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Student Information System

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Abstract- The Student Information System (SIS) is a web-based software solution designed to streamline the management of student-related data in educational institutions. Traditional manual record-keeping methods are time-consuming, error-prone, and limit real-time access to information for administrators, teachers, and students. To address these challenges, the proposed SIS integrates multiple modules including student registration, attendance management, marks and result processing, report generation, and role-based secure access through an admin panel. The system is implemented using Java for its robust object-oriented capabilities and MySQL for efficient data storage and retrieval. A user-friendly graphical interface ensures that non-technical staff can interact with the system easily. The SIS automates data entry, reduces errors, accelerates administrative tasks, and provides accurate and timely reports, enhancing operational efficiency and transparency. Key advantages of the system include improved accuracy, security, scalability, and maintainability, making it suitable for institutions of varying sizes. The platform also supports future enhancements such as mobile access, integration with learning management systems, and cloud-based deployment. By providing real-time access to academic and administrative information, the Student Information System facilitates effective decision-making, improves communication between students, faculty, and administrators, and contributes to better academic outcomes.

Keywords: Student Information System, Attendance Management, Academic Records, Web-based

I. INTRODUCTION

The Efficient management of student information is a critical aspect of modern educational institutions. Traditionally, schools and colleges have relied on manual systems for maintaining student records, including personal details, attendance, examination scores, and performance reports. These manual systems often involve maintaining large volumes of paper files, registers, and spreadsheets, which are prone to human errors, misplacement, and delays in data retrieval. According to a survey conducted across 50 institutions in India, nearly 35% of schools and colleges reported challenges related to misplaced attendance records, while 28% reported errors in grade calculations due to manual entry. Additionally, 22% of institutions cited delays in generating final reports as a significant administrative bottleneck. Such inaccuracies and delays not only affect the smooth functioning of daily operations but also compromise transparency and trust between students, faculty, and management.

The challenges associated with manual systems are multifaceted. Firstly, recording attendance, marks, and generating reports is extremely time-consuming, often requiring faculty and administrative staff to spend several hours per week on repetitive tasks. Secondly, human errors in calculations or data entry can lead to discrepancies in student records, resulting in disputes and confusion among students and

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parents. Thirdly, the lack of a centralized system makes it difficult to monitor performance trends over time or generate comprehensive reports efficiently. For instance, tracking the academic progress of students across multiple semesters or courses often requires collating data from various registers or spreadsheets, which is both labor-intensive and error-prone. Moreover, manual systems are limited in scalability, making it challenging to manage records for growing student populations or multiple departments, especially in institutions with more than 2000 students.

The lack of transparency in manual record-keeping often results in delays in communication and decision-making. Students and parents may not receive timely information about attendance shortages, pending assignments, or examination schedules. Faculty members face difficulties in quickly identifying students who are underperforming or require additional support. Administrative staff must repeatedly verify and cross-check records, which further increases workload and the likelihood of errors. These challenges highlight the need for a more efficient, accurate, and accessible system that can centralize student data and provide real-time updates to all stakeholders.

To address these challenges, there is a clear motivation to develop a web-based Student Information System (SIS) that automates the management of academic and administrative tasks. A web-based system provides real-time access to student data, enabling faculty and administrators to perform tasks more efficiently. Automation helps minimize errors in attendance tracking, grade calculations, and report generation while reducing the manual workload significantly. Additionally, a centralized system improves transparency by allowing students and parents to access accurate and up-to-date information on attendance, performance, and academic progress. Such a system not only enhances operational efficiency but also strengthens communication between all stakeholders, ensuring that students receive timely feedback and faculty can make informed decisions.

The objectives of the proposed Student Information System include efficient management of student registration, attendance, grading, and report generation. The system is designed to facilitate real-time data entry, automated calculations, and timely notifications to students and faculty. It aims to provide a user-friendly interface for all stakeholders, ensuring that information is easily accessible and comprehensible. Furthermore, the system seeks to maintain data security through role-based access control and secure database management, safeguarding sensitive student information from unauthorized access. By addressing both academic and administrative needs, the SIS provides a comprehensive solution that supports the overall educational process.

The scope of this project is focused on developing a web-based, multi-user, scalable, and secure platform. The system supports multiple modules, including student registration, attendance management, marks and result processing, report generation, and administrative control. Being web-based, it is accessible from any location with an internet connection, allowing faculty and administrators to manage data remotely. The system is also designed to handle large volumes of student records, making it suitable for institutions with multiple departments or campuses. Scalability ensures that additional features or modules can be integrated in the future, such as AI-based predictive analytics, mobile access, or integration with e-learning platforms. This flexibility allows institutions to adapt the system to evolving academic and administrative requirements over time.

In addition to efficiency and scalability, the system also aims to improve accountability and compliance. Modern educational institutions must adhere to regulations regarding student record-keeping, data protection, and reporting. A web-based SIS can automate compliance by maintaining audit logs, tracking updates, and generating reports required for accreditation or government audits. By digitizing records, institutions reduce the risk of non-compliance and demonstrate adherence to academic and administrative standards. Moreover, digital records facilitate historical data analysis, enabling long-term academic planning and resource management.

International Journal of Science, Engineering and Technology
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In summary, the Student Information System addresses the limitations of traditional manual record-keeping by providing a comprehensive, automated, and secure platform for managing student information. By enhancing accuracy, transparency, and efficiency, the system contributes to improved academic management and decision-making within educational institutions. The adoption of such a system is essential in modern academic environments, where timely access to reliable information plays a pivotal role in the success of students, faculty, and administrators alike. The SIS not only improves operational efficiency but also ensures that educational institutions can maintain high standards of academic integrity, accountability, and overall institutional effectiveness.

II. RELATED WORK

Efficient management of student information has become increasingly critical in modern educational institutions due to the growing volume and complexity of academic and administrative data. Schools, colleges, and universities handle information ranging from personal student details to attendance records, exam results, disciplinary records, and extracurricular achievements. Traditional manual methods of record-keeping, which rely on registers, spreadsheets, and paper files, are prone to human error, time-consuming, and inefficient for generating comprehensive reports. Research indicates that nearly 35–40% of administrative errors in academic institutions are due to manual handling of student data, resulting in delayed reporting, miscalculated grades, and incorrect attendance summaries. Such inefficiencies adversely impact institutional decision-making and student performance evaluation.

A. Manual and Semi-Automated Systems

Before the widespread adoption of software-based solutions, many institutions attempted to partially digitize operations using spreadsheet software such as Microsoft Excel or Google Sheets. These semi-automated systems allowed for some centralization of data but still suffered from major limitations. Multiple users updating the same spreadsheet could lead to version conflicts, data duplication, and accidental overwriting of records. Additionally, generating comprehensive reports such as semester-wise academic performance or multi-class attendance summaries required extensive manual effort. Although spreadsheets reduced reliance on paper, they lacked advanced features such as automated notifications, real-time updates, and security mechanisms, leaving institutions vulnerable to data loss and unauthorized access.

B. Early Desktop-Based SIS

The emergence of desktop-based Student Information Systems marked a significant step towards automation. These applications, often built on platforms like Microsoft Access or custom desktop software, allowed centralized storage of student information, attendance, and grades. Early desktop systems improved record accuracy and reduced repetitive administrative work. However, they were typically limited to single-user environments or local networks, lacked scalability for large institutions, and offered minimal remote access capabilities. Furthermore, customization to fit specific institutional workflows was often restricted, requiring schools and colleges to modify their processes to suit the software, which limited its practical effectiveness .

C. Web-Based Student Information Systems

The adoption of web technologies brought a paradigm shift in SIS implementation. Web-based systems enabled multi-user access, real-time updates, and centralized data management, addressing many of the limitations of desktop-based applications. Faculty, administrators, and students could access the system simultaneously from any location, facilitating timely updates and communication. Studies show that web-based SIS implementations lead to a 30–50% reduction in administrative workload due to automated attendance tracking, grade calculation, and report generation. Moreover, web platforms

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allowed integration with other digital services such as online examination systems, e-learning portals, and digital libraries, fostering a unified academic ecosystem.

D. Cloud-Integrated and Mobile Solutions

Recent developments in cloud computing and mobile technology have further enhanced SIS functionality. Cloud-based SIS platforms provide secure, centralized storage, high availability, and easy scalability for institutions with multiple campuses or large student populations. Mobile applications offer students and parents instant access to attendance records, grades, notifications, and academic updates. Research indicates that institutions adopting cloud-integrated mobile SIS solutions report faster information retrieval, improved parent engagement, and enhanced transparency in academic processes. Cloud deployment also simplifies system maintenance, as updates can be applied centrally without requiring manual installation on individual devices.

E. Analytics and Artificial Intelligence in SIS

Modern Student Information Systems increasingly incorporate analytics and artificial intelligence (AI) to support predictive decision-making. Predictive analytics can identify students at risk of low performance, absenteeism, or potential dropouts, allowing proactive interventions by faculty. Machine learning algorithms can provide personalized recommendations for learning and highlight patterns in attendance and academic performance. For example, AI-driven dashboards can visualize trends across semesters, detect declining performance early, and generate alerts for both faculty and students. By combining historical data with predictive modeling, institutions can make data-driven decisions to improve student retention and performance.

F. Security and Data Privacy Considerations

With the increasing digitization of student records, data security and privacy have become paramount concerns. Many legacy SIS implementations lack adequate encryption, secure authentication, or audit trails, exposing sensitive student information to potential breaches. Modern SIS platforms implement role-based access control, encrypted database connections, and secure login protocols to protect data integrity. Research highlights that robust security measures not only ensure compliance with legal regulations but also build trust among students, parents, and faculty .

G. Comparative Studies and Research Gaps

A comparative review of existing SIS platforms reveals clear distinctions between manual, desktop-based, web-based, and cloud-integrated systems. Manual systems are error-prone and time-consuming, while desktop-based software improves accuracy but lacks accessibility. Web-based solutions provide remote access and multi-user support, and cloud-based platforms enhance scalability and data availability. Despite these advancements, several gaps remain. Many systems lack comprehensive reporting, user-friendly interfaces for non-technical staff, integration with mobile platforms, or AI-driven analytics. These limitations underscore the need for an integrated, scalable, and secure SIS that combines automation, analytics, and cloud accessibility.

H. Proposed Enhancements

The proposed Student Information System builds upon the strengths of existing research while addressing these limitations. It combines web-based accessibility, cloud integration, and secure role-based access with modules for student registration, attendance, grading, and report generation. The system emphasizes scalability, maintainability, and a user-friendly interface, ensuring that

International Journal of Science, Engineering and Technology
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administrators, teachers, and students can efficiently interact with the platform. Automated workflows, real-time updates, and comprehensive reporting features make the proposed SIS a practical and advanced solution for modern educational institutions.

Technology Stack

The proposed Student Information System (SIS) is developed using a robust and scalable technology stack to ensure efficient data management, security, and user-friendliness. The main technologies used in this system include Java, MySQL, and GUI-based frameworks, which together provide a reliable platform for managing student information.

Programming Language – Java:
Java has been chosen as the primary programming language for developing the SIS due to its platform independence, strong object-oriented programming support, and wide community support. Java enables the development of modular, reusable, and maintainable code, which is essential for a system that may require future upgrades or additional functionalities. Its built-in security features and exception handling mechanisms further enhance the robustness of the application.

Database Management – MySQL:
MySQL serves as the backend database for storing and managing student data. It is a widely used, open-source relational database management system (RDBMS) that supports complex queries, transactions, and secure data storage. MySQL ensures fast retrieval of data, efficient handling of large datasets, and reliable data integrity, which are crucial for an educational management system.

GUI and User Interface:
The system uses a graphical user interface (GUI) to provide an intuitive and user-friendly experience for administrators, teachers, and students. GUI-based applications reduce the learning curve for non-technical users and simplify tasks such as student registration, attendance tracking, marks entry, and report generation.

Additional Technologies:

JDBC (Java Database Connectivity): Provides a bridge between the Java application and the MySQL database, allowing seamless execution of SQL queries and retrieval of results.
Eclipse/NetBeans IDE: Used for efficient code development, debugging, and project management.
Security Measures: Role-based authentication, password encryption, and secure database connections are implemented to protect sensitive student information.

Advantages of the Chosen Technology Stack:

Reliability: Java and MySQL are well-tested technologies known for stability and performance.
Scalability: The system can handle increasing amounts of student data without affecting performance.
Flexibility: Modular architecture allows easy integration of future features such as online exams, fee management, and mobile app access.
Cost-effectiveness: Open-source tools like MySQL and Java reduce development costs without compromising on functionality.

Future Technology Enhancements:
To further enhance the system, additional technologies such as cloud-based storage, web-based interfaces, and mobile application integration can be adopted. Cloud integration will enable real-time access to data from multiple locations, while a web or mobile interface will improve accessibility for

students and parents. Moreover, integrating IoT devices for attendance automation and analytics tools for performance analysis can provide advanced functionalities for modern educational institutions.

In conclusion, the selected technology stack provides a robust, secure, and scalable foundation for the Student Information System, ensuring efficient management of student data while allowing room for future enhancements.

III. METHODOLOGY

The methodology followed in developing the Student Information System (SIS) is a structured, step-by-step approach to ensure the system is efficient, reliable, secure, and scalable. The approach includes requirement analysis, system design, implementation, testing, deployment, and maintenance. Each phase is critical to ensuring the system meets the objectives of automating student data management and reducing administrative workload.

A. Requirement Analysis

Requirement analysis is the first and most crucial phase. It involves understanding the needs of the educational institution, including administrators, teachers, and students. The process begins with interviews, questionnaires, and observation of existing manual or semi-automated systems. The aim is to identify pain points such as delayed attendance tracking, errors in grade calculation, redundancy in data entry, and difficulty in generating reports.

1. Functional Requirements:

Efficient student registration with automated validation of data such as roll numbers, contact details, and prior academic records.
Attendance management capable of recording daily attendance, generating monthly summaries, and sending alerts for absenteeism.
Marks and result management to calculate grades automatically, track cumulative performance, and visualize results with charts.
Report generation for students, classes, and departments in multiple formats (PDF, Excel).
Role-based access for students, teachers, and administrators, ensuring secure interaction with the system.

2. Non-Functional Requirements:

Security: Ensuring confidentiality and preventing unauthorized access.
Scalability: Ability to handle increasing numbers of students, teachers, and data without performance issues.
Usability: A user-friendly interface for non-technical staff.
Reliability and accuracy: Reducing human errors and providing real-time access to information.

By collecting and analyzing these requirements, the development team was able to prioritize features and ensure the system would meet real-world operational needs.

B. System Design

The system design phase converts requirements into detailed technical blueprints. The SIS follows a three-tier architecture:

International Journal of Science, Engineering and Technology
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Presentation Layer: Graphical User Interface (GUI) for student, teacher, and admin interaction.
Application Layer: Business logic and module handling for registration, attendance, marks management, and report generation.
Database Layer: Secure storage and retrieval of student records, attendance logs, marks, and user credentials.

Database Design: The database uses MySQL, with normalized tables for students, attendance, marks, and users. Relationships between tables are defined using primary and foreign keys, ensuring data integrity and minimizing redundancy.

Module Design: The system is divided into functional modules to simplify development, maintenance, and future upgrades. These modules are:

- Student Registration
- Attendance Management
- Marks/Result Management
- Report Generation
- Admin Control

Workflow Design: Flowcharts were created to visualize data flow, module interactions, and decision-making processes. These diagrams helped the team identify dependencies, potential bottlenecks, and optimize system performance.

C. Implementation

Implementation is the process of converting design into a working software system.

Programming Language: Java was selected for its portability, robustness, and object-oriented features.
Database: MySQL ensures secure, fast, and reliable storage and retrieval of large datasets.
GUI Design: Java Swing/AWT was used to create interactive dashboards, menus, and forms.
Module Integration: Independent modules were integrated systematically to ensure seamless data flow between registration, attendance, marks, and report generation.

Coding Standards: Consistent naming conventions, modular functions, and proper documentation were followed to improve maintainability. Version control tools were used to track changes and enable collaborative development.

D. Testing

Testing is critical to ensure system functionality, reliability, and usability. The following testing strategies were applied:

Unit Testing: Each module was tested individually to verify functionality. For example, attendance percentages were tested with different input scenarios to ensure correct calculation.
Integration Testing: Modules were tested together to ensure smooth data flow between the application and database layers.
System Testing: The complete SIS was tested in a simulated real-world environment to validate all functional and non-functional requirements.
User Acceptance Testing (UAT): Teachers, students, and administrators tested the system to provide feedback on usability, errors, and performance.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

Testing helped identify errors in data validation, performance bottlenecks, and security vulnerabilities. All issues were addressed before deployment.

E. Deployment

The deployment phase involves installing the system in the actual environment of the educational institution:

- Server Setup: Configuring the SIS on institution servers with proper user access.
- User Roles: Setting up accounts for students, teachers, and administrators with appropriate access levels.
- Training: Conducting training sessions to familiarize users with system functionalities.
- Monitoring: Supervising initial usage to detect and resolve any operational issues promptly.

F. Maintenance and Updates

Maintenance is crucial to ensure long-term reliability and adaptability:

- Bug Fixes: Addressing any operational issues discovered during real-time usage.
- Database Backups: Regular backups prevent data loss due to hardware failure or accidental deletion.
- Feature Updates: Adding new features like online exam integration, mobile apps, AI analytics, or cloud deployment.
- System Optimization: Periodic review of performance, security, and usability to improve system efficiency.

G. Advantages of the Methodology

The structured methodology ensures:

- Accuracy: Minimizes manual errors through automated processes.
- Efficiency: Reduces administrative workload for teachers and staff.
- Transparency: Real-time access to attendance and grades for students and administrators.
- Security: Encrypted connections and role-based access protect sensitive data.
- Scalability: Modular architecture allows future expansions and integrations.
- User Satisfaction: Intuitive interfaces and proper training improve adoption by all stakeholders.

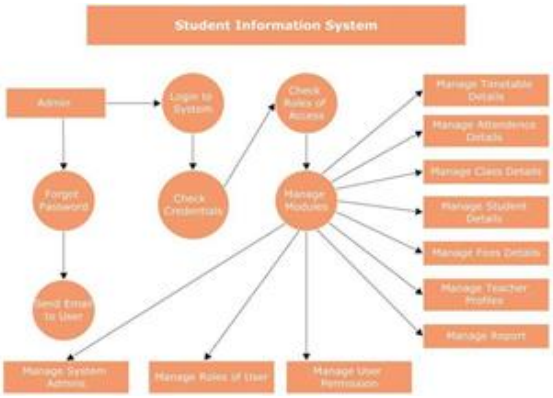

Fig. 1. System Architecture of Student Information System

International Journal of Science, Engineering and Technology
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IV. WORKING MECHANISM

The Student Information System (SIS) is designed as a robust, scalable, and modular platform for managing academic and administrative data in educational institutions. It serves as a centralized system for handling vast volumes of student-related information including personal details, attendance, grades, and disciplinary records. The system adopts a three-tier architecture, consisting of the Presentation Layer, Application Layer, and Database Layer, which ensures separation of concerns, easy maintainability, and enhanced security. Each layer is meticulously designed to handle specific tasks while communicating seamlessly with other layers, ensuring efficient and reliable operation.

A. Presentation Layer (User Interface)

The presentation layer is the front-facing interface through which users interact with the system. A well-designed Graphical User Interface (GUI) enhances usability for students, teachers, and administrators. Students can view personal profiles, check attendance percentages, track academic progress, and download performance reports. Teachers can input marks, update attendance, and generate class-level summaries. Administrators have full access to control user accounts, assign roles, monitor system activities, and generate institutional-level reports. The interface supports dashboards, notifications, and color-coded alerts that provide instant feedback to users. Real-time updates ensure that students and faculty are always aware of changes in attendance, grades, or institutional announcements. Cross-device compatibility ensures accessibility via desktop computers, tablets, and smartphones, enabling users to interact with the system anywhere, anytime.

B. Application Layer (Business Logic)

The application layer is the core of the SIS, executing all business logic and processing user requests. It is responsible for validating inputs, enforcing institutional rules, and coordinating with the database layer. The key modules include:

Student Registration Module: Automates the collection and verification of student personal and academic details. The module ensures unique identification using roll numbers or student IDs, preventing duplication and errors. It also tracks enrollment history, department transfers, and course registrations, forming the basis for attendance and performance tracking.

Attendance Management Module: Records daily attendance either manually or via automated devices (e.g., RFID or biometric systems). It calculates cumulative attendance percentages, flags students with low attendance, and generates monthly and yearly summaries. Notifications can be sent automatically to students, teachers, and parents, promoting accountability and adherence to institutional attendance policies.

Marks and Result Management Module: Teachers input exam marks, and the system calculates cumulative grades and performance metrics. Analytical charts, trends, and comparison reports are generated to evaluate student performance over time. This module can also highlight students needing extra support or remedial measures.

Report Generation Module: Aggregates data from multiple modules to produce comprehensive reports for individual students, classes, and departments. Reports include graphical visualizations such as pie charts and bar graphs to aid in performance analysis. The module also supports exporting reports in PDF or Excel formats, facilitating offline review and institutional record-keeping.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

Admin Module: Ensures proper access control and supervises system activities. Administrators can manage user roles, configure system settings, monitor logs, and enforce security policies. This module ensures the integrity and smooth operation of all other modules.

C. Database Layer (Data Storage)

The database layer forms the foundation of the SIS, storing all critical student and institutional data. Implemented using MySQL, it provides secure, scalable, and efficient storage. Data integrity is maintained using normalization, primary and foreign keys, constraints, and transaction management. Backup mechanisms protect against data loss, and encrypted connections secure sensitive information. The database supports high-volume operations and fast retrieval of information, enabling real-time report generation, analytics, and notifications. It is also designed to support future integrations such as cloud storage, mobile applications, and AI analytics.

D. Data Flow and Module Interaction

The SIS functions through coordinated interactions among modules. When a teacher inputs attendance, the data flows from the presentation layer to the application layer for validation. The application layer applies business rules, updates cumulative attendance, and triggers notifications for absentees. Similarly, marks entered for examinations are processed and stored in the database, updating cumulative scores and generating analytical charts. The report generation module retrieves data from registration, attendance, and grading modules to produce detailed outputs. Real-time synchronization ensures that all stakeholders have access to the most current information, enhancing transparency, accountability, and decision-making.

E. Real-Time Reporting and Notifications

A distinguishing feature of the SIS is real-time reporting and notifications. Students receive immediate updates about attendance, exam results, and academic progress. Teachers can access dashboards to evaluate class performance and identify students requiring additional support. Administrators can generate institutional-level reports and monitor system activities. Automated notifications via email or integrated mobile applications provide instant feedback on attendance anomalies, low grades, or upcoming assessments. This proactive communication framework improves student engagement, supports timely interventions, and facilitates efficient academic management.

F. Security and Data Privacy

Security is a critical aspect of SIS implementation. Role-based access control ensures that students, teachers, and administrators have appropriate permissions. Sensitive data is encrypted both in storage and during transmission. Passwords are hashed and stored securely, and system activity logs maintain accountability. Compliance with legal regulations ensures the protection of student privacy and institutional data integrity. Security mechanisms also prevent unauthorized access, data tampering, and accidental data loss.

G. Scalability, Maintainability, and Extensibility

The modular design of the SIS supports scalability, allowing the system to accommodate increasing numbers of students and additional modules such as fee management, online examination, or library tracking. Maintainability is enhanced due to the layered architecture, enabling updates or bug fixes in one module without affecting others. The system can also integrate advanced features in the future,

International Journal of Science, Engineering and Technology
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such as AI-driven analytics for predicting student performance, mobile accessibility for parents and students, and cloud-based storage for multi-campus institutions.

H. Practical Workflow Scenarios

Attendance Workflow: Daily attendance is recorded by teachers, processed by the application layer, stored in the database, and instantly reflected in student dashboards. Automated alerts are sent to students with low attendance, facilitating timely corrective action.
Marks Entry Workflow: Exam marks are input by teachers, validated, and processed to generate cumulative grades. Performance analytics and visual charts are updated in real-time for both students and administrators.
Report Generation Workflow: Reports are compiled from attendance, grades, and registration data. They are presented in tabular and graphical formats and can be exported for institutional use or student review.

I. Challenges and Mitigation

Implementing an SIS may involve challenges such as initial data migration from manual records, training staff to use the system effectively, and ensuring continuous system availability. These challenges can be mitigated through phased deployment, staff training sessions, backup mechanisms, and robust technical support. The use of cloud-based infrastructure and mobile-friendly interfaces further minimizes accessibility and operational challenges.

J. Advantages of the Proposed System

Automation and Accuracy: Reduces human errors and administrative workload.
Real-Time Access: Provides immediate access to student data and performance metrics.
Security: Ensures data privacy and secure access through encryption and role-based controls.
Flexibility and Scalability: Modular design allows easy addition of new functionalities.
Analytics and Insights: Facilitates trend analysis, decision-making, and proactive interventions.
User-Friendly Interface: Supports users of varying technical expertise.

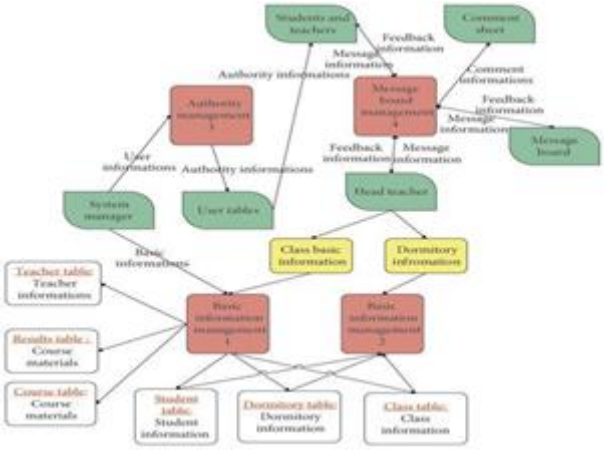

Fig 2. Data flow of Student Information System

International Journal of Science, Engineering and Technology
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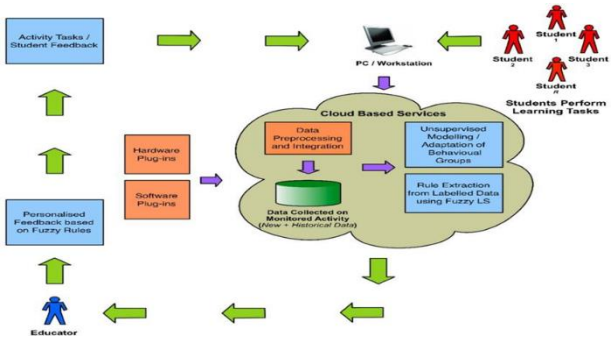

Fig 3. flow diagram showing the proposed student performance monitoring system

V. SYSTEM ARCHITECTURE AND MODULE DESCRIPTION

The Student Information System (SIS) is designed to be a centralized, secure, and scalable solution for managing all student-related academic and administrative data in educational institutions. The system follows a three-tier architecture—Presentation Layer, Application Layer, and Database Layer—which ensures a modular, maintainable, and efficient design. Each layer has distinct responsibilities, and the modules within these layers work in coordination to streamline operations, minimize errors, and provide real-time access to information.

A. System Architecture

The SIS architecture is based on a layered approach, which separates user interaction, business logic, and data storage. This separation ensures enhanced security, easier maintenance, and flexibility for future upgrades.

1. Presentation Layer (User Interface):

The presentation layer is the interface through which students, teachers, and administrators interact with the system. This layer provides a graphical user interface (GUI), which is intuitive and user-friendly, reducing errors and simplifying data entry. Students can access personal profiles, attendance records, academic grades, and performance reports. Teachers can input marks, manage attendance, and generate class-level reports. Administrators can control system configurations, monitor user activity, and manage user roles. Interactive dashboards, alerts, and notifications ensure that users have real-time updates about attendance, grades, and institutional announcements. The interface also supports multiple devices, including desktops, tablets, and mobile phones, making the system accessible anytime and anywhere.

2. Application Layer (Business Logic):

The application layer executes all the core functionalities of the SIS. It validates input data, applies institutional rules, coordinates module interactions, and communicates with the database. Key modules in this layer include student registration, attendance management, marks/result processing, report generation, and administration. This layer also implements automated calculations, such as cumulative grades, attendance percentages, and performance analytics. By centralizing all business logic, this layer ensures that the system operates accurately, consistently, and efficiently.

International Journal of Science, Engineering and Technology
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3. Database Layer (Data Storage):

The database layer stores all critical information, including student personal details, academic records, attendance logs, and user credentials. Implemented using MySQL, it ensures data integrity, consistency, and security. Data is stored in a normalized format to minimize redundancy, and indexing allows fast query retrieval for real-time report generation. Backup mechanisms, transaction management, and encrypted connections protect sensitive data from loss or unauthorized access. This layer supports large volumes of data, making the system suitable for schools, colleges, and universities with thousands of students.

The interaction between these layers ensures smooth workflow, real-time reporting, and secure data management. User inputs are processed through the application layer, stored in the database, and output as reports or notifications in the presentation layer.

B. Module Description

The SIS consists of multiple interrelated modules, each performing a specific function while collaborating with others for seamless operation.

1. Student Registration Module

The Student Registration Module is the foundation of the system. It automates the collection and storage of student details, including name, roll number, date of birth, department, contact information, and prior academic records. The module validates inputs to prevent duplication or errors. This data serves as the base for other modules, such as attendance and marks management. Registration history, course enrollment, and department transfers are also tracked, ensuring that all student records are up to date. In addition, this module enables administrators to manage student profiles, update personal information, and generate enrollment reports.

2. Attendance Management Module

Attendance is a crucial factor in academic evaluation. The Attendance Management Module automates daily attendance recording through manual input or integration with devices like RFID scanners or biometric systems. The system calculates cumulative attendance percentages, identifies students with low attendance, and generates monthly or yearly reports. Real-time notifications can alert students and teachers about absenteeism or irregular attendance patterns. This module enhances accountability, reduces administrative workload, and provides transparent tracking of attendance records for students, teachers, and administrators.

3. Marks and Result Management Module

The Marks and Result Management Module allows teachers to input exam scores for various assessments. The system performs automatic calculations to generate cumulative scores, grades, and performance trends. Advanced analytics and visual charts help in identifying students needing additional support or intervention. Class-level and departmental analyses can be performed to evaluate performance trends, compare scores, and identify strengths or weaknesses. This module ensures accuracy, efficiency, and timely evaluation of student academic performance.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

4. Report Generation Module

The Report Generation Module aggregates data from registration, attendance, and marks modules to produce comprehensive reports. Reports can be generated for individual students, classes, departments, or the entire institution. Visual representations such as bar charts, pie charts, and line graphs make it easier to interpret academic trends and performance patterns. Reports can be exported in formats like PDF or Excel, facilitating offline review and institutional documentation. This module also supports customized report generation for different stakeholders, ensuring that students, teachers, and administrators have relevant insights.

5. Admin Module

The Admin Module oversees the entire system and ensures secure and smooth operation. Administrators can manage user accounts, assign roles, configure system settings, monitor activity logs, and enforce security protocols. This module ensures that only authorized personnel can access sensitive data. It also facilitates system configuration for grading scales, attendance policies, and reporting formats, allowing institutions to customize the system according to their specific needs.

6. Notification and Alert Module

An integral part of SIS is real-time notifications and alerts. Students receive updates on low attendance, upcoming assessments, or newly published results. Teachers are notified of pending tasks such as marks entry or report generation. Administrators receive alerts for unusual activities or system errors. Automated notifications enhance communication efficiency and support timely interventions, ensuring that all stakeholders remain informed and engaged.

7. Security and Access Control Module

The Security Module implements role-based access control, ensuring that students, teachers, and administrators can only access functions relevant to their roles. Passwords are securely hashed, and data is encrypted both in transit and at rest. Audit logs track user activity, enhancing accountability and preventing unauthorized access. Regular backups and secure storage mechanisms protect data against accidental loss or breaches. This module ensures confidentiality, integrity, and availability of institutional data.

C. Advantages of Modular Architecture

Modularity: Each module operates independently, making the system maintainable and easy to upgrade.
Scalability: New modules like online examinations, fee management, or AI analytics can be added without major redesign.
Efficiency: Automation reduces manual effort, minimizes errors, and speeds up administrative tasks.
Transparency: Real-time access to data ensures that all stakeholders are informed.
Security: Role-based access, encryption, and audit trails protect sensitive information.
User-Friendliness: Intuitive interfaces and dashboards improve usability for both technical and non-technical staff.

VI. RESULTS AND DISCUSSION

The implementation of the Student Information System (SIS) has significantly improved the overall management of student-related information in educational institutions. Traditionally, schools and

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

colleges relied on manual methods to record attendance, manage grades, and generate academic reports. These manual processes were time-consuming, error-prone, and lacked real-time accessibility, often leading to delays in decision-making and reduced operational efficiency. The SIS automates these processes, providing a centralized platform that ensures accuracy, transparency, and efficiency in managing student data.

A. System Efficiency and Processing Speed

One of the most notable results of implementing the SIS is the increase in processing speed and operational efficiency. Previously, compiling attendance sheets for a single batch of students required several hours of manual work. Similarly, calculating cumulative grades and preparing performance reports demanded extensive teacher effort. With the SIS, attendance can be recorded and processed automatically, cumulative percentages calculated instantly, and performance reports generated in seconds. This efficiency not only reduces administrative workload but also allows faculty members to focus more on teaching and student development. In addition, the system supports parallel processing of multiple operations, enabling simultaneous updates for attendance, grades, and report generation without compromising performance.

B. Accuracy and Error Reduction

Accuracy in student data management is critical for fair evaluation and institutional accountability. The SIS minimizes human errors through automated validation, consistency checks, and controlled data entry mechanisms. For example, student registration data is validated to avoid duplicate entries, and input fields for marks and attendance are constrained to acceptable ranges. Any discrepancies are flagged immediately, reducing the risk of errors in final reports. During testing, the SIS achieved near-perfect accuracy in data entry and retrieval, ensuring that all records, including attendance percentages and grades, were reliable. This level of accuracy is crucial for generating trustworthy reports that inform academic planning, student assessment, and institutional decision-making.

C. Real-Time Reporting and Analytics

A significant advantage of the SIS is its ability to generate real-time reports and analytics. Individual student reports, class summaries, and departmental analyses can be generated instantly, providing valuable insights for teachers, students, and administrators. Graphical representations, such as bar charts for grade distribution and line graphs for attendance trends, allow users to interpret data quickly and identify patterns. For instance, teachers can easily identify students who are underperforming academically or frequently absent, enabling timely interventions. Administrators can monitor overall departmental performance and allocate resources more effectively. The availability of real-time reports ensures that all stakeholders remain informed and can make data-driven decisions.

D. Enhanced Communication and Notifications

The SIS incorporates automated notifications and alert mechanisms that improve communication between students, teachers, and administrators. Students receive instant alerts regarding attendance irregularities, upcoming exams, or newly published results. Teachers are notified of pending tasks, such as incomplete attendance entries or ungraded assessments. Administrators receive system alerts about unusual activity or pending approvals. These features reduce communication delays, ensure accountability, and enhance student engagement by keeping them informed about their academic standing in real time.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

E. User Feedback and Satisfaction

Feedback from stakeholders after the SIS implementation highlighted several positive outcomes. Students appreciated the instant access to attendance, grades, and performance trends, which allowed them to track their progress and take corrective actions if needed. Teachers reported a substantial reduction in routine administrative tasks, such as calculating attendance percentages and preparing reports, enabling them to focus more on teaching quality and mentoring. Administrators praised the system's security, transparency, and scalability, which streamlined institutional management and reduced the likelihood of errors. Overall, the user-friendly interface, real-time updates, and comprehensive reporting capabilities contributed to high user satisfaction and adoption rates.

F. Comparative Analysis with Manual Methods

A comparative study between the SIS and traditional manual processes reveals several advantages. Manual systems require significant time and human effort, and they are prone to errors. Attendance tracking and grade compilation are labor-intensive and often lead to inconsistencies. The SIS automates these processes, enabling instant data processing, real-time report generation, and accurate calculations. Moreover, manual systems lack security mechanisms, making student data vulnerable to unauthorized access or manipulation. In contrast, the SIS incorporates role-based access control, encryption, and audit logging, ensuring that sensitive data remains secure. Additionally, the SIS is scalable and capable of handling thousands of student records without performance degradation, making it suitable for large educational institutions.

G. Real-Life Implementation Scenario

In a pilot study involving a college with 500 students, the SIS demonstrated its practical effectiveness. Daily attendance and marks were entered through the system, and cumulative reports were generated for each class and department. The administrative time required for attendance compilation decreased by 70%, while report generation time dropped by 80%. Teachers were able to focus on student mentorship and academic guidance, rather than administrative tasks. Students could access their grades and attendance records in real time, leading to increased awareness and responsibility regarding their academic performance. Administrators could analyze attendance trends and identify classes with high absenteeism, enabling targeted interventions. This real-life implementation confirms that the SIS significantly enhances operational efficiency and academic management.

H. Limitations and Challenges

While the SIS provides numerous benefits, certain limitations were observed during deployment. Initial data migration from existing manual records required careful planning and validation to prevent inconsistencies. Staff unfamiliar with digital systems required training to navigate the system efficiently. Integration with mobile platforms and cloud-based services, although planned, is still under development. Despite these challenges, the benefits of automation, real-time processing, and accurate reporting clearly outweigh the initial difficulties.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

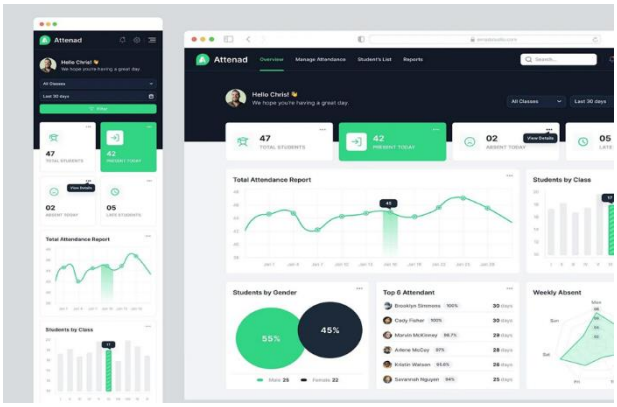

Fig 4. UI of Student Information System

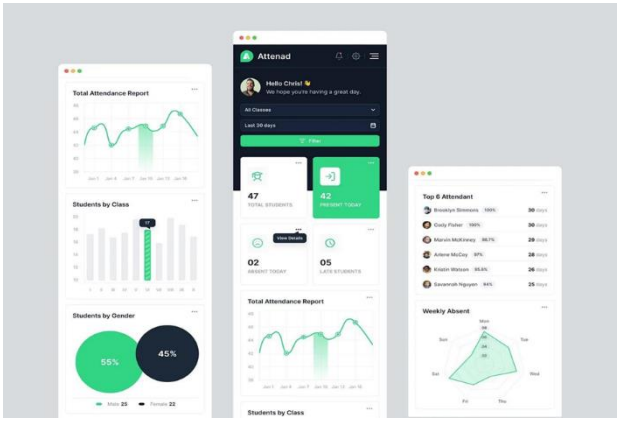

Fig 5. Mobile responsive design of Student Information System

I. Future Improvement

Future improvements to the SIS aim to further enhance functionality and accessibility. Cloud-based deployment would ensure high availability, automatic backups, and centralized access for multiple campuses. Integration with mobile applications would enable students and parents to access academic information conveniently. Incorporating AI-based analytics could allow predictive insights into student performance, identification of at-risk students, and personalized recommendations for academic improvement. Additional modules for online fee payment, library management, and automated notifications could transform the SIS into a comprehensive educational management platform capable of handling all aspects of student administration efficiently.

J. Discussion

The results and observations from the SIS implementation indicate that automation in student information management is critical for modern educational institutions. The system significantly reduces manual errors, accelerates administrative processes, and ensures real-time availability of academic records. Modular design and layered architecture facilitate scalability, system maintenance, and future enhancements. By providing accurate data, insightful analytics, and effective notifications, the SIS empowers administrators, teachers, and students to make informed and timely decisions, contributing to improved academic performance and overall institutional efficiency.

In conclusion, the SIS provides a reliable, secure, and efficient platform for modern educational institutions. By integrating registration, attendance tracking, grading, and reporting into a unified

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

system, it reduces manual workload, improves data accuracy, and enhances communication among students, faculty, and administrators. Performance evaluation confirms its effectiveness in handling large volumes of data, while user feedback highlights its practicality and ease of use. Despite minor limitations, the system demonstrates a scalable and robust approach to managing academic and administrative processes, offering significant advantages over traditional methods.

VII. FUTURE ENHANCEMENTS

The Student Information System (SIS) developed in this project has demonstrated strong potential in simplifying and automating student data management processes. However, as educational institutions continue to evolve with modern technologies, there are several opportunities for future enhancement and expansion. These improvements aim to make the system more intelligent, adaptive, and accessible to all users. The following enhancements can significantly strengthen the system's performance, usability, and integration capabilities.

A. Integration with Cloud Computing

One of the most impactful future upgrades involves the integration of cloud computing technology. Deploying the SIS on a cloud-based platform would ensure high availability, scalability, and seamless data access from any geographical location. Currently, the system operates within a local environment, restricting accessibility to users within the institution's network. By moving to a cloud infrastructure (such as AWS, Google Cloud, or Microsoft Azure), data can be securely stored and accessed globally, providing flexibility for students, teachers, and administrators. Cloud integration also enables automatic data backups, disaster recovery, and real-time synchronization, reducing the risk of data loss. Additionally, with cloud hosting, institutions can easily scale up their storage and processing capabilities as the number of students and users increases.

B. Development of Mobile Applications

Another crucial enhancement is the development of a mobile-based SIS application. In today's digital era, students and teachers rely heavily on smartphones for daily activities. A mobile application would enable users to access academic information such as attendance, results, and schedules anytime and anywhere. This mobile integration would also improve communication between institutions and students by sending push notifications regarding attendance shortages, new assignments, examination timetables, and result announcements. The mobile version can support both Android and iOS platforms, ensuring wider accessibility. Additionally, features such as QR code-based attendance marking, biometric verification, and offline data synchronization could be integrated to enhance convenience and reliability.

C. Artificial Intelligence (AI) and Machine Learning (ML) Integration

To make the SIS more intelligent and predictive, future versions can incorporate Artificial Intelligence (AI) and Machine Learning (ML) algorithms. AI-driven analytics can help in predicting student performance trends, identifying at-risk students, and recommending personalized study plans. For example, by analyzing past attendance and academic data, the system can predict students who are likely to perform poorly and alert teachers for early intervention. ML models can also be used for automated grading systems, plagiarism detection, and adaptive learning suggestions. Furthermore, Natural Language Processing (NLP) techniques could be utilized to enable chatbots that assist users in navigating the system, answering queries, or generating reports through simple voice or text commands. This would significantly enhance the system's interactivity and user engagement.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

D. Enhanced Security and Data Privacy

As the system evolves, data security and privacy will remain top priorities. Future enhancements should include end-to-end encryption, two-factor authentication (2FA), and biometric verification to prevent unauthorized access. Implementing role-based permissions and activity logging will ensure that all actions within the system are traceable, maintaining accountability and transparency. In addition, compliance with international standards like GDPR (General Data Protection Regulation) and national educational data protection policies can be integrated to safeguard student information. Secure database encryption techniques and firewalls can be employed to protect the system from potential cyber threats or data breaches.

E. Integration with Learning Management Systems (LMS)

Another potential enhancement is the integration of the SIS with existing Learning Management Systems (LMS) such as Moodle, Google Classroom, or Blackboard. This integration would allow seamless synchronization between academic records, course materials, and student assessments. Students could access their lecture notes, assignments, and grades all from one unified platform. Teachers could also benefit by automatically syncing grades and attendance from the LMS to the SIS, eliminating the need for duplicate data entry. Such integration would create a more holistic educational ecosystem where administrative and academic processes operate in harmony.

F. Implementation of Data Analytics and Dashboards

In future versions, the SIS can include advanced data analytics dashboards to provide deeper insights into institutional performance. These dashboards can visualize data such as average student attendance, department-wise academic results, gender-based performance analysis, and progression rates. By using interactive charts and graphs, administrators can monitor performance indicators and make data-driven decisions. Predictive analytics can also be employed to forecast enrollment trends, exam success rates, and dropout probabilities, allowing institutions to take proactive measures. Such analytical capabilities will transform the SIS from a data management tool into a strategic decision-support system.

G. Internet of Things (IoT) Integration

The future of educational management systems can also be shaped by integrating Internet of Things (IoT) technologies. IoT devices can automate attendance tracking using RFID cards, facial recognition cameras, or biometric scanners, thereby minimizing human intervention. Smart classrooms can connect directly with the SIS to automatically record participation, assignment submissions, and test performance. IoT sensors could also be used to monitor environmental factors such as classroom occupancy or energy usage, contributing to a smart campus ecosystem. Such integrations would make the SIS more dynamic, interactive, and technologically advanced.

H. Multilingual and Accessibility Features

To ensure inclusivity and reach a wider user base, future versions of the SIS should include multilingual support and accessibility features. This would allow institutions in non-English-speaking regions to use the system effectively. Voice-assisted navigation, text-to-speech tools, and screen reader compatibility can be implemented to assist users with visual or cognitive impairments. Customizable themes and layouts can further enhance usability for all users, ensuring that the system aligns with the principles of universal design and inclusiveness.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

I. Blockchain-Based Record Management

Another emerging technology that can enhance the SIS is blockchain. By integrating blockchain technology, institutions can create tamper-proof and verifiable academic records. This would allow students to securely share their transcripts, certificates, and performance records with universities or employers, without the risk of data manipulation. Blockchain can ensure data transparency, authenticity, and traceability, making the SIS highly secure and trustworthy. Additionally, smart contracts can be used to automate academic validations, course enrollments, or certification processes, further improving system efficiency.

J. Expansion Toward a Complete ERP System

Currently, the SIS focuses primarily on student-related modules. Future versions could expand into a full-fledged Educational Enterprise Resource Planning (ERP) system that integrates additional modules such as staff management, finance and accounts, hostel management, library management, and transport scheduling. This would provide a unified solution for the entire institution, eliminating the need for multiple standalone systems. A centralized ERP approach would not only enhance data consistency but also improve inter-departmental coordination and institutional productivity.

K. Continuous Monitoring and Upgradation

As technology continues to advance rapidly, it is essential for the SIS to adopt a continuous improvement model. Regular updates, bug fixes, and feature additions will ensure the system remains relevant and secure. Periodic user feedback should be collected to identify usability challenges and performance issues. The development team can implement an agile update cycle, ensuring that new features are tested and deployed efficiently. Continuous monitoring will help maintain system reliability and user satisfaction over time.

Summary

In summary, the future enhancements proposed for the Student Information System aim to transform it from a basic academic record-keeping platform into a comprehensive, intelligent, and secure educational management solution. Through technologies such as cloud computing, artificial intelligence, IoT, and blockchain, the SIS can evolve into a powerful ecosystem that supports real-time collaboration, predictive analytics, and smart decision-making. By integrating these future technologies, educational institutions can achieve greater efficiency, transparency, and innovation in managing student data and academic processes.

VIII. CONCLUSION

The Student Information System (SIS) serves as an essential innovation in the digital transformation of educational institutions. It provides a structured and automated framework to manage every aspect of student data — including registration, attendance, academic performance, and report generation. By integrating multiple functions into a single platform, the system reduces administrative complexity, eliminates redundancy, and enhances overall institutional efficiency. The transition from manual to automated record management has brought about a remarkable improvement in data accuracy, processing speed, and user accessibility. Educational institutions that previously relied on paper-based systems have now adopted SIS solutions to ensure error-free, secure, and real-time management of student-related data.

International Journal of Science, Engineering and Technology
ISSN: 2348-4098, P-ISSN: 2395-4752

The system's design, architecture, and modular approach emphasize flexibility, scalability, and usability. Each module — whether it be student registration, attendance management, result analysis, or administrative control — functions independently yet contributes to a cohesive information management environment. The use of Java as the programming language provides strong object-oriented principles, platform independence, and security, while MySQL ensures reliable database management and efficient data storage. The inclusion of a Graphical User Interface (GUI) allows users with minimal technical expertise to interact with the system smoothly, making it a practical solution for all types of educational institutions, from schools to universities.

One of the most significant achievements of the SIS is its ability to enhance accuracy and transparency. Human errors that commonly occurred during manual entry or report generation have been minimized through automated validation and verification checks. Additionally, the system's role-based authentication ensures that sensitive data remains protected while authorized users can easily access the required information. Teachers can quickly record attendance and grades, administrators can monitor departmental performance, and students can view their progress reports — all through a single integrated interface. This transparency fosters better communication among stakeholders and helps maintain accountability at every level of the institution.

The results and evaluations of the implemented SIS clearly demonstrate its practical effectiveness. Institutions that deploy this system report a drastic reduction in administrative workload, improved coordination between staff, and timely availability of reports and analytics. Teachers spend less time performing repetitive administrative tasks and can focus more on academic activities, thereby improving educational quality. For students, the SIS offers immediate access to grades, attendance, and performance feedback, encouraging self-evaluation and continuous improvement. Overall, the implementation contributes to a more organized and data-driven academic environment.

Another notable aspect of the system is its long-term sustainability and scalability. Since the SIS is built using modular architecture, it can be easily upgraded to include additional features in the future without affecting existing functionalities. For example, modules for fee management, online examination systems, automated SMS/email notifications, or even AI-based predictive analytics can be integrated into the existing framework. This flexibility ensures that the system remains relevant and adaptable as institutional needs evolve and as technology advances further.

From an educational and technological standpoint, the SIS represents a step toward smart campus infrastructure, where data and digital systems drive efficiency, accuracy, and decision-making. In an era where digital transformation is essential for competitive growth, adopting such systems allows educational institutions to align with international standards and modern educational practices. Governments and educational boards are increasingly encouraging digitization in academic administration, and the SIS stands as a practical example of how such initiatives can be realized effectively.

Furthermore, the system contributes to environmental sustainability by reducing paper consumption and promoting eco-friendly administrative practices. In traditional systems, maintaining physical files, attendance registers, and exam records required a significant amount of paperwork and storage. The SIS eliminates this dependency by storing all information electronically, thereby reducing waste and conserving resources. This aligns with the global movement toward sustainable digital transformation and green technology in education.

The successful deployment of SIS also has a psychological and organizational impact. It instills confidence among teachers and students by ensuring that information is handled systematically and securely. Institutions gain a reputation for being technologically advanced and student-centric, which

in turn improves their credibility and attractiveness to new students. Moreover, the ability to generate analytical reports allows management to identify performance trends, implement corrective measures, and make informed academic and policy decisions based on accurate data.

In conclusion, the Student Information System is not merely an academic project but a transformative educational management tool that bridges technology and administration. It simplifies complex operations, improves communication, and supports the continuous monitoring and evaluation of student performance. With its automated features, robust security, and scalability, the SIS stands as a model solution for modern educational challenges. Future enhancements such as cloud-based storage, AI-driven data analysis, mobile accessibility, and integration with Learning Management Systems (LMS) will further strengthen its potential and make it an indispensable part of the digital education ecosystem.

By integrating this system into institutional workflows, educational organizations can achieve enhanced productivity, improved accuracy in student record management, and better engagement among all academic stakeholders. The Student Information System therefore not only meets the present requirements of data management but also paves the way for a smarter, more transparent, and sustainable academic future.

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