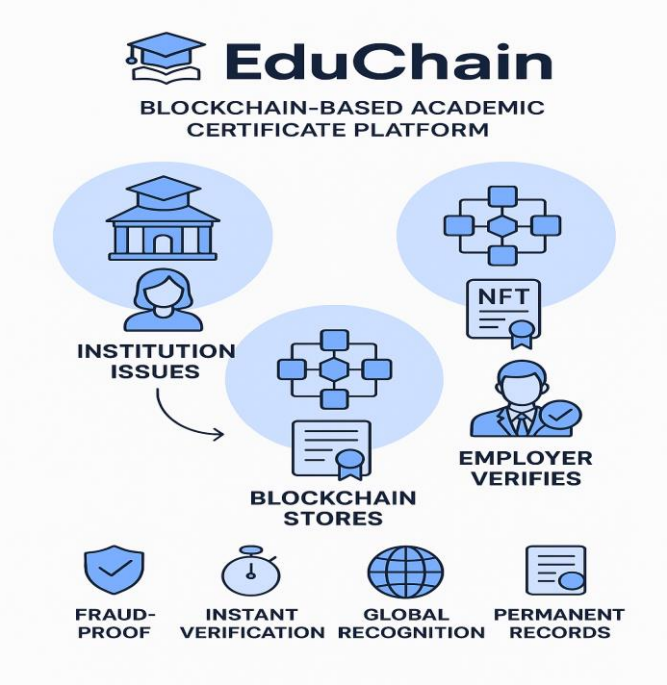
EduChain: Your Blockchain-Based Academic Certificate Platform

EduChain is a revolutionary blockchain-powered platform designed to transform how academic certificates are issued, verified, and managed.



What is EduChain?

EduChain allows educational institutions to issue academic certificates as Non-Fungible Tokens (NFTs). This enables employers, students, and third parties to instantly verify the authenticity of these certificates. The platform aims to eliminate certificate fraud, expedite the verification process, and provide a transparent, permanent record of academic achievements.

Technologies Used

1. Frontend

Framework: React 18 with TypeScript, utilizing Vite as the build tool for efficient development.

UI Library: Shadcn/UI components built on Radix UI primitives, styled with Tailwind CSS for a clean and modern aesthetic.

State Management: TanStack React Query for robust server state management and data fetching.

Routing: Wouter for lightweight and efficient client-side routing.

Form Handling: React Hook Form integrated with Zod for schema validation, ensuring data integrity.

Authentication: JWT-based authentication with local storage persistence for secure user sessions.

Backend Architecture

Framework: Express.js with TypeScript, running on Node.js for a scalable backend.

API Design: RESTful API structure, implemented with middleware for comprehensive logging and error handling.

Development Stack: Custom Vite integration for hot module replacement (HMR) during development, speeding up the iteration cycle.

File Structure: Modular route organization with a separate storage abstraction layer for maintainability.

Smart Contract Layer

Language: Solidity, used for the code that mints and stores certificates as NFTs.

Deployment: Deployed on the Base Network (an Ethereum Layer 2 solution by Coinbase), ensuring low fees and high transaction speeds.

Interaction: Utilizes the contract's ABI and address for seamless frontend interaction.

Web3 Integration

Library: Ethers.js is used to connect the frontend application with the smart contract.

Wallet Connection: Supports wallet connection via MetaMask for facilitating transactions.

Storage & Metadata

Database: MongoDB serves as the primary database for managing user logins and institutional data.

Certificate Metadata Storage: Utilizes IPFS / decentralized storage (via Pinata) to store crucial certificate metadata, including name, course, date, and issuer.

JWT Implementation: Employs JSON Web Tokens for stateless authentication.

Token Storage: Local storage on the client-side with automatic expiration checking for JWTs.

Protected Routes: Route-level authentication guards are implemented to secure access to the institution's dashboard.

User Types: Separate authentication flows are established for institutions and students, ensuring tailored security measures.

How It Works

1. Institution Registration & Certificate Issuance

Institution Onboarding:

Institutions apply to join the EduChain platform.

They submit required documentation, including:

Registration license

Trading license (if applicable)

Government approval documents

Any other proof of legitimacy

The EduChain verification team reviews and approves applications before granting issuing rights.

Certificate Issuance:

Institutions fill out a form with student details (name, course, date, etc.).

Upon submission, the smart contract mints an NFT certificate to the student's wallet.

2. Certificate Verification (Employer / Third Party)

An employer enters the certificate ID or the student's wallet address.

The smart contract directly fetches the certificate details from the blockchain.

No middlemen, no forgery possible.

Core Team Members

KYOTOYINZE ABDULMAJID: CEO & Senior Developer

SEKIZIYIVU PAUL: Networking and Communications Staff

MUDEBO SAMUSI: Programming, and Technologies

SEANINCE: Marketing and Project Awareness

Key Benefits

Fraud-Proof: Certificates cannot be faked or altered.

Instant Verification: Employers can verify certificates in seconds without needing to contact institutions directly.

Global Recognition: Certificates stored on the blockchain are accessible worldwide.

Permanent Records: Certificates are stored permanently, independent of the issuing institution's server.

This documentation provides a comprehensive overview of the EduChain platform.