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AI-Based Personal Finance Recommendation System Using User Behavior Analysis

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ABSTRACT

The increasing complexity of financial products and services makes it difficult for individuals to make informed financial decisions. Traditional financial advisory systems provide generic recommendations that fail to consider individual behavior, preferences, and financial goals. This project presents an AI-based personal finance recommendation system that analyzes user behavior to deliver personalized financial advice. By applying behavioral clustering techniques, users are grouped based on spending habits, risk appetite, and financial goals. Knowledge graph insights are used to model relationships among users, financial products, and market rules, enabling explainable and context-aware recommendations. The proposed system enhances decision-making accuracy, improves user engagement, and supports personalized financial planning.

Keywords: AI-Based Finance, Personal Finance Management, User Behavior Analysis, Behavioral Clustering, Knowledge Graph, Personalized Recommendations, Financial Decision Support**.**

I. INTRODUCTION

Personal financial management has become increasingly challenging with the availability of diverse financial products such as savings plans, loans, insurance, and investments. User financial behavior varies significantly based on income, lifestyle, risk tolerance, and goals. Artificial intelligence enables the analysis of large volumes of behavioral data to uncover patterns and preferences. By combining behavioral clustering with knowledge graph insights, AI-based systems can generate accurate, explainable, and personalized financial recommendations. This project focuses on leveraging these AI techniques to create a smart personal finance recommendation platform.

II. LITERATURE SURVEY

1. Title: **Personalized Financial Recommendation Systems Using Machine Learning**

Author: M. Gomez, J. Chen

Abstract:

This paper explores machine learning approaches for personalized financial recommendations. It highlights the importance of user behavior analysis in improving recommendation accuracy.

2. Title: **Behaviour-Based Financial Advisory Systems**

Author: R. Patel, S. Mehta

Abstract:

The authors propose a behavioral segmentation model for financial advisory platforms. Results show improved user engagement and satisfaction.

3. Title: **Knowledge Graphs for Explainable Financial Recommendations**

Author: L. Zhang, K. Huang

Abstract:

This research demonstrates how knowledge graphs enhance explainability and trust in AI-driven financial advisory systems.

4. Title: **AI-Driven Personal Finance Management**

Author: A. Kumar, N. Singh

Abstract:

The paper presents an AI-based personal finance management framework using user transaction data and predictive analytics.

5. Title: **Clustering Techniques for Financial User Segmentation**

Author: S. Banerjee, T. Rao

Abstract:

This study evaluates clustering algorithms for segmenting financial users and emphasizes their role in personalized recommendation systems.

III. EXISTING SYSTEM

The existing personal finance advisory systems largely rely on rule-based logic or static questionnaires to provide financial recommendations. These systems categorize users into broad segments and offer generic advice without continuous learning. Human financial advisors also depend on manual analysis, which can be time-consuming and biased. Current systems lack deep behavioral understanding and fail to adapt recommendations as user behavior changes over time.

IV. PROPOSED SYSTEM

The proposed system introduces an AI-based personalized finance recommendation engine that analyzes real-time and historical user behavior. Behavioral clustering algorithms group users based on financial habits and risk profiles. A knowledge graph captures relationships between users, financial products, constraints, and market rules. Machine learning models use these insights to generate personalized, context-aware, and explainable financial recommendations. The system continuously learns from user interactions, ensuring improved accuracy over time.

V. SYSTEM ARCHITECTURE

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Fig 5.1: System Architecture

This diagram illustrates an end-to-end workflow of an adaptive recommendation system driven by big data analytics, clustering, and neural collaborative filtering. The process begins with financial input data, which is first cleaned and transformed through preprocessing and feature selection to extract meaningful attributes. These refined features are then analyzed using big data analysis techniques to handle large-scale user and transaction information. Based on user interest patterns, the system applies Fuzzy K-means clustering to group users into overlapping clusters, capturing the uncertainty and diversity in user preferences. The quality of these user clusters is evaluated to ensure effective segmentation. In parallel, a training set containing historical user–item interaction scores is prepared. Both the cluster information and interaction data are fed into a Neural Collaborative Filtering (NCF) recommendation algorithm, which learns complex, non-linear relationships between users and items. The system then generates adaptive recommendations tailored to individual users, and the results are finally assessed through performance analysis to measure accuracy, efficiency, and overall recommendation quality.

VI. IMPLEMENTATION

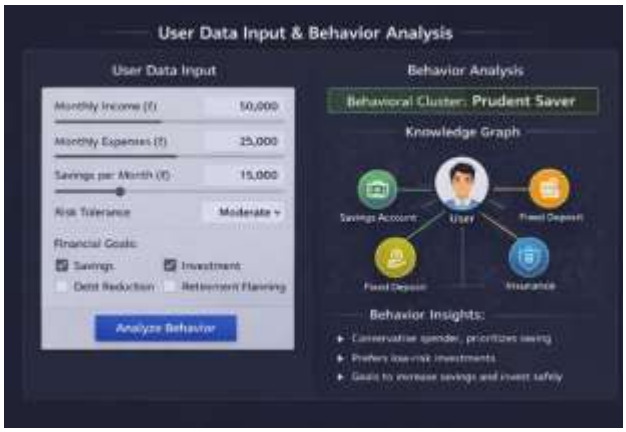

Fig 6.1: Analysis page

Fig 6.2 :Results page

VII. CONCLUSION

The AI-Based Personal Finance Recommendation System Using User Behaviour Analysis presents an intelligent and adaptive approach to personalized financial decision-making. By analyzing individual user behaviour such as spending habits, saving patterns, investment preferences, and risk tolerance, the system effectively transforms raw financial data

into meaningful insights. The integration of machine learning techniques for behaviour analysis and user clustering enables accurate identification of financial profiles, ensuring that recommendations are tailored to each user's unique financial situation.

The use of AI-driven recommendation models enhances the quality and relevance of financial advice by learning from historical data and continuously adapting through user feedback. This dynamic learning capability allows the system to evolve with changing user behaviour and financial goals, thereby improving long-term financial planning and user satisfaction. Additionally, the system emphasizes data security, privacy, and scalability, making it suitable for real-world deployment.

Overall, the proposed system demonstrates how artificial intelligence and user behavior analysis can be effectively combined to deliver personalized, reliable, and efficient financial recommendations. It offers a practical solution to modern financial challenges and serves as a strong foundation for future advancements in intelligent financial advisory systems.

VIII. FUTURE SCOPE

The AI-Based Personal Finance Recommendation System Using User Behavior Analysis offers significant potential for future enhancement and expansion. One major direction is the integration of real-time financial data from banks, digital wallets, and investment platforms, enabling more accurate and up-to-date recommendations. Incorporating advanced deep learning models such as transformers and reinforcement learning can further improve the system's ability to predict long-term financial outcomes and optimize personalized strategies.

Another promising extension is the inclusion of explainable AI (XAI) techniques, which would help users understand why specific financial recommendations are made, thereby increasing trust and transparency. The system can also be enhanced by supporting multi-objective financial planning, such as balancing short-term expenses with long-term goals like retirement, education, and wealth creation.

Future versions may include voice-based and chatbot interfaces for improved accessibility and user engagement, along with mobile app integration for real-time alerts and insights. Additionally, incorporating financial market sentiment analysis and macroeconomic indicators can make recommendations more resilient to market volatility. With continuous innovation, the proposed system can evolve into a comprehensive, intelligent digital financial advisor capable of supporting diverse user needs across different financial ecosystems.

IX. REFERENCES

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