Digital Leave Management System for Academic Institutions: Role-Based Workflows, Load Adjustment, and Interactive Calendar Dashboard

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***Abstract*—Managing leaves is often tedious, error-prone and obscure in most academic institutions. This study presents an Digital Leave Management System (LMS) that eases the process of redistributing tasks, multi-level approvals, and leave applications. For academics, HODs, principals, and administrators, the system offers role-based dashboards; interactive leave calendars through Full Calendar; automatic leave computation that does not include weekends or holidays; support for document uploads; and a Load Adjustment Module for lecture coverage. Improved account-ability, precise leave balance tracking, and increased processing efficiency are all demonstrated by the experimental deployment. To improve operational efficiency in academic environments, the LMS offers a scalable, safe, and intuitive solution.**

***Index Terms*—Leave Management System, Academic institutions, Role-based access, Load adjustment, Calendar integration, Multi-level approval, Web application, Dashboard visualization, Automated workflows, Leave tracking**

I. INTRODUCTION

Academic continuity and administrative effectiveness are guaranteed by efficient leave management. Manual procedures that use paper forms or spreadsheets put a strain on employ-ees, cause mistakes, and take longer to approve. Teaching schedules and student learning are disrupted when departments struggle to keep proper leave records and allocate responsibilities during faculty absences.

Workload redistribution techniques, interactive leave visualization, and organized multi-level approvals are uncommon features of current solutions. As a result, departmental responsibilities become imbalanced, institutional planning becomes difficult, and lecture handover responsibility worsens.

These deficiencies are filled by the proposed Digital Leave Management System (LMS). The faculty members submit leave requests electronically, which means the type of the leave, the time frame, and any supporting documents. Request is regulated in a multi level manner with Head of Department (HOD) approving request first then Principal approving the request. The system automatically sends out notifications in order to keep the consumers updated in real time.

Using the Load Adjustment Module of the LMS, instructors will be able to assign their colleagues to lecture and specify the subjects, time blocks, and responsible individuals. This maintains accountability, departmental balances and ensures a consistent training.

The Calendar and Scheduling Module displays approved, pending and rejected leaves in real time by combining aca-demic and institutional calendars. The correct calculation of the balance of leaves is attained by means of automatic exclusion of weekends and holidays in calculating the leave. Role-based dashboards have guaranteed safe, easy-to-use, and responsive access to all users.

Leave Management System (LMS) reduces the administrative workload, minimizes mistakes, and enhances operational efficiencies through automation of the leave processing, pro-viding the real-time visibility, and enabling the systematic changes in tasks. It is secure and scalable to serve various departmental constructions and institutions sizes.

II. MOTIVATION

Leaves in most learning institutions are normally unproductive and vulnerable to mistakes; their approval systems are not open to transparency. Managing leave requests is often accomplished by faculty and administration using spreadsheet or

paper-based forms resulting in misunderstanding of the department and incorrect calculation of the balance and time of the approval. Moreover, the failure to have an automated system of task adjustment can create inconveniences in sched-ules and adversely affect the learning of students in case the personnel are on leave.

The Leave Management System (LMS) was designed due to the need to transform and optimize the leave process and maintain accountability and transparency. Schools need a system that does not just make leaves of absence to be submitted and approved, but is also efficient in managing the working loads in the department to ensure that classes are not missed.

We will create a platform that is fast, reliable, and user-friendly and will enable the multi-level leave approvals, digital workloads adjustments through the use of the Load Adjustment Module, the display of the leave schedules with the built-in calendar. The LMS will provide role-based dashboards and secure authentication, making all users such as the administrators, professors, and HODs and principals to have access to information and take immediate action.

This is in a bid to remove the inefficiencies in administration, enhance the planning of the institutions, and minimize the human error. The LMS improves the increased efficiency and accountability of the overall operations and facilities in the academic setting by digitalizing the leave operations and offering real-time tracking of the leave balances and changes.

III. OBJECTIVES

The key objectives of the project of the Leave Management System (LMS) are the following:

A) Submit an Automatic Leave Request: Provide faculty members an online platform where they may request leaves electronically with information on the type of leave, duration of the leave and any supporting document they may need to include such as medical certifications.

B) Multi-Level Approval Workflow: You can introduce a step-by-step leave approval process to ensure account-ability and transparency by submitting the requests to the Head of Department (HOD) and the principle.

C) Modification Module Load: Professionals should have the option of assigning a colleague to cover their lectures during their leave with a specification of the subjects and the schedule and responsible individual to maintain workload balance in the department.

D) Completed Calendar View: Develop a consistent view of the academic events, institutional holidays and leave dates through FullCalendar integration to enhance better planning and teamwork.

E) Real-Time Leave Monitoring: Provide users and administrators with real time monitoring of pending, ap-proved and rejected leave requests as well as accurate leave balances factoring in weekends, holidays and carryover policies.

F) Dashboards Based on Roles: Use role-based dashboards with timely, safe and easy-to-use dashboards to ensure that everyone, faculty, HOD, principal, administrator, etc., can access the relevant features and information.

G) Accountability and Efficiency of Operations: Guarantee departmental planning and lecture handovers, de-crease the quantity of manual administrative work, and decrease mistakes in calculating leaves.

IV. LITERATURE SURVEY

Recent research has concentrated on creating automated systems that use online technologies, databases, and interactive dashboards to expedite leave procedures because manual leave administration in academic institutions is frequently laborious, prone to errors, and opaque. This move toward digital transformation in academic administration is reflected in the increasing use of highly automated, role-specific, cloud-based systems coupled with all-inclusive Human Resource Management Systems (HRMS).

In order to improve administrative efficiency, recent studies strongly recommend switching to web-based, automated Leave Management Systems (LMS). Sim et al. highlighted the significance of safe and digitalized procedures in contemporary businesses by introducing a *Smart Leave Management System* that uses web-based interfaces [1]. The effectiveness of digital leave workflows like the *Digital Leave Tracking and Approval Workflow for Academic Institutions* has been validated by further research, which found that automation greatly reduces manual errors and approval delays in educational settings [2]. The deployment of systems with multi-level approval hierarchies and role-based access is a new

trend in this field. The significance of *Role-Based Leave Management Systems* that are available on web and mobile platforms and provide customized dashboards for administrators, department heads, and faculty members was emphasized by Sharma and Kumar [3]. In order to increase workflow efficiency and accountability, additional research suggested a *Optimized Academic Leave Approval Workflow* that sends requests through hierarchical layers [9]. For effective management in academic contexts, further studies investigated the integration of mobile-based technologies and interactive dashboards [14], [20].

For efficient institutional planning, scheduling and visualization technologies must now be integrated. Chen et al. emphasized the significance of *Calendar Integration for Academic Leave Management Systems*, showing how visual tools help with planning and communication by connecting academic calendars with leave data [11]. This method addresses the need for collaboration and transparency by offering a uniform, real-time summary of faculty absences.

The lack of thorough workload adjustment and faculty coverage modules in existing LMS solutions is a significant re-search gap that the suggested approach immediately addresses. In order to maintain academic continuity, Singh and Bansal looked at ways to efficiently manage faculty workloads during absences in a *Smart Leave Scheduling and Faculty Workload Management System* [7]. Chen et al. [17] also investigated automated leave scheduling for better departmental operations.

Recent advancements show a significant trend toward cloud-enabled and mobile-compatible LMS systems to further im-prove accessibility and real-time management. In their discussion on *Automated Leave Tracking and Reporting Using Cloud Technology*, Gupta and Verma emphasized the benefits of scalability, secure storage, and real-time data synchronization [6]. One example of how contemporary cloud architecture improves accessibility and data security is a *Cloud-Enabled Leave Management System with Role-Based Authorization* [13]. Another example was the presentation of a *Real-Time Leave Monitoring and Notification System* [12]. While scalable, cloud-native systems were examined in [18], research looked into web and cloud-based LMS deployments for universities [10]. Additionally, a comparative investigation found that, in comparison to manual techniques, digital leave management systems significantly improve transparency and reduce administrative workload [16].

By incorporating multi-level approval mechanisms, inter-active calendar visualization, and a unique Load Adjustment Module that optimizes faculty workload distribution and ensures smooth institutional operation, the proposed Leave Management System (LMS) expands on these developments to address the intricate administrative and academic continuity challenges faced by educational institutions.

V. METHODOLOGY

The *Leave Management System (LMS)* was developed using a systematic approach that prioritizes academic continuity, process automation, and digital transformation. To expedite leave applications, multi-level approval, and crucial workload adjustments inside educational institutions, the LMS is a scalable, secure web platform. The system as a whole ensures that leave requests are efficiently submitted, approved, and tracked, promoting smooth departmental cooperation and aca-demic continuity. Figure 2 shows the system's main functional workflow.

A. Technology stack and system architecture

The modern, high-performance MERN stack (MongoDB, Express, React, and Node.js) architecture is used in the suggested system to ensure cross-platform deployment, strong scalability, and maintainability. Three fundamental levels logically separate the architecture (Fig. 1):

Beginning with

- Frontend (Presentation Layer): Tailwind CSS is used to style a modern, responsive design that is optimal for all devices, while React.js is used to create dynamic user interfaces. It has separate dashboards for administrators, faculty, HODs, and principals that are tailored to their roles.
- Database (Data Layer): MongoDB offers a configurable NoSQL schema that effectively manages both structured and unstructured data (such as user profiles, leave re-quests, and document uploads).

Fig. 1. System Architecture of the Digital Leave Management System.

Modules of the Core System The LMS's essential features are distributed among four specialized

modules:

A. Workflow Control Multi-Level Approval Module: By processing leave requests in a sequential manner, this mod-ule ensures regulated authorization and transparency while upholding the institutional hierarchy. Starting with

A) Starting a Faculty Request: Through their dashboard, the faculty member makes the request, stating: To pick the type of leave (Casual, Medical, Vacation/Earned, On Duty), use Dates of exact start and conclusion, including half-day alternatives. For certain forms of leave, it is mandatory to upload supporting documentation, such as medical certifications.
B) Approval at the Department Level (HOD): The re-quest is reviewed by the department head, who also considers the immediate impact on the departmental burden. The request for modification may be approved, rejected, or returned by the HOD, who must also provide feedback. Principal Institution-Level Approval: The Principal receives authorized departmental requests and grants final administrative approval.

Throughout the process, the faculty member receives auto-mated, real-time status updates from the system.

B. Academic Continuity Load Adjustment Module: This is a key differentiator intended to lessen scheduling conflicts in the classroom. The faculty member is prompted to use this module after submitting a leave request. Instructors are able to:

Assign Lecturers in Their Place: During the absence period, designate one or more coworkers to cover their planned classes. Specific Coverage Designated: Indicate the precise topics, times, and related departmental responsibilities.

- Monitor and Verify: In order to ensure accountability prior to final leave approval, the module actively monitors and logs the acceptance or confirmation status of the covered assignment, and the system promptly notifies the substitute faculty.

C. Visualization of the Calendar and Scheduling Mod-ule: Planning and cooperation within the organization are improved by this module. To begin itemize ’textbf

- Backend (Business Logic Layer/Application): manages Complementary Calendar Integration: provides an interactive, all server-side logic, API routing, input validation, and secure database interactions using the Node.js and Ex-press.js frameworks. The persistent storage system unified view of academic events, institutional holidays, and all departmental leave calendars through the use of the Full-Calendar API.

Exit the Visualization: For instant visual distinction, pending, authorized, and rejected leaves are shown using distinct color coding.

Reliable Estimation: Weekends and institutional holidays (determined by the administrator) are automatically subtracted from the overall number of leave days taken, guaranteeing an accurate estimate of leave balance.

D. Authentication and Security Module (Data Integrity): To protect data privacy and stop unwanted access, security is applied at every level. Beginning with

- RBAC: Role-Based Access Control Depending on the designated user role (Faculty, HOD, Principal, Admin), access to functions and data is tightly restricted.
- Safe Verification: uses authentication based on JWT (JSON Web Tokens) for safe and stateless session management.
- Password Protection: Before being stored in MongoDB, user passwords are protected via bcrypt-based hashing. API Security:
- The backend uses Helmet.js middleware to prevent common web vulnerabilities (like XSS and CSRF) and secure API handling by providing proper HTTP headers.

B. Data Evaluation and Management

A. Database Persistence and Design: The following are the main models used by the MongoDB database for relation-ship management and data persistence: Beginning with

- User Model: Holds detailed personal information, department assignments, roles assigned, and current yearly leave balances.
- Leave Model: The core model that keeps track of the status of multi-level approvals, manages all leave requests, stores links to document uploads, and documents load adjustment details.
- Department Model: Assigns the current HOD,

establishes department-specific guidelines, and keeps track of workload and leave information.

B. Metrics for Performance Evaluation: The correctness of the working system and its efficiency in work is measured quantitatively:

- Request Processing Time: Measures the efficiency of a workflow by determining the average amount of time it takes between the time a leave request is submitted and when the principal approves the request.
- Load Adjustment Accuracy: Indicates how well the departmental task balance is maintained during leaves and establishes the validity of the lecture coverage assignment as working.
- Dashboard Reactivity: Measures the duration with which role-based dashboards and calendar visualizations update in real time in case a status (e.g. approval or denial) has changed.
- Leave Calculation Accuracy: Ensures the accuracy of the calculation of leave balances using carry-forward principles, by the institutional norms, and in an automatic manner excluding weekends and named holidays.

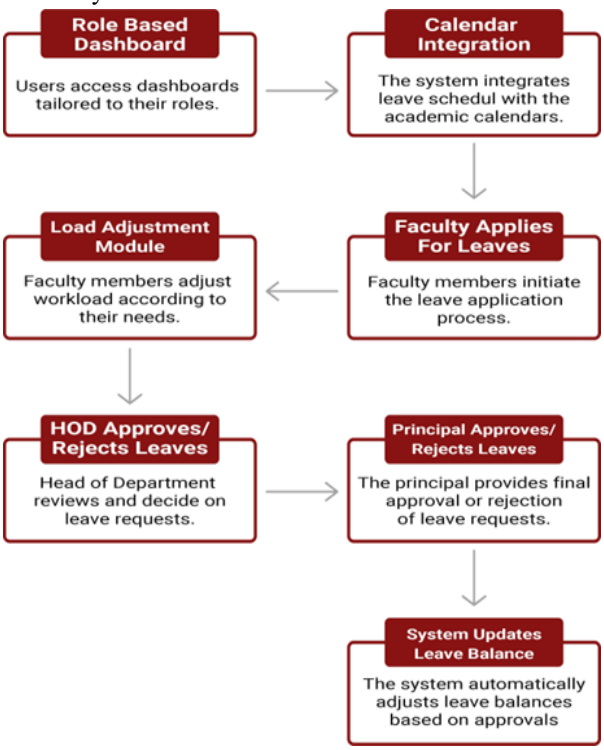

Fig. 2. Leave Management System Workflow

VI. RESULTS AND ANALYSIS

The *Leave Management System (LMS)* is a high-quality administrative efficiency, workload management and leave tracking solutions that can be provided to educational institutions. The system was efficient in terms of processing the leave requests through multi-level approvals within few seconds during testing which in turn gave real-time updates on the same to the teachers, HODs and principle.

The role based dashboards showed the right balances on leaves as well as leave requests that are pending, approved and denied. The Load Adjustment Module was successfully in monitoring the lecture coverage assignments to maintain the balance of departmental tasks. The calendar internalization improved teamwork and planning by displaying academic events, institutional vacations, and leave dates. The delay caused by taking time to simplify file handling and network operations can be avoided in cases where slight delays were only experienced when there were several large document uploads at a time.

Leaves Requests Approved Over Time. The number of the leave requests submitted per week during the period of testing is presented in the bar chart. The trend in the frequency of leave requests and times that leave activity was at its highest are shown in the graph.

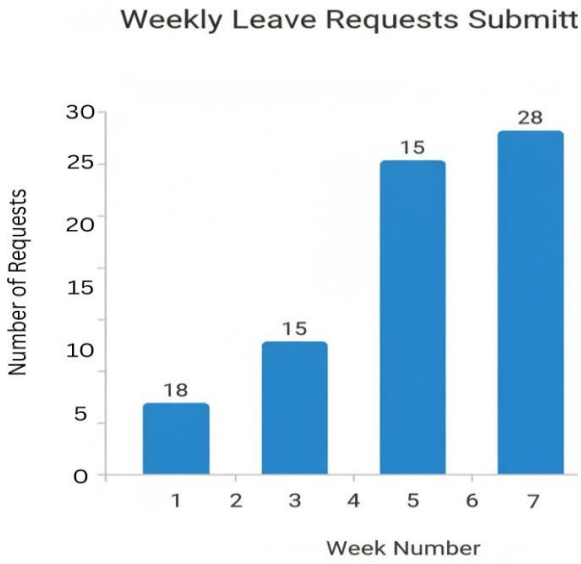

Fig. 3. Weekly Leave Requests Submitted

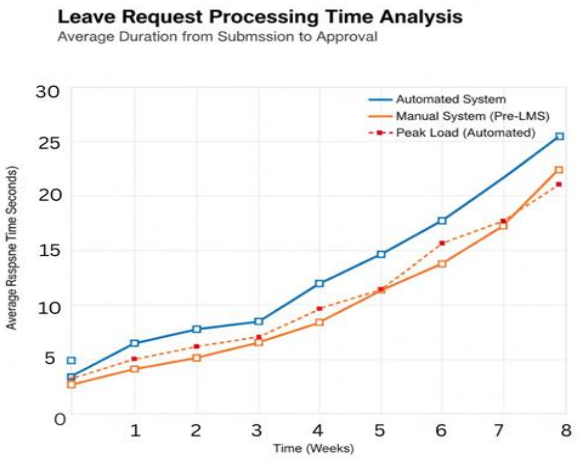

Fig. 4. Leave request processing time analysis

A. Reaction Time Evaluation

The duration taken to submit and get a leave request approved is represented in the line graph. It shows how the system is able to sustain the minimal latency in processing despite varying request volume.

B. Type Distribution of Leave

The pie chart shows the leave request types distribution (vacation, medical, and casual) (Fig. 5). This helps in the realization of departmental burden and strategies of creating a more efficient allocation of resources and identifying the trends in faculty leaves. The research can be applied in determining trends in the use of leave in the company as well as to guide policy adjustment.

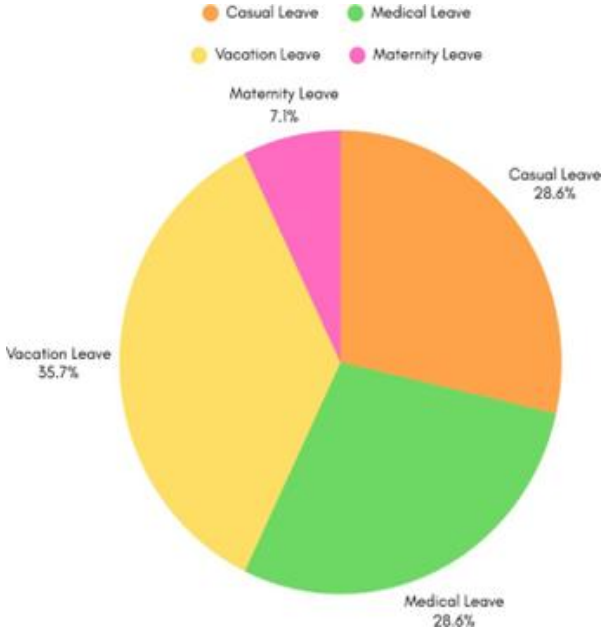

Fig. 5. Distribution of Leave Types

C. A Synopsis of the Analysis

In general, the *Leave Management System (LMS)* is useful in automating the leave management system and ensuring the academic workflow continuity. Some of the major findings include:

- The average time that is taken to process a leave request after submission is a few seconds until the HOD approves it. Proper computation of the leave balance including carry forwards without holidays and weekends. Accurate calculation of leave balance with carry-forward rules, omitting holidays and weekends.
- Load Adjustment Module enables effective monitoring and verification of the lecture coverage.
- It will also give administrators, teachers, HODs, and principals responsive role-based dashboards. Scalability and reliability when faced with the increasing number of document uploads and leave requests.

These findings suggest that the LMS can improve the planning of institutions by increasing the administrative efficiency and reducing the duration of approvals. To make it better in the future, high-risk absences could have advanced analytics.

VII. CONCLUSION

The example of how smart automation can contribute to the continuity of academic work, leave administration, and approval processes in colleges is the *Leave Management System (LMS)*. The system has ensured that leave requests are handled effectively and in a transparent manner through the application of role-based dashboards, real-time notifications, and a systematic multi-level approval process.

This project demonstrates the benefits of the combination of web-based interfaces, visualization of the calendar, and the Load Adjustment Module to collaborate with departments. Regarding the issue of leave monitoring, the technology minimizes paperwork, time wasting and human error. It has been experimentally demonstrated that leave balances are computed correctly, the cover of lectures assignments are checked on a regular basis and any leave request will be done in few seconds.

Future expansion of the LMS is possible through the creation of a personalized mobile application among

teachers and HODs which includes AI-driven leave prediction and job balance, connection with payroll and HR systems, and provision of sophisticated analytics dashboards about the leave trends. Other things may consist of email/SMS reminders, personalized institutional rules and automated leave suggestions. In general, the LMS offers a secure and scalable system that is robust and increases the efficacy of the institution, account-ability, and improves user experience to all stakeholders.

VIII. FUTURE SCOPE

The improvements in the future system will be focused on the intelligent decision-making, scalability, and accessibility. The proposed extensions would involve:

- Extensive Institutional Implementation: deploying the system to other campuses or departments to determine how the system would be affected under higher work-loads in terms of data synchronization, performance, and interoperability.
- Predicting Leave Trends Using Machine Learning: implementing predictive algorithms to analyze previous leave data and predict high leave periods that will help optimize proactive faculty load allocation.
- Cloud Scalability and Deployment: The system is hosted in the cloud so that it can be accessible to the remote users in a seamless manner, with high availability, and elastic scaling.
- Special Mobile App for Immediate Access: They will develop a special mobile application (iOS and Android) to enhance responsiveness and user experience.
- Information and Analysis: The implementation of analytical data and interactive dashboards to provide administrators with information about the workload of the faculties, the leave pattern, and the efficiency of the approvals.
- Academic Timetabling Tool Integration: the integration of the leave plans with the academic schedules to ensure optimal workload management and class rescheduling.
- Adherence to Data Protection Guidelines: increasing the security of the data by following the regulations of the DPDPA in India and the GDPR of data safety of personal and institutional data.

Under these enhancements, the system will be an institutional management system, entirely artificial intelligence-driven, and cross-platform accessible, providing decision sup-port in real-time and predictive analysis to the organization.

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