CSE 540: Engineering Blockchain Applications

Projects

Arizona State University

Overview

- Group Project

- Group Size: 4 – 5 Students

- Projects: Choose One

  - Project 1: Blockchain-Based Supply Chain Provenance System

  - Project 2: Decentralized Identity and Access Management

  - Project 3: Open Innovation – Propose Your Own Blockchain Use Case

    - Requires Instructor Approval

Team Formation

- Deadline: **10/18/2025 11:59 PM** AZ Time

- Post-deadline: Random group assignment

- Add group details here

- Team Contract (Roles, Expectations, Meeting Frequency)

Deliverables

- **Proposal (10%) [10/23/2025]**
  - 1 - 2 pages system concept
    - Problem + Architecture
  - Team Contract

- **Smart Contract Draft (5%) [11/06/2025]**
  - Code (GitHub Repository) + Readme

- **Midterm Progress Update (15%) [11/20/2025]**
  - Initial prototype demonstration
  - Recorded 5-min video + Code (GitHub Repository)

- **Final Submission (70%) [12/04/2025]**
  - Project Demonstration (Recorded 7-10 min video or live)
  - GitHub Repository (Code + Readme)
  - Technical report (4-8 pages) [IEEE 2 Column Format]:
    - Design architecture and smart contract logic
    - Application relevance and potential impact
    - Limitations, risks, and future improvements

Project Components/Requirements

- System Design

- Implementation

- Analysis

Project 1

Implement Blockchain Powered Supply Chain Provenance System

- System Design

  - Identify Stakeholders (Producer, Suppliers, Retailers, etc.)

  - Define Product Journey (Creation, Shipment, Storage, Delivery)

  - Model Transactions and Events

  - Design Smart Contract

  - Design Access Control

Project 1

Implement Blockchain Powered Supply Chain Provenance System

- Implementation

  - Solidity + Ethereum (or Hyperledger Fabric)

  - Smart contracts should handle at least:

    - Product registration and unique ID assignment

    - Status updates and event logging

    - Ownership or custody transfer between entities

    - Implement a simple UI (web or cli) for submitting and viewing product data.

  - Integrate off-chain data (IPFS for certificates, simulated IoT data)

Project 1

Implement Blockchain Powered Supply Chain Provenance System

- Analysis

  - Evaluate scalability, gas cost, and data management tradeoffs

  - Discuss real-world implementation challenges (privacy, interoperability, regulation)

  - Compare blockchain-based tracking to conventional centralized supply chain systems

Review more details about the project in Canvas.

Project 2

Implement Decentralized Identity and Access Management

- System Design

  - Identify Stakeholders (User, Issuer, Verifier etc.)

  - Model Identity Lifecycle

  - Design Smart Contract

  - Incorporate Off-chain Storage

Project 2

Implement Decentralized Identity and Access Management

- Implementation

  - Solidity + Ethereum (or Hyperledger Fabric)

  - Build at least one smart contract that:

    - Registers decentralized identifiers (DIDs)

    - Issues or verifies digital credentials

    - Logs access and verification events immutably

  - Implement a simple UI (web or cli) to demonstrate functionality

  - Simulate Zero-Knowledge Proofs (ZKPs) for privacy

Project 2

Implement Decentralized Identity and Access Management

- Analysis

  - Evaluate scalability, gas cost, and data privacy considerations

  - Discuss how your IAM model compares to centralized systems

  - Identify compliance challenges (GDPR, HIPAA, etc.)

Review more details about the project in Canvas.

Project 3

Open Innovation – Propose Your Own Blockchain Use Case

- Proposal
  - Problem statement and motivation
  - Why blockchain is an appropriate solution
  - High-level system architecture
  - Chosen platform (Ethereum, Hyperledger, Polygon, etc.)

Approval required from instructor before proceeding.

Project 3

Open Innovation – Propose Your Own Blockchain Use Case

- System Design

  - Identify stakeholders, roles, and transaction types

  - Define how trust, transparency, or decentralization are achieved

  - Provide a workflow diagram showing on-chain and off-chain components

Project 3

Open Innovation – Propose Your Own Blockchain Use Case

- Implementation

    - Develop a working prototype of the proposed application

    - Include at least one smart contract demonstrating core functionality

    - Integrate external data (via oracles, APIs, or simulated IoT)

Project 3

Open Innovation – Propose Your Own Blockchain Use Case

- Analysis
    - Evaluate scalability, cost, privacy, and regulatory implications
    - Compare blockchain vs. traditional solutions for your chosen use case

General Evaluation Criteria

- Technical Quality
    - Functionality, code clarity, scalability

- Innovation & Creativity
    - Originality and novelty of the application

- Analytical Depth
    - Insight into challenges, feasibility, and ethics

- Presentation, QA & Communication
    - Clarity of demo, report structure, and visual design

Q&A