BLOCKCHAIN PROJECT

CampusCoins - Campus Token Rewards System

Introduction

CampusCoins is a **blockchain-based token reward system** designed to encourage student participation in academic and extracurricular activities. By leveraging **smart contracts on the Polygon blockchain**, students can **earn tokens** for various achievements (such as scoring well in assessments or attending events) and **redeem them** at campus facilities like the canteen and bookstore. Additionally, a **slashing mechanism** deducts tokens for rule violations, ensuring discipline and fairness in the reward system.

Scope

The project focuses on **rewarding student engagement** through a **transparent and decentralized system**. It aims to:

- **Enable token-based incentives** for academic and non-academic activities.
- **Ensure secure and immutable transactions** via blockchain.
- **Introduce a penalty system** for non-compliance with campus rules.
- **Facilitate seamless transactions** using QR/barcode scanning.
- **Provide a user-friendly interface** for students, faculty, and staff to interact with the system.
- **Support scalability** for future integration with other institutions.

Objectives

The main objectives of the **CampusCoins** system are:

- **Reward Mechanism** – Students earn tokens for participation and achievements.
- **Redemption System** – Tokens can be used for discounts or free items at designated facilities.
- **Penalty Enforcement** – Non-compliance results in token deduction (e.g., missing ID cards, skipping mandatory events).
- **Decentralized & Secure Transactions** – All transactions are processed via smart contracts.
- **Easy-to-Use Web Application** – Students, faculty, and staff can interact with the system through a **React.js + Web3.js** interface.
- **Scalable & Future-Proof** – Designed for easy expansion to other institutions or reward-based applications.

Functional Requirements

Student Side

- Scan ID barcode to earn tokens.
- View token balance in real-time.
- Redeem tokens at campus facilities (canteen, bookstore).
- Receive notifications for transactions and penalties.

Event Organizer Side

- Define token rewards for specific events.
- Generate and manage event IDs.
- Validate student participation and credit tokens.

Canteen/Bookstore Staff Side

- Scan barcodes to redeem tokens.
- Verify the student's token balance before approval.

Admin Side

- Manage token supply and adjust reward structures.
- View, approve, or reject events.
- Monitor transaction history.
- Implement penalties via the slashing mechanism.

Architecture / Block Diagram

The **CampusCoins** system consists of **three primary components**:

Frontend (React.js + Web3.js)

- Provides an intuitive **UI for students, organizers, and staff**.
- Connects with **MetaMask** for blockchain transactions.

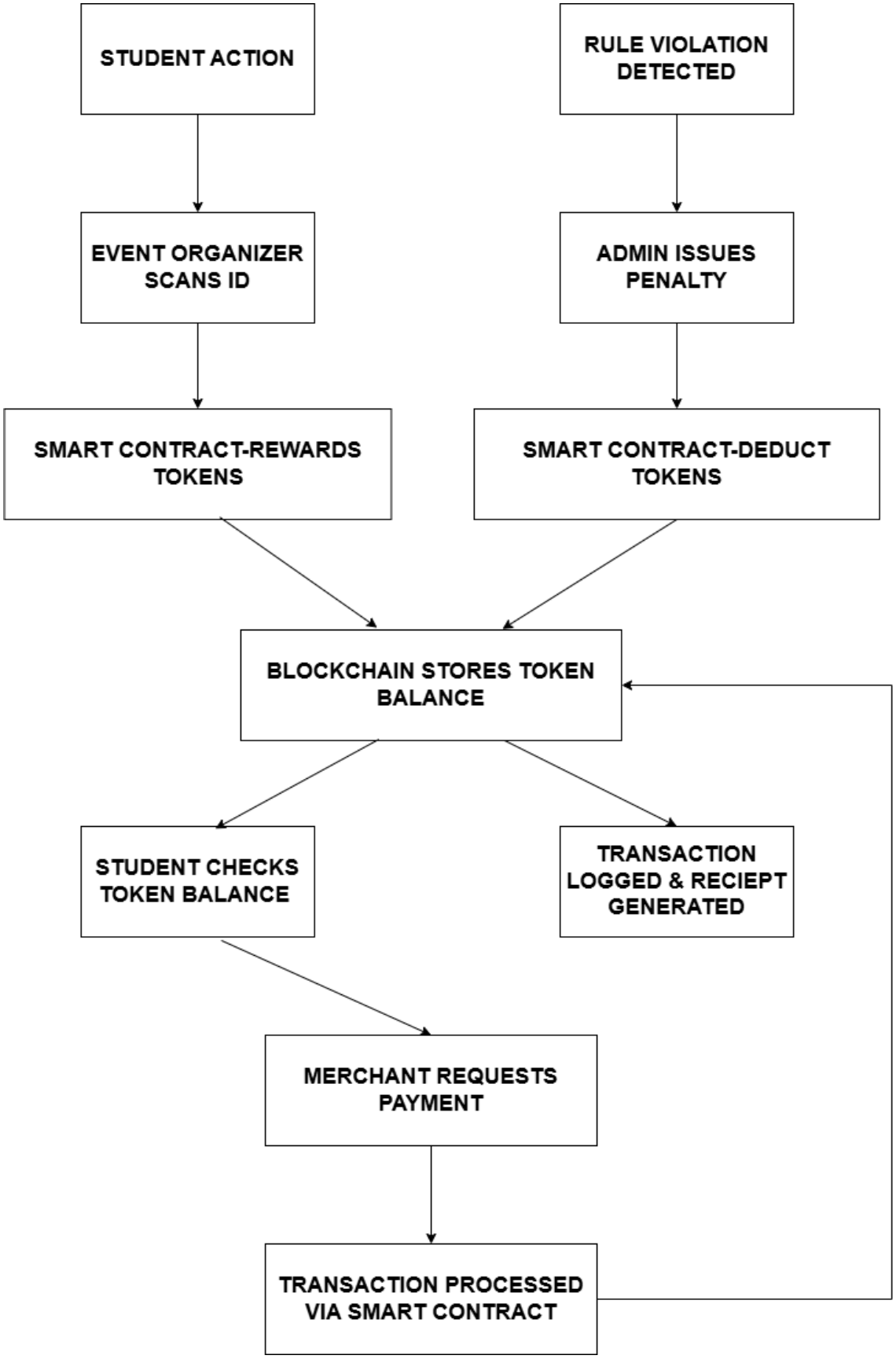
Backend (Node.js + Express.js + MongoDB)

- Manages **user authentication, event data, and metadata**.
- Facilitates **communication between the frontend and blockchain**.

Blockchain (Polygon + Solidity)

- **Stores token balances & transactions securely.**
- Implements **smart contracts** to handle rewards, redemptions, and penalties.

ARCHITECTURE DIAGRAM



Consensus Mechanism

CampusCoins will utilize **Proof-of-Stake (PoS)** as the consensus mechanism since it:

- Is **energy-efficient** compared to Proof-of-Work (PoW).
- Ensures **faster transaction processing** and **lower gas fees**.
- Is **supported by the Polygon network**, making it ideal for microtransactions like token rewards and deductions.

Type of Blockchain to be Used – Justification

We will use the **Polygon blockchain (Layer 2 Ethereum solution)** due to:

- **Low transaction costs** – Polygon offers significantly lower gas fees than Ethereum.
- **Scalability** – Handles high transaction volumes efficiently.
- **Security** – Benefits from Ethereum's security infrastructure.
- **Ease of Integration** – Compatible with **EVM-based smart contracts and Web3.js**.

Expected Outcome

By implementing **CampusCoins**, we expect to:

- **Increase student engagement** in academic and extracurricular activities.
- **Ensure a fair reward system** through transparent blockchain transactions.
- **Enable seamless token transactions** for earning and redeeming.
- **Improve compliance with campus rules** using the slashing mechanism.
- **Reduce administrative workload** by automating rewards and penalties.
- **Lay the foundation for future expansion** into a broader university reward ecosystem.