ÇUKUROVA UNIVERSITY

ENGINEERING AND ARCHITECTURE FACULTY

DEPARTMENT OF COMPUTER ENGINEERING

GRADUATION THESIS

REACT-BASED BLOCKCHAIN WEB3 APPLICATION (TYCHE)

By

2020555403 – Muhammed Mustafa Savar

Advisor

Asst. Prof. MEHMET SARIGÜL

June 2024

ADANA

ABSTRACT

Tyche is a platform designed to simplify the user experience by allowing users to easily track their transactions on various blockchain networks such as Bitcoin, Ethereum, BNB Smart Chain, Avalanche, Solana, and Cosmos. The primary aim of Tyche is to provide a user-friendly interface to access different blockchain networks, saving users time and effort. The platform offers real-time tracking of cryptocurrencies and tokens, portfolio management, and transaction fees.Tyche aims to contribute to community-focused developments, making the Web3 ecosystem more democratic and accessible.

CONTENTS

1- INTRODUCTION

Problem Statement: The usability of blockchain wallets is hindered by their lack of intuitiveness, which makes it challenging for users to track and manage their digital assets. This difficulty is exacerbated when users operate across multiple blockchain networks, leading to a fragmented user experience and increased potential for error.

Objective: The primary objective of this thesis is to address these usability issues by developing an innovative application named Tyche. Tyche aims to streamline the user experience by providing a unified platform for tracking wallet addresses, assets, and transactions across various blockchain networks.

Project Overview: Tyche is designed to simplify the complex landscape of blockchain technology for both novice and experienced users. By supporting major blockchain networks such as Bitcoin, Ethereum, BNB Smart Chain, Avalanche, Solana, and Cosmos, Tyche enables users to monitor their assets and transaction histories from a single interface. This functionality is crucial for enhancing user accessibility and reducing the cognitive load associated with managing multiple wallets across different platforms.

Proposed Solution: Tyche offers an integrated solution that not only tracks cryptocurrencies and tokens but also provides real-time updates on transaction fees and network statuses. The application is designed with user-friendliness at its core, making it accessible for users with varying levels of expertise in the crypto domain. By leveraging Tyche, users can effortlessly monitor their portfolios, track their transaction histories, and stay informed about their assets' performance across different blockchain networks.

2- LITERATURE REVIEW

As blockchain technology continues to develop and become more widespread, it becomes increasingly difficult for users to track their assets and transaction history across multiple networks. Existing solutions often offer complex interfaces and limited functionality, negatively affecting user experience. Tyche addresses this issue by providing an innovative platform designed to make blockchain technology more accessible.

Blockchain technology, while innovative and transformative, has been critiqued for its usability challenges. According to Nakamoto's original whitepaper on Bitcoin (2008), the primary focus was on decentralization and security rather than user experience. Subsequent blockchain platforms, such as Ethereum (Buterin, 2013), have continued this trend, prioritizing technical robustness over ease of use. Studies have highlighted several key usability issues, including complex transaction processes, lack of user-friendly interfaces, and difficulty in tracking assets across multiple platforms [1] [2] [3] .

2.1 Existing Solutions for Wallet Management

Numerous solutions have been proposed to address the usability challenges of blockchain wallets. Current solutions can be broadly categorized into single-chain and multi-chain wallet applications.

2.1.1 Web3 Wallets

Web3 wallets like Metamask, Electrum, Trust Wallet, and Atomic Wallet allow users to track their own addresses and view balances in their accounts. However, they do not provide the capability to visualize assets across multiple networks in a single interface or track detailed portfolios. They are primarily used for making transactions and viewing balances.

MetaMask: Primarily designed for Ethereum and compatible with ERC-20 tokens, MetaMask offers a browser extension that facilitates interaction with decentralized applications (DApps). However, its functionality is limited to the Ethereum network.

Electrum: A lightweight Bitcoin wallet that emphasizes speed and low resource usage but lacks multi-chain support.

Trust Wallet: Supports multiple blockchain networks including Ethereum, Binance Smart Chain, and others. It offers a more comprehensive solution but still faces challenges in providing a seamless user experience across all supported networks.

Atomic Wallet: Another multi-chain wallet that supports over 500 cryptocurrencies. Despite its wide range of supported assets, it can be overwhelming for new users due to its complex interface.

2.1.2 Blockchain Explorers

Blockchain explorers allow you to search for all transactions and addresses on the blockchain. However, their complex interfaces and technical jargon make them difficult for ordinary users to use. For instance:

Etherscan: A popular platform for searching and examining transactions and addresses on the Ethereum blockchain (see Image 1). However, using Etherscan can be quite challenging for a user new to Web3.

> **Interface Complexity:** Etherscan's interface is filled with technical terms and complex graphics, making it difficult for users new to Web3 to navigate and find the information they need.

> **Technical Terminology:** Etherscan uses many technical terms such as "hash," "gas," and "nonce," making it almost impossible for users who do not understand these terms to use the platform.

Data Overload: Etherscan provides a large amount of data, making it difficult to find the information you are looking for and causing users to get lost on the platform.
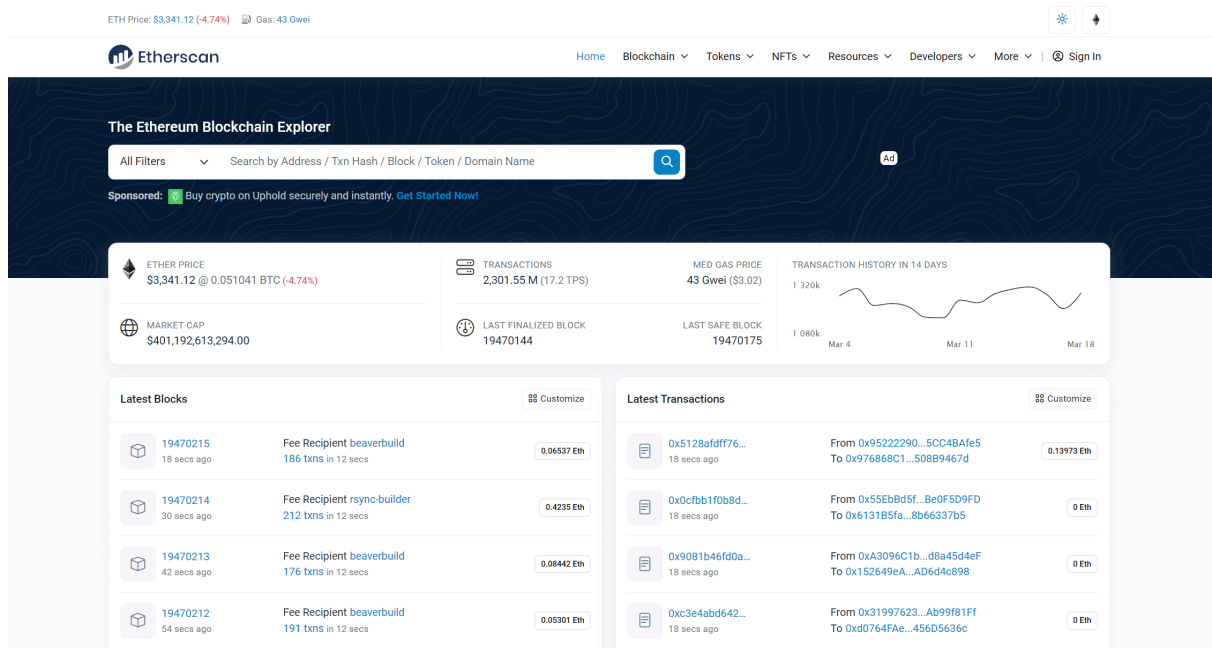

Image - 1. A screenshot of the homepage of the website named Etherscan

2.1.3 Other Portfolio Tracking DApps

Many DApps offer single functionalities like portfolio tracking or tracking transactions on a specific network. This is insufficient for users and creates a necessity to use multiple DApps for different functionalities. They often cater to advanced users with many unfamiliar terms, and their complex interfaces are not suitable for the end user.

2.2 Limitations of Current Solutions

While current solutions offer varying degrees of functionality, they often fall short in several areas:

Fragmented User Experience: Users need to navigate between different interfaces and applications to manage assets on different blockchains, leading to a fragmented user experience [4] [5] .

Complexity: Many wallets are designed with advanced users in mind, making them intimidating for newcomers to the blockchain space [6] .

Limited Cross-Chain Functionality: Although multi-chain wallets exist, they often lack full integration, resulting in a disjointed experience where users cannot view or manage all their assets cohesively [7] .

2.3 Academic Insights and Recommendations

Academic research has underscored the need for more user-centric designs in blockchain applications. For instance, studies by Khairuddin et al. (2016) and Krombholz et al. (2017) emphasize the importance of designing for user mental models and reducing cognitive load [8] [9] . These studies recommend:

Unified Interfaces: Integrating different blockchain interactions within a single interface to simplify the user experience.

Enhanced Visualization: Providing clear visual representations of assets and transactions to aid user understanding[10] .

Educational Features: Incorporating educational tools within wallets to help users understand blockchain operations and security practices[11] .

2.4 Tyche's Position in the Literature

Tyche aims to address the identified gaps by offering a comprehensive solution that integrates the management of multiple blockchain networks into a single, user-friendly interface. Unlike existing solutions, Tyche is designed with both novice and experienced users in mind, providing:

Unified Management: A single interface for tracking and managing assets across major blockchain networks such as Bitcoin, Ethereum, BNB Smart Chain, Avalanche, Solana, and Cosmos.

Simplified User Experience: A focus on usability with intuitive design elements and reduced complexity.

By aligning with the recommendations from academic research and addressing the limitations of existing solutions, Tyche positions itself as a pioneering tool in the blockchain ecosystem.

3-   TECHNOLOGY USAGE

3.1. Interface Design

Figma: Figma was utilized for designing and prototyping the user interface (UI). As a collaborative design tool, Figma allowed the team to create detailed UI designs and user experience (UX) flows (see Image 2 for the initial design of the Tyche project in Figma before coding). Its real-time collaboration features were essential for ensuring that design and development teams stayed synchronized throughout the project lifecycle."
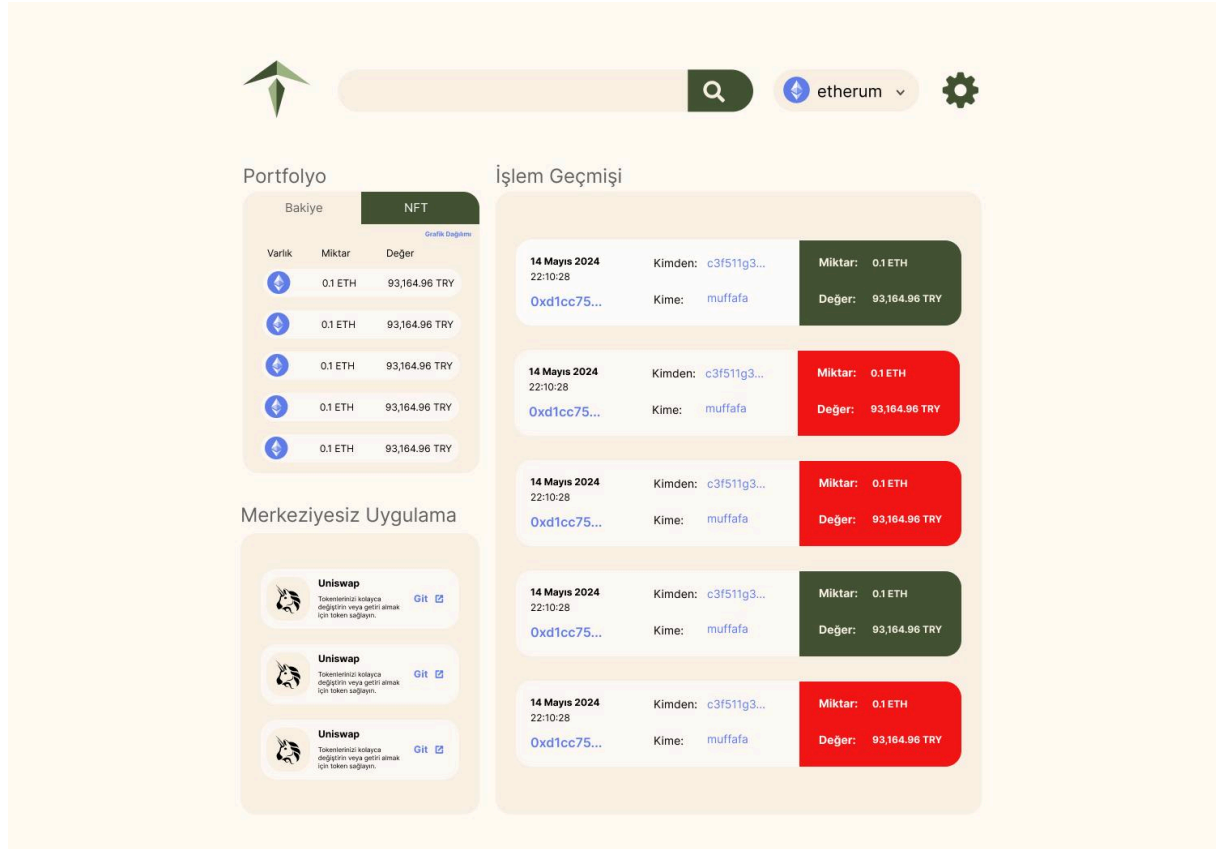

Image - 2. The initial design of the Tyche project in Figma before coding

3.2 Front-end Development

HTML, CSS, JavaScript: Basic web technologies such as HTML, CSS, and JavaScript were foundational in creating the static content, defining styles, and implementing interactions for the application. These technologies provided the structural backbone of the front-end development.

React: React was chosen as the primary JavaScript library for building the user interface components. React's component-based architecture facilitated the creation of reusable UI components, significantly improving the efficiency and consistency of the development process. The use of React also enabled the implementation of dynamic and interactive features within the application, enhancing the overall user experience.

Next.js: Next.js was used for server-side rendering (SSR) and static site generation (SSG). These capabilities of Next.js ensured that the application was SEO-friendly, with faster page load times and optimized performance (see Image 3.1 and Image 3.2 for the MVP version of the Tyche project implemented with Next.js). The framework's built-in features for routing and data fetching were instrumental in streamlining the development process.
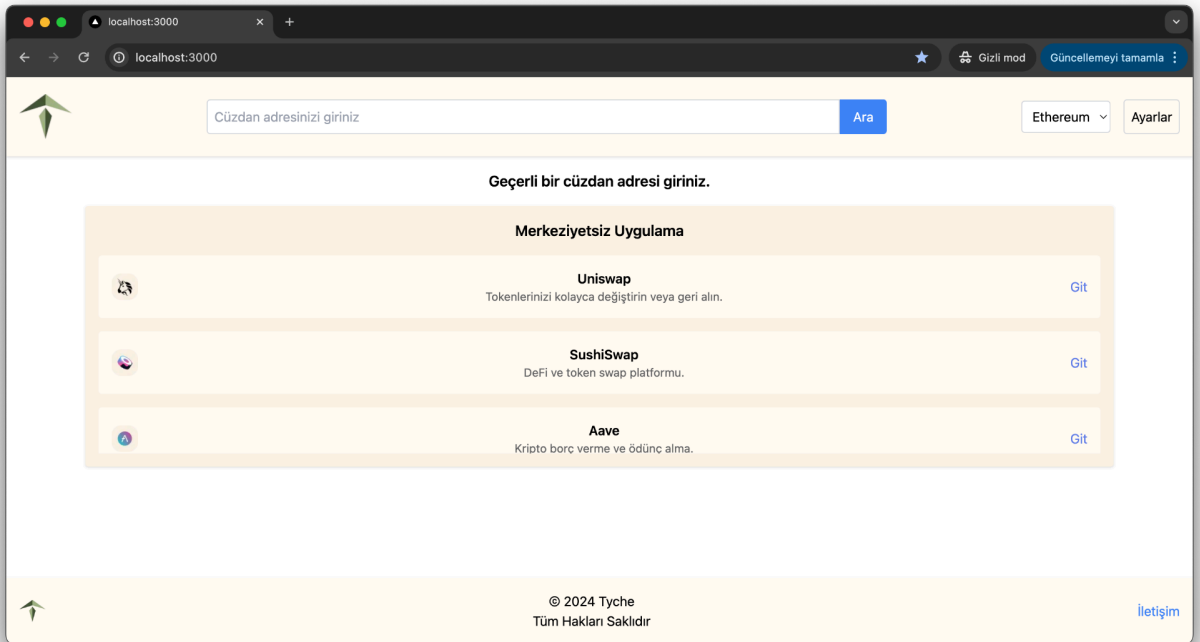

Image - 3.1 The MVP version of the Tyche project implemented with Next.js
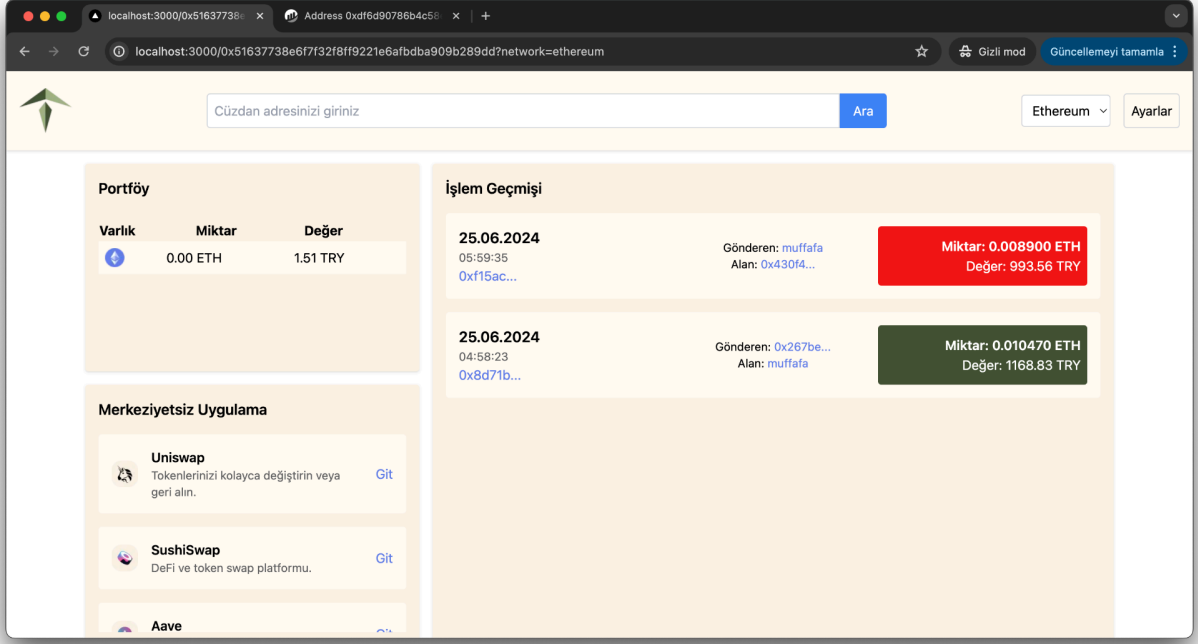
Image - 3.2 The MVP version of the Tyche project implemented with Next.js

Tailwind CSS: Tailwind CSS was employed for styling the application. As a utility-first CSS framework, Tailwind CSS provided a highly customizable and efficient way to apply styles directly within the HTML, reducing the need for extensive custom CSS. This approach not only accelerated the development process but also ensured a consistent design language across the application. The benefits of using Tailwind CSS are evident in the responsive design implemented throughout the project (see Image 4 for an example of the responsive design)."
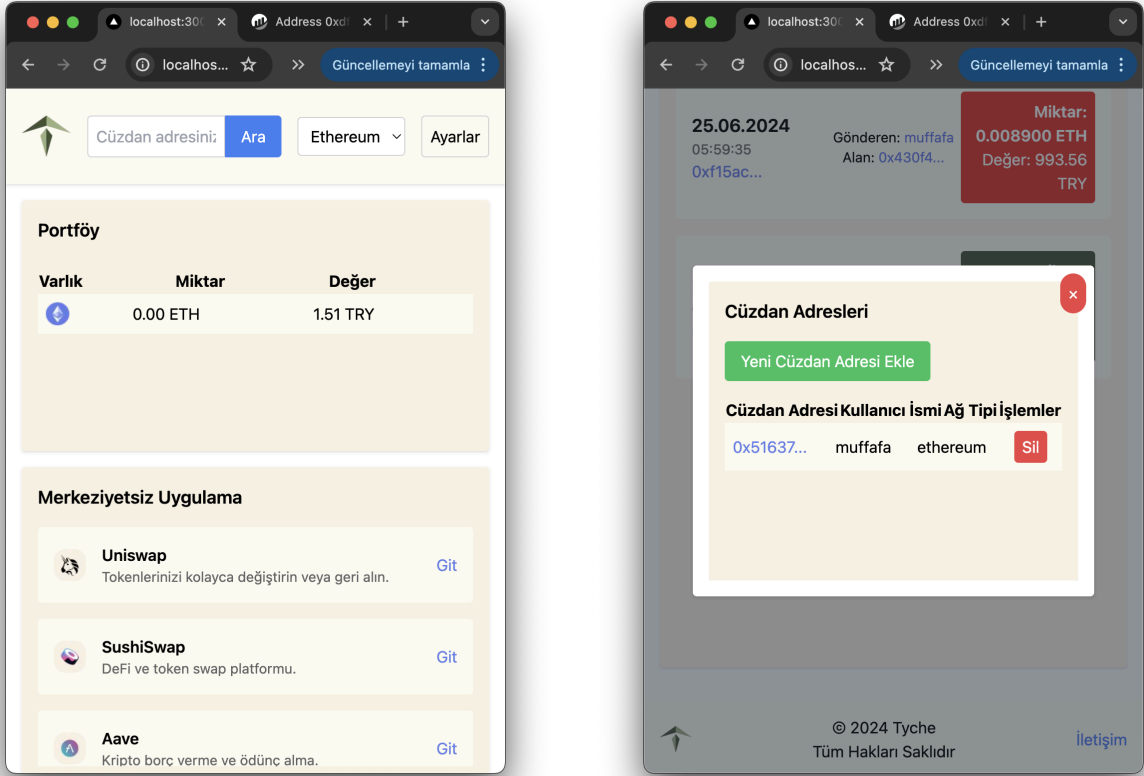
Image - 4. Example of the Responsive Design for Tyche

Axios: Axios was the library of choice for making HTTP requests. It was used extensively to interact with various APIs, including the Etherscan API. Axios provided a simple and intuitive interface for handling asynchronous requests, error handling, and response transformations, which was crucial for fetching and displaying real-time data from the blockchain.

3.3 Back-end Development

Etherscan API: The Etherscan API was utilized to fetch data regarding transactions and wallet balances from the Ethereum blockchain. This API provided reliable and comprehensive data, which was essential for the application's functionality. By integrating the Etherscan API, the application could display real-time transaction histories and balance information for various blockchain addresses, enhancing the utility and accuracy of the platform.

3.4 Development Environment and Tools

Git and GitHub: The Etherscan API was utilized to fetch data regarding transactions and wallet balances from the Ethereum blockchain. This API provided reliable and comprehensive data, which was essential for the application's functionality. By integrating the Etherscan API, the application could display real-time transaction histories and balance information for various blockchain addresses, enhancing the utility and accuracy of the platform.

5- CONCLUSION

In conclusion, Tyche presents a thoughtful approach to improving the user experience in blockchain technology and Web3 applications. By addressing the challenges associated with managing assets across multiple blockchain networks, Tyche aims to simplify and streamline the user experience. This project focuses on creating a user-friendly interface that can cater to both novice and experienced users, aligning with academic recommendations for user-centered design.

Tyche's innovative approach, which includes unified management and simplified user experience, offers a practical solution to the fragmented and often complex nature of current wallet management tools. The platform's potential to make interactions with various blockchain networks more accessible can contribute to better user engagement and understanding of blockchain technology.

By providing support in the Turkish language, Tyche also emphasizes accessibility and inclusivity, making it a valuable tool for Turkish users. While Tyche may not solve all the challenges in the blockchain space, it represents a meaningful step towards making blockchain technology more user-friendly and approachable.

Overall, Tyche aims to make a positive impact by enhancing user experience, promoting accessibility, and supporting the broader adoption of blockchain technology. The project's focus on addressing real-world user needs and its modest, user-centered approach underscore its potential to be a valuable addition to the Web3 ecosystem.

ANNEXES

Project Source Codes: https://github.com/cengcu/graduation-thesis-muffafa.git

REFERENCES

1. Nakamoto, S. (2008) "Bitcoin: A Peer-to-Peer Electronic Cash System."
2. Buterin, V. (2013) "Ethereum Whitepaper."
3. Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J.A., & Felten, E.W. (2015) "SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies." IEEE Symposium on Security and Privacy.
4. Khairuddin, I.E., Sas, C., & Clinch, S. (2016) "Exploring Motivations for Bitcoin Technology Usage."
5. Krombholz, K., Judmayer, A., Gusenbauer, M., & Weippl, E. (2017) "The Other Side of the Coin: User Experiences with Bitcoin Security and Privacy."
6. "Usability of Cryptocurrency Wallets: A User Study." Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems.
7. Trust Wallet and Atomic Wallet reviews and critiques.
8. Khairuddin, I.E., Sas, C., & Clinch, S. (2016) "Exploring Motivations for Bitcoin Technology Usage."
9. Krombholz, K., Judmayer, A., Gusenbauer, M., & Weippl, E. (2017) "The Other Side of the Coin: User Experiences with Bitcoin Security and Privacy."
10. "Designing User-Centered Wallet Interfaces for Cryptocurrencies." Journal of Financial Innovation.
11. "Educational Tools in Blockchain Wallets: A User-Centric Approach." IEEE Transactions on Education.