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Dynamic Financial Planning Platform with Multi Asset Predictive Analytics

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ABSTRACT: Financial decision-making demands advanced systems capable of analysing multi-asset data with real-time accuracy. Traditional financial planning methods are inadequate in managing the volatility of stock, commodity, and cryptocurrency markets, often failing to process dynamic data, which leads to inefficient investment strategies. Our team has proposed the “Dynamic Financial Planning Platform with Multi-Asset Predictive Analytics”, which incorporates Optical Character Recognition (OCR) for automated data input and MongoDB for structured data storage. The platform allows users to manually or automatically input asset information, stored in tabular format and displayed through pie charts for easy portfolio visualization. The investment planning module utilizes real-time risk analysis for various assets, including gold, silver, and cryptocurrencies. Users can input investment amounts, duration, and risk preferences to receive optimized asset allocation recommendations. Continuous real-time updates ensure accurate risk assessments. By integrating OCR, MongoDB, and risk analysis, the platform provides a scalable, adaptive solution that addresses the limitations of traditional financial planning tools, enabling users to make informed, data-driven investment decisions.

KEYWORDS: Data-Driven Decision-Making, Optical Character Recognition, Real-Time Risk Analysis, MongoDB Budget Planning, stocks, Assets, Cryptocurrency.

I. INTRODUCTION

In recent years, the integration of machine learning (ML) into financial analytics has marked a significant shift, fundamentally transforming how stock price forecasting is approached. Traditional econometric models, long the cornerstone of financial analysis, are increasingly being supplanted by advanced machine learning techniques that offer more nuanced predictive capabilities. This shift has been driven by the growing complexity of global financial markets and the increasing need for systems that can analyze a wide variety of interrelated factors. Stock prices are not only influenced by internal market dynamics but also by a complex interplay of external variables such as macroeconomic indicators, political developments, and investor sentiment. This necessitates the use of sophisticated models capable of capturing these multifaceted relationships and providing accurate predictions.

This research focuses on the development of a Dynamic Financial Planning Platform with Multi-Asset Predictive Analytics, designed to offer a comprehensive solution for effective investment decision-making. The platform aims to enhance traditional financial tools by integrating machine learning algorithms that analyze historical stock price data, technical indicators, and real-time sentiment data to predict asset prices and assess risk more effectively. The use of machine learning in this context allows for a more adaptive and responsive approach to stock price forecasting, where predictions are continuously refined based on evolving market conditions and inputs from various data sources. The primary datasets employed in this project cover a wide spectrum of financial data, including historical stock prices, technical indicators such as moving averages, and sentiment data derived from prominent financial news platforms and social media forums. The inclusion of sentiment analysis is particularly important, as it allows the platform to account for investor psychology, a critical factor that often drives short-term market movements. By incorporating data from a diverse range of assets—including stocks, precious metals like gold and silver, and cryptocurrencies—the platform is equipped to handle the volatility inherent in each of these markets. Cryptocurrencies, for instance, are known for their high volatility and sensitivity to market sentiment, making them a particularly challenging asset class to predict. The platform offers more than just price prediction; it provides real-time risk assessment based on user inputs like capital, investment duration, and risk tolerance. It generates personalized asset allocation strategies to balance returns and risk, optimizing investment portfolios. It addresses stock market challenges like volatility, investor biases, and global events using machine learning for predictions, OCR for automation, and MongoDB for data management, empowering investors with accurate insights.

II. LITERATURE REVIEW

The paper "Mobile Bookkeeper: Personal Financial Management Application with Receipt Scanner Using Optical Character Recognition" examines the integration of OCR technology in personal financial management tools, focusing on existing finance tools, OCR technology, and mobile usability frameworks, referencing ISO standards and the QUIS questionnaire for evaluating the Mobile Bookkeeper app [1]. Similarly, Asst. Prof. Dr. Pooja Bhatt et al. (2023) discuss the "Expense Tracker" Android-based application that enhances personal finance management by automating expense tracking, categorizing transactions, and generating reports, while ensuring data security [2]. In the same way, this paper proposes an "Online Income and Expense Tracker", highlighting its ability to streamline financial tracking and minimize manual errors, although it lacks reminder features [3]. The author of this paper explores consumer behaviour regarding exceptional expenses, emphasizing the role of mental accounting in overspending and the importance of better budgeting strategies [4]. In a similar manner, review of OCR technology, outlining challenges such as image quality and character recognition, while discussing OCR's phases and algorithms [5]. This paper presents a "Daily Expense Tracker" with modules for adding, deleting, and viewing expenses, promoting efficient financial management [6]. Similarly, the paper "Expense Tracker Application using Naive Bayes", Introduce a leveraging machine learning to classify SMS messages and automate expense logging with a user-friendly interface [7]. The evolution of digital expense management tools, such as the "Expense Manager", is discussed, highlighting receipt scanning and machine learning for enhanced data processing [8]. Likewise, Lastly, a review of the Internet of Things (IoT) explores its architecture, applications, and challenges, emphasizing its role in sectors like finance and smart cities [9], while the review on financial management applications stresses user interface design and SQL Lite for data storage [10].

Title	Advantages	Disadvantages	Algorithms and Techniques Used
Receipt Image Extraction in Budgeting Mobile Application,[11]	The application simplifies transaction recording through receipt scanning. Users save time by automating data entry from receipts.	Slow analysis time of 5 to 10 seconds. Long loading times due to free hosting service.	Azure Form Recognizer extracts data from receipts. Optical Character Recognition (OCR) identifies characters in images.
Income and Expense Tracker,[12]	The application helps track income and expenses efficiently. Users can add new income and expense categories easily.	The application lacks monthly reminder alerts for users, which may result in unpopulated data.	Google Vision API extracts text and visual information from images.
Image Recognition Expense Extraction,[13]	Users save time by automating data entry from receipts. Users can track, analyze, and optimize their expenses easily.	No free API available for expense data extraction. Smart Receipt Capture often fails to identify receipt boundaries.	Custom algorithms for expense data extraction from receipts. Google's Mobile Vision API for text detection in images.
An AI-Powered Personal Finance Assistant: Enhancing Financial Literacy and Management.[14]	Enhances financial literacy through personalized educational content. Provides customized budgeting aligned with income and spending.	The assistant may require extensive user data for personalization. Potential privacy concerns with data encryption and access control.	Machine learning techniques for personalized budgeting and insights. Predictive analytics for customized investment recommendations.
Home Appliances and Expense Tracker. [15]	The tracker efficiently monitors and manages household expenses. It features a user-friendly interface for easy navigation.	There may be concerns regarding data security and privacy since the application deals with personal financial data.	Agile software development methodologies are employed. Wireframing and prototyping tools are utilized for user interface design.
Expense Tracker and Budget Planner Project,[16]	The platform enhances personal and business financial management. Users can track, analyze, and optimize their expenses easily.	The accuracy of the OCR system can be affected by the quality of the captured documents, issues such as noise and distortion.	AWS Textract analyzes scanned documents to extract structured data like tables.

Table 1. Comparative study

III. PROPOSED METHOD

The following six modules make up the planned work, each of which maintains the primary functionality of the entire project.

Steps of the project:

- Data Analysis
- Data Visualizations
- Plan Investment Module
- Risk Analysis Module
- Show Assets Module
- OCR Selection and Integration

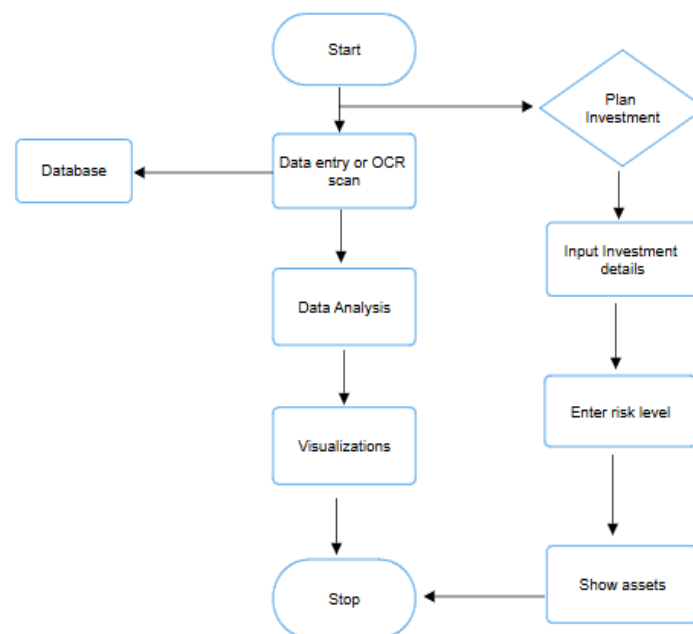


Fig 3.1: Data Flow Diagram

Working Procedure:

The suggested solution operates through an integrated process that leverages OCR technology, data analysis, and machine learning for efficient financial management and investment planning. The process begins with the Data Entry or OCR Scan module, where users input financial data manually or upload scanned documents. OCR algorithms extract structured financial data from these documents, which is validated and stored in MongoDB, ensuring accuracy and reliability. This automation minimizes manual effort and errors, enhancing the efficiency of financial management. The Data Analysis module then processes this data using financial models, predefined rules, or machine learning algorithms to calculate asset performance and conduct risk analysis. Real-time and historical data stored in MongoDB support this backend computation, providing valuable insights that are displayed on the frontend for user decision-making. Next, the Visualization module transforms complex financial data into intuitive graphical formats, such as pie charts and graphs, using libraries like D3.js or Chart.js. These visualizations simplify the interpretation of trends and asset distributions, helping users grasp their financial landscape easily. In the Plan Investment module, users input details such as investment amount, duration, and risk preferences. The backend uses this input alongside real-time risk analysis models to evaluate assets like cryptocurrencies, gold, and fixed deposits, dynamically updating asset risk levels based on market conditions. Personalized investment recommendations are generated and presented on the frontend. The Risk Analysis module plays a crucial role in monitoring asset fluctuations in real-time by utilizing APIs and comparing current data with historical trends stored in MongoDB. It updates risk levels continuously, ensuring informed decision-

making. Finally, the Show Assets module provides users with a dynamically updated list of recommended assets based on their preferences and the real-time risk analysis. These recommendations conclude the planning process, equipping users with actionable insights before making investment decisions. By integrating OCR, the MERN stack, and predictive analytics, the platform provides a seamless, automated solution for financial management and personalized investment planning, ensuring users can make data-driven decisions effectively.

A. Data Analysis

The Data Analysis module serves as the core computational engine of the "Dynamic Financial Planning Platform," processing data collected through OCR or manual entry to provide meaningful insights. The backend utilizes a combination of financial models, machine learning algorithms, and predefined rules to perform risk analysis and calculate asset performance. By leveraging MongoDB, which stores both real-time and historical data, the module ensures accurate and comprehensive analysis. The backend's processing power is critical in handling complex calculations, such as trend predictions and risk assessments, which are derived from large datasets. These insights are then fed to the frontend, where they are displayed in a user-friendly format, enabling users to understand their financial status and asset trends. This process empowers users with actionable data, guiding them to make informed decisions regarding investments while ensuring that risk levels are clearly understood and aligned with their financial goals.

B. Data Visualizations:

The Visualizations module plays a vital role in enhancing user experience by transforming analyzed financial data into intuitive graphical representations, such as pie charts, bar graphs, and line charts. This module bridges the gap between complex financial analysis and user understanding, making intricate data more accessible. The frontend is primarily responsible for rendering these visuals, utilizing powerful JavaScript libraries like D3.js and Chart.js to create dynamic and interactive charts. These libraries ensure that the visualizations are not only visually appealing but also responsive and informative. The data for these visuals is retrieved from the backend, where MongoDB stores relevant financial and asset information. The backend processes the queried data and delivers it in a structured format, which is then converted into graphical outputs on the frontend. By presenting trends, risk levels, and asset distributions in an easy-to-understand format, this module empowers users to grasp financial insights quickly and make informed decisions.

C. Plan Investment Module:

The Plan Investment module is a key component of the platform, enabling users to customize their investment strategies by inputting details such as the investment amount, duration, and risk preferences through an intuitive frontend interface. This data is processed by the backend, which employs sophisticated risk analysis models to identify and recommend suitable assets tailored to the user's preferences. Real-time evaluation of the risk levels for assets such as gold, silver, and cryptocurrencies is performed by analyzing market trends and fluctuations. MongoDB serves as a central repository, storing both user preferences and real-time risk data. The backend dynamically updates risk levels as market conditions change, ensuring that the recommendations remain accurate and relevant. These updated insights are then fed back to the frontend, where users receive personalized asset suggestions. This module simplifies investment planning by combining real-time analytics with user-specific preferences, guiding users toward informed and effective financial decisions.

D. Risk Analysis Module

The Risk Analysis module is a crucial feature of the platform, designed to evaluate the risk levels of various assets in real-time, ensuring users can make informed investment decisions. By leveraging APIs, this module continuously tracks market fluctuations, focusing on volatile assets such as cryptocurrencies, whose values can change rapidly. The backend's powerful analytical engine processes this incoming data, comparing it with historical trends stored in MongoDB to identify patterns and potential risks. This evaluation is guided by predefined rules or advanced machine learning models, enabling precise and adaptive risk assessments. The system dynamically updates risk levels as market conditions evolve, ensuring that the information presented to users remains accurate and timely. These insights are seamlessly communicated to the frontend, where they are displayed in an accessible format. This allows users to monitor asset risks effectively, adjust their strategies as needed, and make data-driven decisions aligned with their financial goals.

E. Show Assets Module:

The Show Assets module serves as the final step in the investment planning process, providing users with a curated list of recommended assets tailored to their input and assessed risk levels. The frontend dynamically displays these

suggestions in a user-friendly interface, ensuring seamless interaction and easy comprehension. The recommendations are sourced from MongoDB, where detailed data on asset risk and performance is stored and continuously updated to reflect real-time market conditions. The backend plays a critical role in personalizing these recommendations by integrating user preferences, such as investment amount, duration, and risk tolerance, with real-time analysis of market trends. This ensures that the asset suggestions are highly relevant and accurate, empowering users with actionable insights. By offering a comprehensive overview of suitable investment options, this module simplifies the decision making process and concludes the planning phase, equipping users to proceed with confidence in their financial and investment choices. Furthermore, it enhances transparency by presenting detailed information about the risk and potential returns for each suggested asset. This comprehensive approach enables users to align their financial strategies with both their short-term goals and long-term aspirations.

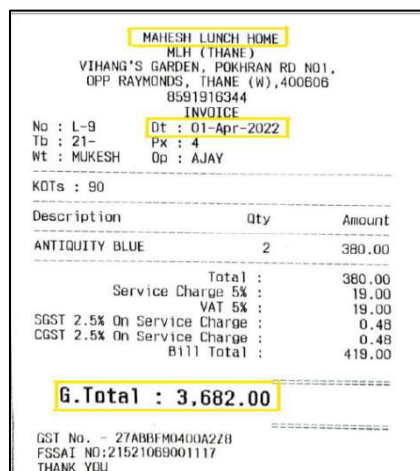
F. OCR Selection and Integration:

Context – Aware OCR:

Context-Aware OCR is an advanced form of OCR technology that uses contextual understanding to improve text recognition accuracy. Traditional OCR systems primarily focus on detecting characters and converting them into digital text, but they often struggle with complex layouts, mixed languages, and noisy environments. Context-aware OCR goes beyond basic recognition by incorporating contextual clues such as semantic information, spatial arrangement, and language structure to improve recognition quality, particularly in real-world, unstructured documents. In context-aware OCR, machine learning and natural language processing (NLP) techniques are used to interpret the meaning behind words, phrases, and entire sections of text. For example, if a document contains dates, addresses, or specific formats, context-aware OCR can use this structural knowledge to identify these elements correctly even if they appear irregularly. It can also adjust its recognition algorithms based on the document type, whether it's a medical report, legal document, or receipt, ensuring a higher accuracy rate in digitizing varied content.

❖ Receipt Recognition:

This system utilizes Python's powerful image processing libraries to automatically extract and organize key transaction information from user-uploaded receipts. This process is broken down into three primary steps: first, the image is imported through image processing tools, allowing the system to handle various receipt formats. Next, the image undergoes analysis and manipulation, where important details such as text and layout patterns are identified and extracted. This stage involves identifying and isolating data points like store name, transaction date, individual item names, item costs, and the total transaction cost. Finally, the processed information is provided as structured output, giving users clear and organized transaction details for tracking and categorization purposes. By automating receipt data extraction, the system ensures accuracy simplifying financial tracking by seamlessly integrating these details into a comprehensive expense management framework. This approach not only saves time but also enhances the accuracy of financial records.



Description	Qty	Amount
ANTIQUE BLUE	2	380.00
Total :		380.00
Service Charge 5% :		19.00
VAT 5% :		19.00
SGST 2.5% On Service Charge :		0.48
CGST 2.5% On Service Charge :		0.48
Bill Total :		419.00
G.Total : 3,682.00		

Fig 3.2: Text Recognition

❖ Sorting Items into Different Categories:

In this application, we leverage powerful machine learning algorithms such as Tesseract and PyTorch to automate the

traction and categorization of data from receipts. The process begins with using Tesseract OCR to extract textual information like the product names and prices from the receipts. Then, with PyTorch, a deep learning framework, we use advanced natural language processing (NLP) techniques to analyze the extracted data and identify keywords such as "Product" and "Price." These keywords help us segregate products from the receipts for further processing. Once the products are identified, they are matched against a comprehensive database of pre-defined categories like Groceries, Clothing, Stationery, and others. This matching process uses machine learning models to determine the most appropriate category for each product based on its name and description. If a product doesn't fit neatly into any category, AI algorithms will either classify it as Miscellaneous or, in future iterations, the system will learn to categorize it correctly through continuous training and updates. This categorization feature allows users to view their expenses grouped by category, offering a more structured overview of their spending. By visualizing the expenses according to categories, users can better analyze their spending habits, identify patterns, and make more informed financial decisions.

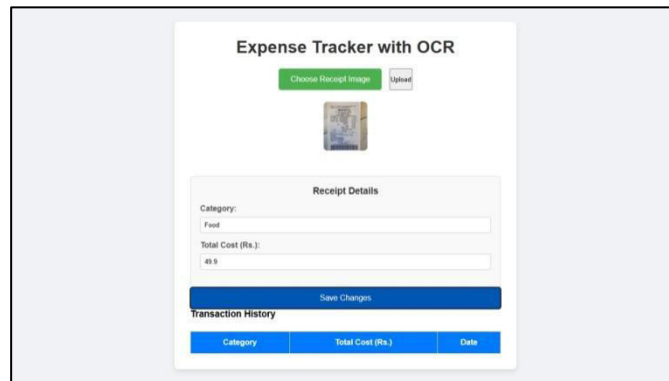


Fig 3.3: Items sorted into Different Categories

IV. RESULTS AND DISCUSSION

In this section we are going to see the results of the project where we got a pretty good result.

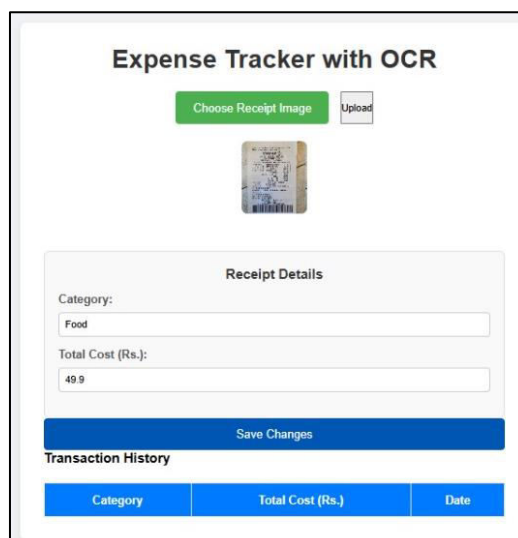


Fig4.1: Manual Entry of Expenses

In result 4.2, It begins with Manual Entry of Expenses, allowing users to record their spending accurately. To streamline this, the system incorporates Expense Identification using OCR, enabling automated extraction of expense details from

receipts which was shown in result 4.2.

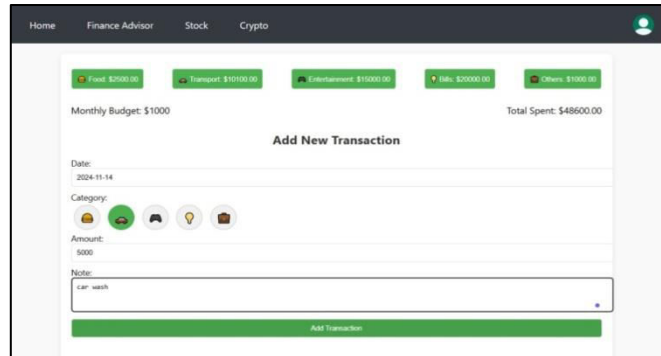


Fig4.2: Expenses Identification using OCR

In result 4.3, A List of Expenses provides users with a organized view of all their recorded expenditures. This feature categorizes expenses based on their type, such as food, transportation, utilities, and entertainment. Users can filter or sort expenses by date, category, or amount, making it easy to identify high -spending areas and track financial habits over time.

Expense List			
Date	Category	Amount	Note
2024-10-20	Entertainment	\$10000	enjoyed snacks
2024-10-20	Food	\$1500	dinner at novotel
2024-10-20	Entertainment	\$5000	shopping
2024-10-20	Transport	\$100	car servicing
2024-10-20	Food	\$1000	food
2024-10-29	Others	\$1000	exam expenses
2024-10-29	Transport	\$10000	car repair
2024-10-29	Bills	\$20000	electric bill
2024-11-14	Transport	\$5000	car wash

Fig4.3: List of Expenses

For long-term financial planning, this model includes an Investment Calculator for Financial Advice, offering tailored investment suggestions which was shown in result 4.4.

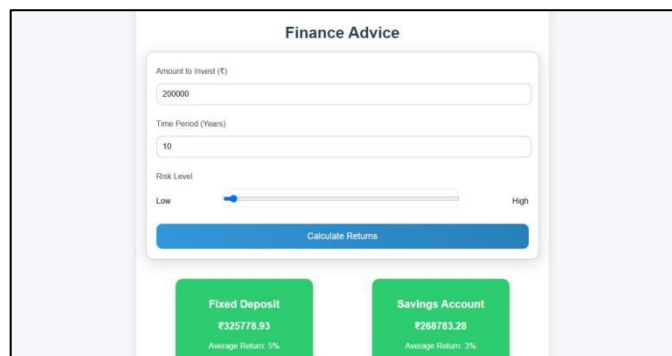


Fig 4.4: Investment Calculator for Financial Advice

A Fixed Deposit Plan Comparison Interface aids users in evaluating and selecting the most suitable fixed deposit options which was shown in Fig 4.5.

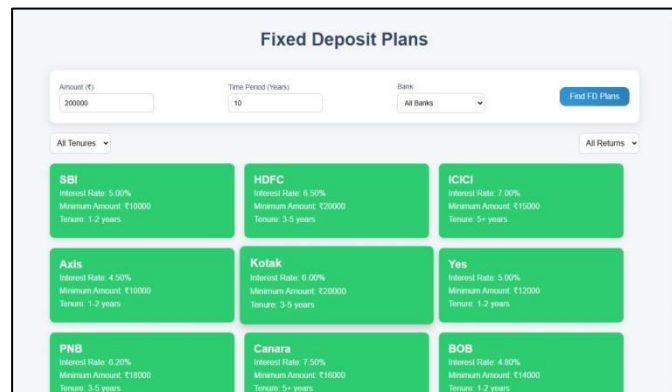


Fig4.5: Fixed Deposit Plan Comparison Interface

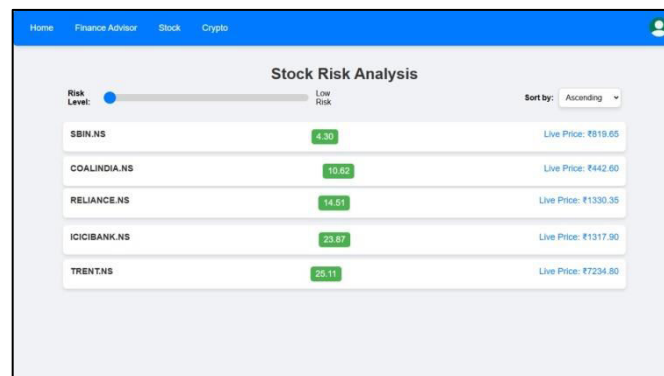


Fig4.6: Low Stock Risk Analysis Interface

For risk management, the application features a Low Stock Risk Analysis Interface, helping investors identify stocks with minimal risk exposure as shown in Fig 4.6.

Additionally, a **Crypto Risk Analysis** module evaluates the volatility and risk associated with cryptocurrency investments as shown in Fig 4.7.

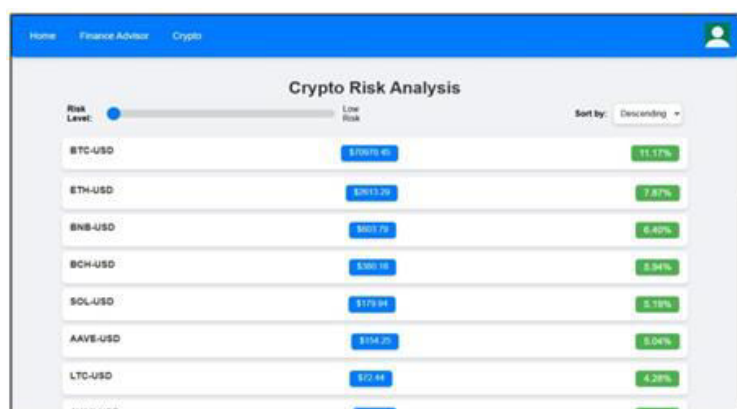


Fig4.7: Crypto Risk Analysis

V. CONCLUSION

The Dynamic Financial Planning Platform with Multi-Asset Predictive Analytics revolutionizes traditional financial tools by delivering real-time, data-driven investment strategies tailored to today's volatile markets. It integrates Optical Character Recognition (OCR) for streamlined data entry and MongoDB for efficient structured storage, enabling accurate asset management with both manual and automated input options. The platform organizes data in a tabular format and offers intuitive visualizations, like pie charts, to simplify complex portfolio insights. Its investment planning module uses real-time risk analysis to evaluate diverse asset classes, including stocks, commodities like gold and silver, and volatile assets such as cryptocurrencies. Tailored asset allocation recommendations are generated based on investment amount, duration, and risk tolerance, supported by continuous real-time updates to ensure timely, informed decisions. By combining OCR, MongoDB, and advanced risk analytics, the platform delivers a user-friendly, scalable solution for dynamic modern investors, empowering both beginners and experts to make precise, proactive, data-backed financial decisions in a rapidly changing market.

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