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AN ARTIFICIAL INTELLIGENT DRIVEN SMART BUDGET TRACKING AND MANAGEMENT APPLICATION

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Abstract
Financial management is a critical issue in the current era. To solve this issue many applications, exist. In traditional web applications, users fill the form containing multiple fields manually to enter the income and expense detail separately. Technical knowledge is required and web form validation also needs to make data consistent. Traditional web applications are relatively slow and dose not able to predict the future expenses or incomes. This application is designed to solve this issue. In this application user will enter a single text message in plain English language. Our application identifies the patterns using Natural language Processing and saves income and expense details into the database in a single go. There are not more fields that are required. In this way less validation is needed. By using machine learning models, we can also predict future expenses and incomes. This system is fully automated and extracts categories (income/expense), details, amount along with current date automatically.

1. INTRODUCTION

udget tracking plays an ample role in managing and maintaining your financial situation. This paper expresses how to create a smart artificial intelligence driven budget tracking application. This application is relatively fast, accurately reliable, user adoptable and user friendly. User experiences better and enjoy during the use of this application. Primary focus of this application is to increase user experience by using modern techniques. In earlier applications user will add expense and income details manually, which is a time taking process. In this application user will add a single text message. This message is then forwarded to the natural language process extractor to convert raw text into structural data. Then this structural data is saved into database corresponding tables i.e. expense table or income table. One of the main features of this application is to predict future income and expenses. We can also analyze our daily monthly and yearly income and expense details. Users can also print daily, monthly, yearly income as well as expense reports. Users can also set limits to restrict the users from doing more expenses and system will generate alert

when expense limit exceeds. System will also maintain the log file of alerts and notifications.

2. Literature Review

Financial education and finance management are very crucial in today's digital life. We have different mobile and web applications for managing and tracking budgets. Review of top 45 budget management applications are discussed in this paper [1]. Many of these applications focused on user types, size of users, storage, multi transactions support, user interface, technologies, flexibility, portability, payment gateway support and budgeting strategies. React Native, Expo, Redux, Recompose and Ramda technology is used in this article [2]. Some developers used Visual Basic.net and MySQL to develop this application [3]. In this manuscript [4] author evaluates many applications and suggests ideas to improve user experience and user adaptability. In this article [5], author introduces machine learning algorithms to develop budgeting applications. Author of this article tells how to enhance financial education and create budgeting applications with less human effort. Also discuss how to reduce manual effort to track expenses. Author [6] of this manuscript tells how to create budget management applications using PHP and MySQL. Author of this manuscript [7] discusses how to create budget tracking and financial management applications using blockchain technologies. Author [8] tells real world online example for managing budgets of an institution. Using digital technologies for creating budgeting applications for households are discussed in this article [9]. Author [10] discusses the efficiency and performance of financial tracking applications. Author [11] introduces Artificial Intelligent budget tracking applications using HTML, CSS, JavaScript, PHP and MySQL. Author of this manuscript [12] creates money management application using SQLite, firebase authentication and firebase store. Applications are developed in less development effort but have conventional methods of capturing expense details.

In this manuscript [13], author introduces optical character recognition and machine learning methods to create smart budget tracking applications. This application takes expense details as an image and converts them into texts and then saves them into database. Human efforts to enter expense details manually are reduced in this application. Generates different types of reports using machine learning algorithms.

Many applications are using conventional ways [14,15,16,17,18,19,20] to track expenses. The user of this application must enter the expense details manually. In these applications, users need to add income and expense details separately. More of these applications are not capable or less capable of predicting future expenses. Our application facilitates the user entering income and expense details in a single text message. System will automatically separate and categorize the income and expense details and save them into our database. Our proposed application is fully capable of predicting future expenses accurately and precisely with less effort of manual entry of expense details.

3. Problem Statement

Manual budget tracking applications are slow and not user friendly. More we cannot predict future expenses smartly in previous applications. There is need to create a user-friendly application which solves the problem Fastly, accurately with less user effort to increase user experience. We can also predict future expenses more precisely.

4. Proposed System/ Methodology

Use case diagram has been shown in figure. This diagram depicts the basic functional requirements of the application. There is only one stakeholder of this application i.e. user.

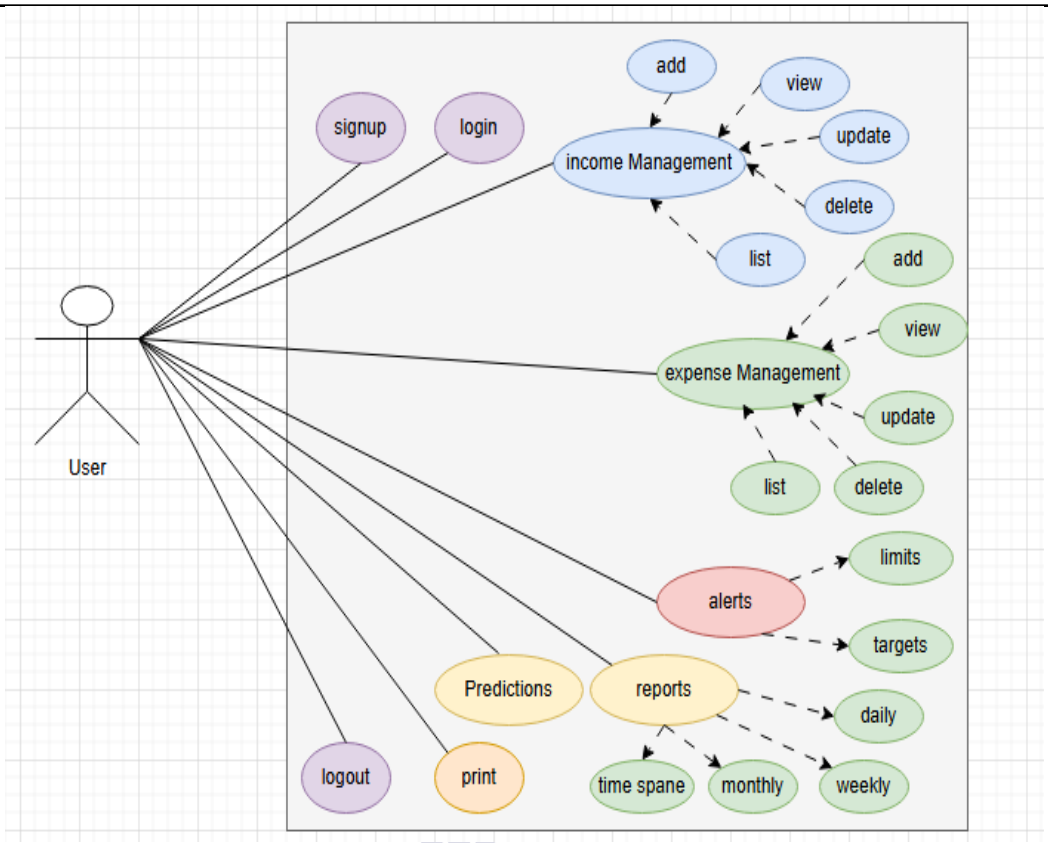


Figure1 : use case diagram of the system

Users will use our application after signing up and login. User authentication will be used, and new sessions will be generated for each user. Each user has its own system to manage his or her expense and income details. Users are also able to set expense limits and set saving targets. System will also generate meaning full reports for each user of the application. Users can also make useful predictions from this application. Machine Learning techniques would be used to make predictions. Data visualization is also part of the application in which we will graphically present details of income and expense and generate useful insights. For this propose we will use useful libraries and packages of python. Application would be user friendly and user adoptable. Application would be reliable and maintainable. Application can be reusable and easy to enhance. Application would be portable, responsive and dynamic.

To develop this application, I will use python flask, HTML, CSS, Bootstrap, JavaScript, and MySQL. To create a structure, I will use HTML and to make application stylish and responsive I will use Bootstrap along with CSS. JavaScript would be used for client-side validation. In this application I am using MySQL database management system to make relational tables. Querying from/to these tables are relatively fast and more accurate. This will affect the speed and efficiency of our application. For report generation and predictions, I will use Pandas, NumPy, Scikit-learn and for data visualization I will use matplotlib, seaborn and or plotly. For frontend integration I will use flask along with jinja2.

Complete process flow diagram is shown in figure. User will first fill in the signup form and do registration with our application.

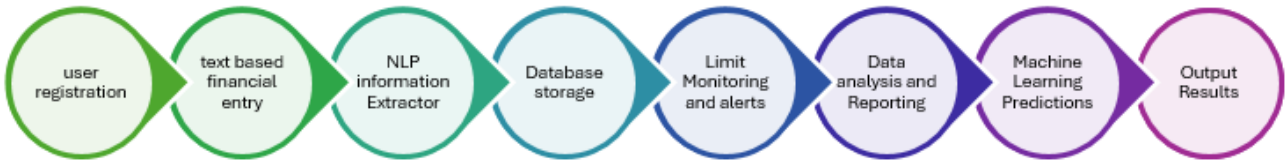


Figure 2: process flow diagram

Users will enter a text message for income and expense transactions. Natural Language Processing (NLP) receives this raw data and converts it into structural data. To do data that first step is text preprocessing. Text preprocessing includes cleaning, tokenizing and normalizing the text. Then we choose a suitable model for extracting useful features from text. For this propose I am using pretrained model. Model prompts raw text from user and converts it into structural data and saves it into the database.

First, information is saved into the database it is easy to analyze and query to and from database. Here I am using MySQL as database management system.

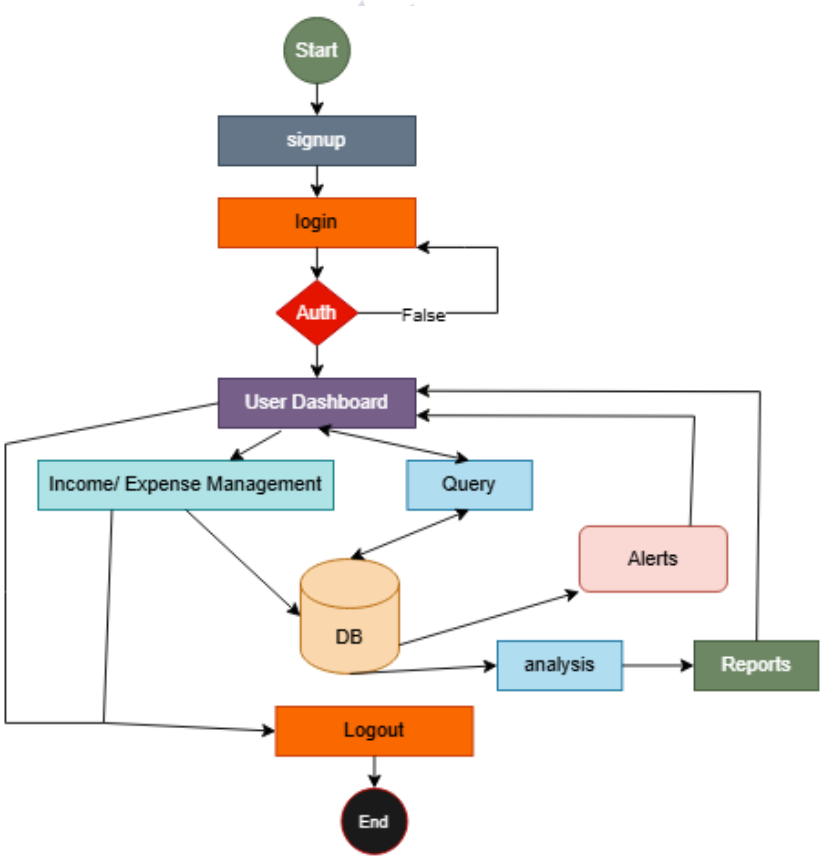


Figure 3: flow diagram of AI- Based Budget Management and Tracking App

Process is started form user registration into our application. Users are registered from valid email and password and login. Users can manage daily income and expense details into our application. To make application user adoptable, secure and reliable, Natural Language Processing techniques are used. Users will write income and expense details in a specific text message format. System will save all details into a database management system. Users can also set limits for alerts. When expense reaches to a limit system will generate alert and notify the user. System will analyze the data that exists in the database and generate different types of report. Users can take different decisions on basis of this result. Users can also analyze history. System will assist the users to analyze previous history and help to make appropriate predictions. For analyzing the data and making appropriate predictions for future, we will use machine learning techniques.

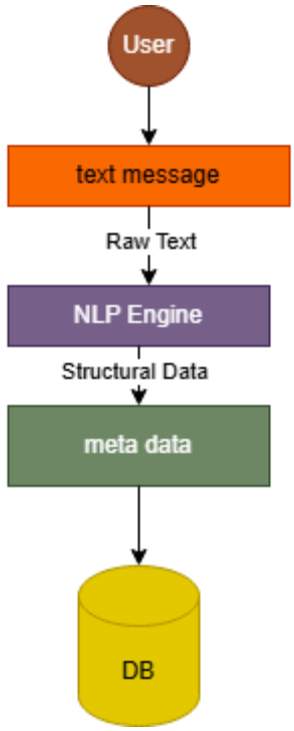


Figure 4: Add Income / Expense process flow

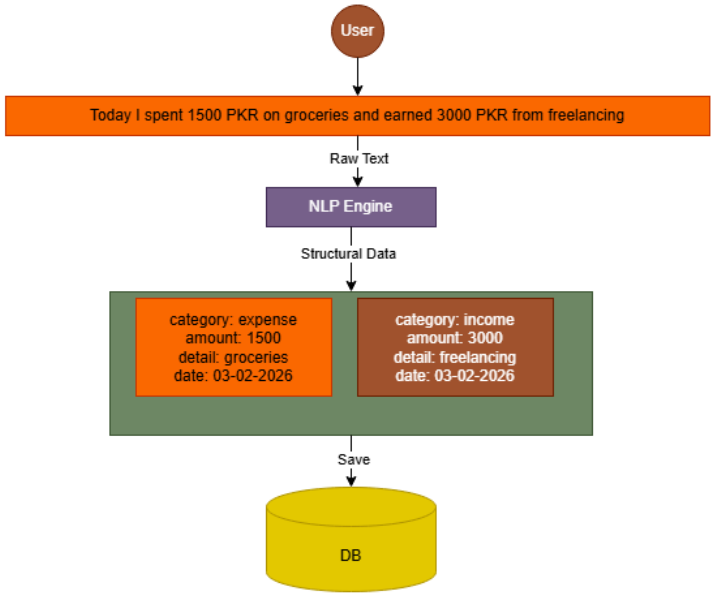


Figure 5: Example of adding income / expense process

Process flow in the NLP Engine is shown in figure.

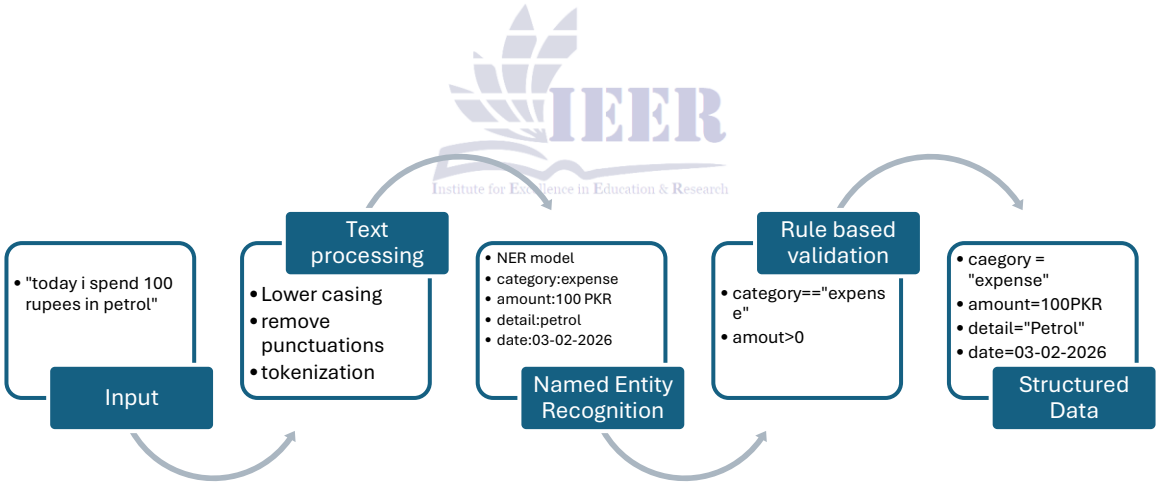


Figure 6: NLP engine process flow diagram

When user sends a text message, this message is in the form of raw text, and it needs to be clean. So, we must perform text preprocessing. So, we first convert all text into lower case then remove punctuations then tokenize the text. Then we find relationships among entities and then finally relate entities to the corresponding values. We also define rule-based validation and apply this validation to make data consistent. As that result finally we get the structured data.

5. Mathematical Model

Let u is the user set U={u_1,u_2,u_3,u_4.....u_n}
Each transaction Ti is defined as:
$T_i=(u_i,a_i,c_i,t_i,d_i)$
Where
u_i -user id
a_i =amount
c_i=category
d_i=date

$$t_i \in \{Income, Expense\}$$

NLP Extraction Function
$E=f_{NLP}(S)$
Where
S= user input text
E={a,c,t,d} extracted entities
Total Expense for a user:

$$E_{total} = \sum_{i=0}^{n} a_i$$

Alert Condition:

$$Alert = \begin{cases} 1, if\ E_{total} \geq L \\ 0, otherwise \end{cases}$$

Historical Dataset:
D={T_1,T_2,.....T_n}
Machine learning (ML) Prediction Model

$$\hat{E} = ML(D)$$

Where

$$\hat{E} = future\ expense$$

Decision Support Function:

$$decision = g(\hat{E}, E)$$

Where E is current expense.

6. System Design and Implementation

To design this application, I am using database first approach. I have developed relational database for this application. The primary focus to make full application with less tables and space.

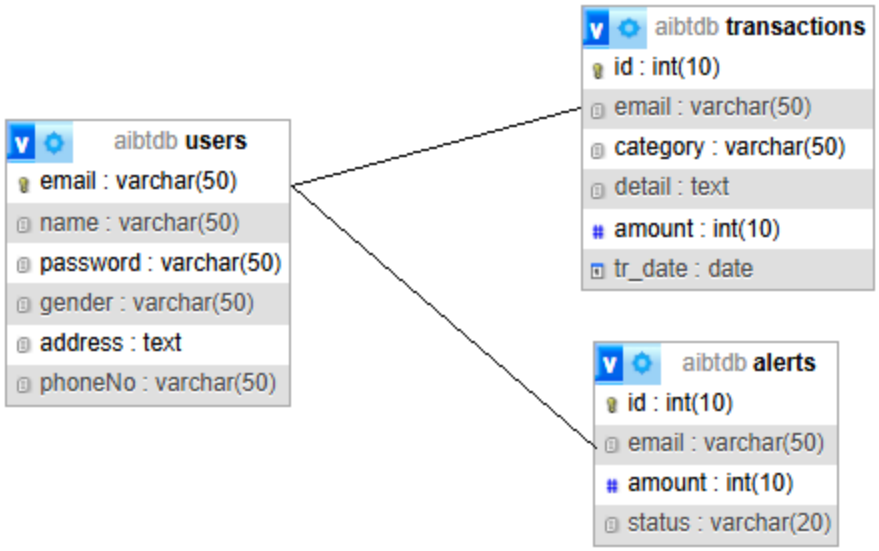


Figure 8: relational database diagram

In this application, I am currently using just three tables i.e. users, transactions and alerts. Tables are related to each other to make query fast and accurate. Users table is used for authentication i.e. registration, login, forget password and change password. All transactions of individual incomes and expenses are saved into transactions table. Similarly, all limits and targets are saved into alerts table. From this simple relational database scheme, we can get useful insights. We can generate daily, weekly and monthly income and expense reports. We can predict future income and expense by using machine learning methods along with this database and analyze data more Fastly and accurately.

After creating database schema, I have created interfaces and backend for this application. To develop this application, I am using these libraries and packages.

Table1: list of libraries and packages use in this application

Library/ Package	Purpose
Flask	Create the web application and handle routes, requests, and responses.
request (Flask)	Receive user input data from forms or APIs
jsonify (Flask)	Convert python data into JSON response
render_template (Flask)	Render HTML templates for frontend
spaCy	Process natural language text to extract meaning (NLP)
re	Perform pattern matching and text extraction using regular expressions
mysql.connector	Connect and interact with MySQL database
datetime.date	Handle and store date values
pandas	Manage, clean, and analyze tabular data
numpy	Perform numerical and mathematical operations
matplotlib.pyplot	Generate charts and visualizations

Sklearn.linear_model.LinerRegression	Build prediction models using linear regression

Sample of script is given below:

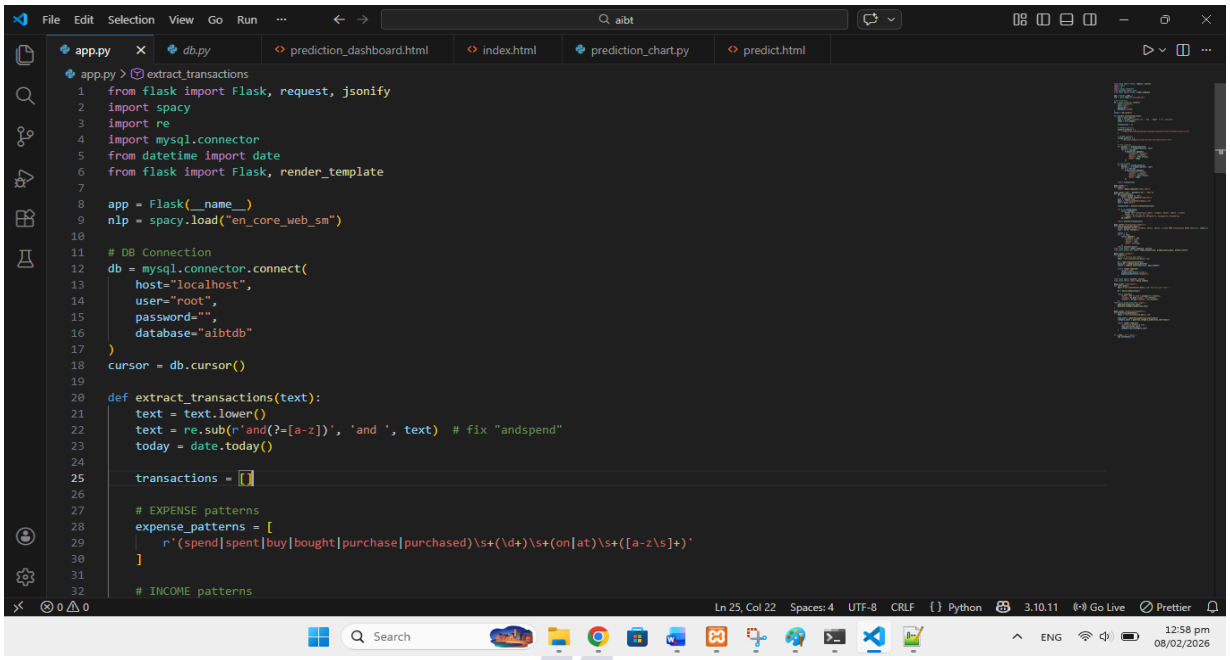


Figure 8: sample code

Sample of GUI is given below

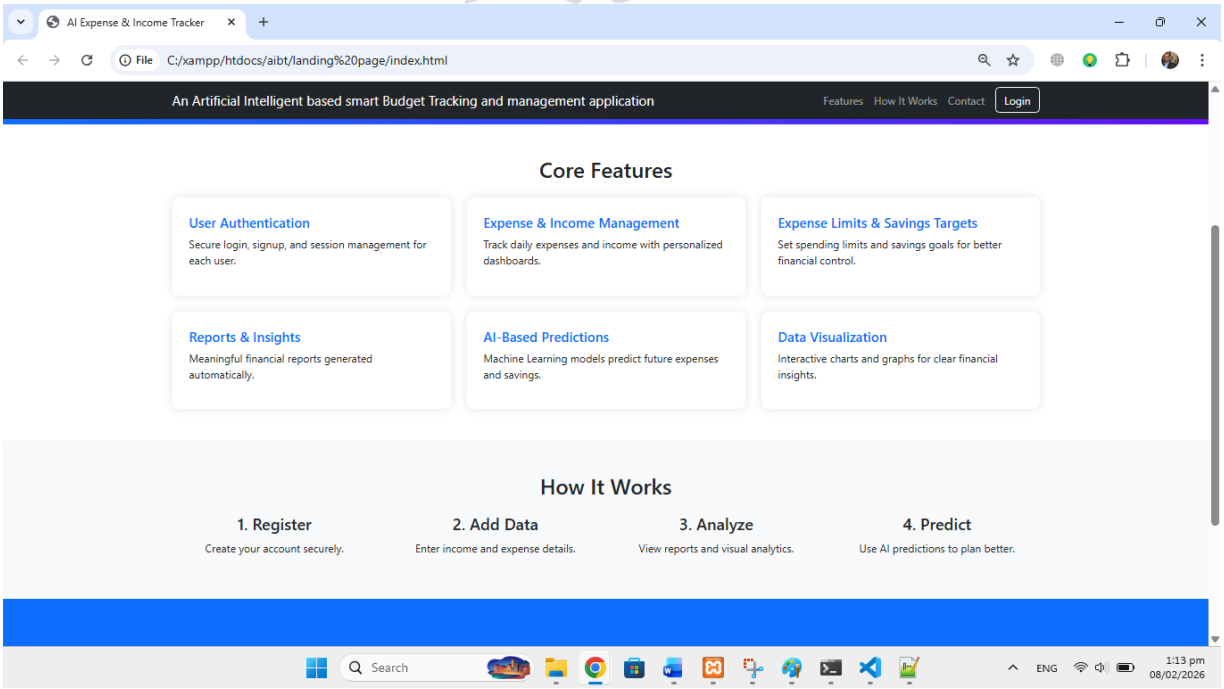


Figure: application interface

7. Result and Evaluation

After user registration and logged in with personal credentials, user will add transactions.

Case 1: "I spend 200 on food and earn 1000 from teaching today"

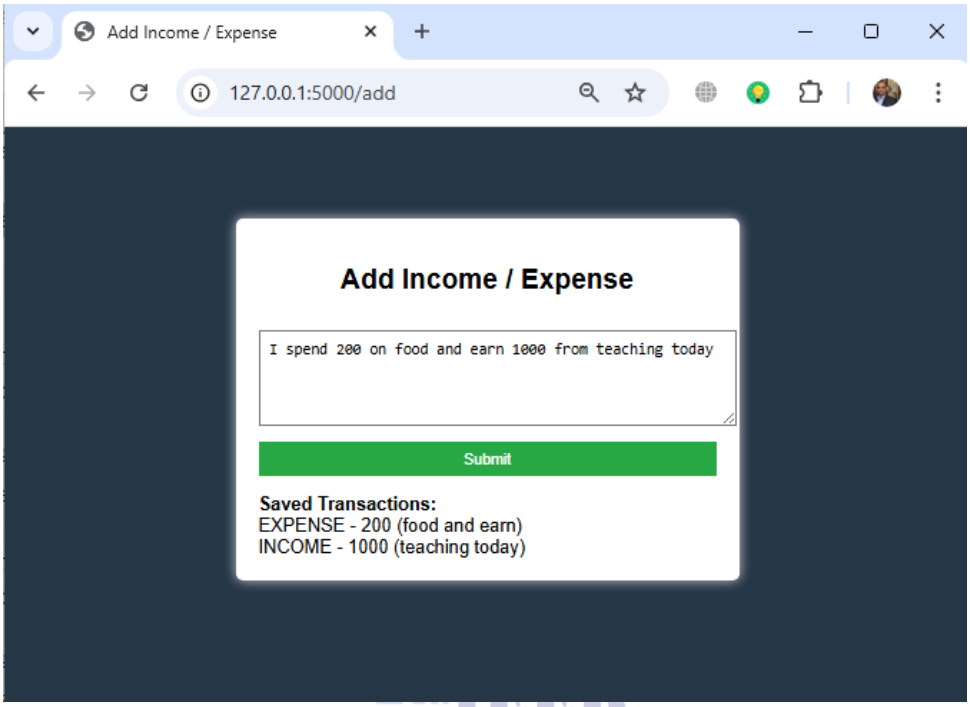


Figure 9: two transactions in a single message

In this way system will divide message into two categories, i.e. expense and income and add separate details of income and expense into the transactions table. To complete this process, system will do two transactions, one for expense and second for income.

Case2: " I spend 200 on food today"

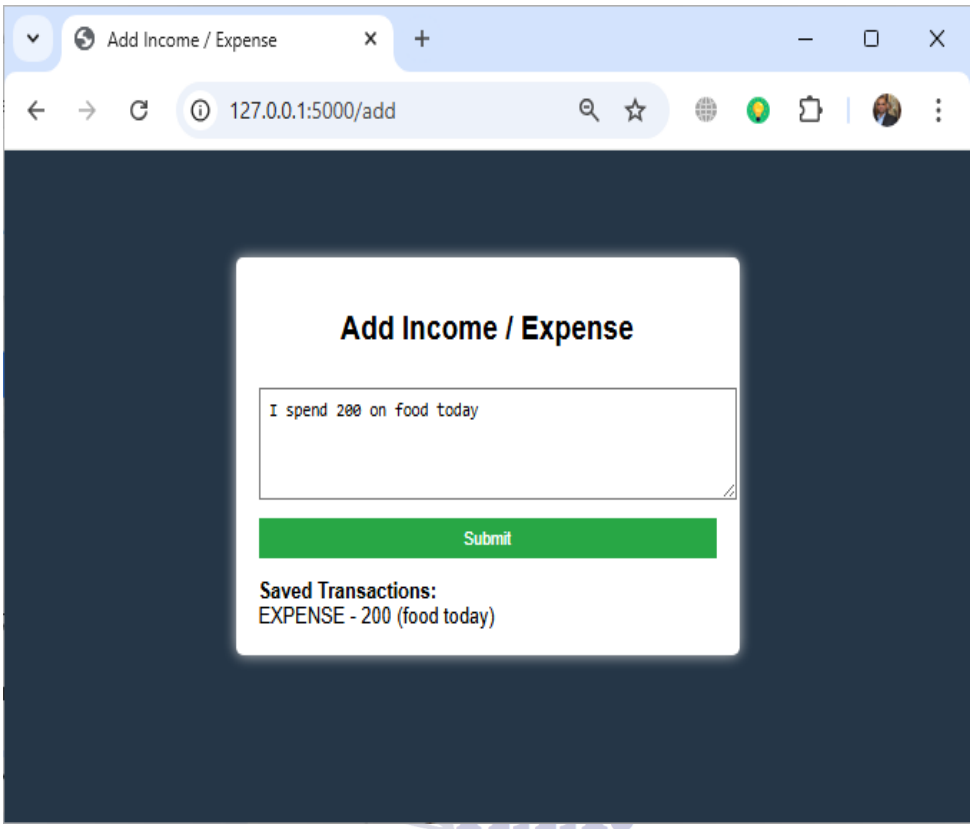


Figure 10: single expense transactions

System will read the message and dose this transaction as expense into transactions table.

Case 3:" I earn 5000 from freelancing today"

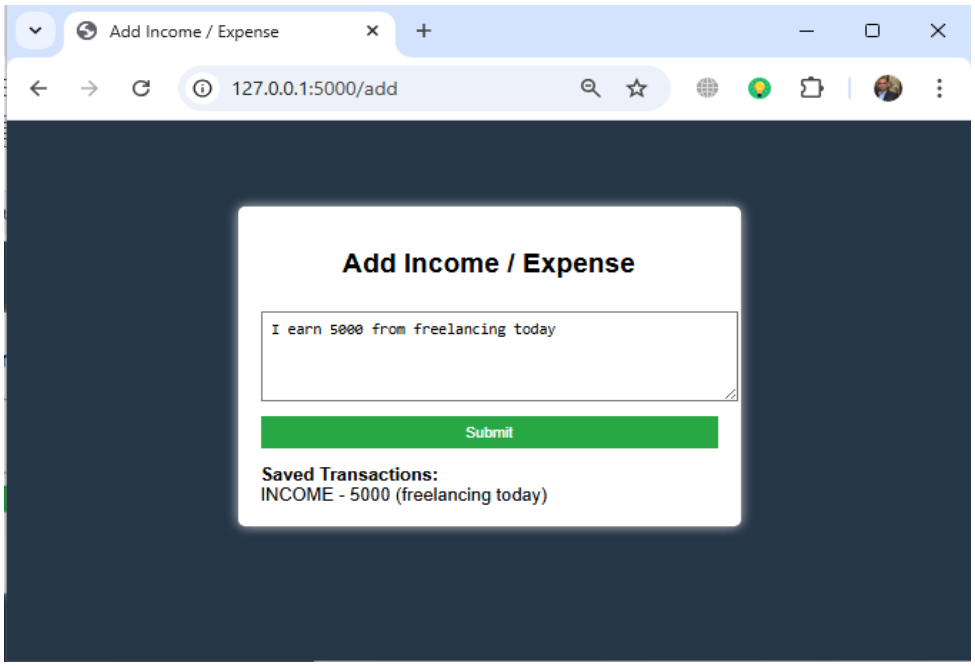


Figure 11: single income transaction

System will read the message and dose this transaction as income into transactions table.

Case 4:" I earn 5000 from freelancing and spend 2000 on petrol today"

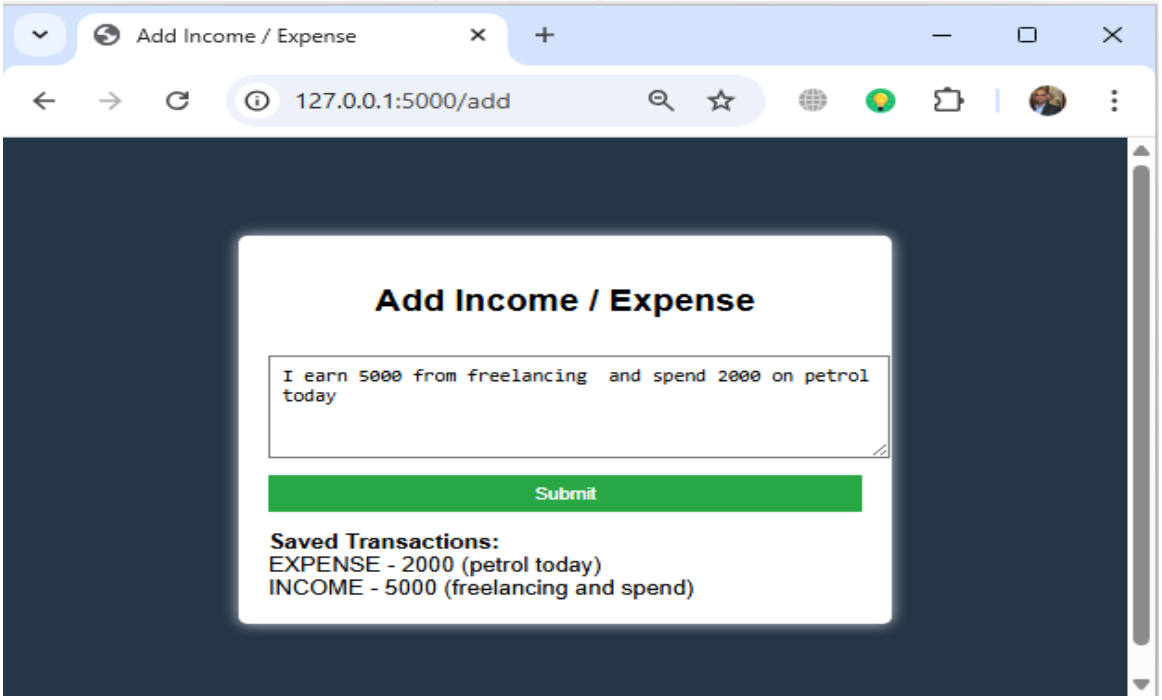
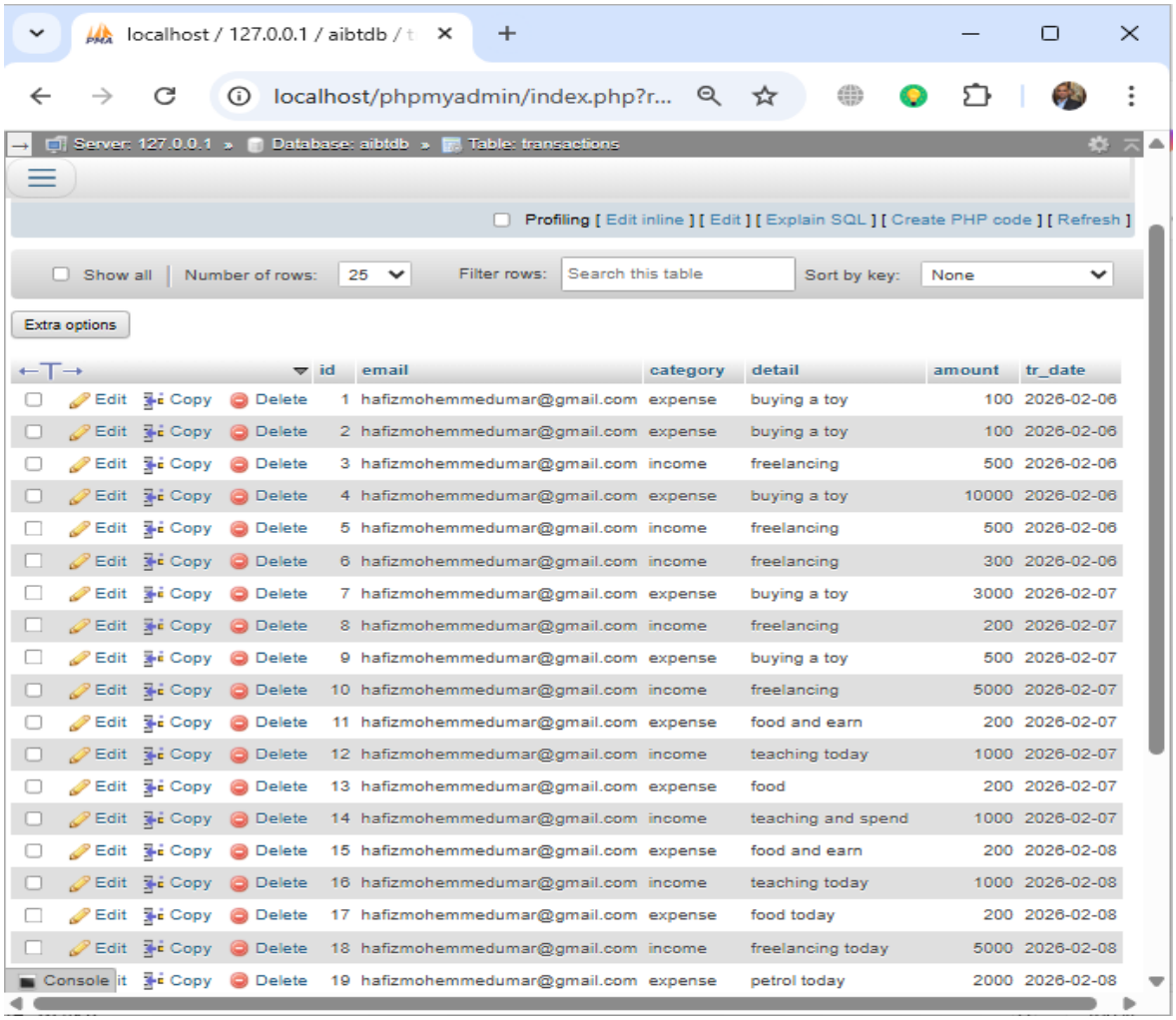


Figure 12: two transactions income and expense in a single message.

System will divide message into two categories, i.e. income and expense and add separate details of income and expense into the transactions table. To complete this process, system will do two transactions, one for expense and second for income.

Transactions are saved into database "transactions" table.



	id	email	category	detail	amount	tr_date
Edit Copy Delete	1	hafizmohemmedumar@gmail.com	expense	buying a toy	100	2026-02-06
Edit Copy Delete	2	hafizmohemmedumar@gmail.com	expense	buying a toy	100	2026-02-06
Edit Copy Delete	3	hafizmohemmedumar@gmail.com	income	freelancing	500	2026-02-06
Edit Copy Delete	4	hafizmohemmedumar@gmail.com	expense	buying a toy	10000	2026-02-06
Edit Copy Delete	5	hafizmohemmedumar@gmail.com	income	freelancing	500	2026-02-06
Edit Copy Delete	6	hafizmohemmedumar@gmail.com	income	freelancing	300	2026-02-06
Edit Copy Delete	7	hafizmohemmedumar@gmail.com	expense	buying a toy	3000	2026-02-07
Edit Copy Delete	8	hafizmohemmedumar@gmail.com	income	freelancing	200	2026-02-07
Edit Copy Delete	9	hafizmohemmedumar@gmail.com	expense	buying a toy	500	2026-02-07
Edit Copy Delete	10	hafizmohemmedumar@gmail.com	income	freelancing	5000	2026-02-07
Edit Copy Delete	11	hafizmohemmedumar@gmail.com	expense	food and earn	200	2026-02-07
Edit Copy Delete	12	hafizmohemmedumar@gmail.com	income	teaching today	1000	2026-02-07
Edit Copy Delete	13	hafizmohemmedumar@gmail.com	expense	food	200	2026-02-07
Edit Copy Delete	14	hafizmohemmedumar@gmail.com	income	teaching and spend	1000	2026-02-07
Edit Copy Delete	15	hafizmohemmedumar@gmail.com	expense	food and earn	200	2026-02-08
Edit Copy Delete	16	hafizmohemmedumar@gmail.com	income	teaching today	1000	2026-02-08
Edit Copy Delete	17	hafizmohemmedumar@gmail.com	expense	food today	200	2026-02-08
Edit Copy Delete	18	hafizmohemmedumar@gmail.com	income	freelancing today	5000	2026-02-08
Console it Copy Delete	19	hafizmohemmedumar@gmail.com	expense	petrol today	2000	2026-02-08

Figure 13: data is saved on the transactions table

All transactions are successfully saved into transactions table.

Complete prediction chart is given below.

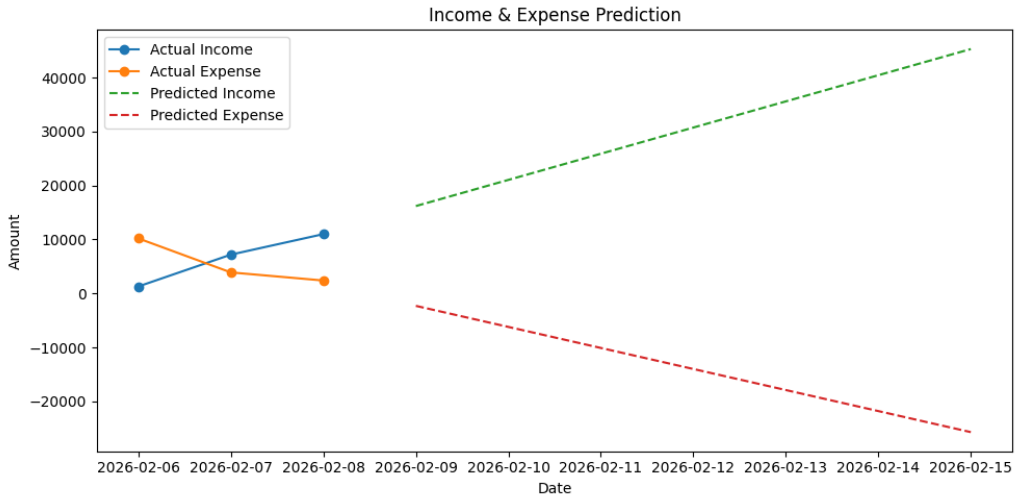


Figure 14: complete prediction chart

Complete predictions chart for income and expense is displayed above. Currently I am predicting weekly predication but we can increase this prediction level from week to month as per our requirements.

Category wise prediction chart is given below.

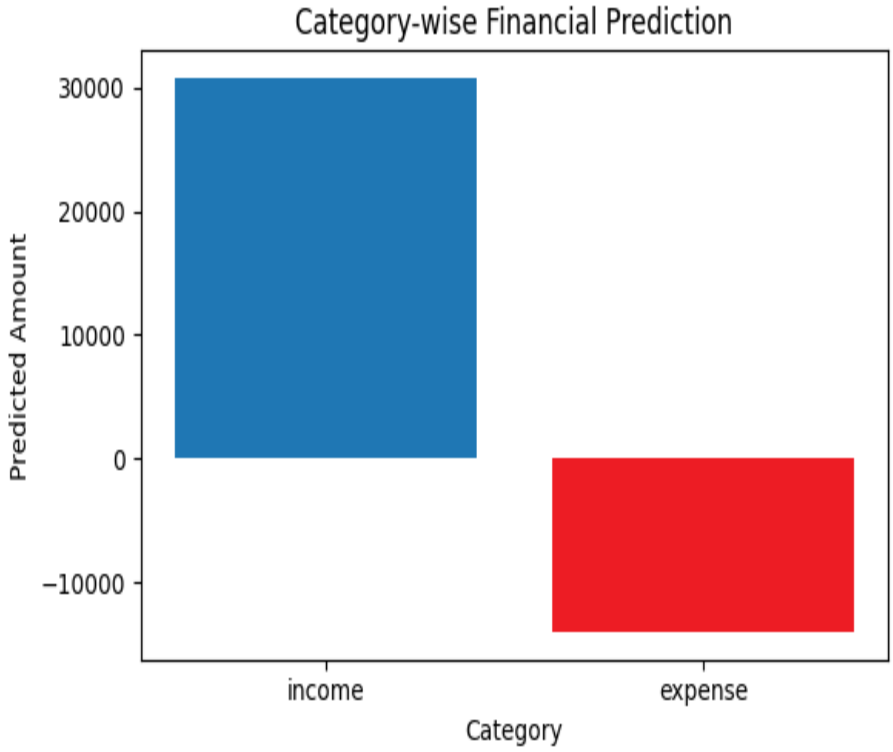


Figure 15: category wise prediction

System will also generate category wise predictions. We can update this prediction from weekly to monthly or yearly as per our requirements. To do that we need the previous transaction history.

7. Discussion

System will provide financial management, predictions and set saving targets for each user. User will add the message in simple English and click on save. The application reads the text, cleans it and uses regular expressions to automatically detect expense and income. Each detected transaction in converted into structured data (category, amount, details, and date) and saved into the transactions table along with user email created in MySQL database. The app provides pages and APIs to add transactions, view saved transactions, and display them as JSON or HTML pages. It also loads saved data to generate charts, daily summaries, and predict future income and expenses using machine learning logic from helper modules. Finally, it shows visual prediction dashboards (time-based and category-based) to help the user understand spending trends and future forecasts.

8. Future Work

This is a web-based application that provides responses in JSON format. This application can be easily integrated with mobile applications using web APIs. This application can also be integrated with modern front-end frameworks and libraries like vue.js, angular, react.js and other emerging technologies. We can also apply testing to ensure this application is more consistent, reliable and user adoptable. Moreover, we can also use optical character recognition method to convert image message into text with this application. Users will upload their income and expense details together in an image form, system will automatically fetch the income and expense details and save them separately into database for further usage.

9. Conclusion

Personal money management is very important in the current era. The aim of this application to make a comprehensive income and expense manager application in which user can register and add daily income and expense details with less manual efforts. Using this application users can easily add income and expense details in a single text message. System will automatically categories income and expense details and save them into database separately. This feature is easy to adopt for all users. Moreover, we can also predict future expenses more correctly.

References

Alenazi, M., & Sas, C. (2025). Creating and managing transactions and budgets: analysis of marketplace descriptions and functionality review of budgeting apps. *Interacting with Computers*, *37*(5), 381-396.

Hezretov, M. (2021). *Budget Tracker Highly Customizable Budgeting Mobile Application* (Doctoral dissertation).

Janobe, J. (2025). Development of budget management system using Visual Basic. NET and MySQL database: A desktop application for personal financial tracking. *Journal Dekstop Application (JDA)*, *4*(1), 24-33.

Alenazi, M., & Sas, C. (2023, August). Evaluating budgeting apps: limited support for budgeting compared to tracking. In *36th International BCS Human-Computer Interaction Conference* (pp. 1-12). BCS Learning & Development.

Naik, S. L., Kumar, G. R., Kiran, A., Ganesh, D., & Madgi, M. (2024, December). Automating Financial Management: An Exploration of Automatic Expense Tracking Systems. In *2024 International BIT Conference (BITCON)* (pp. 1-5). IEEE.

Archeet, K. (2025). Budget Plan and Expense Tracker Using PHP.

Jadhav, S., Lokhande, S., Mali, R., Mahajan, R., Kulkarni, A., & Ashtagi, R. (2025, April). Government Budget Tracking Using Block-Chain Technology. In *2025 4th OPJU International Technology Conference (OTCON) on Smart Computing for Innovation and Advancement in Industry 5.0* (pp. 1-7). IEEE.

Taylor, J. J. (2002). *The real-time world: Using online budget and financial applications at higher education institutions*. The University of Nebraska-Lincoln.

Chumakova, N., Yarushkina, E., Milovanov, V., & Saprykina, V. (2019, March). Digital technologies in households budget management. In *IOP Conference Series: Materials Science and Engineering* (Vol. 497, No. 1, p. 012026). IOP Publishing.

ANAGHA, P. (2025). THE EFFICIENCY AND ADOPTION OF EXPENSE TRACKER APPLICATIONS IN ENHANCING STUDENT'S FINANCIAL MANAGEMENT. *Journal Publication of International Research for Engineering and Management (JOIREM)*, *3*(10).

Nale, K., Pawar, S., Kanthale, A., Kenjale, Y., & Sonkusare, T. (2025). AI Powered Expense & Budget Tracker: A Web Based Financial Planning System. *International Journal of Scientific Research and Technology*.

Cabrera, A. C., Tac-an, C. C. D., & Gatdula, M. M. V. (2025). Moneyge It: A Mobile Application for Shared Expense Tracking. *International Journal of Research and Innovation in Social Science (IJRISS)*, *9*(10).

Shelke, S., Shingre, M., Lebisha, S., & Shaikh, S. (2023, October). Smart BAT-smart budget analyzer and tracker. In *2023 International Conference on Advanced Computing Technologies and Applications (ICACTA)* (pp. 1-5). IEEE.

Passoja, P. (2015). Budgeting and forecasting application development: an evaluation.

Meintjies, A. (2012). *The incorporation of alternative budgeting methods relative to the use of the traditional budgeting method* (Doctoral dissertation, University of Pretoria).

Le Jr, N. H. (2025). Students' Perceptions of Budgeting Apps: Effectiveness compared to alternative methods.

Ahmed, S. (2025). Budgeting Techniques in Dynamic Business Environments. *Journal of Management and Social Sciences Review*, *3*(1), 1-11.

Alenazi, M., & Sas, C. (2023, August). Evaluating budgeting apps: limited support for budgeting compared to tracking. In *36th International BCS Human-Computer Interaction Conference* (pp. 1-12). BCS Learning & Development.

Sabab, S. A., Islam, S. S., Rana, M. J., & Hossain, M. (2018, September). eExpense: a smart approach to track everyday expense. In *2018 4th International Conference on Electrical Engineering and Information & Communication Technology (iCEEiCT)* (pp. 136-141). IEEE.

Popesko, B., Novak, P., Papadaki, S., & Hrabec, D. (2015). ARE THE TRADITIONAL BUDGETS STILL PREVALENT: THE SURVEY OF THE CZECH FIRMS BUDGETING PRACTICES. *Transformations in Business & Economics*, *14*.

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