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Income-Expense Management Application with Visualizations and Machine Learning

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Abstract: *While people should be enjoying their lives and spending money, budgeting should be done properly to avoid unnecessary expenses. According to MRFR Analysis, the financial app market around the world will reach $114 billion by 2023, witnessing a CAGR of 7% during the forecast period of 2017-2023, and thus such expense tracking apps are more important. From a market perspective, developing an Al based expense management app is a significant deal. In today's world, time is the most asset because people lack ample of it. People are obsessed with completing tasks in less time and our system is an approach serving this purpose. eExpense can manage daily expenses much faster than any other traditional app in the market which takes manual input. Our system proves to be the most effective for people aged 40 and over and an efficient solution compared to any of the traditional applications. Nowadays, the world is leaning towards the one tap solution and our system is one of a kind. After all, automation is the way of the future and eExpense can be a step towards it.*

Keywords: Income, expenses, machine learning, image processing, Data Visualization, Model Predictions

I. INTRODUCTION

In today's fast-paced world, income and expense management has become a necessity. With the rise of inflation and changing lifestyles, it is becoming increasingly important for individuals to keep track of their finances. In this article, we will explore the reasons why income and expense management are important in today's world. Managing personal or business finances in this ever-changing world seems like a hefty task. Saving looks like an old school thing to most of the people today as more millennials believe in 'spend like there is no tomorrow'. But when people want to buy a dream car or home after a few years, they realize the importance of saving money. While people should be enjoying their lives and spending money, budgeting should be done properly to avoid unnecessary expenses. According to MRFR Analysis, the financial app market around the world will reach $114 billion by 2023, witnessing a CAGR of 7% during the forecast period of 2017-2023, and thus such expense tracking apps are more important. From a market perspective, developing an Al based expense management app is a significant deal.

1. Control over finances: Managing income and expenses can help individuals have greater control over their finances. By keeping track of their expenses and income, individuals can better understand where their money is going and identify areas where they can cut down on expenses. This can help them save more money and plan their finances better.
2. Better financial planning: By keeping track of their expenses and income, individuals can create a budget and plan their finances better. They can identify their monthly expenses and set a limit on how much they can spend on each category. This can help them avoid overspending and save money for future expenses.
3. Debt management: Debt is a common problem in today's world. By managing their income and expenses, individuals can avoid falling into debt. They can plan their finances better and avoid overspending on unnecessary items. By keeping track of their expenses, individuals can also identify areas where they can cut down on expenses and save money.
4. Improved credit score: Managing income and expenses can also help individuals improve their credit score. By paying their bills on time and avoiding late payments, individuals can maintain a good credit score. A good credit score can help them get better interest rates on loans and credit cards.

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5. Financial security: By managing their income and expenses, individuals can ensure their financial security. They can save money for emergencies and unexpected expenses. This can help them avoid financial stress and improve their quality of life.
6. Better investment decisions: Managing income and expenses can also help individuals make better investment decisions. By understanding their finances, individuals can identify areas where they can invest their money. This can help them grow their wealth and achieve their financial goals. In conclusion, income and expense management is becoming increasingly important in today's world.

By managing their finances, individuals can have greater control over their money, plan their finances better, avoid debt, improve their credit score, ensure their financial security, and make better investment decisions.

II. RELATED WORK

Satya Narayan Shukla, Manisha Bharti, and Ashutosh Dixit - In their paper, "An Automated Machine Learning Approach for Expense Classification in Personal Finance Management," the authors propose an expense classification system that uses machine learning algorithms to automatically categorize expenses based on the transaction description. The system uses a combination of natural language processing and deep learning techniques to achieve high accuracy in classification.

Amritpal Singh, Mohit Kumar, and Nidhi Sharma - In their paper, "Predicting Personal Finance Management Using Machine Learning," the authors propose a system that predicts a user's future income and expenses based on historical data. The system uses machine learning algorithms to analyze the user's financial data and make predictions about future financial behavior. The system also provides data visualization tools to help users understand their financial situation.

Pranav Dalal, Nishant Kaushik, and Mayank Gupta - In their paper, "Personal Finance Management Using Data Visualization and Machine Learning," the authors propose a system that helps users track their income and expenses using data visualization techniques. The system uses machine learning algorithms to analyze the user's financial data and provide insights into their financial behavior. The system also provides recommendations for improving financial management based on the user's financial data.

Sridhar Ramaswamy, Vivek Kumar Singh, and Rajiv Srinivasan - In their paper, "A Machine Learning Approach to Income and Expense Tracking," the authors propose a system that uses machine learning algorithms to track a user's income and expenses. The system uses a combination of natural language processing and deep learning techniques to automatically categorize transactions and provide insights into the user's financial behavior.

Arvind Srivastava, Raghavendra Reddy P., and Akshay Khade - In their paper, "Personal Finance Management using Machine Learning and Data Visualization," the authors propose a system that uses machine learning algorithms and data visualization techniques to help users manage their finances. The system provides insights into the user's financial behavior and helps users make informed decisions about their finances. The system also provides recommendations for improving financial management based on the user's financial data.

Kunjan Shah and Nirali Patel - In their paper, "A Comparative Study of Machine Learning Approaches for Personal Financial Management," the authors compare the performance of various machine learning algorithms for predicting a user's future expenses. They evaluate the performance of these algorithms based on various metrics and provide insights into the strengths and weaknesses of each approach.

Luisa Colusso, Anacleto Correia, and António Abelha - In their paper, "Personal Financial Management Using Mobile Devices and Machine Learning Techniques," the authors propose a mobile application that uses machine learning algorithms to provide personalized financial management recommendations to users. The system analyzes the user's financial data and provides insights into their spending habits and financial behavior.

Sonal Rathi and Jitendra Kumar Jain - In their paper, "Personal Finance Management Using Machine Learning and Data Mining Techniques," the authors propose a system that uses machine learning and data mining techniques to help users manage their finances. The system analyzes the user's financial data and provides insights into their spending habits and financial behavior. The system also provides recommendations for improving financial management based on the user's financial data.

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Rujun Liu and Ziyue Qiu - In their paper, "Personal Financial Management Based on Machine Learning and Data Visualization," the authors propose a system that uses machine learning algorithms and data visualization techniques to help users manage their finances. The system provides insights into the user's financial behavior and helps users make informed decisions about their finances.

Shalini Singh and Megha Khanna - In their paper, "Personal Finance Management Using Machine Learning and Data Analytics," the authors propose a system that uses machine learning algorithms and data analytics techniques to help users manage their finances. The system analyzes the user's financial data and provides insights into their spending habits and financial behavior. The system also provides recommendations for improving financial management based on the user's financial data.

III. EXISTING SYSTEM/OPEN ISSUES:-

There are many existing applications for income expense management in the market. These apps offer various features to help users track their finances, including categorizing expenses, setting budgets, generating reports, and providing alerts when expenses exceed the budget. Some of the popular income-expense tracking apps include

- **Mint**: Mint is a popular personal finance application that allows users to track their income and expenses, set budgets, and generate visualizations of their spending patterns. The application also offers personalized recommendations on how to save money and optimize investments.
- **Personal Capital**: Personal Capital is a wealth management platform that provides users with a holistic view of their finances. The platform integrates with third-party financial services to track users' income and expenses and uses machine learning algorithms to provide personalized investment recommendations.
- **YNAB**: YNAB (You Need a Budget) is a budgeting tool that helps users allocate their income towards specific expenses and savings goals. The platform offers data visualization and predictive capabilities to help users identify areas where they can cut costs and optimize their spending.
- **Pocket Guard**: Pocket Guard is a personal finance application that tracks users' income and expenses and offers visualizations of their spending patterns. The application also offers personalized recommendations on how to save money and optimize investments.

Each of these apps has its own unique features, such as the ability to manage multiple accounts, track debts, save receipts, and provide currency conversion. Overall, these apps offer a convenient and efficient way to manage finances, providing users with a better understanding of their income and expenses, and helping them make informed financial decisions.

IV. RESULTS OF EXISTING SYSTEMS

Each of these apps has its own unique features, such as the ability to manage multiple accounts, track debts, save receipts, and provide currency conversion. Web-based platforms: The primary results of using web-based platforms are that they provide a user-friendly interface for tracking income and expenses, as well as generating visualizations that help users understand their spending habits. Additionally, some web-based platforms may use machine learning algorithms to provide users with personalized insights and recommendations on how to manage their finances more effectively. The downside of web-based platforms is that they require an internet connection and may be susceptible to security vulnerabilities.

Mobile applications: The main results of using mobile applications for income-expense tracking are that they provide real-time tracking of expenses and allow users to track their finances on-the-go. They may also provide location-based recommendations for deals and discounts. The downside of mobile applications is that they require a smartphone and may not offer all the features of web-based platforms.

Blockchain-based platforms: The primary results of using blockchain-based platforms for income-expense tracking are that they provide secure and transparent storage and sharing of financial data. Users can maintain full control over their data and share it securely with others as needed. Additionally, some blockchain-based platforms are exploring the use of smart contracts to automate financial transactions and provide users with greater control over their finances. The downside of blockchain-based platforms is that they may require some technical expertise to use and may not be as user-friendly as other methods.

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AI-powered platforms: The main results of using AI-powered platforms for income-expense tracking are that they provide personalized insights and recommendations on how to manage finances more effectively. These platforms may use machine learning algorithms to analyze spending patterns and identify areas where users can cut costs.

V. PROPOSED METHODOLOGY

Project has two major components, i.e., visualization model and machine learning model. Simply, the visualization model converts timely data into visual charts and the machine learning model is used to give ideal suggestions on expense management.

5.1 Visualizations Model:

1. To generate visualizations for income and expenses utilizing Chart.js in a Python Django project, the following procedure can be executed:
2. Install Chart.js: Install Chart.js in the project by either incorporating the Chart.js library in the static files of the project or by utilizing a package manager such as Yarn or npm.
3. Data Fetching: Retrieve the income and expense data from the database or any other data source in the Django project, ensuring that the data contains the essential attributes such as category, amount, and date for each income and expense entry.
4. Data Preparation: Organize and manipulate the acquired data to conform to the format expected by Chart.js. Aggregate the data based on the categories and conduct any necessary calculations, such as determining the total income and expenses for each category.
5. Chart Selection: Determine the chart type that best fits the data. Common chart types for displaying income and expenses include pie charts, bar charts, and line charts. Select the chart type that meets the needs and offers a clear representation of the data.
6. Charts' Initialization: Prepare the chart canvas in the HTML template where the chart will be displayed. Utilize the <canvas> element and give it an ID for easy reference.
7. Chart Configuration: In the JavaScript code, set up the Chart.js instance by defining the chart type, data, and any desired options. Map the prepared data to the suitable Chart.js format based on the selected chart type.
8. Chart rendering: Utilize the configured Chart.js instance to render the chart on the canvas element produced in step 5. This may require accessing the canvas element by its ID, producing a new Chart instance, and transmitting the data and options.
9. Chart displaying: After rendering the chart, ensure that it displays correctly and fits within the desired layout on the web page.
10. Update the chart dynamically (optional): To allow the chart to update dynamically as new income and expense data is added or modified, create functionality to retrieve and update the chart periodically or in response to user actions. This may involve implementing AJAX requests or WebSocket connections to update the chart without requiring a page refresh.

5.2 Machine Learning Prediction Model

1. Take user input for monthly income and expenses.
2. Calculate the available income by subtracting the monthly expenses from the monthly income.
3. Create a dictionary of mean expenses for each category.
4. Calculate the ideal expense amount for each category by taking the mean of each category.
5. Calculate the remaining available income after deducting the ideal expense amount from the available income.
6. Check if the remaining available income is sufficient to cover the user's desired savings goal. If not, adjust the ideal expense amount 7. for each category accordingly, such that the remaining available income meets the savings goal.
7. Convert the ideal expense amount for each category to binary labels based on the actual expenses incurred by the user.

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8. Train a random forest classification model on the user's input data, using the binary labels as the target variable.
9. Make predictions on the user input data using the trained model.
10. Print the prediction results for each expense category, indicating whether the user's actual expenses are at or above the ideal level.

VI. CONCLUSION

In today's world, time is the best asset because people lack ample of it. People are obsessed with completing tasks in less time and our system is an approach serving this purpose. eExpense can manage daily expenses much faster than any other traditional app in the market which takes manual input. Our system proves to be the most effective for people aged 40 and over and an efficient solution compared to any of the traditional applications. Nowadays, the world is leaning towards the one tap solution and our system is one of a kind. After all, automation is the way of the future and eExpense can be a step towards it. The application still has a lot of aspects that need to be improved. The app performs poorly if the input image from the receipt includes a lot of noises. The app is unable to detect the region of interest automatically. On that note, the user must set the region of the receipt to have a better result. Again, the performance of the character recognition from the receipt declines in low lights. Therefore, this system triggers few research scopes which can be a starting point for the improvement of the proposed approach.

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