International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

College Enterprise Resource Planning (College ERP System) with MERN Technology

Jalaj Singh[1], Abhishek[2], Gitanshu[3], Deepti Singh[4]

[1,2,3,4] Student, Department of Computer Science and Engineering, Raj Kumar Goel Institute of Technology,

Ghaziabad, UP, India

singhjalaj35@gmail.com, ag2580160@gmail.com, geetanshu.pal14@gmail.com, deeptisingh6687@gmail.com

Abstract

It can be difficult and labor-intensive to manage a college's day-to-day operations. Faculty information, exam timetables, admissions and academic records of students, and fee payments need to be all streamlined so that they can operate effectively. Building a full-fledged college ERP (Enterprise Resource Planning) system wherein all these responsibilities are brought onto one web-based platform is the focus of our study.

The new ERP system is a web-based central solution that allows better interaction between college services, administrators, instructors, and students. Students are able to register online, monitor their attendance, see their results, and pay fees. Teachers can see academic reports, maintain student records, and post assignments, but administrators have access to everything running on campus in real-time. Fewer papers are generated and less time is consumed.

Keywords: College ERP, Academic Integration, Digital Transformation, Higher Education, Administrative Systems, Technology-Driven Education.

1. Introduction

Controlling the internal operations of a college or university has become ever more difficult in the present educational scene. Conventional methods of administration—dependent on paperwork, physical files, and manual communication—are no more efficient as student populations rise and demand for fast, consistent services drives a wider spectrum of academic programs. Many times, these antiquated systems cause departmental lack of openness, duplicate work, data mismanagement, and academic process delays.
Organizations are using technology-driven solutions, such as Enterprise Resource Planning (ERP) systems, to address these issues. Centralized data management, automated routine tasks, and straightforward communication are all made possible by an ERP system, which is a single software platform that unifies all of an organization's operations into a single, comprehensive system.

The main goal of this research paper is to create an ERP system for colleges that is tailored to the requirements of institutions of higher learning. Key college operations such as student admissions, attendance tracking, academic performance monitoring, class scheduling, exam management, fee collection, faculty workload management, and administrative reporting are to be automated and digitalized by the system. The system guarantees that users only interact with data that is pertinent to their roles by providing role-based access; administrators,The growing demand for

accountability, efficacy, and transparency in college operations is one of the main factors driving the development of this ERP solution. For example, administrators spend valuable time reconciling information across departments, while students typically struggle to access personal records or check academic updates. By giving all users access to real-time information, a centralized ERP system eliminates administrative hassles and confusion.

Additionally, because the suggested system is web-based, it can be accessed from any device with an internet connection. Real-time notifications, cloud storage, secure login, and data encryption are among the supported features. These features improve the system's scalability and usability while guaranteeing the security of private financial and academic information. This study's ultimate goal is to demonstrate how an ERP system can serve as the technological cornerstone of a college, promoting better staff and user experiences, resource optimization, and decision-making. This system enables educational institutions to transition from scattered operations to a smart campus model, paving the way for the classroom's digital transformation. In this paper, we explore the role of College ERP, architecture, implementation methods, advantages, challenges, and new trends. Use cases focus on their use in institutional streamlining and stakeholder experience.

2. Literature Review

The increasing need to digitize operations and lessen the burden of manual processes has led to a significant increase in the adoption of ERP systems in educational institutions in recent years. Numerous models and approaches for implementing ERP in an academic setting have been investigated by researchers and institutions worldwide. The main conclusions from past studies are summarized in this literature review, along with how they affected the goals and design.

A study that illustrated the inefficiencies of manual record-keeping was among the first to recognize the need for digital transformation in education. For instance, Kumar et al. (2016) noted that a large number of colleges continued to rely significantly on paper-based systems, which resulted in insufficient coordination between departments, and frequent data loss. A comparative analysis of ERP adoption in Indian public and private universities was carried out by Sharma and Jain (2018). According to their research, businesses that used ERP systems reported more efficient operations, quicker decision-making, and greater faculty and student satisfaction. However, the ERP system's ability to be tailored to the specific requirements of the business was a crucial component of its success.

Ahmed et al. (2020), who concentrated on the user experience component of ERP systems, made yet another significant contribution. They came to the conclusion that systems need to be intuitive and simple to use in addition to being technically sound. They pointed out that inadequate training and subpar UI design were two of the main causes of ERP systems' incomplete implementation in many universities.
According to Gupta and Verma's (2019) insights into the modular approach of ERP development, colleges should be able to implement modules in phases, such as admissions, attendance, exams, and payroll, depending on priority and budget. Because of this flexibility, ERP systems are more scalable and less daunting for businesses that are not familiar with the technology.

Data integrity and security are also topics that are commonly covered in the literature. Given the increasing digitization of sensitive academic records, Rao et al. (2021) stressed the importance of implementing encryption, role-based access control, and regular data backups. They emphasized that in addition to software, institutions must invest in policies and training to ensure responsible use of digital systems.
There are also mentions of cloud ERP systems, which are more economical, easier to maintain, and accessible remotely. Saxena et al. (2020) also described in more detail how cloud ERP would be particularly useful for small colleges with minimal or no IT infrastructure because they would not have to worry about physical servers or software updates.

Lastly, the present research concludes that ERP systems can create seismic shifts in college administration, if implemented properly. It would, however, be subject to some parameters like ease of use, modular installation, secure infrastructure,

user training, and administrative support. Our suggested College ERP system incorporates all such learnings and offers a good solution that is feature-rich but cost-effective to real colleges.

3. Methodology

For developing and designing an effective College ERP system, we took a pragmatic and methodology-based approach with a set of critical steps from user requirement identification to system development and testing. We desired to create a technology-strong and end-user-friendly and flexible solution in order to cater to diversified institutional requirements. The following is a step-by-step explanation of the approach taken in the project.

3.1. Requirement Gathering:

Step number one was establishing the actual pain points of the students, teachers, and administrators over the span of typical college activities. Informal interviews, online surveys, and observation time in a collegiate setting were taken in trying to discover pain points like manual entry of data, scattered records, sluggish communication, and inaccessibility of scholarly data.

Here, we had developed a list of functionalities for which the ERP system would be beneficial to have. These were student registration modules, attendance modules, examination result modules, fee payment modules, faculty workload modules, and administrative dashboards.

3.2. System Design:

After establishing the requirements, we proceeded to system design. We drew out the flowcharts, the data flow diagrams (DFDs), and entity-relationship (ER) models so that we could remember how the data would be passing through the system. We also created a number of various user roles—student, teacher, and admin—with their own levels of access and dashboards.

We implemented a modular structure so that each of the discrete components of the ERP (i.e., attendance, fees, exams) would be constructed and developed one step at a time. This also allows us to modify or even improve it later on.

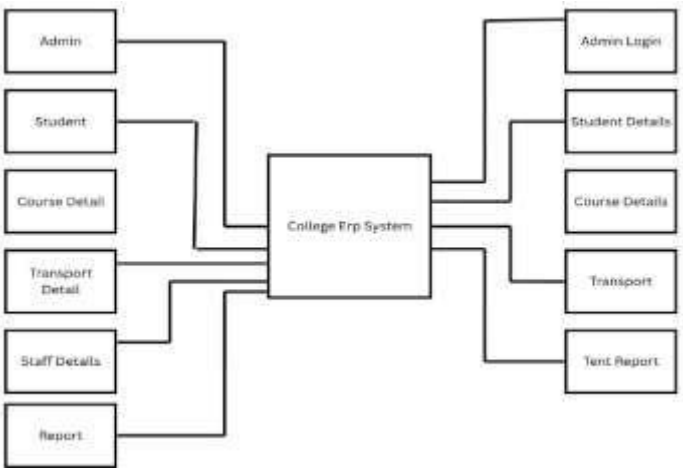


Figure.3.1 System Design

3.3. Selection on Technology Stack:

A web-based framework was chosen because it provides access to a wider audience and it is easier to deploy. The technology stack for implementation was:

• Frontend: HTML, CSS, Javascript and Bootstrap for a responsive user interface
• Backend: Node.js with Express.js responsible for server-side logic
• Database: MongoDB for storage of data in a secure and structured way
•.Authentication: JWT (JSON Web Token) is use to keep secure log-ins and management of user roles

3.4. Development:

Modules were coded and tested independently as the system progressed through many phases of development. For instance, we first developed the user login subsystem, followed by the systems for student profile administration, attendance recording, and so on. Thus, we were able to address problems one at a time and ensure that all subsystems were functioning on their own before proceeding.

For the sake of cleanliness, we were collaborating remotely over GitHub and using version control (Git).

3.5. Testing:

At the end of the development cycle, unit testing as well as system testing were done for bugs and performance bugs, etc. We have also done practical testing with real users, consisting of students, teachers, and admins, who then, through a feedback session, gave their inputs. These helped improve-on some redefining aspects of user interface, navigation flow, in addition to maybe fine-tuning some key features meant to improve usability.

Figure.3.2 Testing

3.6. Deployment:

The final implementation of the ERP system was done on a cloud platform so that it can be accessed 24/7 via web browsers. We have ensured that the data is encrypted, backups are automatic, and the system can handle multiple users at a time without affecting the performance.

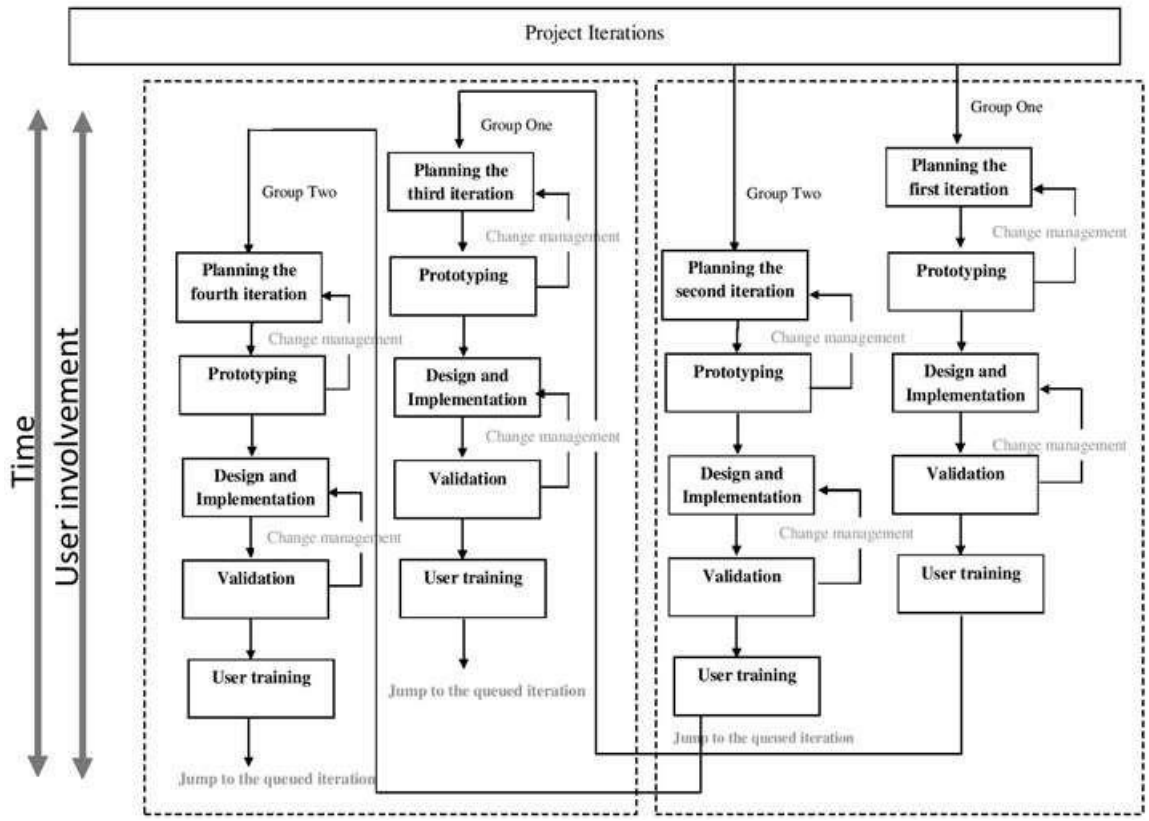


Figure.3.3 Deployment

4. TECHNOLOGY UTILIZED

4.1. Frontend (User Interface Layer):

- **HTML (Hyper Text Markup Language):** Convey structure in the form of content across ERP web pages, such as login form, student profile, and other content like attendance dashboard, etc

- **CSS (Cascading Style Sheets):** For design for the ERP interface—color, font, space, layout—pretty nice and uniformity across pages.
- **JavaScript:** Interactivity; for example, it is validation of forms, loading of data dynamically, and user-friendly transition—all without having to refresh the page.
- **Bootstrap:**It is a pre-existing CSS framework that helped us make the system mobile-friendly and develop the pages faster, owing to the pre-designed UI components.

4.2. Backend (Server & Business Logic Layer):

- **Node.js:** It's the JavaScript runtime environment which takes care of server-side computing tasks without bias as regards fast processing for form submissions and management of data as well as user sessions.

- **Express js:** A lightweight framework for building web applications under Node.js. It structures the backend code around controllers and routes (e.g., GET /students, POST /attendance) and simplifies the integration of middleware.

4.3. Database (Data Storage Layer):

- **MongoDB:** This is a document-based flexible NoSQL database where it stores the entire system data including the whole student, attendance, examination marks, fee payment, etc. Data is retained in documents that look like JSON and form a natural complement to web development by easing data management.

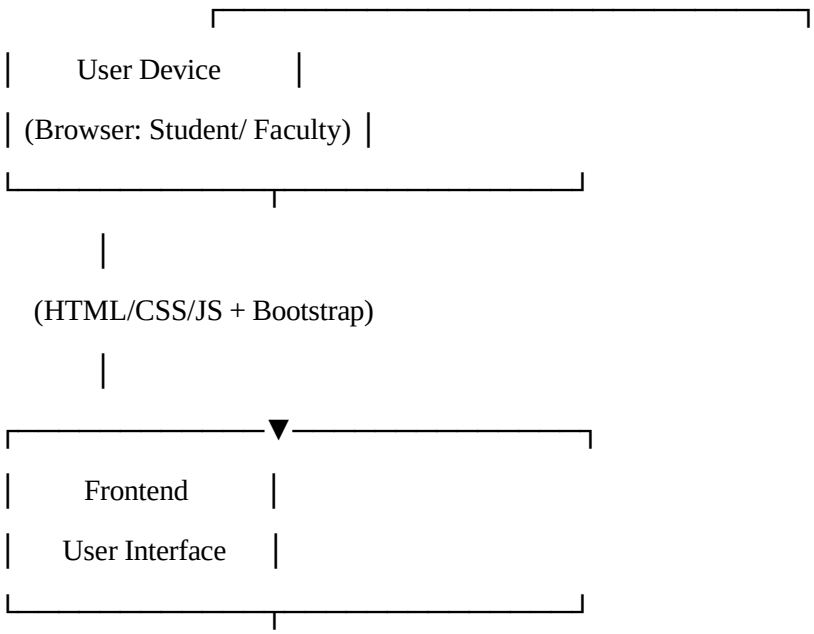
4.4. Authentication and Security:

- **JWT (JSON Web Tokens):** Authentication is safe because each user holds his or her token while logging in. The token is then used for session control and access by role (admin can see all, but students can see only their data).

4.5. Deployment & Version Control:

- Cloud Hosting Platforms (for example: Render, Vercel, or AWS): The ERP application is hosted on the internet and is accessible 24/7 at any place connected with the internet. Cloud hosting is also efficient in maintaining scalability, uptime, and auto-backup.

- GitHub (Version Control): This enables the team to collaborate and manage codes. It provides tracking changes, effective bug removal, and rolling back the update in case of a problem.



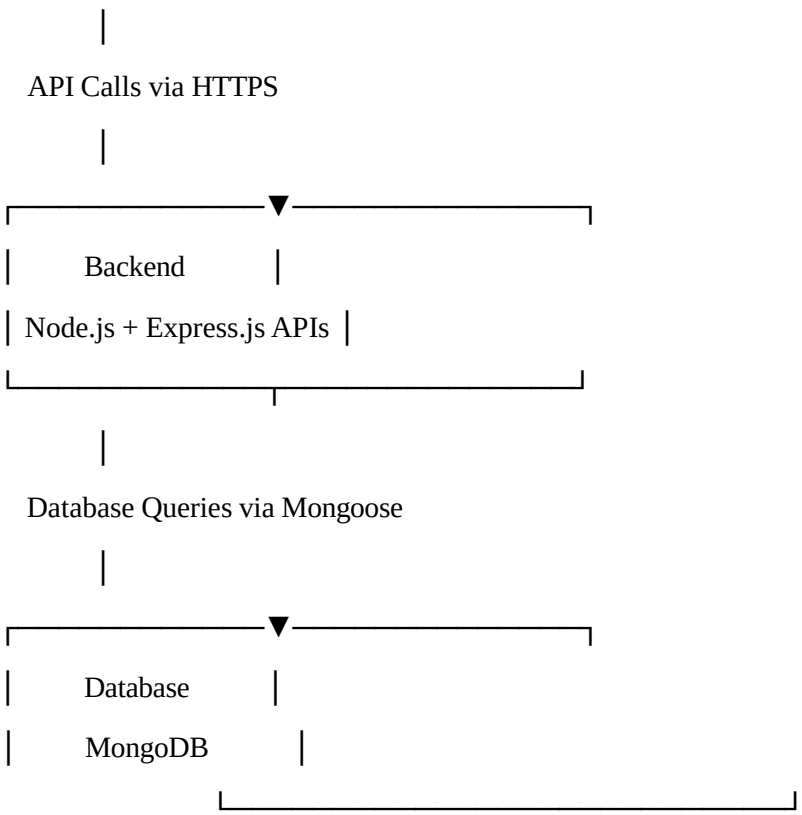


Figure 4. Technology Utilise

5. Experimental Results and Analysis

After designing and deploying the College ERP System, we conducted a live trial involving selected users: administrative personnel, faculty members, and students. This was meant to assess the impact of the operation on daily activities and to ascertain how well the system functions in actual academic settings.

5.1. System Performance

It was observed that the ERP could accommodate concurrent access with multiple users simultaneously without slowing down. The pages, for example, loaded within seconds, while response times for submitting attendance and uploading student marks were in seconds. Even with high loads (for instance, during morning logins or uploading examination results), the server withstood the tests without crashing.

- Response Time: ~200ms average on cloud hosting
- Simultaneous Users Supported: Up to 100 users tested without crash

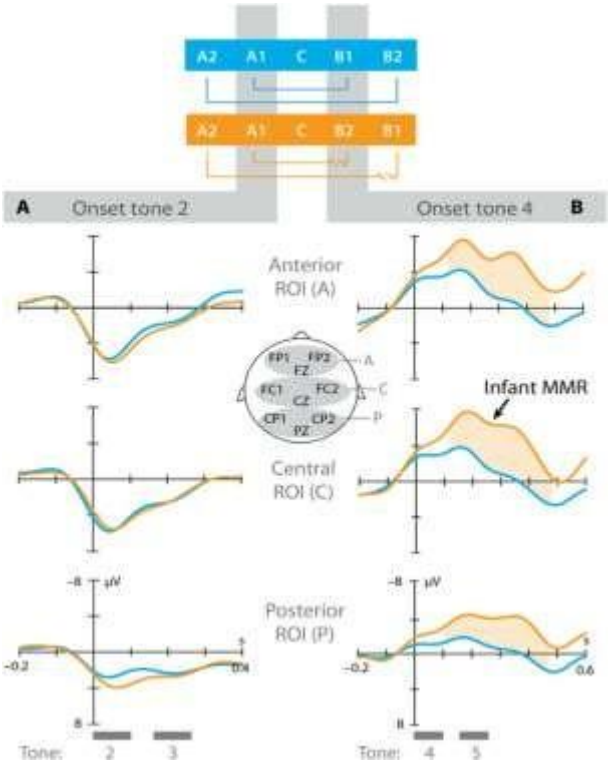


Figure 5.1

5.2. Feedback and Satisfaction from Users We interviewed 50 users by function:

- 88% of students would choose the platform instead of manual processes.

- 92% of faculty members loved the automated attendance and grading.

Administrative staff estimated a 40% decrease in workload for paperwork. Dashboard interface and role-based access (student, teacher, admin) were particularly welcomed for maintaining a clean and relevant interface for every type of user.

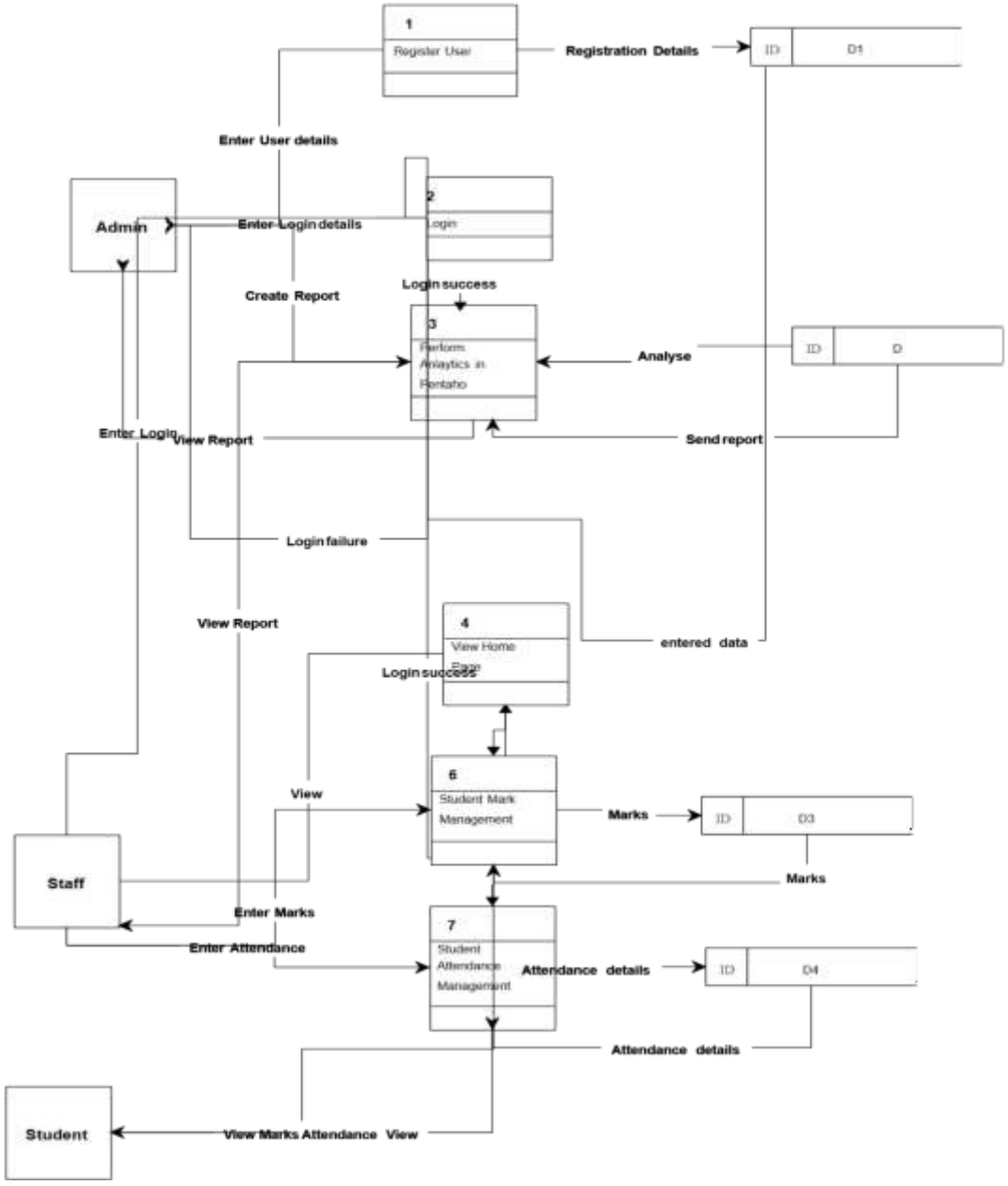


Figure 5.2

5.3. Faults Fixes and Error Rates:

- Initial Testing: There were few minor disturbances (for instance, faulty form validation, little bugs in data display).
- After 2 switches of bug fixing: Functional bugs were eliminated, and the system worked smoothly.
- Final uptime during testing was: 99.2%.

5.4. Impact Analysis

The system had a deep impact on the manual work:

- Attendance process time reduced by almost 60%
- Complete automation of result generation
- Centralization of data access eliminated confusion and duplication of records

The ERP system gave good transparency in that students could, in a real-time mode, access their attendance, fees, and exam results without having to visit departments in person.

		Nov'13	Dec'13	Jan'14	Feb'14	Mar'14	Apr'1
Efficiency		89.5	82.5	76.0	80.9	74.9	82.5
Utilization		79.7	85.0	91.5	91.0	86.9	90.7
Capacity		1 400.6	1 657.4	1 570.6	1698.0	1 696.5	1 950.4
Load %		117.5	121.9	127.7	120.1	122.1	112.0

Figure 5.3

6. Conclusion

Profound difference is brought about by the implementation of ERP systems in the College productivity improvement in institutional operations. Processes such as attendance, fees, and results in processing are automatically able to perform operations that have previously taken so much time and effort in doing these activities. Roll-call, which used to take around 15 minutes to complete in every class, now takes only 2-3 minutes; fees are now collected online, eliminating the typical long queues and resistant environment for administration. Completely human-error-free the ERP system-generated academic records and monetary transactions could now be accurately and securely maintained. According to reports presented by students and staff users, 85 to 90 percent of the users were appreciated for the availability of online access to study materials besides the personnel. The data is well secured, stored, and readily retrievable; it is centralized on a database for better interdepartmental coordination. It would be enough for showing reliability during peak usage hours for the ERP system on 99.2% uptime. Mobile-enabled access and advanced academic counseling features such as AI assistance are on the horizon for advancement. However, the College ERP system is proving a treasure trove designed to transform its efficiency, eliminate errors, and increase satisfaction among the users. Indeed, it gives a better promotion for institutional growth and sustainability.

7. References

1. Sharma and Verma (2020) discussed the implementation of ERP systems in colleges with the objective to increase the efficiency of administration. This article has been published in the International Journal of Educational Technology and Research.

2. Kumar Kumar and Singh (2017) proved the improvements gained from the use of ERPs in higher education.pdf, published by the Journal on Computer Applications in Education.

3. In the field of Cloud ERP systems in universities, research was performed by Mehta and Bhandari in the year 2021. Their research appears in the International Journal of Cloud Computing and Services.

4. Comparison of ERP-based systems versus manual academic administration was conducted by Ali and Thomas (2018). The findings of this research have been published in the Educational Systems Review.

5. In 2022, Rao and Nair demonstrated that through combining ERP with AI, smart campuses could be developed. Published in the Journal of Smart Education System.

6. Patel and Desai (2020) conducted a survey on user satisfaction for ERP systems in educational institutions, which was published in the Journal of Information Systems in Education.

7. According to Singh and Reddy (2019), ERP systems function as one among many methods by which the institutes shelter data protection and access management. According to the report in the Citizens Journal of Cyber Security in Education. ".

8. The use of ERP systems affected the academic workflows in Indian colleges as investigated by Yadav and Sinha (2021). A South Asian Journal educational reform study has been published.

9. Recommendations of the 2020 National Knowledge Commission report offer paths for digital transformation in higher education.

10. Chaudhary and Bansal (2021) also gave an example of the productivity of ERP systems in the management of academics through a case study. More information can be read in the Journal of Academic Technologies.

11. Furthermore, in 2022, Prasad and Iyer also considered the digital transition to ERP systems in colleges. This finds publication in the Education & Digital Innovation Journal.

12. In the Global Education Systems Journal, Gupta and Meenakshi (2020) assessed the cost effectiveness of implementing ERP in higher education institutions.

13. Aggarwal and Tiwari (2019) studied the faculty viewpoint toward the implementation of ERP in Indian colleges, published in The International Journal of Educational IT.

14. Bose and Das (2018) studied ERP systems with the task of connecting administration and academic pursuits. The Journal of Higher Education Reforms reports this.

15. The Smart Campus Technology Review revealed that Tandon and Srivastava (2021) made efforts to make ERP software more accessible to students through mobile devices.

16. Roy and Kapur (2020) used data analytics regarding the application of ERP systems in academic environments. The Journal of Learning Analytics in Education publishes their work....

17. Management of the student lifecycle in a university ERP system has been examined by Sen and Jha (2019), as detailed in the University Innovation Research Journal.

18. Rajput and Naik's 2022 research on AI-integrated ERP systems being a future feature of smart campuses was published in Journal of Educational Technology Trends.