IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

Smart College Utility Hub

Mr. Aryan Gangrade[1], Mr. Habib Mansuri[2], Mr. Archit Barge[3], Mrs. Sujata Gawade[4]
Student, Computer Technology[1-3]
Guide, Computer Technology[4]
Bharti Vidyapeeth Institute of Technology Kharghar, Navi Mumbai, India

Abstract: *Efficient academic management is essential for ensuring transparency, communication, and operational effectiveness within educational institutions. Traditional college management systems rely on manual processes and disconnected digital tools, resulting in delays, data inconsistencies, and limited real-time accessibility. Recent advancements in web technologies and cloud computing enable the development of centralized platforms capable of managing academic and administrative tasks efficiently. This research presents the design and implementation of the Smart College Utility Hub, a cloud-based multi-portal academic management system that integrates Admin, Teacher, Student, and Parent modules. The proposed system is developed using HTML, CSS, JavaScript, JSP, Servlets, and MySQL, and deployed on AWS cloud infrastructure for remote accessibility. The platform supports secure role-based authentication,*
real-time attendance tracking, assignment management, marks monitoring, and announcement broadcasting through a structured web dashboard. Experimental validation demonstrates reliable performance, secure data handling, and improved operational efficiency, making the system suitable for institutional-level deployment.

Keywords: Academic Management System, Cloud Deployment, JSP, Servlets, MySQL, AWS EC2, Role-Based Access Control, Three-Tier Architecture, Smart Campus

I. INTRODUCTION

Educational institutions increasingly face challenges in managing academic and administrative operations efficiently. Traditional college management systems rely on manual record-keeping, paper-based processes, and fragmented communication methods, resulting in delays, data inconsistencies, and limited transparency. Such systems are often inefficient and unsuitable for real-time monitoring and centralized access.

Recent advancements in web technologies and cloud computing enable the development of integrated digital platforms for academic management. These technologies support secure authentication, structured data storage, and remote accessibility through web-based dashboards. This research focuses on developing the Smart College Utility Hub, a cloud-based multi-portal academic management system that centralizes institutional processes and provides real-time access to attendance, assignments, marks, and announcements. The proposed system aims to improve operational efficiency, enhance communication, reduce manual workload, and ensure secure data management within educational institutions.

II. METHODOLOGY

The methodology of the Smart College Utility Hub involves integrating frontend interfaces, backend processing, database management, authentication mechanisms, and cloud deployment modules. The system follows a structured three-tier architecture to ensure modularity, security, and scalability.

A. User Interface Development

The Presentation Layer is developed using HTML, CSS, and JavaScript to design structured login pages, dashboards, forms, tables, and navigation menus. Separate interfaces are created for Admin, Teacher, Student, and Parent users to

DOI: 10.48175/IJARSCT-31526

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

ensure role-based accessibility. Client-side validation is implemented to enhance usability and reduce invalid data submission.

B. Backend Processing

The Application Layer is implemented using JSP and Servlets. Servlets handle authentication, session management, request processing, and business logic execution. User credentials are validated through database queries, and authorized users are redirected to their respective dashboards. Backend logic ensures controlled data access and structured workflow management.

C. Data Management

The system uses MySQL as the relational database for storing student records, attendance data, assignments, marks, and announcements. JDBC connectivity enables secure interaction between the application layer and the database. Primary and foreign keys maintain referential integrity and prevent data redundancy.

D. Cloud Deployment and Access

The application is deployed on AWS EC2 infrastructure running Ubuntu Linux and Apache Tomcat server. The deployment ensures remote accessibility, secure configuration, and scalability. The cloud environment supports multi-user access and maintains stable system performance under concurrent operations.

III. MODELING AND ANALYSIS

The modeling of the proposed Smart College Utility Hub is represented using standard UML diagrams to describe system behavior, user interactions, and structural relationships. These diagrams help in understanding workflow execution, role-based access control, data flow mechanisms, and overall system logic. Modeling ensures clarity in system design and validates the architecture before full-scale implementation.

The sequence diagram illustrates the interaction between the User Interface, Servlet Controller, Database, and Dashboard during system operations such as login and data retrieval.

Sequence of Operations:

1. User enters login credentials on the web interface.
2. The request is sent to the corresponding Servlet for validation.
3. Servlet verifies credentials by querying the MySQL database.
4. Database returns authentication result to the Servlet.
5. Servlet creates a session and redirects the user to the appropriate dashboard (Admin, Teacher, Student, or Parent).
6. Dashboard requests relevant academic data from the database.
7. Data is retrieved and displayed on the user interface in real time.

This sequence ensures structured communication between the Presentation Layer, Application Layer, and Database Layer, maintaining secure and efficient request- response handling.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

A. SEQUENCE DIAGRAM – SMART COLLEGE UTILITY HUB

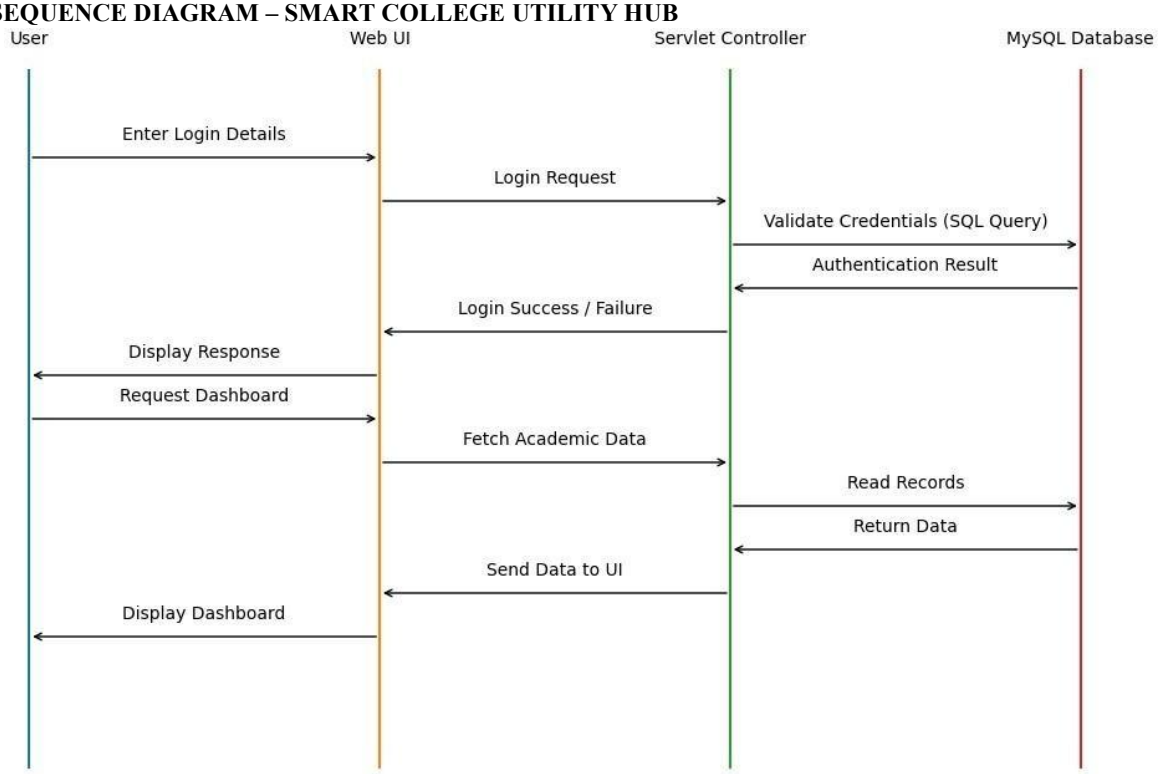

Fig 1: Sequence Diagram – System Operation Flow

DOI: 10.48175/IJARSCT-31526

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

B. Activity Diagram – System Workflow

The activity diagram represents the overall workflow of the system from sensing to alert generation.

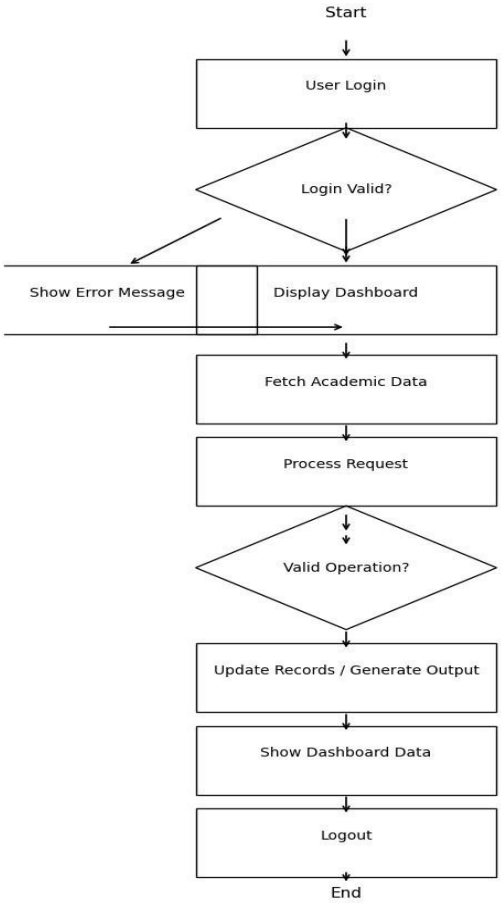

Fig 2: Activity Diagram – System Workflow

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

C. Class Diagram – System Structure

The class diagram defines the structural relationship between major system components.

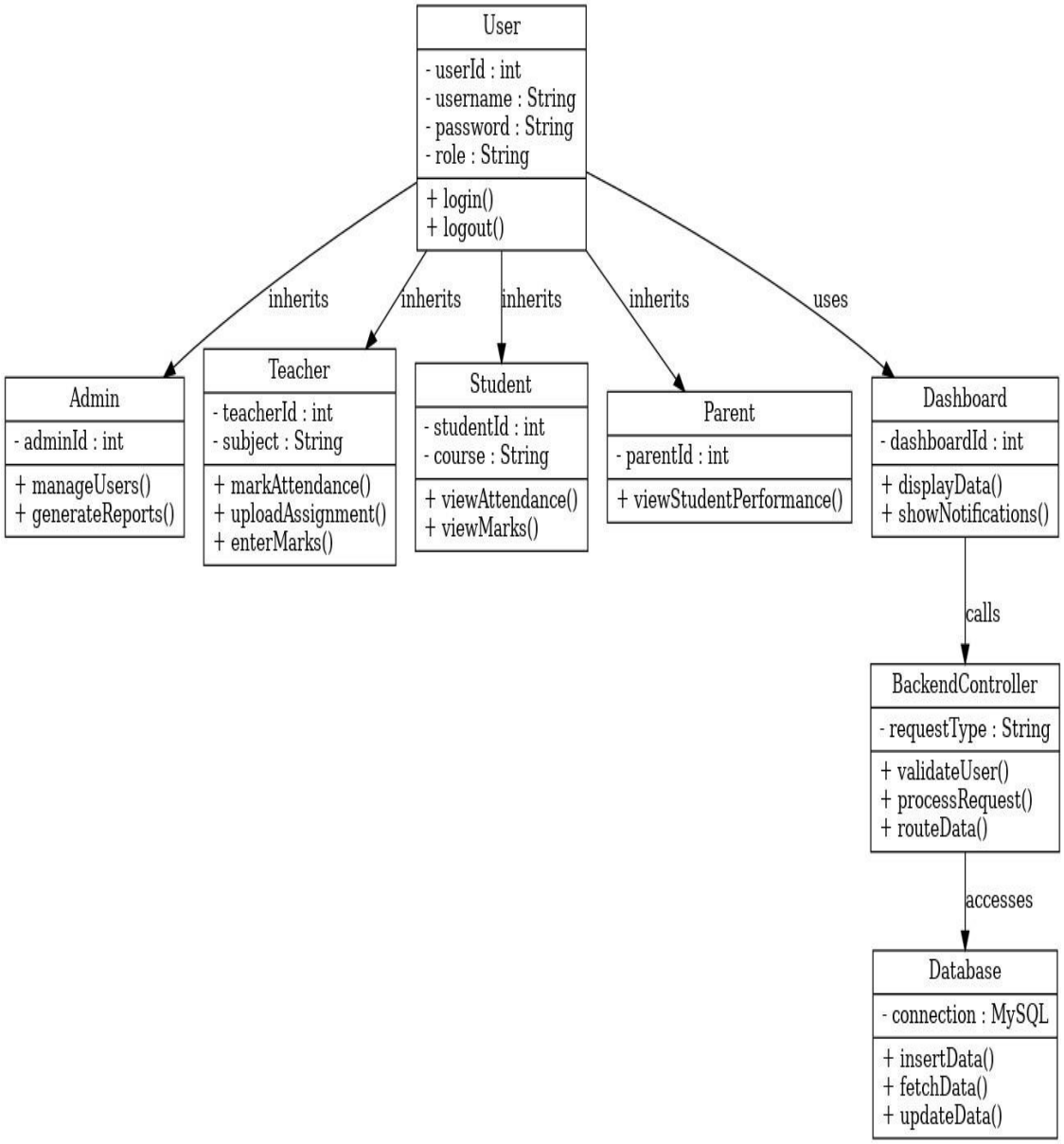

Fig 3: Class Diagram – System Structure

DOI: 10.48175/IJARSCT-31526

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

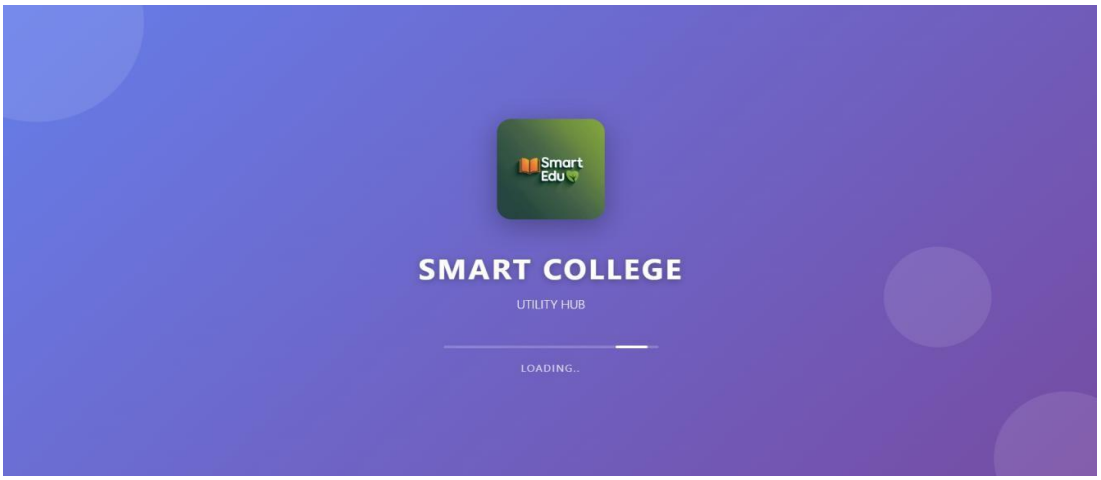

Fig 4: Splash Screen of Smart College Utility Hub Displaying

Application Loading Interface

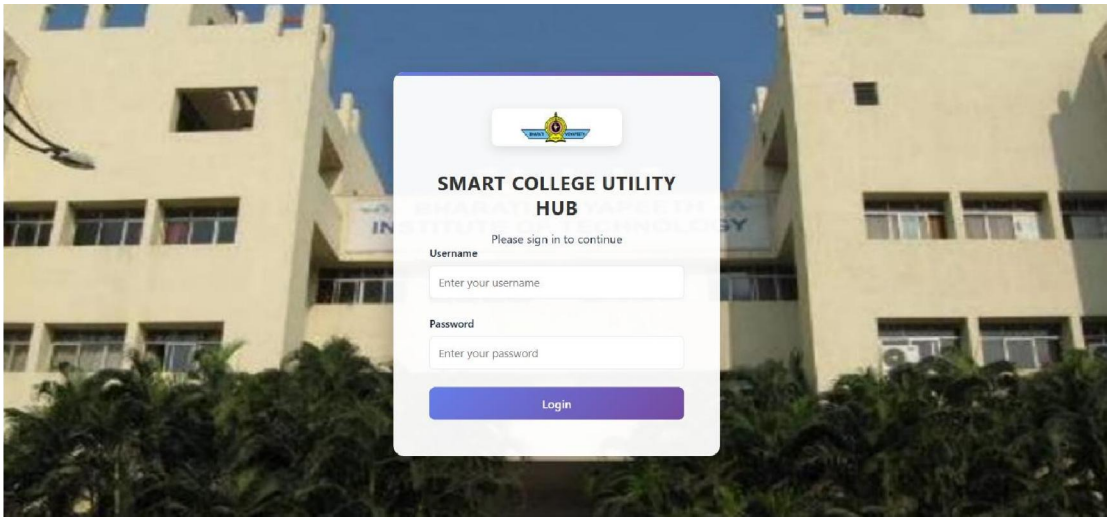

Fig 5: Authentication Interface – Login Page of Smart College Utility Hub with Username and Password Fields

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, March 2026 Impact Factor: 8.2

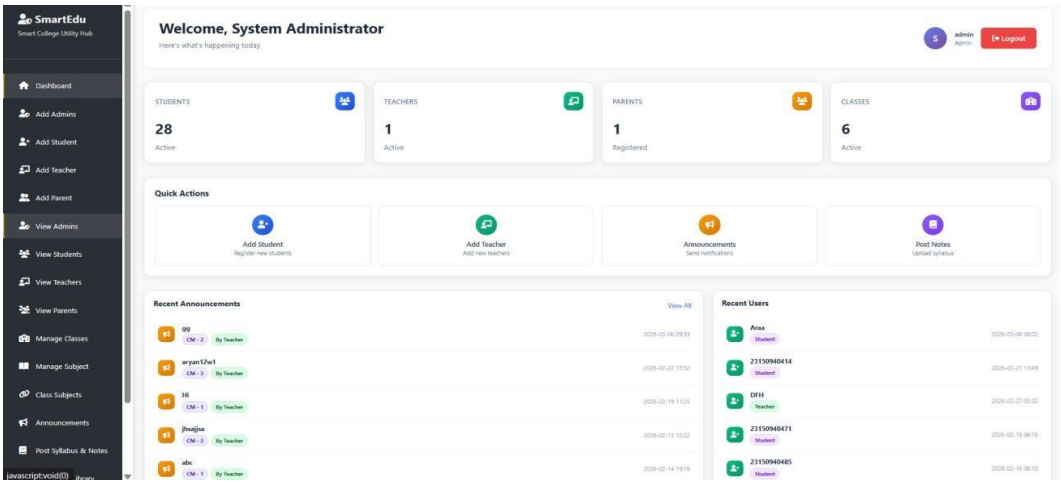

Fig 6: Sequence Diagram – Authentication and Data Retrieval Workflow of Smart College Utility

V. RESULTS AND DISCUSSION

Experimental deployment of the Smart College Utility Hub under multiple testing scenarios demonstrated stable system performance and secure data handling. The platform successfully processed login authentication, attendance updates, marks entry, and dashboard data retrieval with an average response time of approximately 1–2 seconds.

Role-based access control effectively restricted unauthorized operations, ensuring data integrity across Admin, Teacher, Student, and Parent portals. Real-time dashboard updates improved transparency and communication efficiency. Comparative evaluation indicates reduced manual effort, faster data processing, and improved institutional workflow compared to traditional management systems.

VI. CONCLUSION

The proposed Smart College Utility Hub successfully delivers a centralized, secure, and efficient academic management platform. Integration of web technologies, structured database management, and cloud deployment provides a scalable and practical solution for modern educational institutions. The system enhances transparency, reduces manual workload, and improves communication among administrators, teachers, students, and parents. The platform is suitable for institutional deployment and supports future expansion toward a fully digital smart campus environment.

VII. ACKNOWLEDGMENT

The authors express their sincere gratitude to the project guide, faculty members, and the Department of Computer Technology for their continuous guidance, encouragement, and valuable support throughout the development of the Smart College Utility Hub. The authors also thank the institute for providing the necessary infrastructure and resources to successfully complete this research work.

REFERENCES

[1]. Oracle Corporation, Java Platform, Standard Edition Documentation, Oracle, 2023.
[2]. Oracle Corporation, Java Servlet Technology Overview, Oracle Documentation, 2022.
[3]. Oracle Corporation, JavaServer Pages (JSP) Technology, Oracle Documentation, 2022.
[4]. Oracle Corporation, MySQL 8.0 Reference Manual, Oracle, 2023.
[5]. Amazon Web Services, Amazon EC2 User Guide for Linux Instances, AWS Documentation, 2023.
[6]. R. Pressman and B. Maxim, Software Engineering: A Practitioner's Approach, 8th ed., McGraw-Hill, 2019.