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Blockchain-Based Attendance Management System with Performance Analytics

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Outline

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- Objectives
- Results

Introduction

Attendance management in educational institutions is still largely centralized and manually controlled.

Traditional systems suffer from:

- Proxy attendance
- Record tampering
- Lack of transparency
- Manual errors

Blockchain technology provides decentralized, tamper-proof record keeping using smart contracts.

This project focuses on designing a blockchain-based attendance recording system.

Introduction

In PBL-1, the system stored attendance securely using a smart contract.

In PBL-2, the system is extended by:

- Adding attendance analytics
- Structured dataset validation
- Performance tracking mechanism
- Scalability planning

This improves the system from storage-only to decision-support system.

Literature Review

Existing Approaches:

1. Traditional Database Systems
    - Centralized
    - Vulnerable to tampering
2. Biometric Attendance Systems
    - Hardware dependent
    - Expensive deployment
3. RFID-Based Systems
    - Limited scalability

Blockchain-based systems provide immutability and transparency.

Literature Review

Limitations in Existing Blockchain Attendance Systems:

- Only storage without analytics
- No performance evaluation layer
- Lack of scalability testing

This project extends attendance storage with analytical computation and structured evaluation.

Problem Statement

To design and enhance a secure blockchain-based attendance management system that not only stores attendance records immutably but also provides analytical insights for performance monitoring.

Objectives

- To develop a smart contract for secure attendance recording
- To extend the system with attendance analytics
- To evaluate structured multi-subject dataset
- To propose scalable deployment architecture

Proposed Methodology

System Architecture Overview

- The system is designed using a decentralized architecture.
- Attendance data is stored using a Solidity smart contract.
- The smart contract acts as the core logic layer.
- Data is recorded on the Ethereum Virtual Machine (Remix VM).
- Users interact with the contract through Remix interface.

Flow:

User → Smart Contract → Blockchain Storage → Retrieval

Proposed Methodology

Smart Contract Design

The smart contract consists of:

1. Student Structure
   - Roll Number
   - Name
2. Attendance Record Structure
   - Roll Number
   - Subject
   - Present/Absent Status

Main Functions Implemented:

- addStudent()
- markAttendance()
- getRecord()
- totalRecords()

This ensures secure and immutable storage of attendance records.

Proposed Methodology

Performance Analytics Extension (PBL-2 Enhancement)

In PBL-2, the system is extended to include analytical capabilities:

- Count total attendance records per student
- Track subject-wise attendance
- Calculate attendance percentage (conceptual logic)
- Identify low attendance scenarios

This transforms the system from simple storage to a performance evaluation tool.

Proposed Methodology

Deployment and Testing

Implementation Steps:

1. Smart contract written in Solidity.
2. Compiled using Remix IDE.
3. Deployed on Ethereum Virtual Machine (London version).
4. Tested using structured dataset:
    - 5 Students
    - 6 Attendance Entries
    - Multiple subjects
5. Validated retrieval and total record counting.

The system demonstrates secure, tamper-proof attendance recording and analytical processing.

Result

Attendance Dataset (Execution Results)

Roll No	Student Name	Subject	Attendance Status
101	Amit	Maths	Present
101	Amit	Physics	Absent
102	Riya	Maths	Present
103	Rahul	English	Present
104	Sneha	Chemistry	Absent
105	Vikram	Biology	Present

- Total Students: 5
- Total Attendance Records: 6
- Present: 4
- Absent: 2

Result

Analytical Summary (PBL-2 Extension)

Roll No	Student Name	Total Classes	Present	Attendance %
101	Amit	2	1	50%
102	Riya	1	1	100%
103	Rahul	1	1	100%
104	Sneha	1	0	0%
105	Vikram	1	1	100%

The analytical computation demonstrates performance evaluation capability added in PBL-2.

Outcome

Current Status:

✓ Smart contract deployed
✓ Attendance records stored
✓ Structured dataset validated
✓ Analytical extension designed

Future Work (End-Term Plan):

- Automated percentage calculation
- Threshold-based low attendance alert
- Basic web interface integration

References

- Ethereum Documentation
- Solidity Official Documentation
- Research papers on Blockchain in Education
- Remix IDE Documentation

Thank You