SMART PERSONAL EXPENSE ANALYTICS AND BUDGET FORECASTING SYSTEM

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***Abstract*— Maintaining and tracking our expenses manually by entering all the expense details in a book, dairy, spread-sheet may take lot of manual efforts and many people are struggling to track their daily expenses and it is leading to poor financial planning and overspending. To overcome these traditional approaches, we developed an application called Smart personal expense analytics and budget forecasting system, which is useful to track the expenses of the user by just taking expense details as input. It will analyze the data and show the insights to the user in the form of graphs and charts and if the user spending exceeds the limit, it will give alerts. By using this application, we can know our spending patterns and decrease our spending on unnecessary things.**

Keywords— Expense Tracking, Categorization, Personal Finance Management, Financial Literacy, Data Visualization, Spending Patterns.

I. INTRODUCTION

In these days financial management is very crucial because the people who are managing their income in a proper way are leading their life in a good way at the same time the people who are not maintaining their income in a proper way are getting into crisis. finance management is not a big task in these days but the problem is financial ignorance, and it is very dangerous not only to an individual life but also their future generations. In order to overcome this problem, we have developed an application called "Smart Personal Expense Analytics and Budget Forecasting System", which is used to track the expenses of the user by just taking the income and expense details as input and provide insights in the form of charts and graphs [1].

This application will reduce the manual calculations for their daily expenditures and also keep the track of the same. By using conventional methods such as writing expense details in notebook, dairy, excel sheets, word document may take lot of manual efforts and may cause wrong outputs while calculating manually and moreover it's a big task to maintain the note books safely, if the book is gone then everything will be lost [2]. The main purpose of this project is to introduce an application that makes the expense tracking system easy for the user, so that user can easily manage and track the spending patterns efficiently. This application is mobile based application, we have used React Native for graphical user interface, and cascading style sheets (CSS) for styling, Spring boot for backend and MySQL database to store user data [3]. There are many existing applications are available today to track the expense of an individual, but the problem is they have some limitations such as lack of user-friendly interface, and lack of good presentation methods for insights such as charts and graphs [4]. By using this application, we can overcome all the manual burden of writing expense details and maintain it safe, and moreover we can know the spending patterns such as how much money we are in spending in a day, week, month and year as well. And we can know for which purpose we are spending much money, for which purpose we are spending less money and for which purpose we are spending money unnecessarily and so on. And finally, we can know the spending patterns and then we can decrease our overspending on unnecessary things. And we use this application at any time, from anywhere and there is no chance of data loss because data will be stored safely in the database. This application is also useful for small businesses for tracking their income and expense details in an efficient manner [5].

In the process of financial management parents influence on children plays a crucial role so it is a good thing that parents' guide the children in a proper way by telling the importance of money and financial management in the life so that the children will know about it and lead their life financially independent [6]. This application is useful to introduce the financial education especially to the young adults, because adults are not much responsible and lack of patience to track the expense details manually and not good at managing money, so this application makes the adults good at financial management [7], [8].

II. RELATED WORK

There are several existing systems that are closely related to the proposed systems, but we are developing an application which is a mobile based application and it is a user-friendly application. By using this application rural people also can manage and track their expense details in an efficient way and make their financial management good [9]. The application is for tracking day-to-day expenses of the user, which can be done by just giving expense details as input to the application and it will be categorized based on the predefined categories. By integrating a digital tool. This application is a mobile based application and it contains mainly three layers user-interface layer, logical and analyzing layer and database layer. The user can interact with GUI and he/she can enter their daily expenses as input to the application [10], [11]. The data entered will be stored in the database. Logical and analyzing layer retrieves the data from the database, analyze it and show the insights on the Graphical User Interface in the form of graphs and charts [12]. User can enter any number of expense details in a day.

Notification alert system has developed in the application, so that it will send alerts to the user if the user expenditure exceeds the daily limit or weekly limit or monthly limit and if the user does not enter expense

details in the application till the end of the day and so on. This application also makes the people self-discipline in saving money by showing the spending patterns, so that user knows the spending patterns and reduce the unnecessary spending [13]. The main goal of this project is to develop a user-friendly and efficient application for the people who are not aware of their spending patterns, and making them to track their daily expenses in an easy and efficient way. Saving behavior of the user depends on the financial literacy, if the person is good at financial literacy, then the person more likely to save than the person who is not good at financial literacy. By using the application students can enhance their financial literacy and make their financial management better [14].

III. Methodology

The proposed system will be more user-friendly so that users can easily enter their expenses and track their spending patterns.

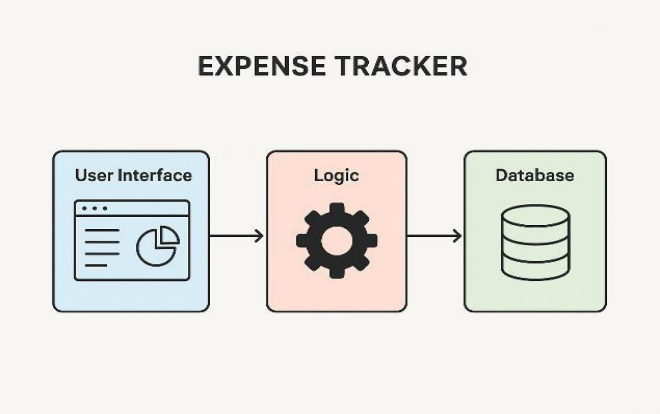

Fig. 1. Architecture

Figure.1 illustrates that application consists of mainly three layers graphical user interface, logical layer and database layer. The user will interact with graphical user interface and enter his/her daily expense then it will be stored in the database. Logical layer will retrieve the expense details from the database, analyze it and visualize the data in the form of graphs and charts.

Automated Expense Tracking and Financial Management System mainly consists of three layers they are frontend layer, logical layer and database layer. Frontend layer consists of user interface, it is used to interact with the application and backend layer is responsible for implement the crud operations , create , read, update and delete on the database and act as a bridge between frontend and database.

A. *User Authentication Module*

User Authentication module consists of register button, login button, register popup page and login popup page. If the person is new to the application, he/she has to register first and then only they will be allowed to login to the application using their registered credentials. If the person is existing user, then he can login from anywhere and in any device to use his/her account.

B. *Income Entry Module*

Income entry module consists of the button and popup window, whenever we click on the button popup window will open so that we can enter the income amount, source of income, date of income and some description about the income and save it.

C. *Expense Entry Module*

Expense entry module consists of the button and popup window, whenever we click on the button, popup window will open so that we can enter our expense amount, purpose of spending, date of expenses and some description about the expense and save it [15].

D. *Categorization Module*

categorization module is useful to categorize the expenses into predefined categories such as food, education, health, entertainment and so on. By this categorization module we can know that on which category we are spending more money and on which category we are spending less money. User can add new categories as well , so that if the user spends money and add that expense details in the application then that money will be add into that specific category of the user

E. *Reports and Visualization Module*

Reports and visualization module renders the details such as balance amount, expense amount, income amount in the form of cards, and then categorization details in the form of charts and graphs. It also shows monthly income details, monthly expense details in the form of graph and charts [7].

F. *Notification Module*

Notification module will send the alerts regarding expenses such as user exceeds the daily expense limit, weekly expense limit or monthly expense limit and if the user does not enter the expense details till the end of the day and so on.

G. *Database Management System*

The backend database is where the data of the user will be stored, data includes user login credentials, user expense details, user income details and so on. User login credentials include, username, password, email. User income details include user source of income, amount, data of income added and some description about source of income. User expense details include expense amount, expense purpose, date of expense and some description about the expense.

H. *Application Flow*

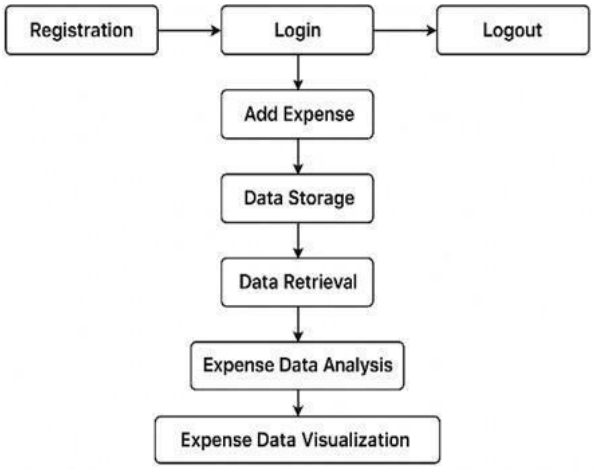

Fig. 2. Application flow

Figure.2. illustrates the flow of the project

1. User Login: It is used to logged into the application using username and password.
2. Income Entry: user enters his/her income details and some description of their source of income, then the income details will be stored in the database.
3. Expense Entry: user enters his/her expense details and purpose of expense and some description about expense, so that expense details will be stored in the database.
4. Analyze Expenses: On adding every expense, data of expenses and income will be retrieved from the database and analyzed.
5. Visualization: After adding every expense, data retrieved from database, analysis will occur, expense details will be updated on the interface such as total expense amount, total balance amount, total income amount and it shows the expense details in the form of charts and graphs as well for better understanding purpose.

IV. Result and Discussions

The proposed Automated Expense Tracking and Financial Management System was successfully evaluated for functionality and usability. The application enables users to enter expense details, categorize expenses and visualize spending patterns in an effective way. React Native provides a smooth and interactive user interface and the mysql ensures reliable data storage. The application successfully avoids manual calculations and saves time for users.

Fig. 3. Dashboard

Figure.3 illustrates all the necessary details such as expense entry button, income entry button, navigation buttons, total balance amount, total income amount, total expense amount, recent transactions details, categorization and visualization graph shown in Fig.3. All these components describe the spending patterns of the user in an efficient manner so that the user can get the knowledge about spending patterns and there will be a chance to decrease of unnecessary spending by the user.

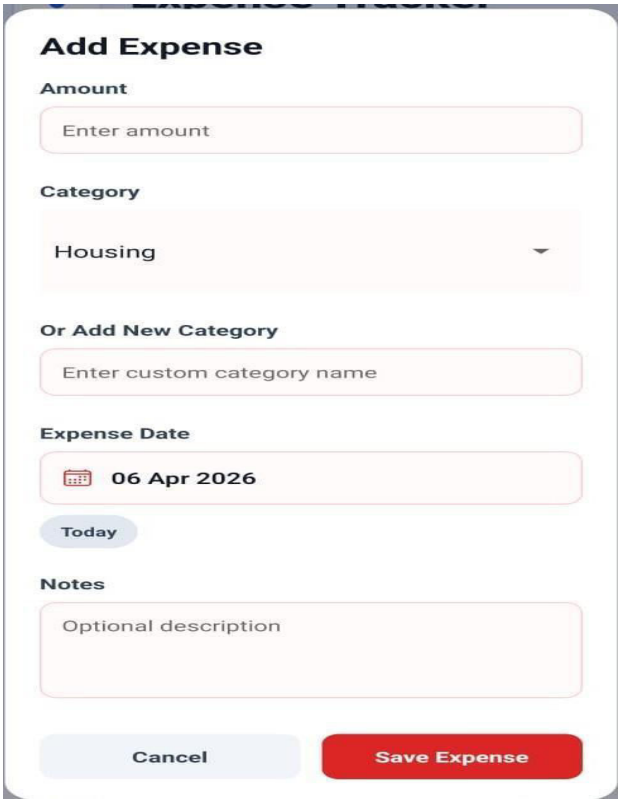

Fig. 4. Add Expense details

Figure.4 illustrates about expense entry, add expense button allows the user to enter their daily expenses any number of times in a day. This is a popup window and it contains fields like expense amount, category, date and description about the expense, user need to fill all the fields and save it and then the expense details will be stored in the database.

Fig. 5. Visualization bar graph

Figure.5 illustrates the spending details of the current month of the user.it will show the spending details of the user using the bar graph, which shows the spending details of the user for the whole month.

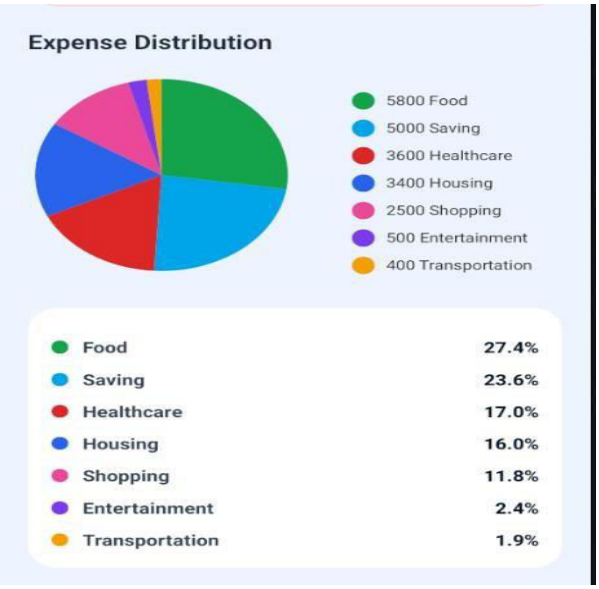

Fig. 6. Categorization pie chart

Figure.6 illustrates the categorization of expenses into different categories such as food, saving, healthcare, housing, shopping, entertainment, transportation so on. Each slice shows the specific purpose of spending money and the area of slice resembles the how much money was spent, if the slice area is low then spent money was less and if the slice area is large then the money spend was more. By this pie chart user can easily know that for which purpose the user is spending more money and for which the user is spending less money. And moreover we can easily know the categorization percentages of each category, it will give us full clarity about our spending patterns.

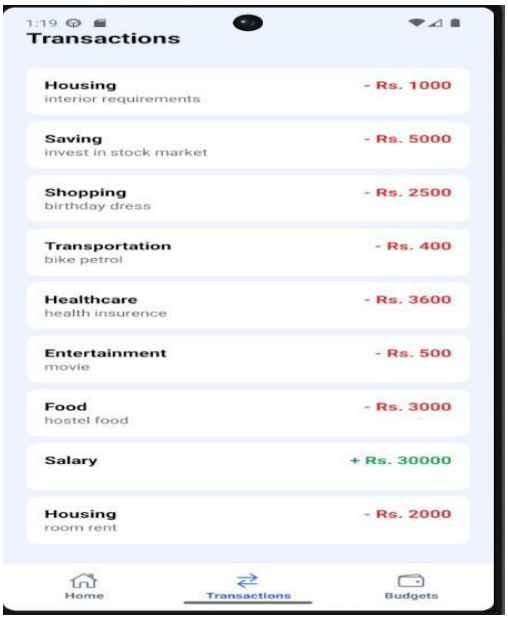

Fig. 7. Recent transactions details

Figure.7 shows the recent transactions of the user, that is the latest transaction done by the user. It shows the details such as transaction purpose, transaction date and the amount was spent. It is useful to know out previous transactions of the user.

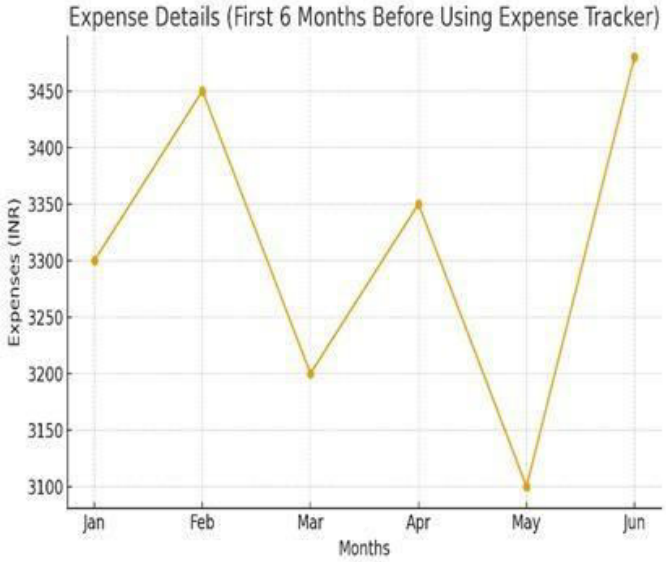

Fig. 8. Spending details of user before using expense tracker

Figure.8 shows that, the spending details of the user before using expense tracker application. As we can see that the spending amount is different and random in different months of the year. There is no proper pattern of spending money by the user, some months the user is spending less money at the same time, some months the user is spending extremely huge money because of lack of tracking the user expense details. To avoid this problem, we have developed an application called as “Smart Personal Expense Analytics and Budget Forecasting System”, by using this we can track our expense details and know our spending patterns as well, so that we can decrease our spending at unnecessary things.

Average expense of a month = sum of expenses of all the months/number of months

Average expense of a month = (3300+3450 +3200+3350+3100+3470)/6 =3311

Average expenses in a month before using expense tracker is 3311

Fig. 9. Spending details of user after using expense tracker

Figure.9 shows that, the spending details of the user after using expense

tracker application. As we can see that the spending amount is gradually decreasing day by day, from this we can say that users are understanding their spending patterns by using the application and decreasing their spending on unnecessary things, saving their money and taking better financial decisions. In this way the Smart Personal Expense Analytics and Budget Forecasting System helps a lot in managing money and helps in taking better decisions related to finance management.

Average expense of a month = sum of expenses of all the months/number of months

Average expense of a month
= (3200+3180+3100+3050+2950+2850)/6=3055

Average expenses in a month before using expense tracker is 3055.

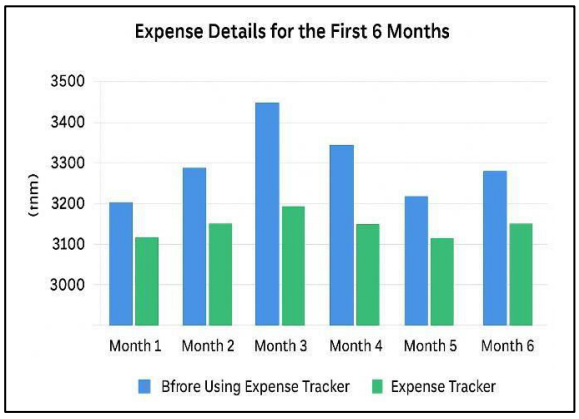

Fig. 10. Spending details of user before and after using expense tracker in a single bar graph

Figure.10 shows that the expense details of the user of 6 months, the blue bars show the expenses of the user before using expense tracker, at the same time green bars shows the expenses of the user after using expense tracker application. From the graph we can clearly say that the expenditure of the user is gradually decreasing and the user stops spending money for useless things.

Table.1: Comparative Expense Analysis Before and After Using the Expense Tracker

Metrices	Before Using Expense Tracker	After Using Expense Tracker
Total	19870	18330
Average	3311	3055
Expense reduction %	-	7.7

Table.1 shows the comparison of expense analysis before and after using the expense Tracker, that is expenses of the user before and after using expense tracker application. Before using expense tracker application, the user spends a money of 19870 in six months with an average of 3311 but, after using expense tracker application the expenses of the user are reduced to 18330 in six months with in average of 3055. From the analysis it is clear that around 7.7 % spending is reduced by the user in the last 6 months. From this we can clearly say that the expense tracker application is helping a lot to the user by describing the expense details and expense patterns to the user and plays crucial role in financial decision making.

V. Conclusion

The proposed smart personal expense analytics and budget forecasting system provides a user-friendly and efficient user interface to interact with application and it simplifies financial management system by taking user expense details and visualize spending patterns in the form of charts and graphs. By integrating technologies like React Native for graphical user interface, Spring boot for backend and MySQL to store user data in the database. The inclusion of charts and graphs helps the users to understand the spending patterns easily and taking better financial decisions. Finally, user is getting their spending patterns by using the application and they are decreasing their spending on unnecessary things and investing their money at profitable places such as stocks, fixed deposit, mutual funds and so on. This application has a good future scope ,that is everybody in India are using UPI (Unified Payments Interface) today so that we can integrate this application with UPI so that everybody who are using UPI can know their spending patterns.

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