

A Secure Real Time Cryptocurrency Portfolio Management System Using Blockchain and Predictive Analytics

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Abstract- The rapid growth of cryptocurrency markets has increased the demand for secure and intelligent portfolio management solutions. Most of the current systems present in the market mainly provide basic functions such as tracking assets purchased, monitoring prices of the assets and displaying simple price charts, but they lack deeper analytical capabilities and user - centric design. This study proposed an improved and user - friendly cryptocurrency portfolio management system that incorporates real - time data handling, secure authentication methods for the users and intelligent decision support for overall user-friendly experience. The system leveraged modern web technologies and API integration to access ongoing market data and generate accurate portfolio analysis. Additionally, the proposed model included predictive analysis and risk evaluation features to support better investment decisions. Special attention was given to making the system easy to use for beginners through a simplified interface and well - guided functionalities. Overall, the proposed system overcame limitations of modern tools by delivering a secure, scalable and intelligent platform for managing digital assets effectively.

Keywords: Cryptocurrency, Blockchain, Predictive Analytics.

I. INTRODUCTION

Cryptocurrency has become an acknowledged digital asset category, attracting a large number of investors due to its decentralized system and potential for high returns. However, with the increasing growth in the number of cryptocurrencies and the variability of the market, smart and efficient financial management has become increasingly difficult. Cryptocurrency portfolio management systems allow users to monitor, analyse, and manage their digital assets in a centralised platform which can be easily accessible. Despite this, most existing systems only offer common features such as price tracking and easy visualisations, lacking advanced analytics, strong security measures, and user-friendly interfaces. This research focuses on designing and developing a well - optimised system that enhances usability, security, and decision-making using modern technologies and intelligent features.

A cryptocurrency portfolio management system refers to a software application that helps users manage their invested funds in digital money. It examines the performance of various coins and provides tools for analysis. These systems can range

from simple price trackers that indicate buying and selling opportunities to advanced platforms capable of making future predictions. Managing a cryptocurrency portfolio is challenging due to the massive number of investment options and expeditiously changing market conditions. Therefore, many investors rely on portfolio management tools that help them track assets, evaluate performance, and observe overall market trends within the emerging automated ecosystem, where control is distributed among users rather than centralised. Although several cryptocurrency portfolio management systems are available, most of them are limited to basic portfolio tracking and price monitoring.

They often lack advanced features such as predictive analytics, comprehensive risk assessment, and robust security mechanisms that can support better investment decisions. These limitations highlighted the need for a more secure, intelligent, and user-friendly portfolio management system. Therefore, this study aimed to design and implement a cryptocurrency portfolio management system that integrates real-time market data, enhanced security, and predictive analytics to improve investment

monitoring and assist users in making informed decisions.

II. LITERATURE REVIEW

In recent years, various cryptocurrency portfolio management platforms have been introduced to help users in managing digital assets. Popular platforms such as CoinMarketCap, CoinGecko and Delta mainly provide basic functions including real time price updates, portfolio evaluation and simple graphical representations. While these platforms are useful for analysing and tracking investments but they lack advanced analytical features and personalised decision building capabilities [1], [10].

Research studies show that most traditional portfolio trackers solely depend on API integration for obtaining real time market data but do not have integrated predictive analysis or risk management techniques. Due to the highly volatile nature of cryptocurrency markets, users require more advanced and well optimised systems that can analyse trends, sentiments of the markets and evaluate risks rather than just displaying prices. Some studies indicate the use of machine learning models for future price prediction however; these solutions are not yet widely implemented in user friendly applications [2], [3].

Security is another critical issue in existing platforms. Many platforms have centralised authentication methods, making them susceptible to hacking and data breaches leading to user privacy related issues. Research highlights the need for stronger security mechanisms such as multi factor authentication and blockchain based security integrated systems to safeguard user data and transactions [9].

Usability is also a major concern. Most applications are designed for experienced users and are often

difficult for beginners to understand. Studies suggest that simplified interfaces, guided features, and clear data visualisation can significantly enhance user experience [5].

Furthermore, recent research emphasises the role of Web3 technologies in enabling decentralised control and improving transparency. However, only a few systems have fully implemented these concepts in portfolio management [4].

Overall, existing studies show that while current tools provide essential tracking features, they lack intelligent analytics, strong security, and beginner-friendly design. This highlights the need for a comprehensive system that integrates real-time processing, predictive analysis, risk assessment, and improved usability.

III. LIMITATIONS OF PREVIOUS MODELS

Most existing cryptocurrency portfolio management systems focus primarily on basic functionalities such as tracking prices and displaying portfolio summaries, but they do not include advanced analytical features. There is a significant lack of predictive analysis and risk evaluation, which are essential for making informed investment decisions in a volatile market. Security remains a major concern, as many systems rely on centralised authentication methods that are vulnerable to cyberattacks. Additionally, these platforms are often not user-friendly, especially for beginners, due to their complex interfaces. They also fail to provide personalised insights and make limited use of Web3 and decentralised technologies. These shortcomings highlight the necessity for a more secure, intelligent, and user-friendly system.

Table 1 : Limitations of Previous Models

S.No.	Existing System Features	Limitations (Research Gap)	Proposed Improvement
1	Basic portfolio tracking and visualisation	Lack of advanced analytics for deeper insights	Integrate predictive analytics for better decision-making
2	Static data representation	No use of machine learning techniques	Implement ML-based trend prediction
3	Basic authentication (username/password)	Weak security for financial data	Use JWT authentication and encryption techniques

4	Limited data protection mechanisms	Risk of unauthorised access and data breaches	Apply secure data storage and hashing (bcrypt)
5	Generic user interface	Lack of personalisation for users	Provide customisable dashboard and preferences
6	Complex interface for beginners	Not beginner-friendly	Design simple and intuitive UI
7	Limited real-time integration	Delayed or inaccurate portfolio updates	Use real-time APIs like CoinGecko API for live data

IV. METHODOLOGY

The proposed methodology consists of several stages, including secure user authentication, portfolio management, real-time data integration, portfolio value calculation, system workflow, security implementation, and system architecture. Each component was designed to ensure accurate portfolio tracking, secure data management, and efficient communication between the frontend, backend, database, and external APIs. The following sections describe these components in detail.

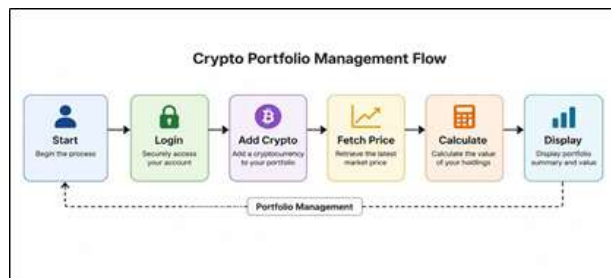


Figure 1 : WORKFLOW OF CRYPTO PORTFOLIO MANAGEMENT

V. USER AUTHENTICATION

To maintain security, user passwords are not stored directly. Instead, they are converted into hashed values using encryption techniques. For session handling, secure tokens are generated to ensure authorised access and prevent misuse.

$$Hash = \text{bcrypt}(\text{Password})$$

For session management, a secure token is generated:

$$JWT = \text{GenerateToken}(\text{UserID})$$

This helps in maintaining secure access and prevents unauthorised usage

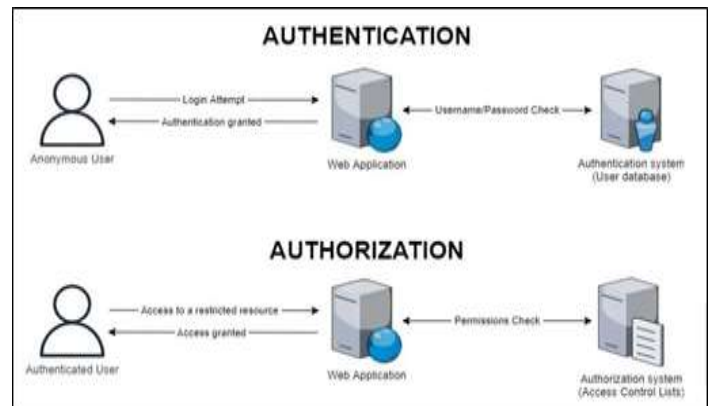


Figure 2: SECURE LOGIN FLOW WITH PASSWORD HASHING AND TOKEN GENERATION

Portfolio Management

Each user can store multiple cryptocurrency entries. Every entry contains the coin name and its quantity:

$$C_i = (\text{coin}_i, \text{quantity}_i)$$

The complete portfolio is represented as:

$$\text{Portfolio} = \{\text{Coin1}, \text{Coin2}, \text{Coin3}, \dots, \text{Coinn}\}$$

This allows efficient storage and retrieval of user data.

Real-Time Data Integration

The system fetches live cryptocurrency prices using an external API. The price of each coin is dynamically obtained as:

$$\text{Price} = \text{API}(\text{CoinID})$$

This ensures that the data displayed is always up-to-date.

Portfolio Calculation

The total value of each cryptocurrency is calculated using:

$$\text{Portfolio Value} = \text{Quantity} * \text{Current Price}$$

The overall portfolio value is:

$$\text{Total Portfolio Value} = \sum \text{Portfolio Value}$$

Profit or loss is determined by:

$$\frac{\text{Profit}}{\text{Loss}} = \text{Current Value} - \text{Invested Value}$$

These calculations help users understand their investments clearly.

VI. SYSTEM WORKFLOW

The system workflow begins when the user securely logs into the application using authenticated credentials. After successful authentication, cryptocurrency details are entered into the portfolio. The application retrieves live market prices from the CoinGecko API and stores the information securely in the MySQL database. Portfolio value, profit, and loss are then calculated automatically before displaying the updated information through the user dashboard.



Figure 3: INTERNAL SYSTEM WORKFLOW OF SYSTEM

VII. SECURITY MEASURES

The proposed system implemented password hashing using bcrypt to prevent unauthorized password disclosure. JWT-based authentication was used to maintain secure user sessions, while input validation techniques protected the application against malicious requests. These security measures

collectively improved data confidentiality and system reliability.

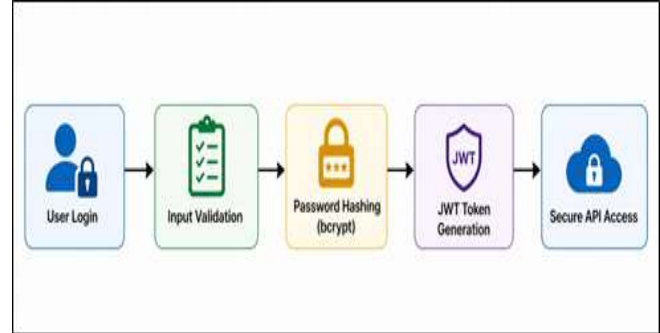


Figure 4: USER AUTHENTICATION AND AUTHORIZATION PROCESS

VIII. SYSTEM ARCHITECTURE

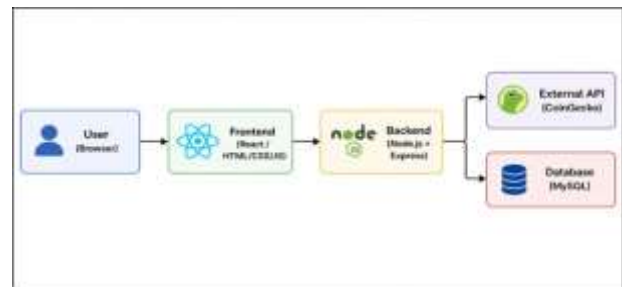


Figure 5: SYSTEM ARCHITECTURE OF THE PROPOSED PORTFOLIO TRACKER

IX. IMPLEMENTATION

The frontend was developed using HTML, CSS, and JavaScript to provide an intuitive user interface. The backend was implemented using Node.js and Express.js to handle server-side operations and API communication. The user and portfolio data were stored securely in MySQL database. CoinGecko API was used to retrieve real-time cryptocurrency prices. For security, passwords were hashed using bcrypt and JWT authentication was used to manage secure user sessions.

X. RESULTS

The system delivers effective results under test conditions. The system allowed users to register, log in securely, add cryptocurrency assets, and track their portfolios. Real-time pricing was consistently accurate, calculations for total value and profit/loss

were error-free. The dashboard displayed portfolio information in a clear and user-friendly manner, making it easy for users to monitor their investments. During testing, the system successfully performed secure user authentication, retrieved real-time market data, and accurately calculated portfolio value and profit or loss, demonstrating its reliability and effectiveness.

XI. ADVANTAGES

The proposed cryptocurrency portfolio management system offers several advantages that improve both security and usability. It enhances data security by implementing password hashing and token-based authentication, ensuring that user information remains protected from unauthorized access. The integration of the CoinGecko API enables the system to provide accurate real-time cryptocurrency market updates, allowing users to monitor their investments effectively. By consolidating multiple cryptocurrency holdings on a single platform, the system simplifies portfolio management and provides a comprehensive view of all investments. It also automatically calculates and displays profit or loss, helping users make informed financial decisions. In addition, the application features a simple and user-friendly interface that makes it accessible to both beginners and experienced investors, while its built-in security mechanisms contribute to a reliable and secure portfolio management experience.

XII. FUTURE SCOPE

The proposed system can be further enhanced by incorporating artificial intelligence techniques to analyze market trends and provide personalized investment recommendations. Security can be strengthened by implementing two-factor authentication (2FA) and advanced encryption methods to offer better protection for user data. In the future, a mobile application can be developed to improve accessibility, allowing users to manage their portfolios anytime and anywhere. Additional features such as real-time price alerts and the integration of multiple cryptocurrency exchange accounts into a single dashboard can further improve the user experience by providing a more

comprehensive and convenient platform for cryptocurrency portfolio management.

XIII. CONCLUSION

This project has successfully developed a secure and user centric cryptocurrency portfolio tracker, addressing the limitations of existing systems. The application allows users to track digital assets by providing real-time data and clear insights through a simple interface. The system strengthens security with encrypted authentication while providing an intuitive, beginner-friendly experience. By combining modern technologies and live data APIs, the project provides an efficient solution for managing cryptocurrency investments. This study highlights the imperative of merging robust security protocols, streamlined user experience, and intelligent automation in portfolio management. Furthermore, it outlines potential enhancements through advanced data analytics and decentralized web technologies. However, the current implementation depends on third-party APIs for real-time market data and does not include advanced machine learning models for highly accurate price prediction. These limitations can be addressed in future work.

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