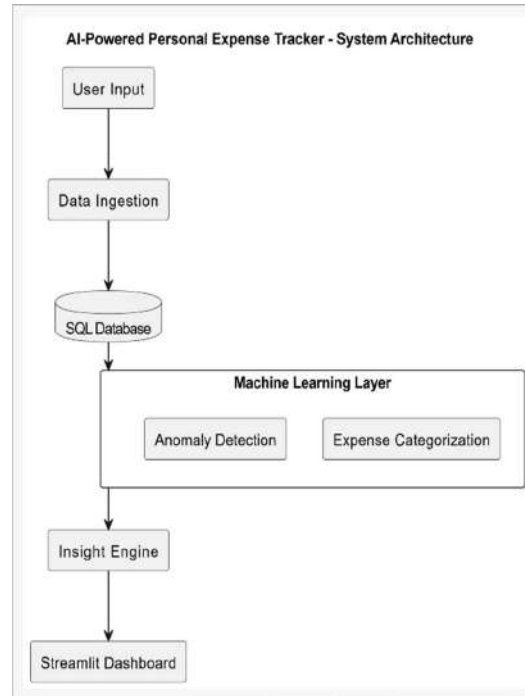
The proposed framework adopts a layered analytical architecture consisting of:

- data acquisition and storage layer,
- data preprocessing and transformation layer,
- analytics and indicator computation layer, and
- visualization and interaction layer.

The architecture allows independent modification of each layer and supports scalable data integration.

4. Data Processing and Analytical Workflow
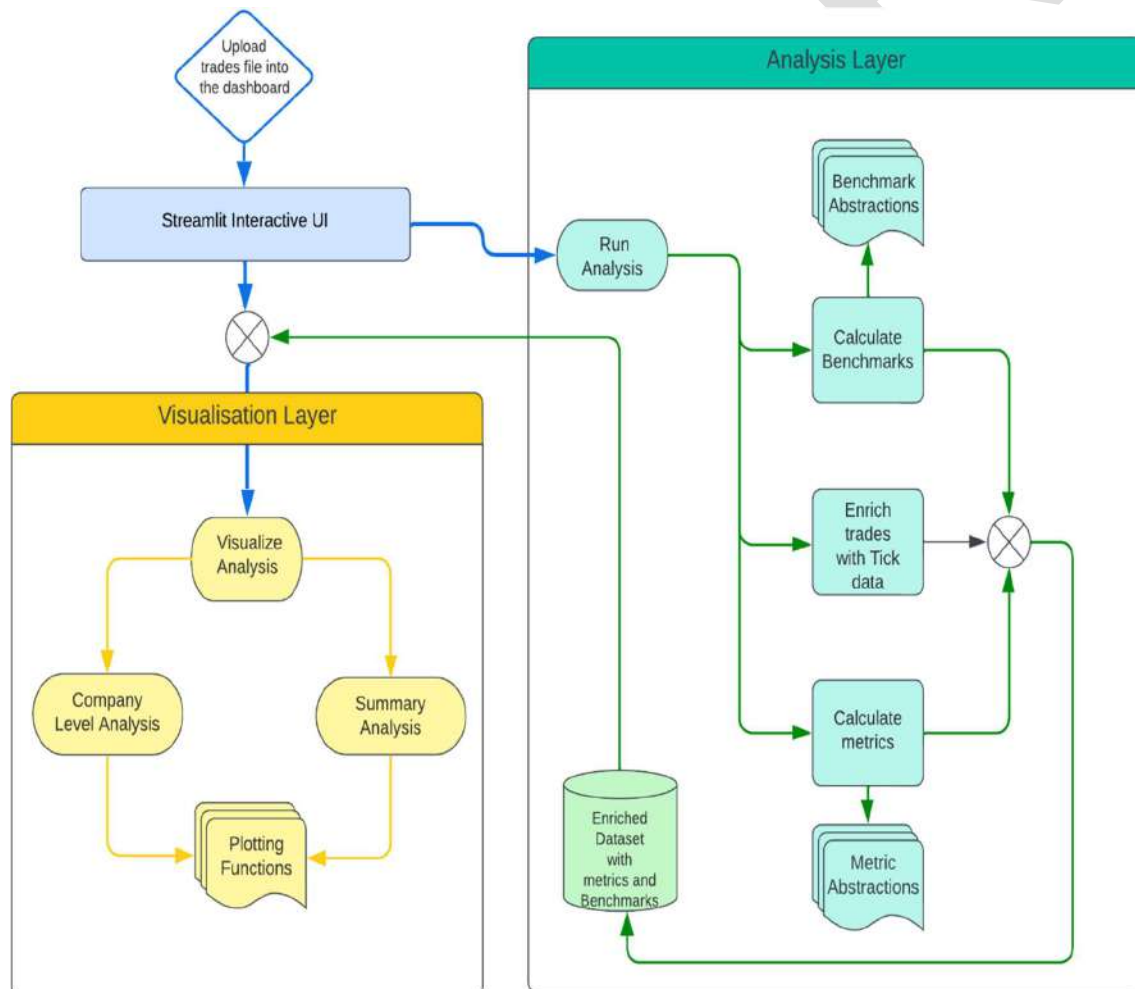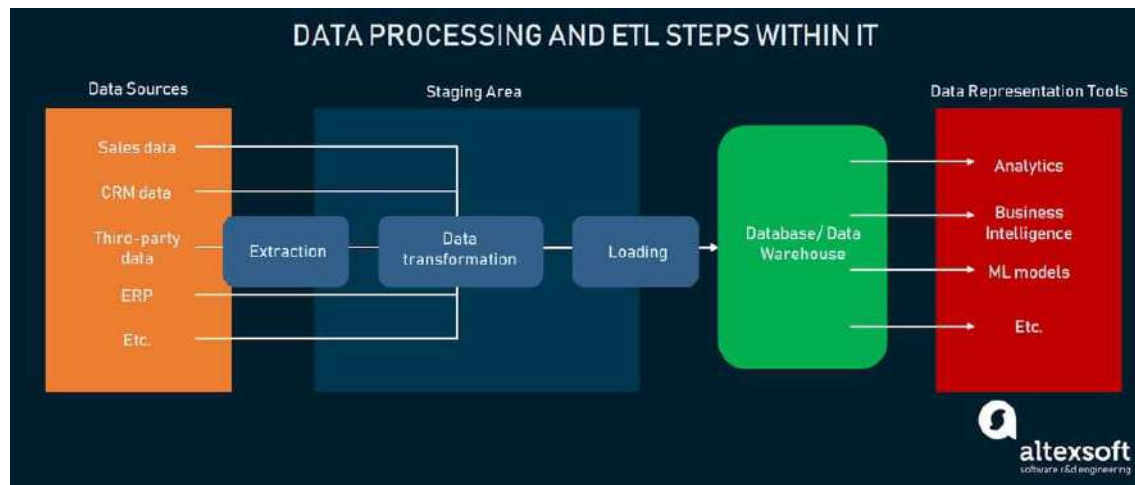
The operational workflow is organized as follows:

1. financial transaction data are collected from digital statements,

2. records are stored in a structured relational database,

3. preprocessing and transformation are performed in spreadsheets,

4. analytical indicators are computed, and

5. interactive dashboards are generated for exploration.

This structured pipeline ensures data consistency and reproducibility of analytical results.

5. Data Model and Storage Design

A relational schema is designed to store transaction records, including:

- transaction identifier,
- date and time of transaction,
- category of expense,
- payment mode,
- transaction amount, and
- income or expense indicator.

The database design supports flexible querying for monthly, weekly and category-wise analysis. Indexing and optimized SQL queries are employed to ensure efficient retrieval of large transaction histories.

6. Data Cleaning and Feature Engineering

Data preprocessing is performed to remove duplicates, resolve missing category labels and standardize transaction descriptions. Feature engineering operations include:

- derivation of monthly and weekly spending aggregates,

- identification of recurring expenses,

- calculation of cumulative expenditure, and

- generation of savings indicators.

This step plays a crucial role in improving analytical accuracy and visualization quality.

7. Analytical Indicators for Budget and Savings Evaluation

The system computes several decision-support indicators:

- **Budget Variance Index** – difference between allocated and actual spending,

- **Monthly Savings Ratio** – percentage of income saved each month,

- **Category Contribution Index** – contribution of each category to total expenses, and

- **Cash Flow Stability Index** – variation of income and expenses across months.

These indicators enable users to objectively assess financial discipline and identify improvement opportunities.

8. Interactive Dashboard Design
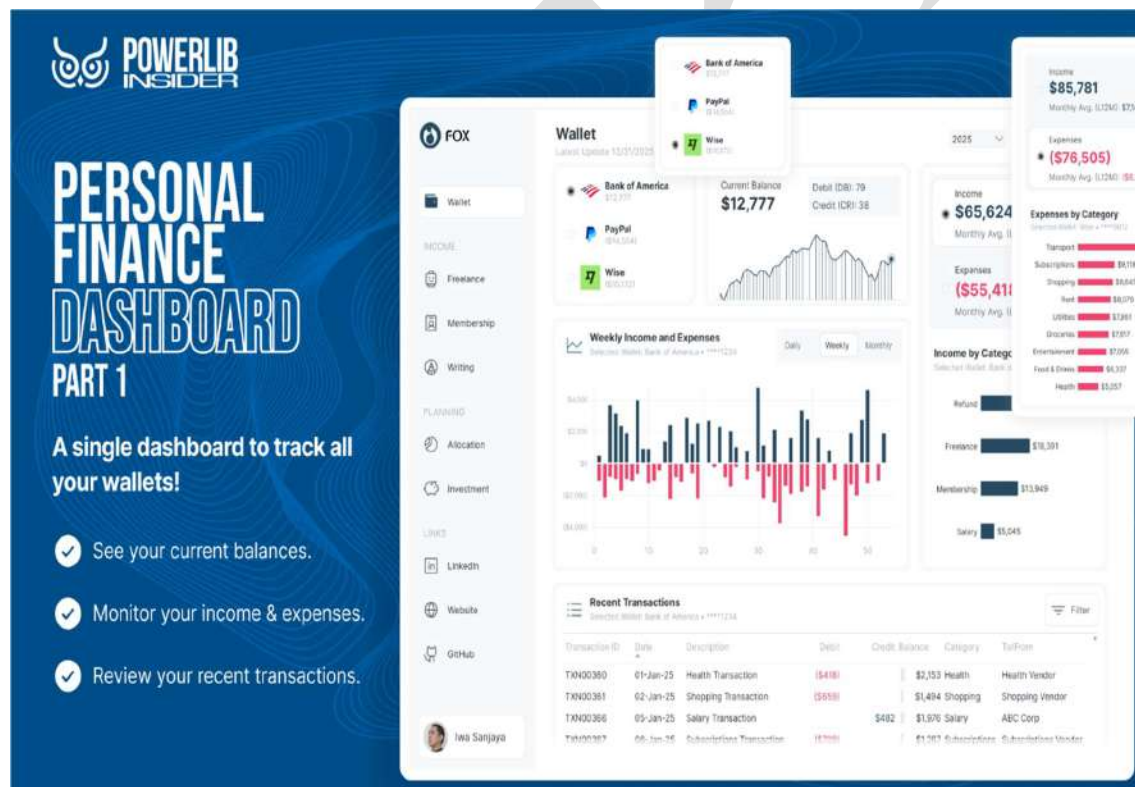
The dashboard interface is designed to support self-service analytics. Key visual components include:

- income versus expense comparison charts,
- category-wise expenditure distributions,
- payment mode utilization patterns, and
- monthly savings trend analysis.

Slicers and filters allow users to dynamically explore specific time periods, categories and transaction types.

9. System Implementation

The system is implemented using the following technology stack:

- SQL database for structured data storage,
- spreadsheet platform for preprocessing and feature computation, and

- Power BI for interactive visualization and dashboard deployment.

The dashboards are configured to refresh automatically whenever new transaction data are inserted into the database, enabling near real-time financial monitoring.

10. Experimental Setup and Evaluation Methodology

A real transaction dataset collected over several months was used to evaluate the proposed framework. The dataset includes income records, multiple expense categories and diverse payment modes.

The evaluation focuses on:

- correctness of analytical indicators,
- usability of interactive dashboards, and
- response time during data filtering and exploration.

User-centric validation is performed by analysing dashboard interaction patterns and decision-making effectiveness.

11. Results and Discussion

The results show that the dashboard framework clearly highlights dominant expense categories and reveals previously unnoticed spending patterns. Users can quickly identify months with abnormal expenses and investigate the underlying transactions through interactive drill-down.

The savings trend visualization enables continuous monitoring of financial discipline. The computed budget variance indicators help users detect overspending at an early stage, supporting proactive budget correction.

Overall, the proposed system significantly improves financial awareness compared to static spreadsheet summaries.

12. Security and Privacy Considerations

Financial transaction data are sensitive and must be handled securely. The proposed framework stores data locally within a controlled database environment. Access to dashboards is restricted using authentication mechanisms. No third-party data sharing is performed, and only aggregated analytical views are presented to users.

13. Comparative Analysis

Compared with traditional expense tracking tools, the proposed system offers:

- interactive and customizable analytical views,
- automated computation of financial indicators, and
- improved transparency of spending behaviour.

Unlike mobile applications that rely on predefined visual templates, the dashboard framework allows flexible customization and deeper analytical exploration.

14. Limitations

The current framework requires manual import of transaction data. Automatic integration with banking APIs is not implemented. Additionally, predictive analysis and automated budget recommendations are not included in the present version.

The evaluation is conducted using a limited dataset, which may not fully represent diverse financial lifestyles.

15. Conclusion

This paper presented an interactive dashboard-based analytical framework for personal financial transaction analysis aimed at improving budget control and savings behaviour. By integrating structured data storage, preprocessing, analytical indicator computation and interactive visualization, the proposed system provides a comprehensive and user-friendly financial decision support environment.

The experimental results demonstrate that the framework enhances financial awareness, facilitates identification of overspending patterns and supports consistent savings planning. The system offers a scalable and practical solution for individual-level financial analytics.

16. Future Work

Future enhancements will focus on:

- automatic bank statement integration through secure APIs,
- machine learning-based spending prediction models,
- personalized budget recommendation engines, and
- mobile-friendly dashboard deployment.

References

1. Few, S., *Information Dashboard Design*, Analytics Press, 2013.
2. Eckerson, W., *Performance Dashboards*, Wiley, 2011.
3. Provost, F., and Fawcett, T., *Data Science for Business*, O'Reilly, 2013.
4. Munzner, T., *Visualization Analysis and Design*, CRC Press, 2014.
5. Knaflic, S. N., *Storytelling with Data*, Wiley, 2020.