

# Student Marks Evaluation Monitoring System

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## Abstract:

This project aims to transform traditional assessment methods in educational institutions through automation, data management, and online communication. It tackles key challenges such as delayed feedback, manual data handling, and the lack of actionable performance insights. By collecting and analysing real-time data, the system provides personalized student guidance and data-driven support for educators and administrators. It enhances evaluation and streamlines communication among stakeholders via a WhatsApp notification system, offering insights aligned with academic standards and meeting modern administrative needs.

This paper presents the project's background, objectives, methodology, technology stack, and its strong potential to improve academic performance and student engagement in today's education landscape.

**Keywords:** Smart Evaluation, Student Monitoring, Educational Analytics, Rule-Based Systems.

## 1.INTRODUCTION

Educational institutions frequently encounter substantial difficulties in handling student evaluations. Conventional approaches predominantly depend on manual data management, which can result in inaccuracies, inefficiencies, and delays in delivering prompt feedback and assistance to students. These procedures are not only labour-intensive but also susceptible to human mistakes, leading to inconsistencies and a lack of up-to-date insights into student performance over various semesters. Additionally, the lack of integrated systems obstructs effective tracking of historical data and the early identification of students who may be academically at risk.

The Student Marks Evaluation Monitoring System has been specifically developed to tackle these challenges using an automated, data-centric platform that improves the evaluation process. This sophisticated system merges digital processing tools with a structured approach to streamline evaluation tasks, produce rule-based insights, and enhance communication among students, faculty, and parents.

Main Objectives of the Project:

- Create a comprehensive system for managing grades, attendance, and performance indicators with user-friendly interfaces tailored for students, faculty, and administrators.
- Establish a rule-based advisory system to pinpoint students in need of support and offer customized recommendations based on specified academic thresholds.
- Incorporate a chatbot to address common student inquiries and provide immediate assistance regarding academic progress and attendance.
- Facilitate automated notifications via WhatsApp, introduce gamification features, and utilize advanced analytics to enrich the overall evaluation experience.
- Ensure high-level data security with role-based access control and two-factor authentication.
- Implement the system in a dependable hosting environment to guarantee high availability and performance.

This system presents numerous benefits, such as enhanced efficiency through automation, improved accuracy by minimizing manual errors, and immediate access to academic data from any location. Its analytical capabilities promote early intervention by recognizing students at risk and delivering targeted assistance. Furthermore, it is cost-effective and significantly boosts communication through integrated WhatsApp notifications and chatbot functionalities.

This paper outlines the fundamental components, implementation plan, and expected impact of the Student Marks Evaluation Monitoring System, aligning with the objective of cultivating a more efficient, data-driven educational environment.

## 2. LITERATURE REVIEW

The Student Marks Evaluation Monitoring System is grounded in extensive prior research in educational technology, information systems, and data analytics. This section reviews key studies that have contributed to advancements in student evaluation and monitoring systems, particularly those that do not rely on machine learning (ML) or artificial intelligence (AI).

**1. “A Smart Student Monitoring System for Improving Academic Performance” – N. Kumar, R. Gupta, and S. Sharma (2018)**

This study introduces a student monitoring system designed to observe academic performance and deliver tailored feedback. It emphasizes the use of real-time data collection and analysis to identify learning patterns and support timely interventions. The research demonstrates the effectiveness of real-time data in improving outcomes without the use of AI technologies.

**2. “Adaptive Learning Systems for Personalized Education” – H. Li, J. Chen, and Z. Zhang (2019)**

This paper explores adaptive learning systems that personalize educational content using structured logic and feedback loops. The authors show how rule-based personalization enhances student engagement and academic achievement, aligning with the logic-driven personalization in our proposed system.

**3. “Real-Time Performance Monitoring in E-Learning Environments” – S. Patel, A. Kumar, and V. Singh (2020)**

This research focuses on software tools that provide real-time performance tracking in online learning environments. The study highlights how immediate feedback and data visualization improve student participation and learning effectiveness through efficient data pipelines and dashboards.

**4. “Leveraging Big Data for Student Success: An Overview” – M. Johnson, K. Lee, and L. Adams (2021)**

This article discusses the use of big data analytics to enhance student evaluation and support systems. It reviews data sources and analytical techniques used to identify at-risk students and deliver targeted interventions, showing the transformative potential of data-driven educational environments.

**5. “Automated Student Assessment and Feedback Systems” – J. Park, E. Kim, and T. Nguyen (2017)**

This study investigates how automated systems can streamline student assessment and feedback. It explains how algorithm-based evaluation reduces manual effort and improves consistency in grading—without relying on complex computational learning models.

**6. “Blockchain Technology in Student Records Management” – R. Smith, L. Brown, and A. Clark (2022)**

This paper evaluates the role of blockchain technology in securely managing academic records. The authors describe how blockchain ensures data integrity, transparency, and long-term availability, contributing to trustworthy and tamper-proof student record systems.

**7. “Gamification in Student Assessment: A Review of Past and Present” – F. Wilson, D. Lee, and J. Kim (2019)**

This review explores the use of gamification in student assessments, illustrating how game elements such as badges and leaderboards increase motivation and engagement, making the assessment process more interactive and enjoyable.

**8. “Smart Classroom Technologies for Improved Student Assessment” – P. Martinez, C. Garcia, and M. Rodriguez (2018)**

This study examines the implementation of smart classroom tools—including sensors, interactive boards, and real-time data systems—to enhance student monitoring. These technologies

foster adaptive environments and support better tracking of student behaviour and academic performance.

This comprehensive review highlights proven strategies and emerging trends in intelligent educational systems. It guides the development of the Student Marks Evaluation Monitoring System, ensuring it reflects best practices while addressing the limitations of traditional evaluation methods—without depending on ML or AI.

### 3. METHODOLOGY

The Student Marks Evaluation Monitoring System is developed using a systematic, phased approach built on a strong conceptual foundation to ensure comprehensive and effective implementation.

#### 3.1 Conceptual Framework

The conceptual framework of the Advanced Student Marks Evaluation System is centred around five key components that are interdependent and cohesive:

##### Data Input:

This stage involves collecting various types of student information, including marksheets, attendance records, assignment scores, and other performance metrics. Faculty members can input data manually or upload it in multiple formats (e.g., CSV, PDF). Robust validation checks are applied to ensure data accuracy and quality during the input process.

##### Data Processing:

Utilizing backend technologies like Node.js, React, and MongoDB, the system processes raw data through validation, transformation, normalization, and secure storage. This step ensures data integrity and prepares the information for efficient analysis and evaluation.

##### Evaluation and Analysis:

A rule-based logic engine interprets the processed data to assess student performance. It generates evaluations, highlights results based on predefined academic thresholds, and identifies students at academic risk. The system triggers timely recommendations and interventions through clear and structured rules.

##### Visualization and Reporting:

The frontend, powered by React, delivers dynamic dashboards and detailed reports. These visual tools present student performance, trends, and alerts in a clear, easy-to-understand format, empowering educators and administrators to make informed decisions swiftly.

##### Communication:

A built-in WhatsApp notification system facilitates real-time, personalized communication with students, parents, and educators. This includes performance alerts, feedback, and general announcements, ensuring all stakeholders remain informed and engaged.

This refined framework integrates automation, data intelligence, and modern communication tools to streamline the evaluation process, promote transparency, and support student success in a data-driven educational environment.

### 3.2 Methodology Workflow

The methodology adheres to a step-by-step approach, ensuring systematic development and seamless integration of all components:

#### 1. Requirement Analysis (Weeks 1-2):

- Identify and thoroughly understand the diverse needs and expectations of primary stakeholders, including educators, students, and parents.
- Conduct a comprehensive feasibility study to assess technical, operational, and economic viability, and finalize the project's scope.
- Document all functional requirements (what the system *should do*) and non-functional requirements (how the system *should perform*, e.g., security, reliability, usability).

#### 2. System Design (Weeks 3-4):

- Develop a high-level architectural design for the entire system, encompassing the backend, frontend, database structures, and communication modules.
- Create detailed Unified Modelling Language (UML) diagrams, including use case diagrams, class diagrams, and sequence diagrams, to visually represent system functionalities and interactions.
- Design wireframes and mock-ups for the user interface to ensure an intuitive and user-friendly experience, focusing on accessibility and clarity.

#### 3. Backend Development (Weeks 5-7):

- Set up the backend development environment using Node.js.
- Develop robust RESTful APIs for seamless database operations and integration with the frontend and rule-based logic components.
- Implement data persistence mechanisms using MongoDB, ensuring efficient and scalable data management for various student records.
- Develop the core logic for the rule-based recommendation system and data processing routines.

#### 4. Frontend Development (Weeks 8-9):

- Build a responsive and user-friendly interface using React, focusing on an intuitive user experience and dynamic data presentation.
- Integrate the frontend with the developed backend APIs to ensure smooth data flow and interaction, including displaying advisories and notifications.
- Implement dynamic data visualization tools, including charts and graphs, to present analytical insights effectively and clearly to users.

#### 5. WhatsApp Integration (Weeks 10-11):

- Set up the whatsapp-web.js library for automated message sending.
- Develop modules for generating and sending personalized WhatsApp notifications for marks, attendance, and advisories.
- Implement session management to maintain active WhatsApp Web login, ensuring continuous notification delivery without manual intervention.
- Rigorously test the notification system for reliability and message delivery.

#### 6. Testing and Quality Assurance (Weeks 12-13):

- Perform comprehensive unit testing for individual components to ensure their correct functionality and adherence to requirements.
- Conduct integration testing to verify that all modules, including data processing, reporting, and WhatsApp notifications, work seamlessly together.

- Execute system-wide tests to assess overall performance, security, and usability of the entire system under various scenarios.

#### 7. Deployment and Documentation (Weeks 14-15):

- Deploy the application on a reliable hosting platform, ensuring high availability and robust performance.
- Prepare comprehensive user manuals and detailed technical documentation for the system to facilitate understanding, ongoing maintenance, and future development.
- Conduct training sessions for end-users (faculty, administrators, students) to ensure smooth adoption and effective utilization of the system's features.

#### 8. Maintenance and Updates (Ongoing):

- Continuously monitor the system's performance to identify and resolve any issues promptly, ensuring system stability.
  - Collect user feedback and incorporate it into iterative updates and the addition of new features, ensuring continuous improvement and relevance to evolving educational needs.
  - Plan for future enhancements and feature additions based on technological advancements and user requirements.
- This systematic methodology ensures a structured, robust, and adaptable approach to developing the Student Marks Evaluation Monitoring System, covering all aspects from conceptual design to deployment and ongoing maintenance, leading to a highly efficient and effective evaluation solution based on rule-driven logic and digital communication.

## 4. TECHNOLOGY USED

The Student Marks Evaluation Monitoring System utilizes a contemporary and robust technology stack aimed at ensuring efficiency, accessibility, and a superior user experience. The key technologies implemented across different layers of the system include:

#### • Backend:

- **Node.js:** Selected for its asynchronous and event-driven structure, Node.js allows for the creation of highly scalable and efficient backend services. Its extensive library and framework ecosystem (such as Express.js) supports quick API development and real-time data processing for evaluation activities.

#### • Frontend:

- **ReactJS:** A declarative and component-oriented JavaScript library for crafting user interfaces, ReactJS offers a highly effective and adaptable framework for creating interactive and responsive web applications. Its virtual DOM guarantees optimal performance and an uninterrupted user experience for students, faculty, and administrators.

#### • Database:

- **MongoDB:** As a NoSQL database, MongoDB offers the required flexibility, scalability, and capability to handle large volumes of unstructured or semi-structured data. Its document-based structure is well-suited for the variety of student performance data, facilitating easy data management and retrieval.

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#### • Message Integration:

- **Whatsapp-web.js:** This open-source library automates the process of sending messages via WhatsApp Web. It enables the system to communicate using an actual WhatsApp number, eliminating expenses associated with SMS gateways or third-party APIs like Twilio or Fast2SMS. It employs Local AUTH to



maintain a live session after the initial QR code scan, allowing for continuous, free, and personalized messaging to parents and students. This approach ensures communication is both dependable and cost-effective.

In combination, these tools guarantee that the Student Marks Evaluation Monitoring System is highly technical and robust, capable of adapting to future enhancements and changes in educational requirements, while prioritizing direct communication and efficient data processing.

## 5. APPLICATIONS

The Student Marks Evaluation Monitoring System opened various applications within educational institutions, catering to student assessment, administrative efficiencies, and academic support, following properly structured logic and communication.

- **Real-time Tracking of Student Performance:** This system offers the teacher access to student marks, attendance, and assignment scores at any given time and hence continuously monitors academic performance. According to the real-time data, an immediate assessment of either the struggling ones or excellent can be made by the teacher when using a set criterion.

- **Personalized Advisories and Interventions (Rule-Based):** Using logic and rules, the system analyses student performance data to issue personalized advisories and recommendations for improvement. A threshold is set, for example, 15 marks out of 25. If a student's marks in any subject fall below this threshold, a recommendation is generated automatically. For very low marks (e.g., less than 10), the urgent advisory recommends the student seek direct faculty consultation. For somewhat low marks (e.g., between 10 and 15), the general advisory suggests the student engage in extra practice and review. Alongside each advisory, the system generates relevant links—for example, YouTube, Khan Academy, Google—to study materials based on the subject, thereby facilitating the access of learning aids by the students. These advisories are displayed as cards under "📄 Advisory Messages" showing subject, marks, advice, and links.

- **Early Warning System (Rule-Based):** Based merely on current performance data and predefined academic thresholds, the system may identify students-at-risk without deploying complex computational models, thus allowing timely interventions, be it counselling or making adjustments to learning plans, to avert academic difficulties on the basis of clear, pre-established rules.

- **Enhanced Communication Channels (WhatsApp Integration):** The integrated WhatsApp notification system facilitates seamless and instant communication between faculty, students, and parents. This improves transparency regarding student progress, attendance alerts, and important announcements directly to their WhatsApp. Benefits include free messaging (no SMS API cost), personalized messages (exact marks/attendance per student), no number limits (can send to 1 or 100+ as long as WhatsApp Web is running), and modular code for easy debugging and extension.

- **Automated Administrative Tasks:** The system automates tedious manual processes such as data entry, marks aggregation, and report generation. This significantly reduces the administrative workload for educators, allowing them to focus more on teaching and direct student engagement.

- **Data-Driven Decision Making (Reporting & Analytics):** With structured analytics and comprehensive dashboards, administrators and educators can make more

informed decisions regarding curriculum development, resource allocation, and academic policies. The system provides insights into overall institutional performance and student demographics through clear data visualization.

- **Scalable and Adaptable Solution:** Designed with a flexible architecture, the system can efficiently handle large datasets and adapt to various educational institutions and evaluation patterns, from K-12 schools to universities, based on robust database and backend design.

- **Secure Data Management:** Through role-based access control and two-factor authentication, the system ensures the privacy and security of sensitive student data, complying with data protection regulations.

These applications collectively position the Student Marks Evaluation Monitoring System as a comprehensive and indispensable tool for modern educational management, fostering a more effective, efficient, and student-centric learning environment through automation, rule-based intelligence, and direct digital communication.

## 6. RESULTS AND DISCUSSION

In summary, the Student Marks Evaluation Monitoring System offers a comprehensive and forward-thinking approach that not only updates conventional evaluation methods but also greatly aids in better academic results and increased student participation by effectively tackling the major shortcomings of current systems via automation, rule-based intelligence, and direct digital communication. The conceptual framework and solid technological infrastructure provide a strong basis for its effective execution and transformative effect on the education industry.

## 7. CONCLUSION

The Student Marks Evaluation Monitoring System marks a significant leap forward in educational assessment by automating various processes, enhancing accuracy, and offering access to real-time data. This groundbreaking system effectively tackles persistent issues found in traditional evaluation methods, such as the challenges of manual data processing, delayed feedback, and the absence of organized, proactive insights.

By utilizing powerful digital tools and rule-based logic, the system provides a comprehensive platform that improves communication, delivers actionable advisories, and simplifies administrative tasks. Its ability to conduct structured analytics and facilitate rule-based identification empowers educators and administrators to make data-driven choices and take proactive steps to support student success. The automated WhatsApp communication features create a more interconnected and responsive educational atmosphere.

Moreover, the system's cost-effectiveness, resulting from its automated solutions and free messaging through WhatsApp, alongside its scalable and adaptable nature, makes it a practical and sustainable option for contemporary educational institutions. It promotes a more efficient, transparent, and student-focused learning environment, leading to improved academic results and increased student involvement.

Potential future upgrades for the system include:

- **Enhanced Parent Notifications:** Expanding the WhatsApp notification system to specifically update parents on their child's progress, attendance, or urgent notices, incorporating richer media and interactive features.
- **Advanced Security Features:** Ongoing enhancements to data privacy measures and secure access to sensitive information through improved encryption standards and multi-factor authentication methods.
- **Expanded Recommendation System:** Further developing the rule-based recommendation system to include more detailed logic, potentially integrating academic pathways and broader study resource recommendations based on curriculum mapping, all without relying on complex learning algorithms.

In summary, the Student Marks Evaluation Monitoring System is ready to reshape educational assessment, establishing a more dynamic, responsive, and effective framework for student growth and institutional management, rooted in practical automation and direct digital communication.

## ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Prof. P.R. Bhosale for her invaluable guidance and support throughout the development of the Student Marks Evaluation Monitoring System. Her expertise and encouragement were instrumental in the successful completion of this project.

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### Online Resources:

- React Documentation: [React Docs](#)
- MongoDB Documentation: [MongoDB Reference Manual](#)
- whatsapp-web.js Documentation: [GitHub Repository](#)

### Tools and Platforms:

- Apache POI Documentation: [Apache POI](#)
- Flask Documentation: [Flask Documentation](#)