Mini-DeFi App: A Testnet Simulation of Token Swaps Using React + Ethers.js

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Abstract

This paper presents **Mini-DeFi App**, a decentralized finance (DeFi) application prototype built using **React, Vite, and Ethers.js**, designed to simulate token swaps on Ethereum testnets. The application demonstrates wallet connection, transaction simulation, and user interaction in a simplified DeFi environment. This work serves as a practical reference for engineers and researchers interested in DeFi front-end development and blockchain simulation.

1. Introduction

Decentralized finance (DeFi) has rapidly gained traction in the blockchain ecosystem. Developing test applications is essential for understanding transaction flows, wallet integration, and smart contract interactions. **Mini-DeFi App** provides a controlled environment for experimenting with these concepts without financial risk.

Objectives of this project:

1. Build a responsive front-end interface for token swaps.

2. Implement wallet connection via MetaMask.

3. Simulate token swap transactions on Ethereum testnets (Goerli/Sepolia).

4. Prepare a foundation for future full-scale DeFi implementations.

2. Related Work

- Uniswap V3 and other automated market makers (AMMs) as benchmarks for token swaps.

- Front-end DeFi applications leveraging React + Ethers.js.

- Wallet integration studies for Ethereum testnets.

3. System Architecture

3.1 Technology Stack

- **Front-end:** React + Vite

- **Blockchain Library:** Ethers.js

- **Wallet:** MetaMask

- **Network:** Ethereum testnets (Goerli, Sepolia)

- **Notifications:** Toast notifications for simulated transactions

3.2 Application Flow

1. User connects MetaMask wallet.

2. Wallet address is displayed.

3. User selects token pair and amount.

4. Swap is simulated and a notification is shown.

4. Implementation

4.1 Wallet Connection

- Utilizes window.ethereum provider.

- Connection triggers retrieval of wallet address and network verification.

4.2 Swap Simulation

- Swap logic is implemented in JavaScript for demonstration purposes.

- No actual transactions occur on the blockchain in v1-demo.

4.3 User Interface

- Responsive design inspired by Binance wallet layout.

- Supports desktop and mobile screens.

5. Results

- Successfully connected MetaMask wallets on Goerli and Sepolia testnets.

- Swap simulation notifications confirmed for multiple token pairs.

- Application loads in under 2 seconds on a typical development machine.

6. Discussion

The Mini-DeFi App demonstrates that a fully functional DeFi front-end can be built and tested without deploying smart contracts on mainnet. Future enhancements include:

- Integration with Uniswap V3 for real token swaps.

- Displaying real-time balances of ETH and ERC20 tokens.

- Adding transaction history and analytics.

7. Conclusion

Mini-DeFi App v1-demo serves as a proof-of-concept for DeFi application development and testing. The repository provides reusable components and a practical example for engineers, researchers, and blockchain enthusiasts.

8. Future Work

- Full DeFi integration with live testnet swaps.

- Security auditing and smart contract deployment.

- Multi-token support and advanced analytics dashboards.

9. References

1. Uniswap V3 Documentation, https://docs.uniswap.org

2. Ethers.js Library, https://docs.ethers.io

3. Ethereum Testnets, Goerli & Sepolia, https://ethereum.org

10. Acknowledgements

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