

Cardano HFT Platform — Technical Architecture

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1) Vision & Purpose

Enable automated, strategy-based trading on Cardano DEXs with secure wallet management, real-time token discovery, and non-custodial execution. Outcome: production-ready platform bridging traditional HFT with Cardano DeFi.

2) Architectural Overview

A **hybrid three-tier system** built for scalability, security, and real-time performance:

A. Frontend Layer (React + TypeScript + Vite)

- **Framework:** React 18 with TypeScript for type safety
- **Build Tool:** Vite for fast development and optimized production builds
- **State Management:** Redux Toolkit for global state (wallet, tokens, strategies)
- **UI Components:**
 - Custom-designed components with Tailwind CSS
 - Sonner for toast notifications
 - Dark mode support

- **Wallet Integration:**
 - Mesh SDK (CIP-30) for browser wallet connections (Nami, Eternl, Flint)
 - Cardano wallet adapter for multi-wallet support
- **Routing:** React Router for SPA navigation

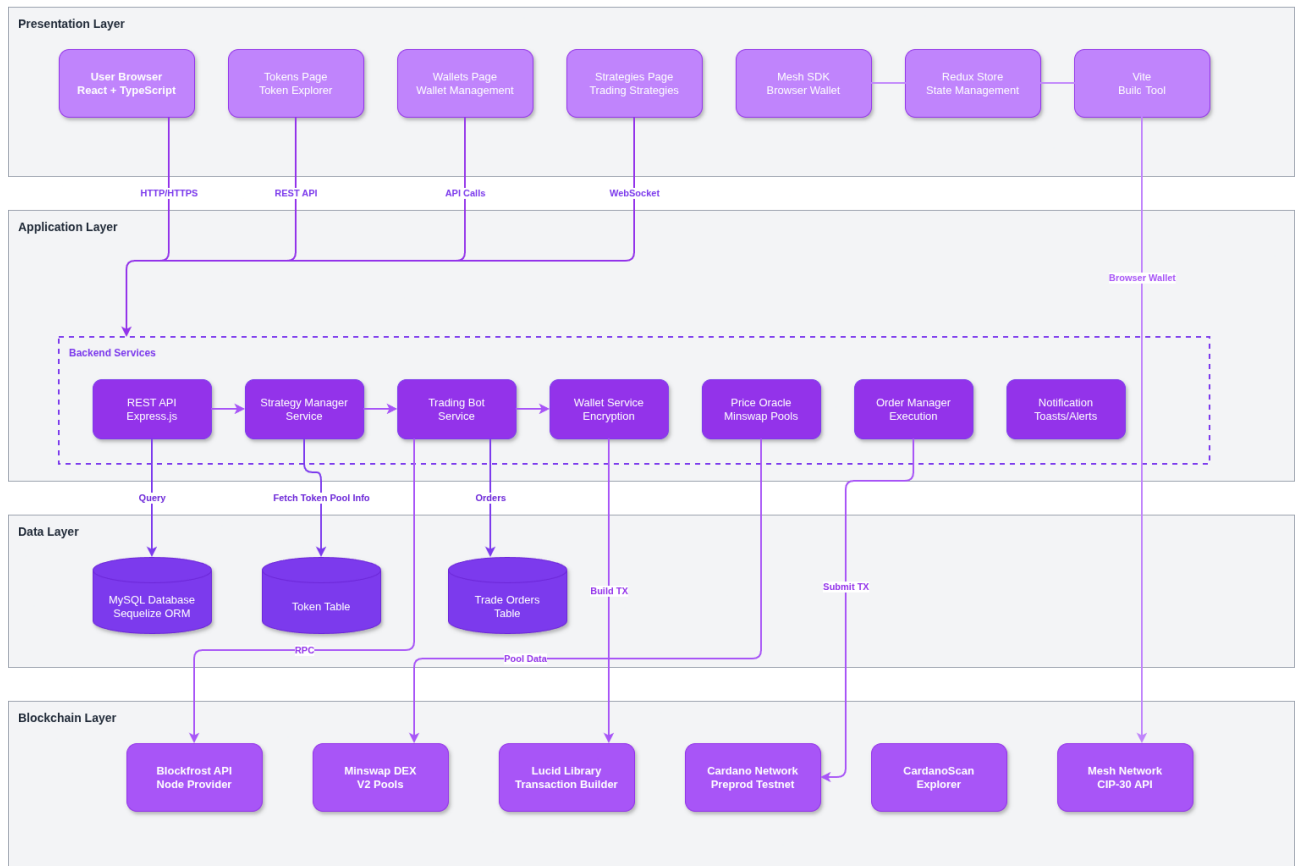
B. Application & API Layer (Node.js + Express + TypeScript)

- **Runtime:** Node.js with Express.js REST API
- **Architecture:** Service-oriented design with clear separation of concerns
- **Core Services:**
 - **Strategy Manager Service:** Orchestrates trading strategies lifecycle
 - **Trading Bot Service:** Monitors prices and executes orders
 - **Wallet Service:** Manages encrypted wallet storage and transactions
 - **Price Oracle Service:** Fetches live prices from Minswap pools
- **API Endpoints:** RESTful JSON under `/api` for wallets, tokens, strategies, orders
- **Security:** AES-256-GCM encryption for seed phrases, environment-based secrets

C. Data + Blockchain Layer

- **Database:** MySQL with Sequelize ORM for structured data
 - **Tables:** Wallets, Tokens (Pools), Trade Orders, Strategies
- **Blockchain Integration:**
 - **Cardano Network:** Preprod Testnet (production-ready for Mainnet)
 - **Node Provider:** Blockfrost API for blockchain queries
 - **DEX:** Minswap V2 pools for token swaps
 - **Transaction Builder:** Lucid-Cardano for building/signing transactions
 - **SDK:** Minswap SDK for pool calculations and swap execution

Cardano HFT Platform - System Architecture



3) Technologies Used in the Solution

Category	Technology	Purpose
Frontend	React + TypeScript	Type-safe UI development with component reusability
Build Tool	Vite	Fast HMR and optimized production builds
State Management	Redux Toolkit	Centralized state for wallet, tokens, and strategies
Styling	Tailwind CSS	Utility-first CSS for rapid UI development
Backend	Node.js + Express	Scalable REST API with TypeScript
Database	MySQL + Sequelize	Relational database with ORM for structured queries
Blockchain	Cardano (Preprod/Mainnet)	Layer-1 blockchain for transaction settlement
APIs & Integrations	Lucid + Blockfrost APIs	Blockchain interaction and node queries
DEX Integration	Minswap V2 SDK	Pool data fetching and swap execution
Wallet Integration	Mesh SDK (CIP-30)	Browser wallet connections (Nami, Eternl, Flint)
Encryption	AES-256-GCM (Node crypto)	Secure seed phrase storage

Category	Technology	Purpose
Payments	ADA (Lovelace)	Native Cardano token for gas and liquidity
Math Library	Big.js	Precise decimal arithmetic for token amounts

Key Differentiators:

- **React for frontend** ensures high performance and developer productivity
- **Python (FastAPI)** is NOT used; **Node.js + Express** provides unified JavaScript/TypeScript stack
- **Lucid + Blockfrost APIs** enable direct blockchain interaction without custom node infrastructure
- **AES-256-GCM encryption** secures wallet seed phrases at rest

4) Core Principles

Principle	Rationale
Hybrid Off/On-Chain	Strategy logic off-chain for speed; execution on-chain for immutability
Wallet-as-Identity	CIP-30 wallets replace auth; signatures authorize actions
Non-Custodial	Backend wallets encrypted; private keys never exposed to frontend
Real-Time	Bot checks prices (10s), UI updates (5s)
Auditability	Every order has DB record + on-chain txHash

5) Key Components

Frontend: Tokens (search 100+ pools), Wallets (create/import/fund/delete), Strategies (price-target with start/stop/delete controls).

Backend Services: Strategy Manager (30s execution loop), Trading Bot (10s order polling + Lucid swaps), Wallet Service (BIP39 + encryption), Price Oracle (Minswap pool data).

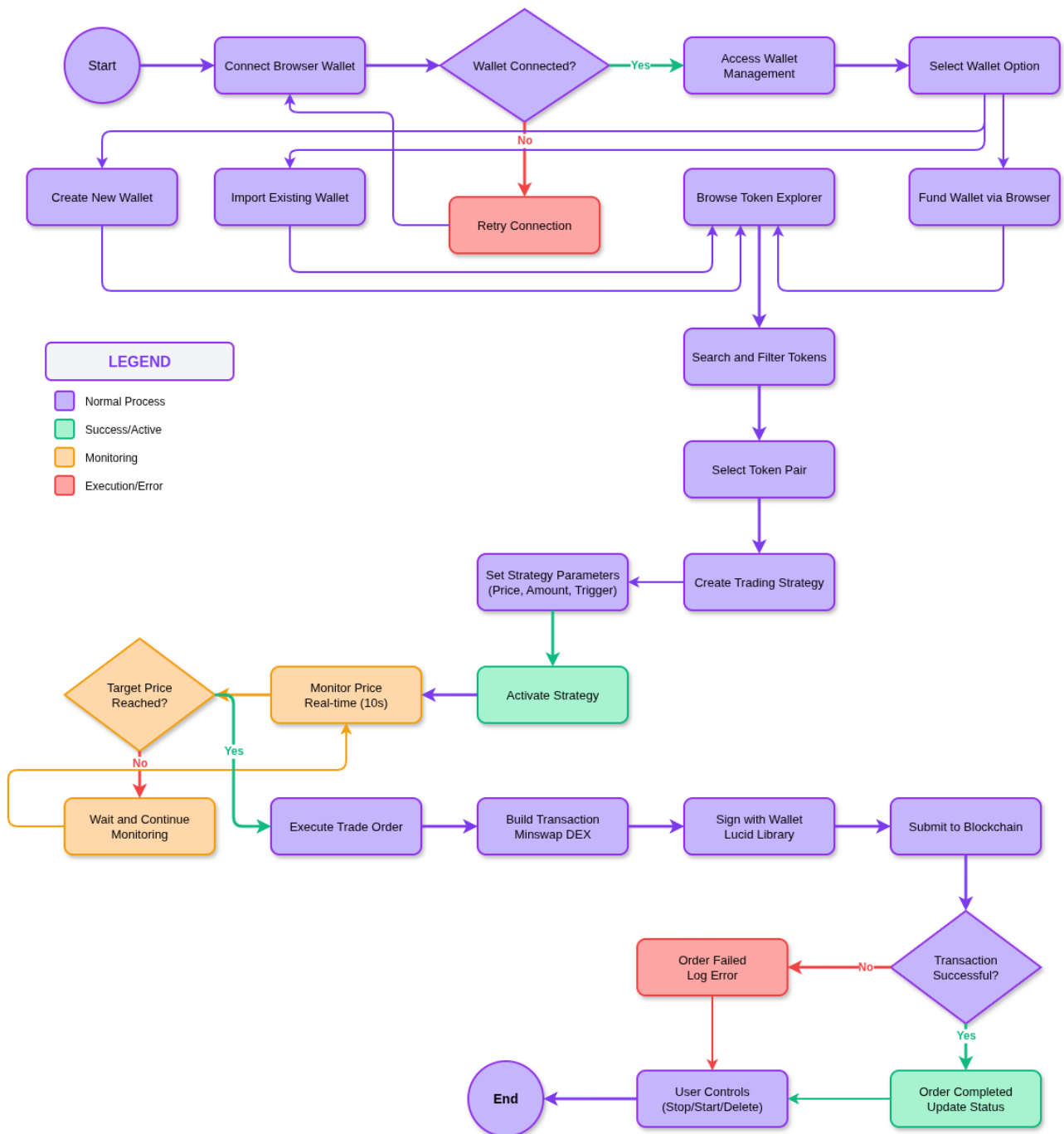
6) Data Flow (End-to-End)

1. **Connect** browser wallet (Mesh SDK) → store address
2. **Create** backend wallet → encrypt mnemonic → save file
3. **Fund** via browser wallet → Lucid transaction
4. **Browse** tokens → MySQL pools via `/api/tokens`
5. **Create** strategy → `POST /api/strategy/price-target`
6. **Execute** loop: Strategy Manager → Trading Bot → Lucid swap → Cardano

7. **Monitor** frontend polls `/api/strategy/live` (5s)

8. **Controls**: Stop/Start/Delete via API

Cardano HFT Platform - Process Workflow



7) API Families

Wallets: `/api/wallet` (create, add, list, balance, remove)

Tokens: `/api/tokens` (list, search, refresh)

Strategies: /api/strategy (price-target, live, stop, start, delete)

Orders: /api/orders (list, details)

8) Data Models

PoolToken

Field	Type	Description
id	number (PK)	Auto-increment ID
policyId	string	Cardano policy ID
assetName	string	Token asset name
symbol	string	Token symbol (e.g., MIN)
name	string	Full token name
decimals	number	Token decimals
assetA	string	Pool asset A identifier
assetB	string	Pool asset B identifier
reserveA	string	Reserve amount for asset A
reserveB	string	Reserve amount for asset B
totalLiquidity	string	Total pool liquidity
createdAt	Date	Timestamp

TradeOrder

Field	Type	Description
id	string (PK)	UUID
walletAddress	string (FK)	Reference to Wallet
tradingPair	string	e.g., MIN-ADA
baseToken	string	Policy ID + asset name
quoteToken	string	Quote token (ADA)
isBuy	boolean	Buy or Sell order
amount	number	Order amount in tokens
targetPrice	number	Trigger price in ADA
currentPrice	number	Current market price
triggerAbove	boolean	Trigger above or below target
status	enum	pending, executing, completed, failed
txHash	string	Cardano transaction hash
executedPrice	number	Actual execution price
executedAt	Date	Execution timestamp
errorMessage	string	Error details if failed
createdAt	Date	Order creation timestamp

Strategy (In-Memory)

Field	Type	Description
id	string	UUID
name	string	Strategy name
walletAddress	string	Backend wallet address
tradingPair	string	e.g., MIN-ADA
baseToken	string	Policy ID + asset name
quoteToken	string	Quote token (ADA)
isActive	boolean	Strategy active status
targetPrice	number	Price trigger in ADA
orderAmount	number	Order size in tokens
side	enum	BUY or SELL
triggerType	enum	ABOVE or BELOW
executeOnce	boolean	One-time or recurring

9) Security

AES-256-GCM for seed phrases, non-custodial design, txHash for auditability, encrypted wallet files, no logs of seeds.

11) Roadmap

Grid trading and DCA strategies.

Multi-DEX aggregation.

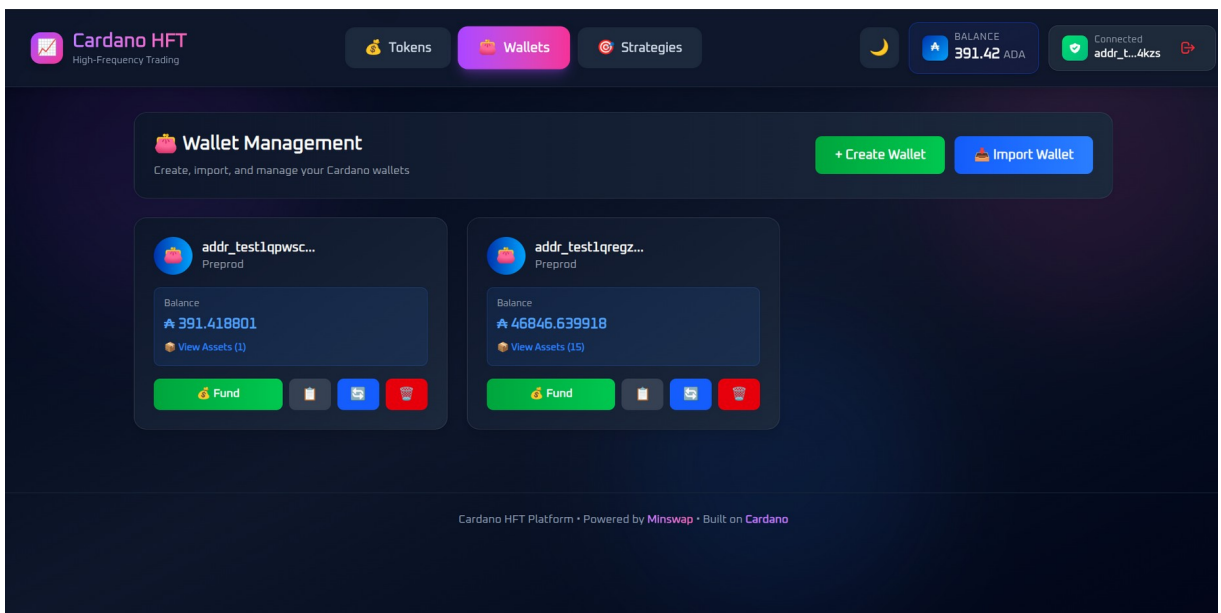
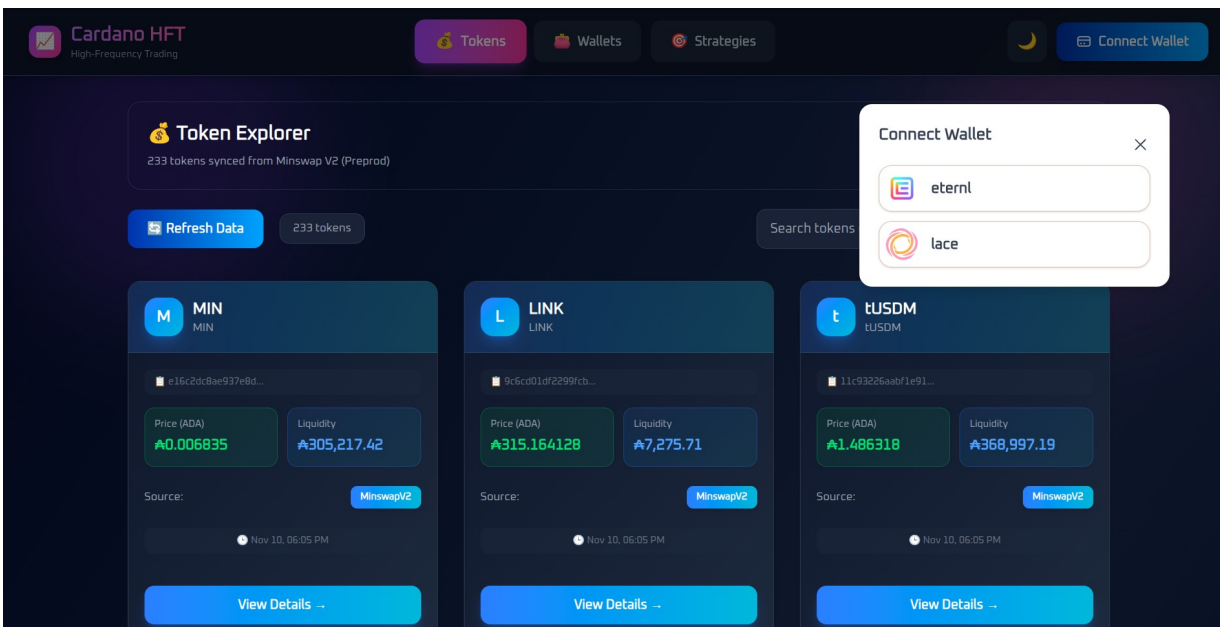
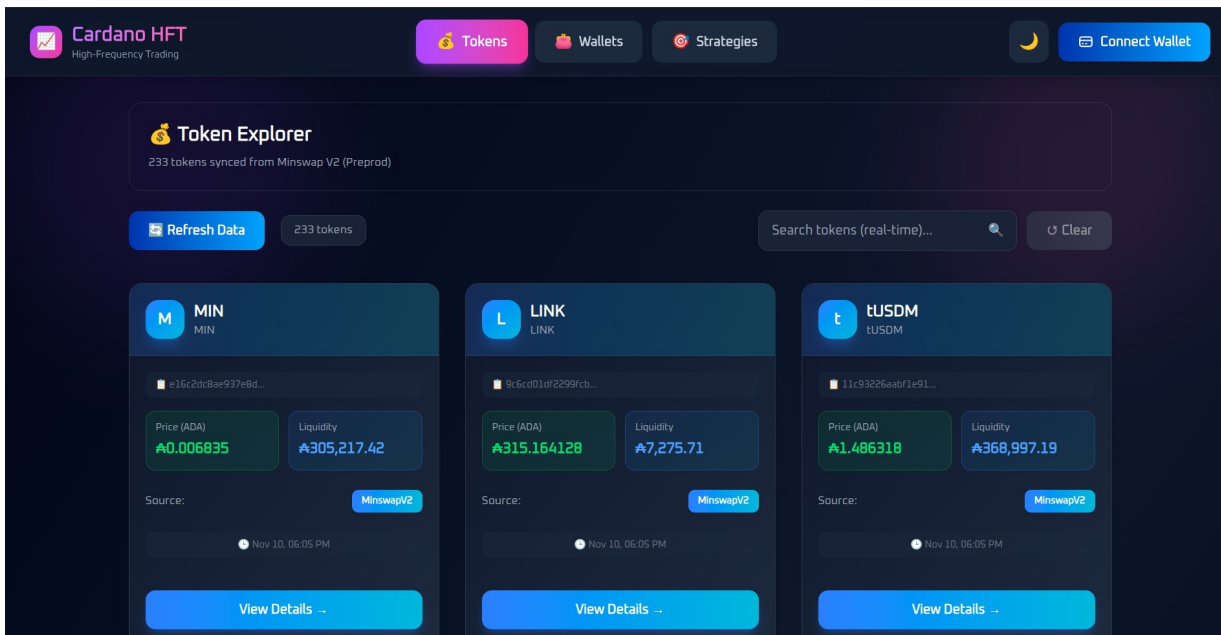
WebSocket real-time feeds for sub-second updates.

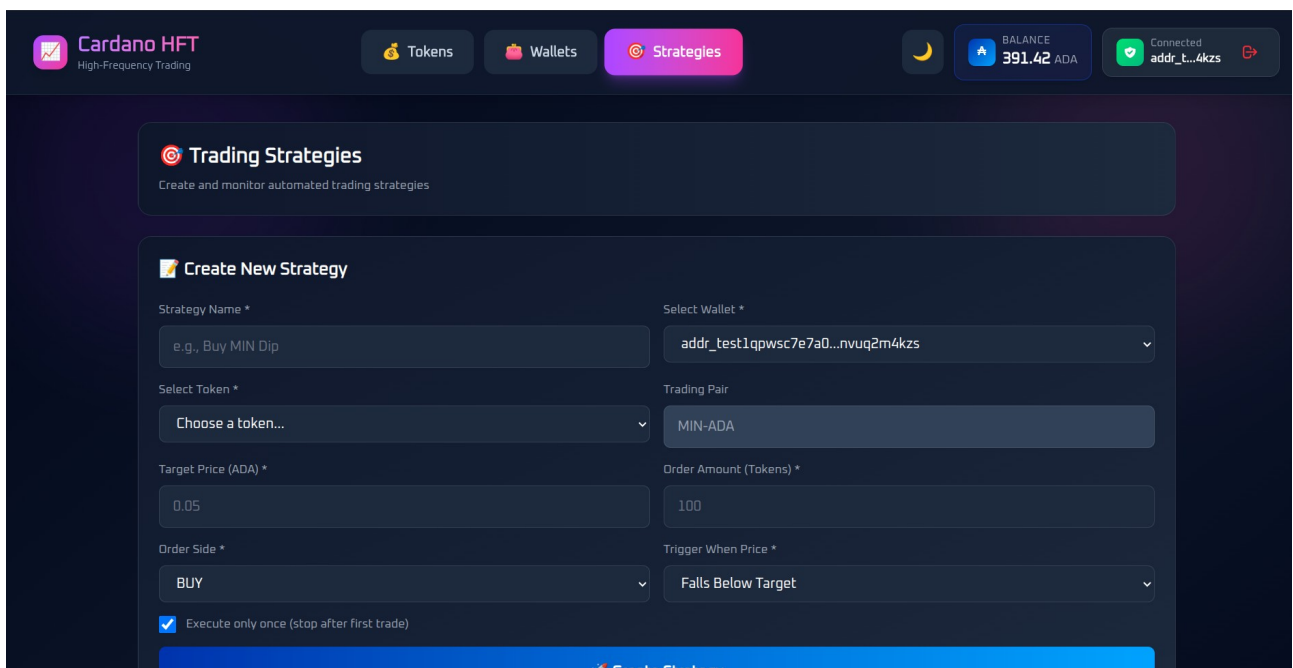
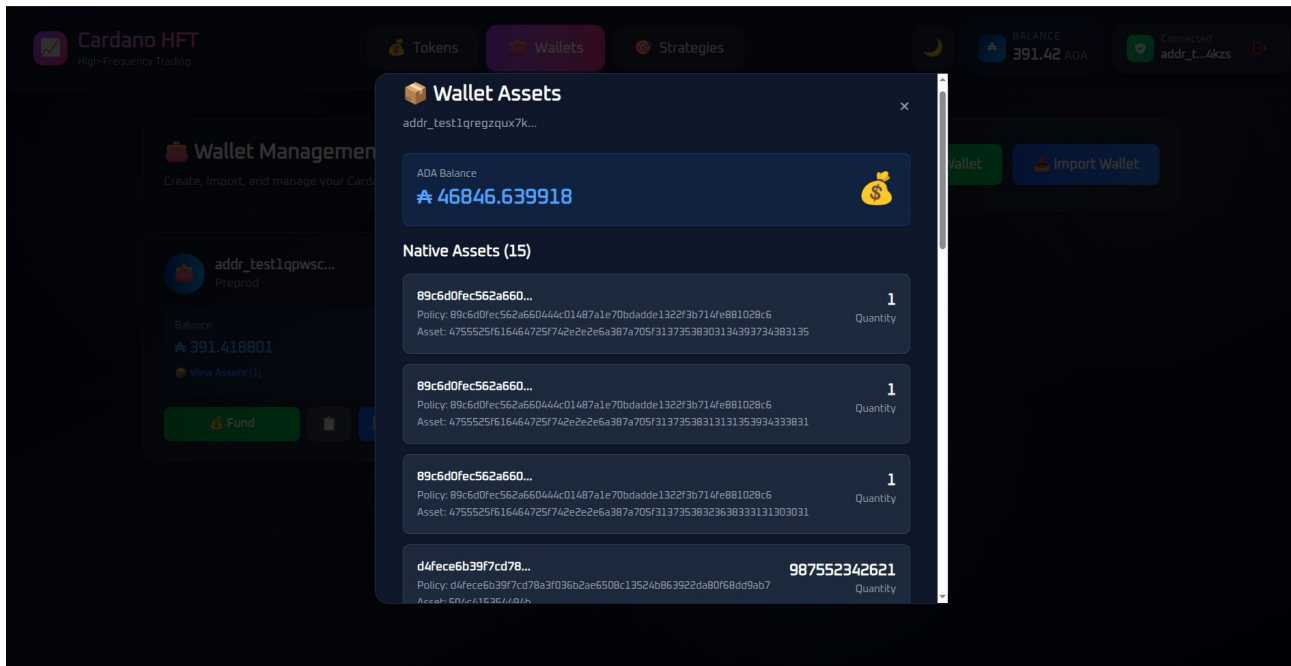
Portfolio analytics with P&L tracking.

API access for algorithmic traders.

Mainnet deployment with institutional security.

11) Mockup Screens





Create and monitor automated trading strategies

Create New Strategy

Strategy Name *

e.g., Buy MIN Dip

Select Wallet *

addr_test1qpWSC7e7a0...nvuq2m4kzs

Select Token *

MIN - ADA

Trading Pair

MIN-ADA

Target Price (ADA) *

0.007835

Order Amount (Tokens) *

200

Order Side *

BUY

Trigger When Price *

Falls Below Target

☒ Execute only once (stop after first trade)

Strategy Preview: Will BUY 200 MIN when price falls below **#0.007835**
Using wallet: addr_test1qpWSC...

Create Strategy

Active Strategies

Next update in 4sLast updated: 12:23:22 PM

MIN DIP

MIN-ADA

ActiveStopDelete

Will BUY 200 MIN when price Falls below 0.007835 ADA

Cardano HFT Platform • Powered by Minswap • Built on Cardano

NFTs	Today		
Activity	Received	2.00 tADA, 200 asset1marr...tksl	1.13 USD
	12:24:19		
Staking	Sent	-4.19 tADA	-2.36 USD
	12:23:59		
Voting Center			