

An AI-Powered Personal Planning and Budgeting System Using Sentiment Analysis and Insight Generation

Khushi Agrahari, Mr. Siddharth Singh

1.B. tech student, Department of IT, Noida institute of Engineering and Technology. Gr. Noida

2.Assistance professor, Department of IT, Noida institute of Engineering and Technology. Gr. Noida

Abstract - Managing our money is getting harder because the cost of living is going up and we are spending money without thinking. We also do not know much about money. Most budgeting apps just help us track what we spend and do math. They do not understand how we feel or what we need.

This paper is about a system that uses artificial intelligence to help us plan and budget our money. It looks at how we feel about what we do and what we need to give us advice on money. The system looks at what we buy, what we want to do and how we feel when we write about our money. It uses this information to make a budget that's just for us and to give us good ideas about money.

The system can tell how we feel when we spend money like if we are stressed or happy. It uses this information to change our budget and give us advice. The system was. It works better than other budgeting systems. It helps us make choices about money and we like using it more.

The new system is a step towards making smart financial planning systems that understand people and can predict what will happen with our money. Personal financial management like this can really help us in the world. The system is about personal financial management. It uses personal financial management to make our lives better.

Key Words: Artificial Intelligence, Budgeting System, Sentiment Analysis, Financial Planning, Machine Learning, Natural Language Processing, Insight Generation.

1.INTRODUCTION

Financial management is very important for individuals and families to stay financially stable. These days people make a lot of payments and transactions which generate a huge amount of financial data every day. However, a lot of people have trouble with spending a lot of money not

saving enough and not planning their finances well. Most budgeting apps just give you numbers and categories. They do not understand how people really feel and think about money.

Artificial Intelligence is a technology that can help people make better decisions by looking at the future and giving personalized advice. Sentiment analysis is a way to understand how people feel from what they write. If we combine sentiment analysis with budgeting it can really help people manage their money better by finding out when they spend money because of their feelings and giving them advice that fits their needs.

This research is about making a budgeting system that uses Artificial Intelligence and sentiment analysis to help people make good financial decisions. The system looks at how people spend money, how they feel and what they want to achieve and then gives them personalized advice helps them predict their budget and shows them where their money is going.

The main things we did in this research are:

- * Made a budgeting system using Artificial Intelligence.
- * Added sentiment analysis to understand how people feel about money.
- * Created a system that gives people personalized advice.
- * Used machine learning to predict expenses.
- * Made a system that changes to fit the user's needs.

The goal of the system is to help people be more careful, with money save more and get help that understands how they feel. Financial management and Artificial Intelligence can work together to make people's lives better. The system uses Artificial Intelligence to make financial decisions easier and more personal. Financial

management is a part of life and Artificial Intelligence can help people do it better.

II. LITERATURE REVIEW

People have done a lot of research on how to combine intelligence and financial management systems. The old way of doing finances was just to look at what people spent their money on and take a picture of it. But now that intelligence and natural language processing have gotten better, we can make smarter systems.

Some studies have looked at how to understand how people feel from what they write. They used computer programs like Long Short-Term Memory and Bidirectional Encoder Representations from Transformers to figure out how people feel. These programs are good at understanding how people feel.

There are systems that help people make a budget and track their money. They can even give people advice on how to save money. These systems do not really understand how people feel. They do not make plans that're just for one person. Some new systems try to use math to predict what people will spend money on. They do not usually combine understanding how people feel with advice on money.

Artificial intelligence is used a lot to predict what people will do with their money and to give them advice. These systems look at what people spend money on and try to figure out what they will spend money on next. They can even find things that people do with their money. Systems that use intelligence are better at making decisions.

Even with all these new things not many people have looked at how to combine understanding how people feel with making a budget. This project is trying to fix that by combining intelligence and understanding how people feel to help people manage their money. Artificial intelligence and financial management systems are used together in this project. The project uses intelligence to make a system that is just for one person and helps them with their money.

III. PROBLEM STATEMENT

Most personal budgeting apps have some problems.

They do not really get how people feel when they spend money.

They give the old budget advice without really thinking about what you need.

They are not very good at predicting what you will spend money on.

They do not give you advice that's just for you and your money.

They are boring. Give you the same old money tips that do not really help you.

As a result, people have time sticking to their budget plans and making good choices about money. They often struggle with budgeting over time and do not make smart decisions about their money. Personal budgeting apps have these issues and people have trouble using them to make financial decisions about their money and budget.

IV. PROPOSED SYSTEM

The new system has an intelligence powered financial helper that understands how people spend money by looking at how they feel about it and gives financial ideas that change all the time.

A. What the System Wants to Do

The main goals of the system are:

- * To keep track of what people, buy and sell.
- * To figure out when people buy things because of how they feel using an analysis.
- * To guess what people will spend money on next using computer programs.
- * To give people ideas on how to make a budget that is just for them.
- * To help people plan their money and save better.

B. How the System Works

The system has big parts:

- * A user interface module
- * A data collection module
- * A sentiment analysis engine
- * A budget prediction engine
- * An insight generation module
- * A recommendation system
- * A database management system
- * The workflow of the system

People using the system put in what they buy and sell and what they want to achieve with their money.

The system collects what people write about what they buy.

A special analysis looks at what people write to see how they feel about spending money.

Computer programs guess what people will buy next.

The system gives people personalized ideas on how to manage their money.

People get budget plans that change and reminders to help them stay on track with the helper and the system.



V. METHODOLOGY

A. Data Collection

The system gathers the following kinds of information about the user:

- * User income information
- * Daily transaction records
- * Spending categories
- * Savings goals
- * User feedback and emotional comments

For example, the user might say something like:

“I regret spending much on shopping.”

They might say:

“I feel satisfied after saving money this month.”

B. Sentiment Analysis

We use Natural Language Processing techniques to figure out how the user is feeling.

The sentiment categories are:

- * Positive
- * Negative
- * Neutral

We calculate the polarity score using machine learning-based classification algorithms.

The sentiment prediction function is like this:

$S(x)$ is the sentiment classification

x is what the user types in

C is the sentiment category

We use some techniques to get the words ready for the computer to understand, like:

- * Breaking the words down into parts
- * Removing common words that do not mean much
- * Changing words to their form
- * Finding the words using something called TF-IDF

C. Budget Prediction Model

We use some computer algorithms like Linear Regression and Random Forest to guess what the user will spend in the future.

The predicted budget equation is like this:

Y is the predicted future expenditure

X is the financial information

β is the model coefficients

D. Insight Generation

The insight generation engine gives us:

- * Spending habit analysis

- * Savings recommendations

- * Expense anomaly detection

- * Monthly financial summaries

- * Budgeting suggestions

For example, the insights might say something, like:

“Entertainment expenses increased by 25% this month.”

It might say:

“You are likely to exceed your shopping budget next week.”

Even:

“Your savings rate improved compared to last month.”

VI. IMPLEMENTATION

A. System Implementation Overview

The proposed AI-Powered Personal Planning and Budgeting System is built using Artificial Intelligence, Machine Learning and Natural Language Processing. The system helps users manage their finances by analyzing spending habits, emotions and financial goals.

The system is made up of modules. Each module does a job. These jobs include managing transactions, analyzing emotions, predicting budgets and making recommendations.

The implementation process has phases. These phrases are:

- * User Authentication and Security
- * Expense and Income Management
- * Sentiment Analysis Processing
- * Budget Prediction using Machine Learning
- * Intelligent Insight Generation

- * Recommendation System
- * Dashboard Visualization
- * Database Management
- * API Integration
- * System Deployment

B. Frontend Implementation

The front end is built using React.js. It provides a responsive user interface. The frontend talks to the backend server using REST APIs.

Some of the features implemented in the front end are:

- * User Registration and Login
- * Dashboard Interface
- * Expense Entry Forms
- * Budget Management
- * Financial Reports
- * AI Insight Display
- * Sentiment Visualization
- * Expense Charts and Graphs
- * Monthly Planning Interface

The dashboard shows:

- * Total Income
- * Total Expenses
- * Remaining Balance
- * Savings Percentage
- * Monthly Expense Categories
- * AI-generated Financial Suggestions

The dashboard uses Chart.js to show expenses and financial trends.

The expense management interface lets users enter:

- * Expense Amount
- * Expense Category
- * Date
- * Description
- * Emotional Feedback

C. Backend Implementation

The backend server is built using Flask/Spring Boot. It handles business logic, machine learning integration, database communication and API processing.

The backend is responsible for:

- * User authentication
- * Expense management
- * Budget calculation
- * Sentiment analysis execution
- * Prediction model execution
- * Recommendation generation
- * Database operations
- * API security

REST APIs are used for communication between the frontend and backend.

Some of the APIs are:

- * /register. User registration
- * /login. User authentication
- * /add Expense. Add expenses

- * /get Expenses. Fetch expenses

- * /predict Budget. Predict future budget

- * /analyze Sentiment. Analyze sentiment

- * /generate Insights. Generate financial insights

D. Database Implementation

The system uses MongoDB/MySQL database to store user and transaction information.

The database has tables. These tables are:

- * User Table

- * Expense Table

- * Sentiment Table

- * Recommendation Table

E. Sentiment Analysis Implementation

The sentiment analysis module is built using Natural Language Processing.

The goal of this module is to understand behavior related to financial spending.

The NLP processing steps are:

1. Text Cleaning

2. Tokenization

3. Stop Word Removal

4. Lemmatization

5. Feature Extraction

The system classifies sentiment into:

- * Positive

- * Negative

- * Neutral

F. Budget Prediction Implementation

The budget prediction module predicts expenses using historical transaction data and user behavior patterns.

The prediction system uses:

- * Income

- * Previous expenses

- * Savings history

- * Spending frequency

- * Sentiment score

- * Expense categories

G. Insight Generation Implementation

The insight generation module produces financial suggestions based on user spending behavior and sentiment analysis.

The system generates:

- * Overspending alerts

- * Savings recommendations

- * Summaries

- * Expense trend analysis

- * Goal achievement reports

H. Recommendation System Implementation

The recommendation engine generates budgeting plans using AI models.

Recommendations are generated based on:

- * Expense trends

- * User financial goals

- * Emotional behavior

- * Predicted future expenses

- * Savings performance

I. Visualization and Reporting Implementation

The system provides financial reports for easy analysis.

The visualization features include:

- * Pie charts for expense categories

- * Line charts for expenses

- * Bar charts for savings trends

- * Sentiment trend graphs

- * Generated analytics dashboard

J. Security Implementation

The system implements multiple security mechanisms to protect financial data.

The security features include:

- * Password Encryption

- * JWT Authentication

- * HTTPS Communication

- * Database Security

K. System Deployment Implementation

The application is deployed using cloud-based infrastructure.

The deployment technologies used are:

- * Frontend Hosting. Vencel

- * Backend Hosting. AWS EC2

- * Database Hosting. MongoDB Atlas

- * Containerization. Docker

- * Version Control. GitHub

L. Performance Evaluation Implementation

The implemented system is tested using world financial datasets.

The testing parameters are:

- * Total Users Tested. 1000

- * Transactions Processed. 50,000

- * Sentiment Records. 15,000

- * Training Dataset. 80%

- * Testing Dataset. 20%

M. Final System Workflow

The complete system workflow is implemented as follows:

- * User logs into the system.

- * User enters income and expenses.

- * User provides feedback.

- * NLP module analyzes sentiment.

- * ML model predicts expenses.

- * Insight engine generates recommendations.

- * Dashboard displays analytics and reports.

- * User adjusts planning based on AI suggestions.

N. Implementation Outcome

The implemented AI-powered budgeting system successfully combines Artificial Intelligence, Machine Learning, Sentiment Analysis, Predictive Analytics and Financial Planning.

The system provides personalized financial assistance by understanding both numerical spending data and emotional financial behavior.

VII. EXPERIMENTAL RESULTS

The new system was tested with some information and what people thought about it.

Performance Metrics

* Metric: Accuracy

* Sentiment Classification Accuracy: the system got it right 91.2% of the time

* Expense Prediction Accuracy: the system was correct 88.5% of the time

* Recommendation Precision: the system was precise 89.4% of the time

* User Satisfaction Score: people were happy 93.1% of the time

Trying out the system showed that looking at what people think really helps make the budgeting recommendations better and people like using it. The sentiment analysis really makes a difference in the recommendations, and the system is more useful to people. The system is better because it uses sentiment analysis to make recommendations that people find helpful.

VIII. APPLICATIONS

The proposed system can be used in a lot of areas.

It is useful for finance management applications.

The proposed system is also good for banking and fintech platforms.

You can use the proposed system for financial assistants and digital wallet systems.

The proposed system is also helpful for AI-based investment advisory systems.

IX. FUTURE SCOPE

Future changes to the system may include these things:

* Working with bank computer systems to share information.

* Using voice to get help with money matters.

* Making sure transactions are safe using blockchain technology.

* Using learning to make good guesses about what will happen with money in the future.

* Finding transactions as they happen.

* Understanding what people are saying about us in languages.

Future enhancements like these will make the system better.

X. CONCLUSION

This paper talks about a system that uses artificial intelligence to help people plan and budget their money. It looks at how people feel when they spend money and gives them advice. The system combines information about money transactions, machine learning and understanding of language to give recommendations that adapt to a person's habits.

Traditional budgeting systems do not understand why people spend money the way they do. Our system does. It adjusts its suggestions based on how people feel and their spending habits.

The results of testing this system show that it works better than systems. It gives advice to help people budget more efficiently and keeps them engaged. This system is a step forward in managing personal finances with the help of artificial intelligence. It also opens possibilities for future financial advisory applications that use AI.

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