

Sentinels Management System

Automated Student Attendance Monitoring & Analytics System

1. Abstract / Executive Summary

The **Sentinels Management System** is a centralized web-based platform designed to automate student attendance tracking while providing meaningful analytics to improve academic engagement. Traditional attendance systems often rely on manual marking or proxy-prone mechanisms, which fail to reflect actual student participation.

This project introduces an **innovative quiz-based attendance validation mechanism**, ensuring that attendance is marked **only when a student actively participates in the class session**. Alongside attendance automation, the system provides **trend analysis, averages, and semester-wise comparisons** to assist teachers, parents, and administrators in monitoring academic engagement effectively.

The system is built using **Next.js, Tailwind CSS, Prisma ORM**, and a secure authentication mechanism, ensuring scalability, performance, and data security.

2. Problem Statement

Educational institutions still rely heavily on:

- Manual attendance registers
- Basic digital systems prone to proxy attendance
- Fragmented student data across departments

Key Problems Identified

- **Proxy attendance** reduces system reliability
- **No engagement validation** during attendance marking
- **Lack of analytics** for trends and semester comparisons
- **Limited visibility** for parents and administrators

These issues lead to inaccurate attendance records and reduced student accountability.

3. Objectives

Primary Objectives

- Automate student attendance securely
- Prevent proxy attendance
- Provide centralized student information access

Secondary Objectives

- Generate attendance analytics (trends, averages)
 - Enable semester-wise comparison
 - Improve student engagement through interaction-based validation
 - Support multiple stakeholders (students, parents, teachers, heads)
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4. Proposed Solution

The **Sentinels Management System** acts as a **central authority** for student data and attendance management.

Core Innovation

Attendance is marked **only after a student successfully answers a short quiz question related to the class**, such as:

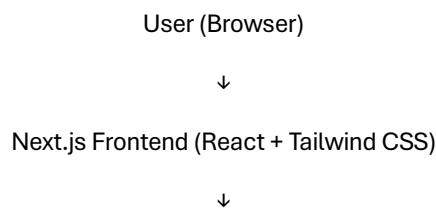
- “What topic was covered in the last slide?”
- “Which concept was explained in today’s session?”

This ensures:

- Physical presence
 - Cognitive engagement
 - Zero proxy attendance
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5. System Architecture

High-Level Architecture



Next.js API Routes / REST APIs

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Authentication Layer (NextAuth / JWT)

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Business Logic Layer

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Database (Prisma ORM)

6. Module Description

1. Authentication & Authorization Module

- Secure login using **NextAuth / JWT**
- Role-based access:
 - Student
 - Teacher
 - Parent
 - Head/Admin

2. Student Information Management

- Personal details
- Academic records
- Attendance history
- Semester-wise performance

3. Attendance Validation Module (Core Innovation)

- Teacher triggers attendance session
- Students answer quiz questions
- Attendance marked only on correct response
- Time-bound submission to avoid misuse

4. Analytics & Reporting Module

- Attendance percentage

- Monthly and semester trends
- Comparative analysis
- Visual insights for stakeholders

5. Stakeholder Access Module

- Parents: View attendance & trends
 - Teachers: Manage classes & analytics
 - Admins: System-wide monitoring
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7. Technologies Used

Frontend

- **Next.js 16**
- **React 19**
- **Tailwind CSS**

Backend

- **Next.js API Routes / REST APIs**
- **Node.js Runtime**

Database

- **Prisma ORM**
- Relational database (PostgreSQL / MySQL – configurable)

Authentication & Security

- **NextAuth (subject to change)**
- **JWT**
- **bcrypt for password hashing**

Development Tools

- **ESLint**
 - **Prisma CLI**
 - **Git for version control**
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8. Implementation Details

Attendance Flow

1. Teacher initiates attendance
2. System generates quiz question
3. Student submits answer
4. Backend validates response
5. Attendance is marked securely

Security Measures

- Encrypted passwords
- Token-based authentication
- Role-based access control
- API route protection

Data Handling

- Normalized relational schema
 - Prisma client for type-safe queries
 - Centralized student records
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9. Analytics & Insights

The system provides:

- Daily attendance trends
- Average attendance per subject
- Semester comparison charts
- Identification of low-engagement students

These insights help institutions **take proactive action** instead of reactive measures.

10. Results & Current Status

Implemented

- Project structure setup

- Authentication base
- Student management schema
- Attendance workflow design
- Analytics logic planning

Working Prototype

- Secure login
 - Student dashboard
 - Attendance marking logic (initial phase)
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11. Challenges Faced

- Designing proxy-proof attendance logic
- Balancing usability with security
- Managing multi-role access control
- Structuring scalable analytics queries

Solutions

- Quiz-based validation
 - Prisma ORM abstraction
 - Modular API architecture
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12. Future Enhancements

- AI-based engagement scoring
 - Face recognition (optional)
 - Mobile application support
 - LMS integration
 - Advanced visualization dashboards
 - Notification alerts for low attendance
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13. Conclusion

The **Sentinels Management System** provides a **reliable, scalable, and intelligent attendance solution** that goes beyond traditional methods. By validating student engagement through interactive quizzes and offering deep analytics, the system ensures accurate attendance and promotes accountability.

This project demonstrates how **modern web technologies** can solve real-world educational challenges effectively.

14. References

- Next.js Documentation
- Prisma ORM Documentation
- JWT Authentication Standards
- Web-based Attendance Research Papers