



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

LEARNING PATH DASHBOARD

1. Prof. Manisha Shitole, 2. Digvijay Virendra Shinde, 3. Malhar Dave

4. Ayushi Vikash Singh, 5. Ajinkya Balasaheb Deore

Department of Computer Science and Engineering

MIT ADT University, Pune, India

Abstract— Management of all the content in the courses, student progress, attendance in an efficient way is still a big challenge in the universities and organizations which results in unorganized data and less transparency into student's performance. The already present methods in the market are time consuming and take lots of hard work for the educators to maintain a proper track of learning path and provide proper guidance to the students. To overcome these limitations, the proposed “Learning Path Dashboard” is developed to provide a web based solution that combines automated learning path creation along with attendance management and resources. The platform under the supervision of the teacher automatically generates a learning path according to the course duration and along with that the educators can also upload the resources such as videos, images, pdf's with each topic. It also has attendance tracking which has a record of daily participation and also links it with the topics covered that day to highlight the learning gaps. The system is built using a React-based frontend and with Material UI features whereas the backend is handled using spring boot to ensure smooth performance and scalability. Some important features include dynamic topic planning, centralized resource handling, attendance monitoring and performance tracking through an interactive dashboard. With this approach, the system supports better and easier academic management, rescues the load of manual efforts, and helps improve the student learning.

Index Terms— Learning Path Dashboard, Educational Technology, Learning Path Generation, Student Progress Tracking, Attendance Management System, Resource Integration, Web Application, React, Material UI, Spring Boot, Data-Driven Education, Academic Analytics, E-Learning Systems, Student Performance Monitoring

I. INTRODUCTION

A good and effective academic management depends on a structured approach of content delivery, continuous student monitoring and attendance tracking. But, in many of the universities and organizations, these things are handled using manual tools and methods making it hard for the educators to have consistency and efficiency. Due to unavailability of such systems, it results in the overall quality of the education.

To solve these problems, we present the “Learning Path Dashboard”, a web based system which is designed to change the academic management system which includes learning path generation. Resource organization, attendance, progress report all under one platform. The system aims to create a structured learning experience by automatically distributing the course topics across a schedule in a given duration of course. This approach helps to maintain a clean record of learning path for both teachers and students.

The platform gives access to the educators to upload various learning resources over the platform which can be accessed by the students, ensuring centralized access. It also has the attendance tracking system which tracks and records the attendance daily and links it with the topic coverage to highlight the learning gap of missed topics of that student. This helps to understand more about students' engagement and performance in academics.

The system is built using the modern web technologies which has a quick and responsive UI interface built with React and Material UI along with the backend developed using the spring boot. All this creates an efficient architecture supporting efficient data handling, scalability, and smooth user interaction. The dashboard provides information such as attendance, progress, and performance.

By combining all the things such as the learning paths, resource management, performance, attendance tracking within a single system, the learning path dashboard ensures to reduce the manual work and improve the transparency between teachers and students and improve education quality. This solution is a must for today's growing data driven and technology supported education systems for better education.

II. LITERATURE REVIEW

Anderson and Regenbrecht et al. [1], in “Traditional Approaches to Resource Management and Attendance Monitoring” (2012), have stated that the manual work of academic systems is largely dependent on the paperwork and manual records for maintaining the attendance and the learning resources. This has slowed down the process and takes lots of time and hard work to sort the things out manually which results in less efforts in teaching. The data inconsistency and higher chances of human errors can cause lots of problems in education. In addition to the above, tracking the student progress becomes very hard due to lack of monitoring systems which are centralized. To overcome all the above issues, the proposed “Learning Path Dashboard” is providing an integrated solutions and digital platform to overcome all the issues above.

Bower et al. [2], in “The Emergence of Digital Solutions in Education” (2016), have told and explained the increasing adoption of the tech-based platforms for enhancing the academic management. Their work has shown how the digital technologies have helped to simplify and make the academic operations easier. Though multiple solutions just focused on the content delivery and lacked the attendance integration. Hence, the proposed “Learning Path Dashboard” is a combination of both attendance and progress along with learning path.

Siemens and Baker et al. [3], in “Data-Driven Insights and Predictive Analytics in Education” (2014), focused on the analysis of understanding the student behavior along with the academic trends and performance. Their study showed that data based decision making can help the educators to identify the weak areas of the student at the early stage. But usually such systems require separate analytics tools. The proposed “Learning Path Dashboard” includes built in dashboards and reports for simplified academic insights.

Wagner et al. [4], in “Personalized Learning Pathways for Modern Education” (2017), have proposed adaptive models that change and adapt according to the learning pace of the learner. These techniques help to improve student engagement and understanding. Though, the control of the instructor remains limited which is a backdrop. Hence, the proposed “Learning Path Dashboard” introduces the automated topic scheduling while letting the faculty supervise and do manual adjustments if required.

O’Neil et al. [5], in “Technology and Pedagogy Balance in Smart Classrooms” (2018), studied maintaining a balance between automation and teaching quality. The research concluded that technology should only assist the educators rather than replacing instructional planning. The proposed “Learning Path Dashboard” is designed as a support tool to the instructors to reduce the workload and manage resources and student progress effectively.

Gikandi and team et al. [6], in “Online Assessment and Feedback Systems” (2011), found out that the digital monitoring systems help to improve the transparency and timely feedback of the students. Though these systems improved the communication, they did not integrate the attendance and syllabus both in it. Therefore, the proposed “Learning Path Dashboard” links the attendance records to the covered topics to get to know about the learning areas for students.

Almost every existing study that is present is addressing only one part of the academic management. The focus is only on one topic such as attendance, content delivery, analytics or personalized learning. There are still issues which are fragmented tools and scalability limitations and delay in the reporting remain common in multiple organizations. Manual work is making everything slower. So the aim is to focus ahead and make a platform combined with multiple functions at a single place such as the real time monitoring, flexible scheduling and efficient resource handling are becoming essential requirements.

III. METHODOLOGY

A. System Phases

PHASE 1: System Initialization: The learning path dashboard shows how a good organized and adaptive educational platform can make teaching and learning better for everyone. It brings many modules together such as attendance marking, report making, query section, analytics so both teachers and students can work together more easily.

PHASE 2: Registration Flow: When a new user joins the system they have to register themselves first and then they can login into the website and use required services available. Admin and faculty accounts are set up first by filling in the necessary details, once that is completed students are added to the system along with their course information. After this user is mapped to their role.

PHASE 3: Dashboard Interface Loading: When the dashboard loads, the system fetches the information based on the user mapped role. Faculty members can create courses, schedule topics, record attendance, and generate reports all from one place. Students get a clear view of their learning path, assigned study material, attendance record, and progress through a simple and easy to navigate interface.

PHASE 4: Learning Path Generation: When a faculty member creates a course they give the course details which includes topics, number of hours assigned to each topic and how each module is connected, then the system automatically spreads the topics across the academic schedule in a logical order. Once the learning path is generated it gets saved in the database and reflected in real time on the dashboard.

PHASE 5: Resource Integration: Instructors can upload different types of learning material such as PDFs, video links, and references and attach each one to a specific topic in the course. Students can then find and access all these resources directly from their dashboard, keeping everything organized in one common place.

PHASE 6: Attendance Processing: When the teacher marks attendance the system checks the student records and saves the day’s participation data to the database. Each attendance entry is also linked to the topics covered in that session.

PHASE 7: Analytics and Report Generation: Insightful outcomes are generated using a specialized analytics module that examines historical academic data. This system performs all required calculations automatically including attendance rate, student learning progress and topic completion rate. Additionally the platform generates well structured reports specifically designed for detailed academic analysis.

PHASE 8: Update and Record Management: The administrator or teachers can modify any course related information, update the schedule, or remove unnecessary data when required. If a course is deleted from the database, the associated data will be handled properly to prevent any issues within the system.

B. System Workflow

- System Initialization – Server starts, configurations load, and database connection is established.
- User Registration and Login – Admin, faculty, and students register and access their dashboards.
- Dashboard Interface Loading – Personalized course, attendance, and progress data is displayed.
- Learning Path Generation – Course topics are automatically arranged into a structured schedule.
- Resource Integration – PDFs, videos, notes, and links are mapped to topics.
- Attendance Processing – Faculty mark attendance and missed topics are recorded.
- Analytics and Reports – Performance insights, attendance summaries, and reports are generated.
- Record Management – Courses, schedules, and user records are updated or removed.

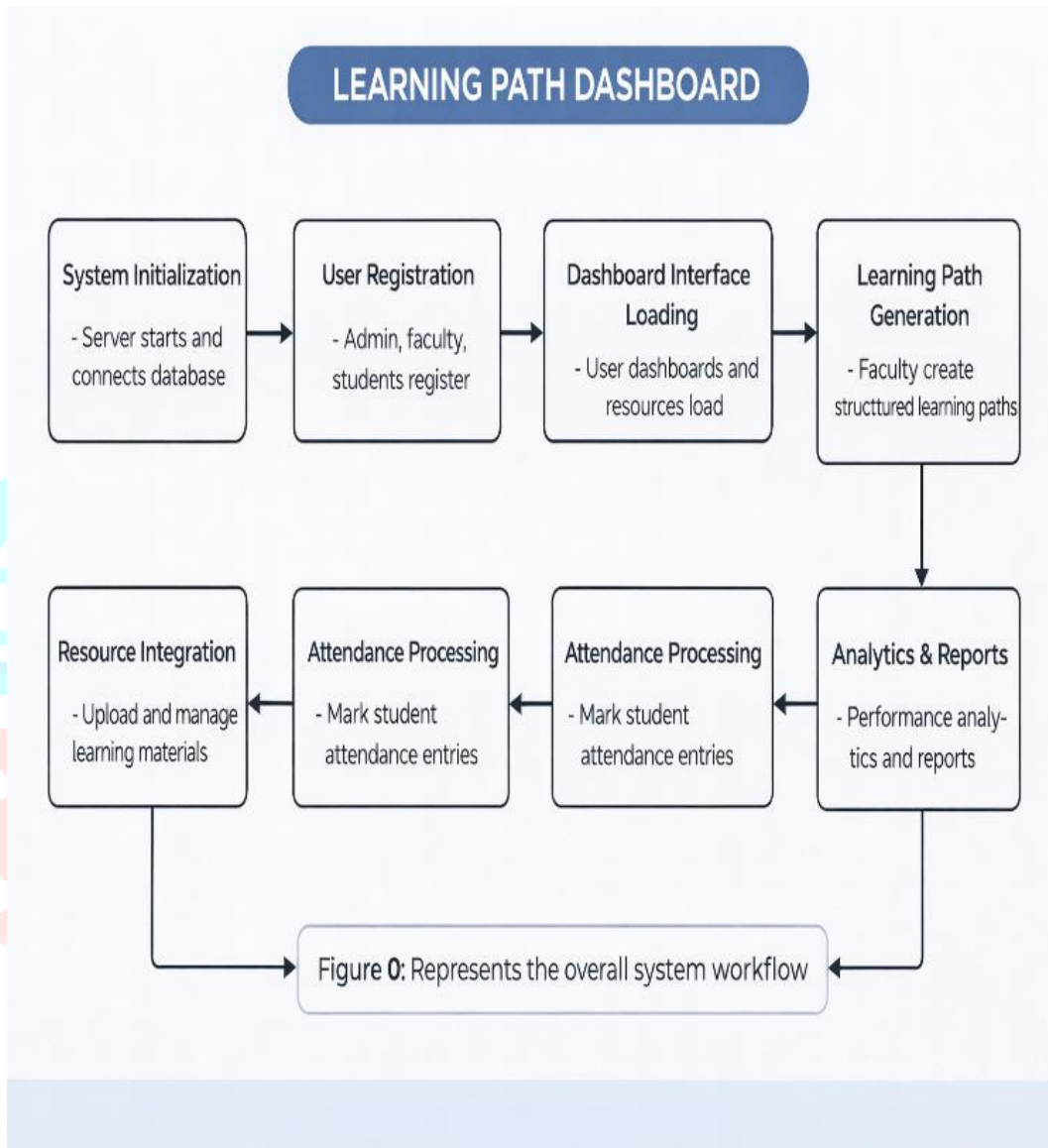


Figure 0: Represents the overall system Workflow.

C. Software Components

The learning path dashboard system is built by combining various advanced Web and databases to enhance its efficiency, scalability and usability. It integrates various services, front end interfaces and optimized data storage methods to deliver a smooth and effective learning experience for both students and instructors.

Spring Boot (Backend Development): Spring Boot serves as the main backend framework that supports the execution of core system functionalities. It provides RESTful APIs to handle operations such as user authentication, learning path creation, attendance tracking and data analysis. The framework includes features like auto configuration and an embedded server which speed up the development process. Spring Boot ensures secure communication through role based access control allowing different access levels for students and instructors.

React.js (Frontend Development): React is used to develop a responsive and user friendly interface for the application. It is based on reusable components making it easier to structure and manage interface elements. The use of virtual DOM technology improves performance and flexibility of the application. Users can easily navigate through the platform, access learning materials, track their progress and manage their activities efficiently.

Material UI (User Interface Design): Material UI plays an important role in enhancing the visual design of the application. Integrated with React, it helps in creating an attractive and functional dashboard for users. Pre-built components like cards, tables, forms and navigation tools simplify development, improving both usability and accessibility across different devices.

MySQL (Relational Database): MySQL is used for storing structured data within the system, including user details, course information, progress records and study materials. It helps maintain organized data storage using relational models that ensure consistency and integrity. This allows efficient querying and enables fast and accurate report generation.

MongoDB (NoSQL Database): MongoDB is used to handle data with flexible and hierarchical structures. It mainly manages learning paths that include multiple layers such as courses, units, topics and schedules. Since it follows a schema-less design, data can be easily modified as course content evolves over time. It works alongside the relational database to efficiently manage dynamic educational data.

REST APIs (Communication Layer): REST APIs act as the communication bridge between the frontend and backend components of the system. They handle requests such as retrieving learning paths, updating attendance records and generating analytics. These APIs ensure smooth and efficient data transfer across different parts of the system.

Authentication and Security: To maintain system security, the application uses JSON Web Tokens (JWT) for authentication and authorization. This ensures that only verified users can access the platform based on their assigned roles. Secure data transmission and controlled access mechanisms help maintain confidentiality, reliability, and system integrity.

D. Data Flow

Data Collection: The system continuously gathers data generated from user interactions on the platform including attendance progress, activity logs and course participation. This data is collected through the dashboard interface and stored securely in the database for further processing.

Data Processing and Analysis: Once collected, the data is processed by backend services to generate meaningful insights. Attendance data is linked with learning paths to identify missed topics while progress data is analysed to determine completion levels. This transforms raw data into structured information that supports better decision making.

Action Generation: Based on the generated insights the system performs actions such as updating the dashboard, creating reports and displaying visual feedback. Notifications and progress indicators guide users, helping them stay on track and improve their overall learning experience.

IV. SYSTEM ARCHITECTURE AND IMPLEMENTATION

The system's architecture has a client-server model. The Learning Path Dashboard is a unified platform which integrates attendance tracking, learning management and analytics within a modular and scalable web-based system. Each component acts independently while also maintaining communication through well-defined APIs. The different educational environment in a system ensures flexibility, maintainability and efficient system performance.

User Profile Management: Function: It ensures storage and management of user information for both teachers as well as students. Implementation: The system stores important details like name, course enrollment, role and activity records during registration. Role-based access ensures teachers and students interact with relevant features only. Authentication is handled using secure login mechanisms and structured information is stored in MySQL.

Learning Path Creation and Management: Function: Instructors can design structured learning paths for their courses. Implementation: The courses, units, and topics defined by teachers are arranged over a timeline. Based on course duration and complexity an automated distribution logic organizes topic day-wise. MongoDB is used to support hierarchical data structures and efficient storage of data.

User Interface (Dashboard): Function: Learning activities are efficiently managed, providing users to access the interactive features on the platform. Implementation: React.js and Material UI is used for the frontend, which offers responsive and intuitive components such as tables, dashboards, and progress trackers. Students access resources, view assigned topics, track their progress while teachers manage content, attendance and analytics.

Attendance Management System: Function: Students attendance is tracked and learning activities are managed and linked in structured format. Implementation: The dashboard helps teachers mark attendance daily. MySQL records attendance and associates entries with specific courses and dates. The system identifies any missed topic, correlating attendance with learning paths.

Resource Integration: Function: Educational materials are integrated within learning paths. Implementation: Linking or uploading resources such as PDFs, videos and external references becomes easier. This centralized learning platform helps students access resources directly from the dashboard without external navigation.

Data Processing and Analytics: Function: For decision-making raw data is converted into meaningful insights. Implementation: Attendance, progress, and activity data is processed by backend services to generate analytics. Charts and reports are displayed on the dashboard helping teachers evaluate student's progress and identify learning gaps.

API Communication Layer: Function: It enables interaction between backend and frontend components. Implementation: Spring Boot is used in the backend to develop RESTful APIs handling requests such as fetching learning paths, recording or updating attendance, and retrieving analytics. The system ensures efficient, secure, and real time communication across modules.

Notifications and Reporting System: Function: Updates and performance of the student is notified from time to time. Implementation: Summarized attendance and progress is generated as automated reports. When updates occur, notifications are triggered, ensuring changes and deadlines are communicated to all students and teachers.

Feedback and Interaction Loop: Function: Continuous improvement and engagement is enhanced. Implementation: Dashboards and reports act as the feedback provided by the system, making sure corrective actions are taken. Modification of learning paths based on performance and trends can be done by the teachers.

Scalability and Performance: Function: The system handles varying loads efficiently. Implementation: The system's architecture supports concurrent users through efficient API handling and optimized database queries. It has a modular design ensuring future integration of advanced features can be done easily without affecting existing functionality.

V. TESTING AND VALIDATION

To evaluate the system's accuracy, reliability and performance, comprehensive testing was conducted across all modules of the Learning Path Dashboard. The goal was to ensure correct functionality, proper data handling and smooth user interaction throughout the system.

Functional Testing: Core features such as learning path creation, attendance tracking, resource management, and report generation were thoroughly tested to verify expected outcomes. The system effectively maps attendance with the relevant topics helping identify missed learning content accurately.

Performance Testing: The APIs developed using Spring Boot were tested under multiple concurrent user requests. Even under heavy usage the system maintained stable performance without noticeable degradation ensuring smooth communication between frontend and backend components.

Database Testing: Both MySQL and MongoDB were evaluated for accuracy, query performance and scalability. Optimisation techniques ensured efficient handling of large data sets without affecting system performance.

UI and Workflow Testing: The user interface developed using React and Material UI was tested for responsiveness and usability. The system was evaluated to ensure smooth navigation, proper interaction and consistent user experience.

VI. DEPLOYMENT

After successful testing, the learning path dashboard is deployed as a web based application accessible to schools, colleges and online learning platforms. The system requires basic infrastructure such as internet connectivity, web browsers and backend server support. It is designed to handle multiple users efficiently without performance degradation.

When teachers update learning paths, mark attendance, or upload new resources, the changes are instantly reflected on the student dashboard. Notifications and reports are generated in real time, ensuring timely communication and an improved learning experience.

VII. RESULTS

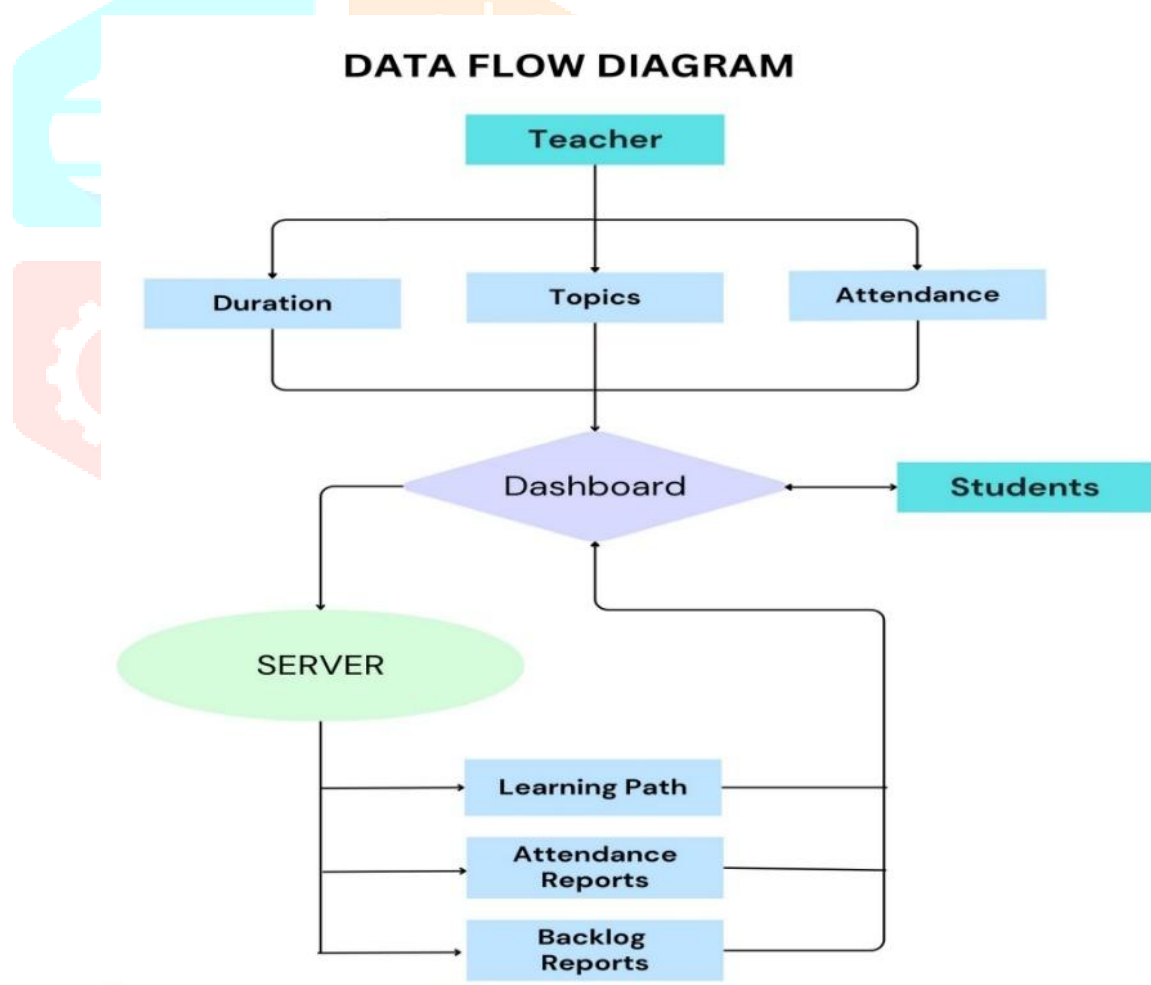


Figure 1. The given figure has an overview of architecture and workflow of the Learning Path Dashboard, demonstrating stages like admin and teacher access, attendance reports, topic allocation, course planning and duration through dashboard, at the same time report creation, backlog tracking and secure data handling is done through server.

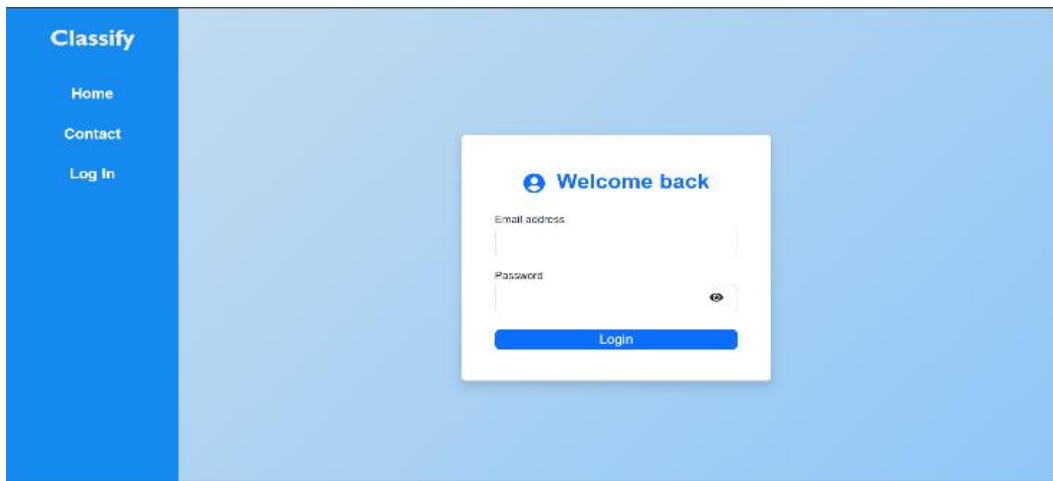


Figure 2. This is the Landing page of the Learning Path Dashboard demonstrating the interface of the website with navigation options like home, contact, and login. The page has a secure login portal which provides user access for admin, teachers, and students, according to their role, here users can navigate to their respective dashboards and system functionalities.

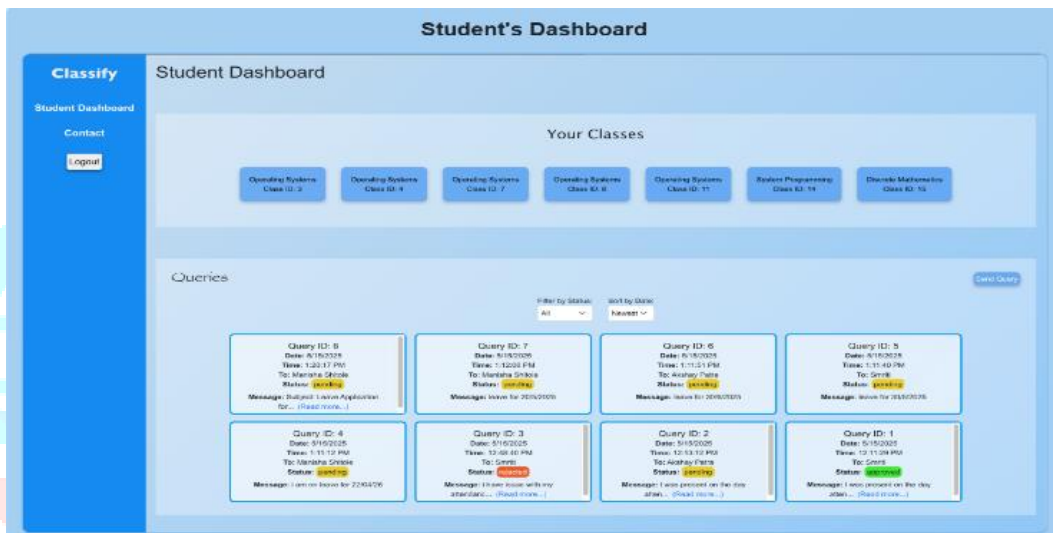


Figure 3. This is the Student dashboard interface of the Learning Path Dashboard which includes enrolled classes, query management section, status tracking, which helps students to solve their queries on time, communicate with faculty efficiently and access reports or academic information anytime.

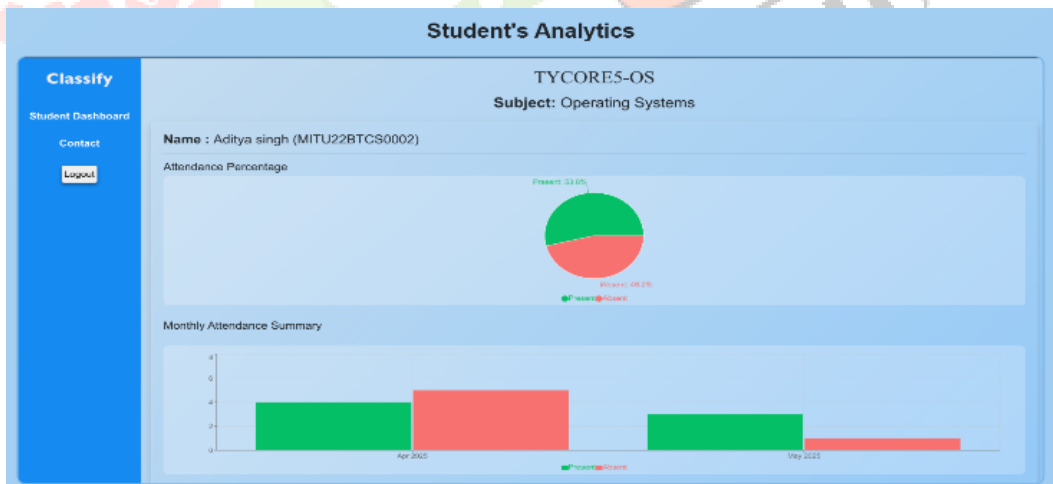


Figure 4. This is the Homepage interface of the Learning Path Dashboard demonstrating student analytics where attendance percentage, monthly attendance summary, subject details of individual students are displayed in graphical representation for monitoring academic progress and performance in real time.

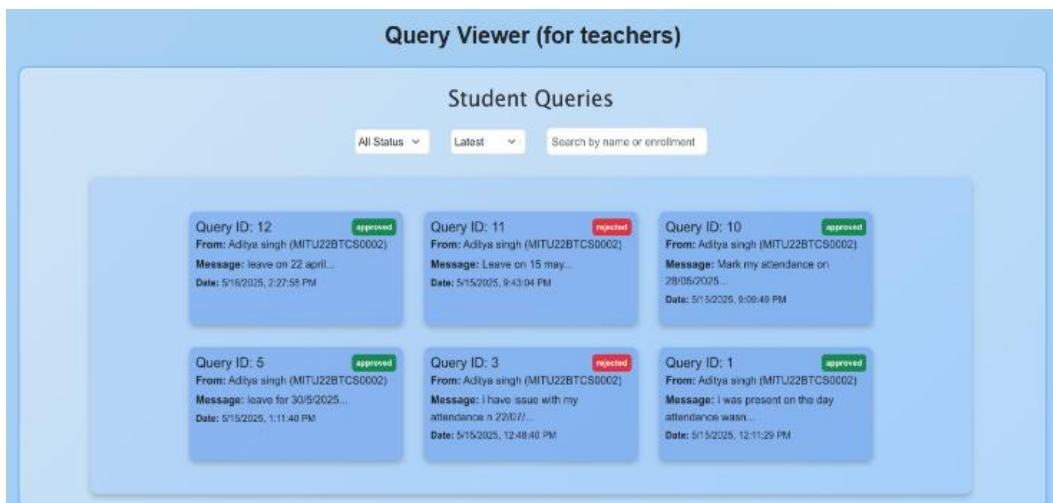


Figure 5. This is the Query viewer interface of the Learning Path Dashboard, where student queries are displayed with details along with their name, enrollment number, message content, date and request status. The request status helps students to see if their query was resolved or not. It also has search, sorting and filter options that help teachers to review the query properly. The faculty can see the student’s query and approve or reject them, ensuring smooth and efficient communication within the overall system.

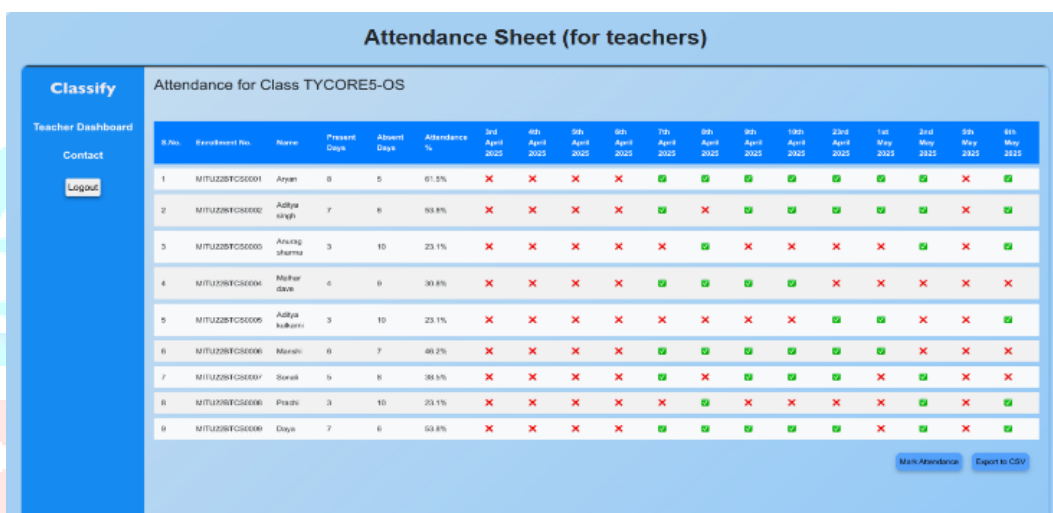


Figure 6. Attendance records panel for teachers in web based learning path dashboard system, showing student data which includes enrollment number, names, present days, absent days, total attendance, it also has options for ticking attendance, exporting records which helps teachers to maintain student progress, and backlog topics.

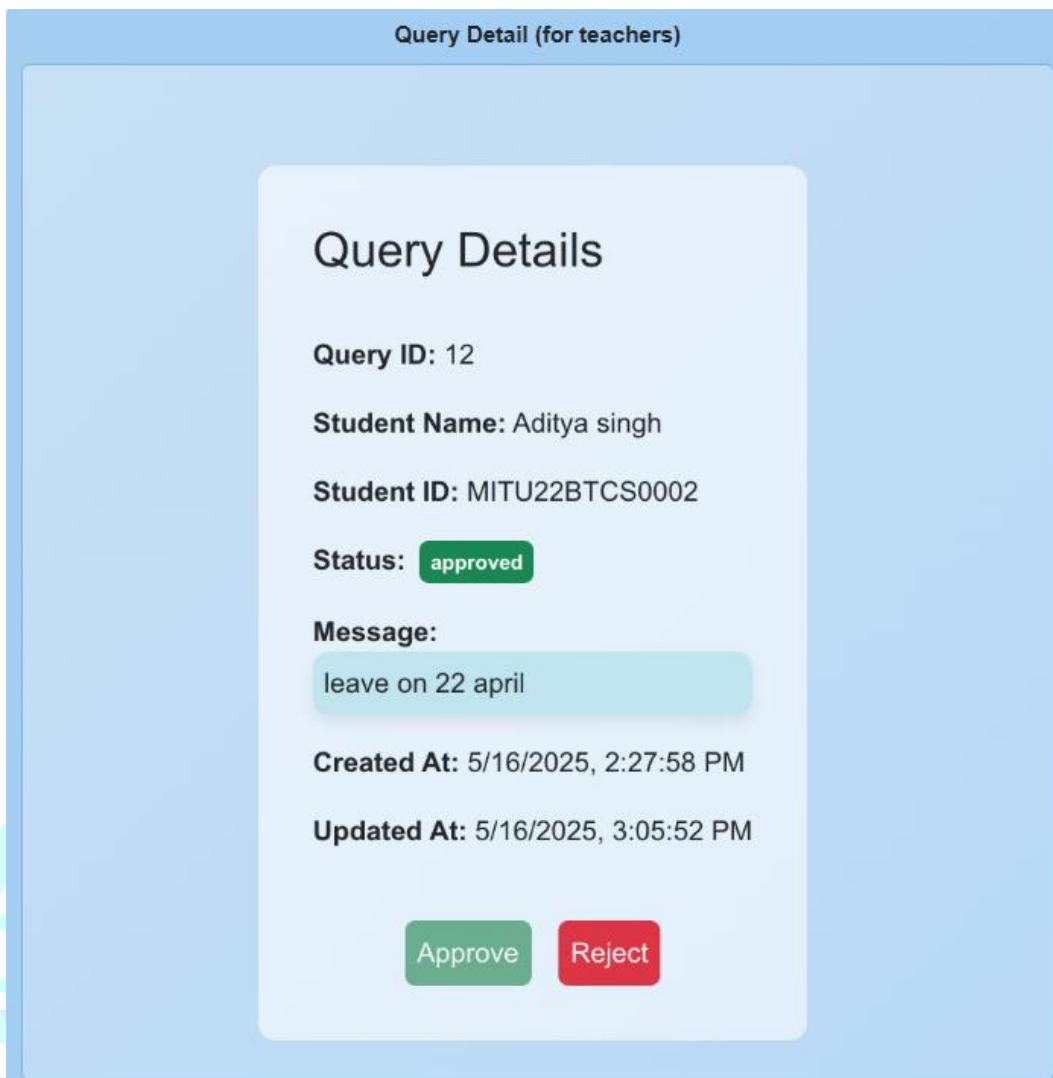


Figure 7. The above snapshot shows query pop up which is the feature of LMS in which the student can write query to a particular subject teacher. It can be related to topics which are required to be taught again, applying for leave, or any query related to academic progress. The query reaches to the particular teacher and they can accept or reject it, ensuring a smooth and easy communication way between student and teacher.



Figure 8. This is the panel of admin in which the admin has all the rights to add users as teachers, students and can also add subjects of particular course and if required can also delete the record. The admin can also add and remove classrooms of different streams. Each university who uses the website has at least one admin.

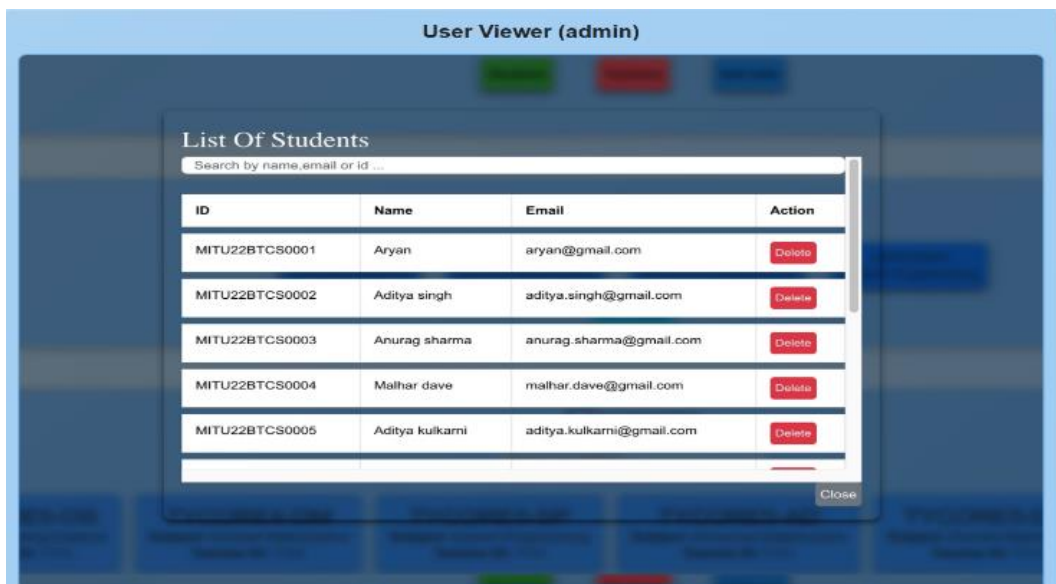


Figure 9. Student Interface view of the admin panel has all the list of students with all their enrollment number, roll number, name, mail Id, and option to remove the particular user of the list which helps in maintaining the information in secure and integrated way and allows the university to maintain code of conduct.

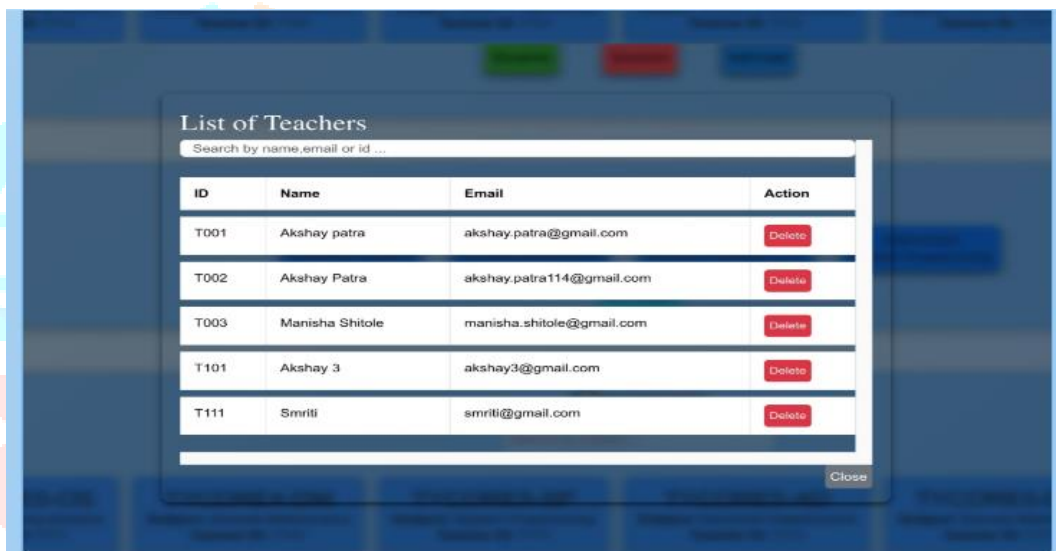


Figure 10. The Teacher Interface view of the admin panel has all the list of teachers with all their teacher ID, registration number, name, mail Id, and has the option to remove the particular teacher from the list. It also helps in maintaining the information in secure and integrated way and allows the university to maintain code of conduct.

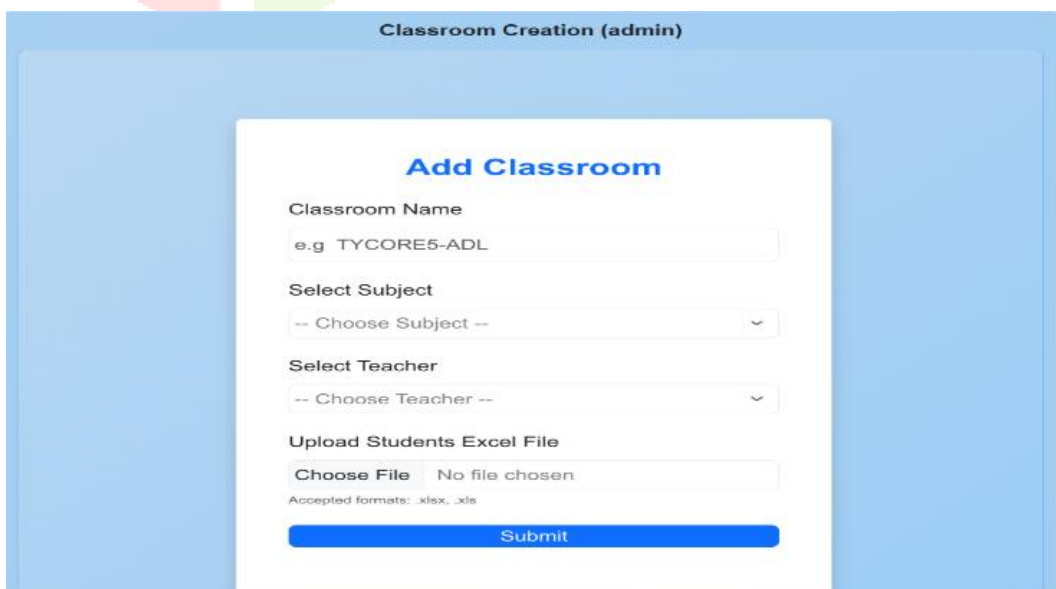


Figure 11. Classroom creation panel has five options to perform. Firstly the right person will be able to name the classroom and can select the subject of particular classroom code and then can choose the name of the teacher who is going to teach and publish the required material in the classroom and can upload the list of students enrolled.

Classroom Details

Classroom ID
3

Classroom Name
TYCORE5-OS

Subject
Operating Systems

Teacher
Smriti (smriti@gmail.com)

Students

MITU22BTCS0001	Remove
MITU22BTCS0002	Remove
MITU22BTCS0003	Remove
MITU22BTCS0004	Remove
MITU22BTCS0005	Remove
MITU22BTCS0006	Remove
MITU22BTCS0007	Remove

[Add Student](#)

Update Classroom

Delete Classroom

Figure 12. Classroom complete detailed panel admin dashboard in learning path dashboard displaying classroom info like classroom number, name, subject, and the particular teacher assigned to subject. This Module also provides options to add and remove data, change classroom data, and delete classroom, which ensures flexible data exchange and efficiency on data within the system.

VIII. CONCLUSION

The Learning Path Dashboard shows how a good learning platform can make teaching and learning easier. It brings learning paths, attendance tracking, and data together in one place. This helps students to keep track of their progress and also helps teachers to understand how to teach in a better way.

The platform is built using React, Spring Boot, SQL and many more web tools, so it works well on laptop, mobile, and on any display and can grow as your needs. It can be used by schools and colleges. By keeping data and performance tracking in one place, it reduces the time and effort wasted with old traditional methods.

The system sends automatic reports, updates information in a monthly cycle, and gives each student and teacher a learning path that fits for a particular course. This keeps students more interested and helps them do better in their studies. In short, this project helps to build a learning environment that is simple to use and based on real data, and focused on the student.

ACKNOWLEDGEMENT

All of us as a team would like to sincerely thank our Prof. Vice Chancellor Dr. Ramchandra Pujeri, Dean Dr. Ganesh Pathak, Director Dr. Vipul Dalal, and our project guide Prof. Manisha Shitole. Their continuous support was not just in academics but it was personal, patient, and really encouraging. Our Project Learning Path Dashboard exists in its current form because of the direction and belief they showed in all of us.

We are also really thankful to all our team members because they put their valuable time in this innovative project and due to which we were able to deliver a solution which could really impact our society.

Each person brought something new to the project and that collective effort is something we are truly proud of. The Journey was very challenging but with each other's support we got to the final output. This project is a reflection of everything we invested into it: our time, our skills, and our trust in each other. Finally, we extend our heartfelt thanks to our institution for providing us the resources, environment, and infrastructure that made this Major Project possible.

REFERENCES

- [1] Anderson, T., & Regenbrecht, H. (2012). Traditional Approaches to Resource Management and Attendance Monitoring in Educational Institutions. *International Journal of Educational Management*, 26(4), 215–223.
- [2] Bower, M. (2016). The Emergence of Digital Solutions in Modern Education Systems. *Computers and Education*, 98, 45–58. <https://doi.org/10.1016/j.compedu.2016.03.012>
- [3] Siemens, G., & Baker, R. S. (2014). Learning Analytics and Educational Data Mining: Towards Better Student Outcomes. *British Journal of Educational Technology*, 45(3), 438–450. <https://doi.org/10.1111/bjet.12163>
- [4] Wagner, E. D. (2017). Personalized Learning Pathways: Challenges and Opportunities in Higher Education. *Journal of Educational Technology Systems*, 46(2), 165–180.
- [5] O'Neil, H. F. (2018). Balancing Technology and Pedagogy in Smart Learning Environments. *Educational Technology Research and Development*, 66(5), 1121–1138.
- [6] Gikandi, J. W., Morrow, D., & Davis, N. E. (2011). Online Formative Assessment in Higher Education: A Review of Feedback Systems and Student Engagement. *Computers and Education*, 57(4), 2333–2351. <https://doi.org/10.1016/j.compedu.2011.06.004>
- [7] Frontiers in Education. (2020). Adaptive Learning Paths in Education: Intelligent Models for Structured Course Delivery. *Frontiers in Education*, 5, 56. <https://doi.org/10.3389/educ.2020.00056>

