

## 1. BrainArena:

The migration of a Quiz Application from the MERN (MongoDB, Express, React, Node.js) stack to a blockchain network introduces decentralized architecture, enhanced security, and improved transparency. This transformation shifts critical data and processes—such as quiz content, user scores, and transaction histories—from centralized servers to distributed ledgers and smart contracts. Key advantages include immutable records that prevent tampering, decentralized storage for increased fault tolerance, and the ability to integrate token-based rewards, thereby enhancing user engagement.

Proposed changes:

On-Chain Data:

1. Immutable and trust-critical data:
2. Quiz metadata (quiz ID, category, timestamps).
3. Scores.
4. Token or reward transactions.

Reason: Blockchain ensures transparency and tamper-proof records.

Off-Chain Data:

1. Large or frequently changing data.
2. Quiz questions, options and answers.
3. User profile details (email, preferences).

Smart Contracts:

1. Develop contracts to handle:
  - 1.1 Quiz session initialization.
  - 1.2 User participation and scoring.
  - 1.3 Linking on-chain records to MongoDB via quiz/question IDs.

Frontend Changes:

Introduce blockchain wallets (e.g., MetaMask) for users to sign and verify transactions.

## 2. BlockEstate:

This project focuses on developing an Ethereum-based auction platform for real estate transactions, leveraging blockchain technology to enhance transparency, security, and decentralization. The platform uses smart contracts to automate and enforce auction rules, enabling trustless interactions between buyers and sellers without reliance on intermediaries.

Participants can list properties for sale, set starting bid prices, and define auction durations. Buyers place bids securely, with all transactions recorded on the blockchain to ensure tamper-proof and transparent operations. Upon the auction's conclusion, smart contracts facilitate the automatic transfer of property ownership to the highest bidder after successful payment.

The platform integrates with the Ethereum network using Web3.js, providing wallet connectivity, transaction tracking, and decentralized identity verification. Escrow functionalities add an additional layer of security, ensuring safe exchanges of funds and property ownership.

By creating a global and borderless marketplace for real estate auctions, this platform enhances operational efficiency, reduces fraud risks, and democratizes access for buyers and sellers worldwide.

### 3. Voting System:

The adoption of blockchain technology in voting systems marks a revolutionary step toward achieving secure, transparent, and tamper-proof elections. Blockchain's decentralized, immutable, and verifiable nature ensures that every vote is recorded accurately and can be audited without compromising voter anonymity. This technology addresses challenges such as voter fraud, election tampering, and lack of transparency, offering a robust solution for modern democracies and organizational decision-making processes.

Data Updated in the Blockchain:

1. Voter Registration: Encrypted voter identities to verify eligibility without revealing personal details.
2. Ballot Information: Digital representation of available choices or candidates.
3. Cast Votes: Encrypted and anonymized records of each vote, ensuring privacy.
4. Vote Counting and Tallying: Real-time aggregation of votes with publicly verifiable results.
5. Election Metadata: Election dates, rules, and regulations stored for future reference and audits.
6. Smart Contracts: Predefined rules for vote validation, dispute resolution, and result declaration.
7. Audit Logs: Immutable logs of any interactions or updates within the voting system for transparency and accountability.