An-Najah National University

Faculty of Engineering & Information Technology

Computer Engineering Department

Graduation Project 1

HR Vision

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Disclaimer

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Abstract

HR vision system was designed and implemented to address the growing need for efficient and intelligent employee management at An-Najah National University, as it still depends on manual or semi-automated HR processes, which often lead to inefficiencies, errors and delays. The proposed system aims to automate and organize core employee management processes through an integrated web and mobile platforms supported by artificial intelligence features.

The key components of the proposed system include a centralized human resource management platform that manages employee records, attendance, leave requests, exit permissions, and workload allocation. In addition, artificial intelligence techniques were employed to ensure fair and efficient distribution of workloads among teaching assistants. The system also incorporates an intelligent recommendation engine to support Heads of Departments (HODs) in assigning teaching assistants to laboratory sessions and course sections. Furthermore, a user-friendly interface provided to allow teaching assistants to easily submit and track their leave and exit requests.

The system was developed using a multi-layered architecture. A web application was implemented using React.js, while a cross-platform mobile application was developed using React Native to support both Android and iOS devices. The backend was built using Node.js, with MySQL employed as the primary database management system. The system supports role-based access for Human Resources (HR), Heads of Departments (HODs), and Teaching Assistants (TAs). Core functionalities include attendance management, leave and exit requests, employee registration approval, department management, workload and section distribution, schedule creation, announcements, and meetings management. Additionally, intelligent features such as a chatbot, notification system, and real-time chat were integrated to enhance usability and communication. An artificial intelligence module based on a pre-trained Ollama model was incorporated to support system assistance, suggestions, and analytical operations.

Although various HR management systems are available, many focus primarily on basic administrative tasks and lack effective integration between academic workload management and communication tools. This project distinguishes itself by providing a unified platform that combines HR operations, academic scheduling, intelligent assistance, and real-time communication, offering a more cohesive and practical solution tailored to the university environment.

Chapter 1: Introduction

General background

HR management systems play an important role in the effectiveness of institutions operation, as it directly influences employee performance, productivity and overall organizational efficiency. An-Najah National University, in particular face complex administrative and challenges, due to the diversity of roles, large number of employees and continuous interaction between academic and administrative departments. Despite rapid technology growth, the university still uses a legacy system, that relay on manual human resources process, which is time-consuming and inefficient.

The growing demand for digital transformation in higher education highlights the need for integrated, intelligent, and user-friendly HR systems that can support both administrative and academic operations. This project addresses this need by implementing an advanced HR Vision System tailored specifically to the university environment.

Objectives

The primary objective of this project is to design and implement an intelligent and integrated HR Management System that enhances efficiency, accuracy, and transparency in employee management at An-Najah National University. The system aims to automate core HR processes and reduce dependency on manual procedures.

The specific objectives of this work include:

- Automating employee management tasks such as attendance recording, leave requests, exit permissions, and employee registration approval.
- Providing a centralized platform that integrates HR operations with academic workload and scheduling management.
- Utilizing artificial intelligence techniques to ensure fair and efficient distribution of workloads among teaching assistants.
- Assisting Heads of Departments through intelligent recommendations for assigning teaching assistants to laboratory sessions and course sections.
- Enhancing communication through real-time chat, announcements, meetings management, and notification systems.

Significance of the work

The significance of this project lies in its ability to address critical challenges faced by NNU institution in managing human resources efficiently. With the increasing number of employees and academic activities, the university requires a smart system that go beyond basic administrative functionality.

Unlike many the existing system that focus mainly on payroll and record-keeping, the proposed HR Vision System integrates academic workload management, intelligent decision support, and communication tools within a unified platform. This integration reduces administrative overhead, minimizes errors, and improves coordination between HR departments, Heads of Departments, and teaching assistants. In addition, the incorporation of artificial intelligence including workload optimization, intelligent recommendations, and chatbot assistance has added value by supporting data-driven decision making.

organization of the report

This report is organized into several chapters:

Chapter 1 introduces the project by presenting the background, objectives, significance, and structure of the report.

Chapter 2 reviews related work and existing HR management systems, highlighting their limitations and differences from the proposed system.

Chapter 3 describes the methodology followed in developing the system, including the software architecture, development technologies, system requirements

Chapter 4 presents the results of the system implementation, including functional validation and feature evaluation supported by screenshots and test outcomes.

Chapter 5 provides a discussion of the results, analysing the effectiveness of the web and mobile applications in meeting the project objectives.

Chapter 6 concludes the report and provides recommendations for future enhancements.

Chapter 2: Theoretical Background and Previous Work

HR management systems are widely used to support administrative tasks such as employee record management, attendance tracking and leave processing. However, HR management extends to include workload distribution, teaching assignments and coordination between departments. Many existing HR systems are not specifically designed to support these academic requirements.

At An-Najah National University, Heads of departments assign teaching assistants to sections and laboratories manually. Number of missions, projects and laboratory hours are entered for each section separately without automated validation or indicators to detect conflicts or workload imbalance. This manual process often leads to unfair workload distribution, where some TAs are overloaded while others have significantly fewer responsibilities.

Recent advancements in artificial intelligence have led to the use of intelligent decision-support tools in HR systems, such as recommendation systems and workload analysis methods. These tools help reduce personal bias, improve fairness, and increase efficiency. However, most existing HR platforms still focus mainly on basic administrative tasks and do not provide intelligent support suited to academic environments, especially in helping Heads of Departments assign teaching assistants and manage workloads fairly.

Communication is another critical aspect of HR systems. In many universities, including An-Najah National University, communication relies primarily on email, with no formal chat or notification systems integrated into HR platforms. This results in delayed communication and reduced coordination. Prior work indicates that integrated messaging and notification systems significantly improve organizational communication and usability.

Overall, current HR systems and research solutions solve some aspects of the problem, but they do not offer a single, integrated solution that brings together academic workload management, intelligent recommendations, and real-time communication. This project builds on existing work by introducing an HR vision system designed specifically for the academic environment, providing a practical and unified platform that overcomes these limitations.

Chapter 3: Methodology

3.1 System design and architecture

3.1.1 System Architecture

HR Vision system is built using a modern Three-Tier Architecture, designed to provide a seamless, scalable, and secure experience for both administrative staff and academic employees. The architecture ensures a clean separation of concerns between the presentation, logic, and data storage layers.

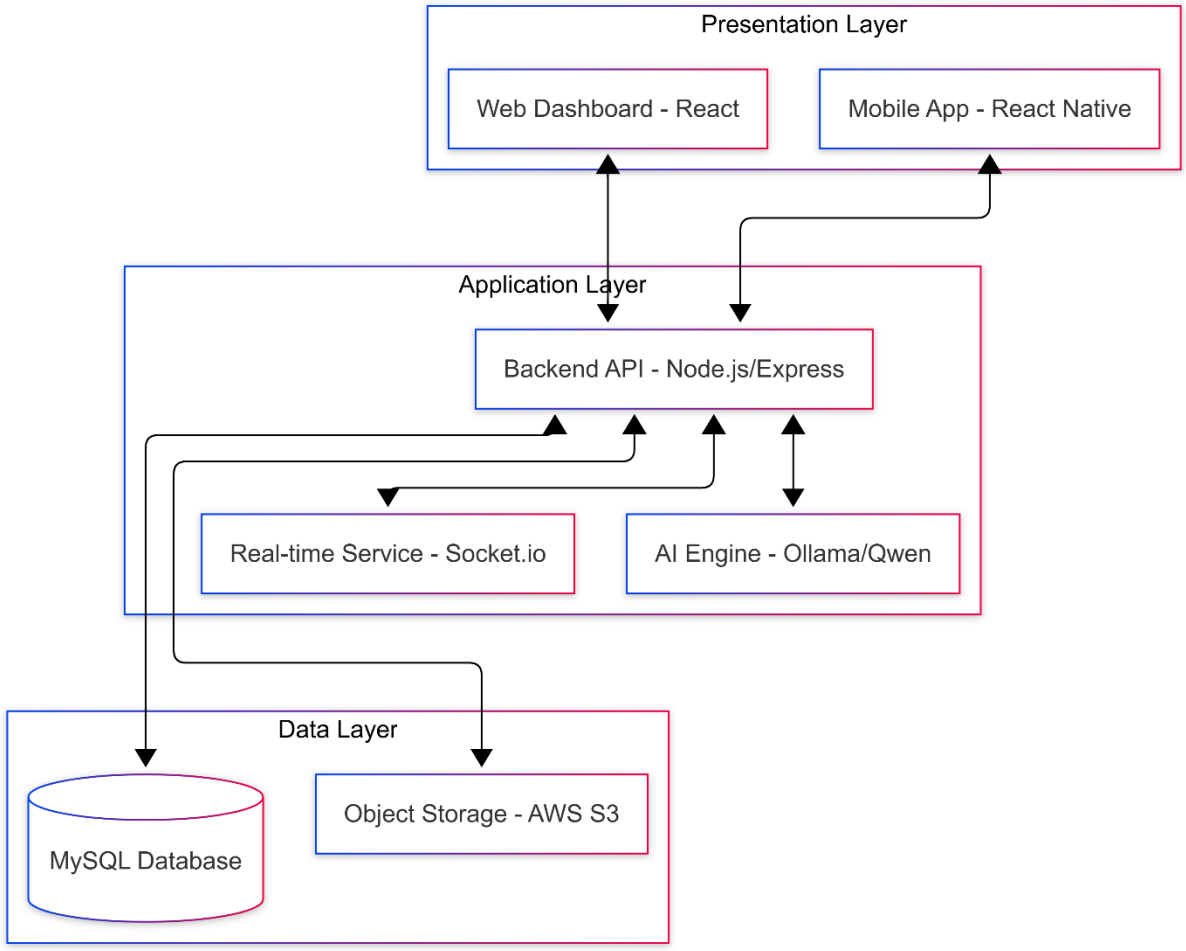


Figure 1 system architecture

3.1.2 System Design

The system follows a three-layered architecture consisting of Presentation, Application, and Data Layers, designed to provide a scalable, real-time, and AI-powered web and mobile platform.

1. Presentation Layer
   includes a web dashboard built with React and a mobile app built with React Native. These interfaces allow users to interact with the system, view data, and receive real-

time updates. Both communicate with the backend through APIs and WebSocket connections.

2. Application Layer
   the core of the system, consisting of a Node.js/Express backend, a real-time service using Socket.io, and an AI engine using Ollama. The backend handles requests from the frontend, processes business logic, communicates with AI services for predictions or recommendations, and sends real-time updates to clients.

3. Data Layer
   stores and manages all persistent information. A MySQL database handles structured data like user records and logs, while AWS S3 provides object storage for files and media. This combination ensures data reliability and scalability for large datasets.

3.1.3 Data Flow

When the frontend sends a request to the backend API, the backend processes it and may interact with several components depending on the task. It can call an AI engine to generate predictions or recommendations, or a real-time service to deliver immediate notifications. Additionally, the backend accesses data from MySQL or S3 storage as required. Once processing is complete, the response is sent back to the frontend, which may receive updates in real time via WebSocket.

3.2 Technologies

3.2.1 React

is used for building interactive and dynamic web interfaces. It enables the development of reusable UI components, which enhances code maintainability and accelerates development. In this project, React is combined with Tailwind CSS for modern, responsive styling and Recharts for data visualization, allowing the frontend to display complex information through interactive charts and graphs.

3.2.2 React Native

is used to develop the mobile application, enabling cross-platform compatibility with both iOS and Android devices from a single codebase. This approach reduces development time while ensuring a consistent user experience. The project utilizes Expo to simplify the build and deployment process and Expo Router to manage navigation within the mobile application.

The project integrates several Expo modules to extend the functionality of the application. For instance, expo local authentication and expo location to ensure registering attendance within campus borders, react native gifted charts is employed to display charts and graphical information in a visually appealing and responsive manner.

3.2.3 Node.js/express

The backend of the system is implemented using Node.js with the Express.js framework. Node.js provides an asynchronous, event-driven runtime environment that efficiently handles concurrent requests from both web and mobile applications, making it suitable for real-time applications. Express.js simplifies server-side development by offering a robust routing system and middleware support. The backend is responsible for processing API requests, managing business logic, interacting with databases and AI models, and integrating cloud services, ensuring seamless communication between the frontend and backend components.

3.2.4 AWS services

The project leverages Amazon Web Services (AWS) to provide reliable and scalable cloud infrastructure. AWS RDS (Relational Database Service) is used to host the MySQL database, ensuring high availability, automated backups, and efficient management of structured data. This allows the backend to handle large volumes of user and system data reliably while maintaining strong data integrity and performance. Additionally, AWS S3 (Simple Storage Service) is utilized for storing files, such as user uploads, reports, and media content. S3 provides secure, durable, and scalable storage, enabling the application to manage and retrieve files efficiently. Together, these AWS services enhance the overall robustness of the system, providing scalable data management and storage solutions that support both web and mobile application functionality.

3.2.5 Ollama

A local large language model (LLM), is integrated to provide AI-driven predictions and recommendations. By processing data locally, the system ensures faster response times and greater privacy for sensitive information. Ollama enables intelligent decision-making and enhances the overall functionality of the application, allowing it to provide personalized suggestions and automated insights.

3.2.6 MySQL

MySQL is utilized as the relational database management system for the project. It efficiently handles structured data, supports complex queries, and ensures data integrity through ACID-compliant transactions. MySQL serves as the primary storage for user information, system logs, and application data, enabling the backend to retrieve and manipulate data efficiently while maintaining high performance and reliability.

3.3 Database design

HRVision system uses a relational database hosted on AWS RDS to manage university human resources and academic operations. Using RDS ensures high availability, automated backups,

security, and scalability, allowing the system to handle growing numbers of users, departments, and courses efficiently. The database is designed using a relational model, with foreign keys and constraints to maintain data integrity and consistent relationships between entities.

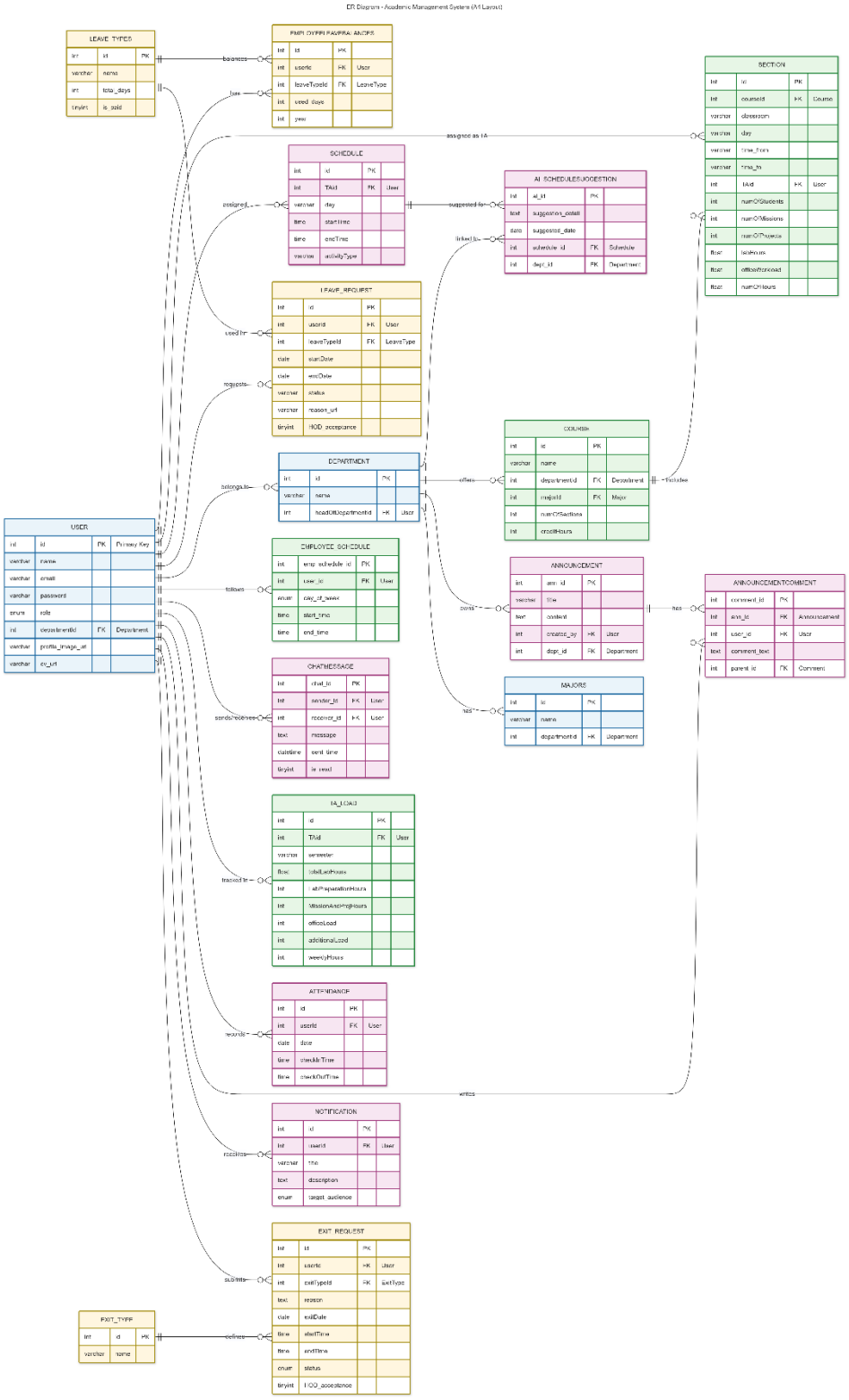


Figure 2 Database Design

3.4 System features

HRVision provides a comprehensive, role-based human resources management solution tailored for academic institutions. The system streamlines employee management, attendance tracking, leave and exit workflows, internal communication, and academic scheduling while leveraging modern technologies including AI assistance, cloud storage, and real-time communication. The feature set addresses the complete lifecycle of HR operations from employee onboarding through daily attendance, leave management, and advanced analytics.

3.4.1 Authentication and access control

Ensures that all users access the system safely and according to their assigned roles. Users log in using ID and password credentials, while secure token-based sessions maintain persistent access. Role-based access control restricts system features to authorized roles, including Teaching Assistants, Heads of Departments, HR personnel, and Administrators.

The module also includes password recovery functionality with email-based OTP verification that expires after five minutes, ensuring secure and efficient account management. These measures collectively protect sensitive employee and academic data while maintaining a smooth user experience.

3.4.2 User management

Handles the complete lifecycle of user management, from onboarding to profile maintenance. Administrators can add users and assign them to departments, while HR personnel review and approve new user registrations. Users can manage their own profiles, update personal information, and upload documents such as profile images and CVs, securely stored in AWS S3. The module also supports batch management, enabling filtering and sorting to manage large numbers of employees efficiently.

3.4.3 Department management

Organizes the university's academic structure and hierarchy. Departments and maintained, and Heads of Departments are assigned to oversee their departments. Teaching assistants assigned based on workload and availability. This ensures that courses are properly staffed and that academic operations are aligned with department hierarchies. It also integrates with attendance and scheduling features to monitor TA participation and compliance with assigned duties.

3.4.4 Attendance, leave, and exit management

Tracks employee attendance, manages leave requests, and processes exit approvals. Daily check in and check out records are automatically captured, with mechanisms to detect late arrivals, early departures, and actual hours worked, comparing with their weekly schedule. Employees can submit multi-type leave requests, which follow a two-stages approval process involving HODs and HR. Exit requests are similarly managed, with tracking of hours and automatic conversion to leave days when exceeding certain number of exits hours.

3.4.5 AI and analytics

Provides intelligent insights and decision support for HR and academic operations. AI-driven analysis evaluates teaching assistant performance, attendance trends, and workload distribution to suggest optimized schedules and fair assignments. The system incorporates the Ollama local LLM for natural language queries, allowing users to ask questions about HR and academic data in plain language.

Dashboards present visual analytics, trends, and comparative statistics, while AI-assisted scheduling helps avoid conflicts and balance workloads. This enhances operational efficiency and supports data-driven decision-making for administrators and department heads.

3.4.6 Communication and notification

The communication and notification module makes it easy for users to share information and stay updated. Users get real-time notifications through a central hub, which can be sent to specific individuals, roles, or departments. Announcements and meetings can include attachments, expiration dates, and comment threads. The internal chat system allows instant messaging, shows who is online, and keeps a history of conversations. This helps employees collaborate effectively and ensures important information reaches the right people quickly.

Chapter 4: Results

This chapter presents the results obtained from the design, implementation, and testing of the proposed HR Vision System.

4.1 User management

In HR vision system we do not allow typical sign-ups to maintain security and avoid unauthorized registrations. Instead, admin adds new user info, but still not added to the system until the HR accept that user addition.

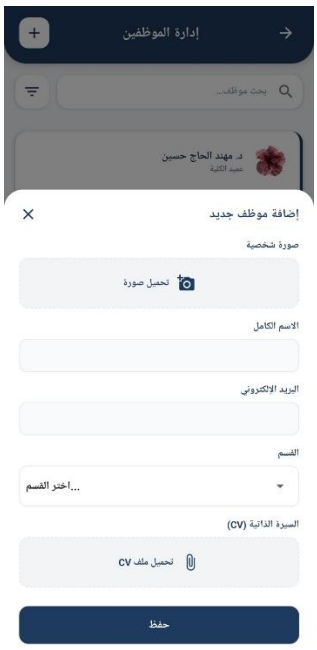


Figure 3 Admin add new user request (mobile)

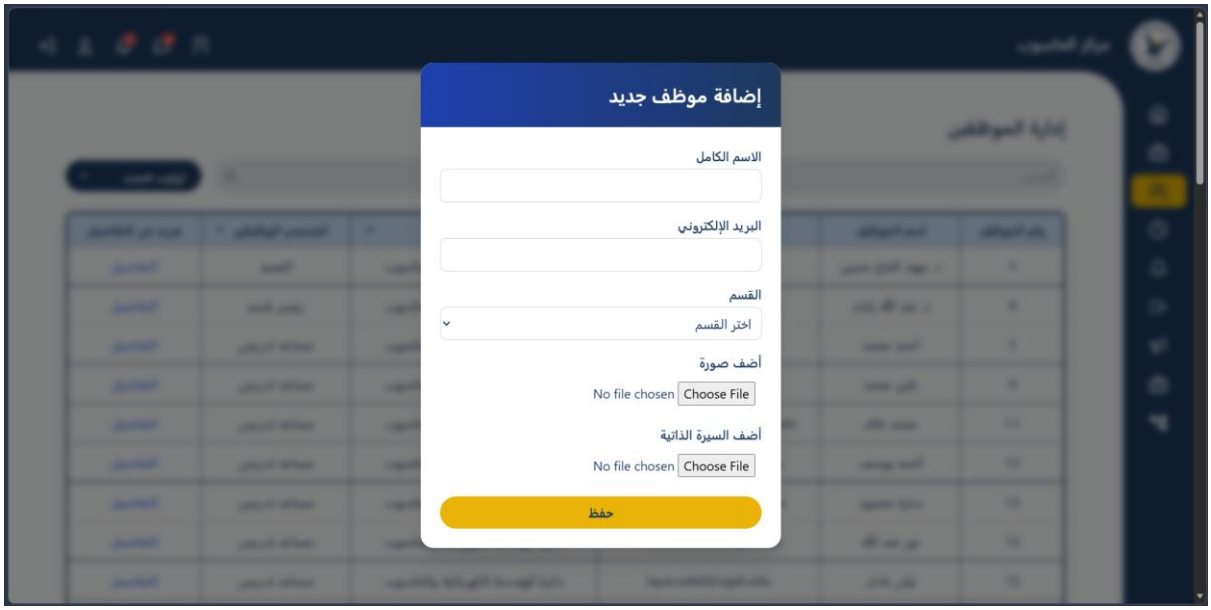


Figure 4 Admin add new user request (web)

Figure 5 HR accepts or rejects new user request (mobile)

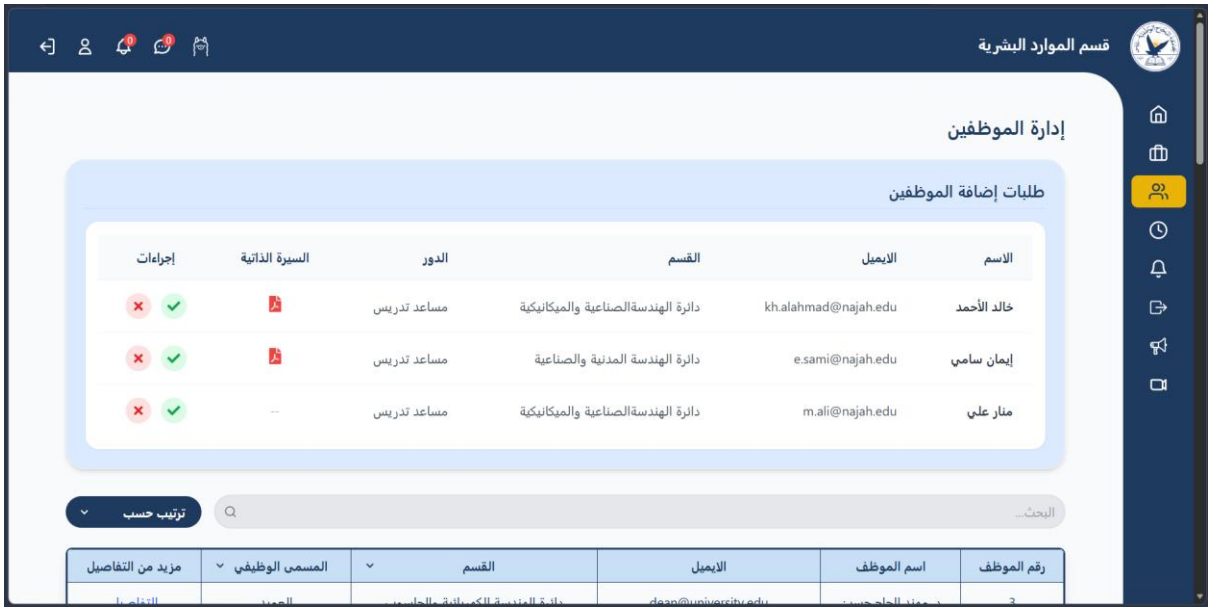


Figure 6 HR accepts or rejects new user request (mobile)

After the HR accepts the new user request, the user is added to the system and can login with the provided ID and default password “123456” as follows:

Figure 7 Login page (mobile)

Figure 8 Login page (mobile)

And finally, users can manage their profile, edit their information, upload profile picture and CV

Figure 9 User profile

Figure 10 Edit profile information

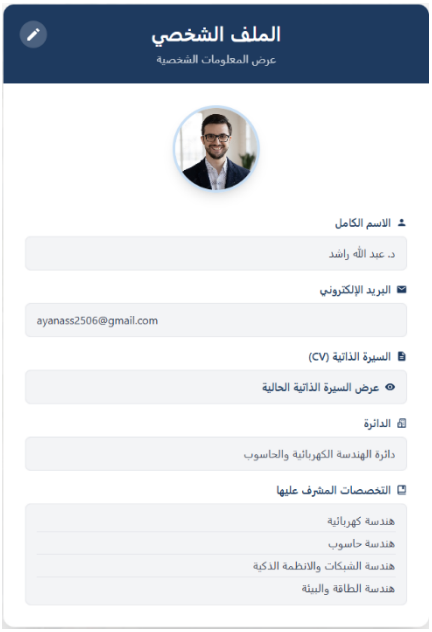


Figure 11 User profile (web)

Figure 12 Edit profile information (web)

4.2 OTP password recovery

To ensure account security, a 6-digit One-Time Password (OTP) system was deployed. Users can initiate a password reset via their registered university email. The system generates a temporary encrypted code with a 5-minute expiry window. This eliminates the risks of static recovery questions and ensures that only verified owners can regain access to their accounts.

Figure 16 Password reset stage 1 (mobile)

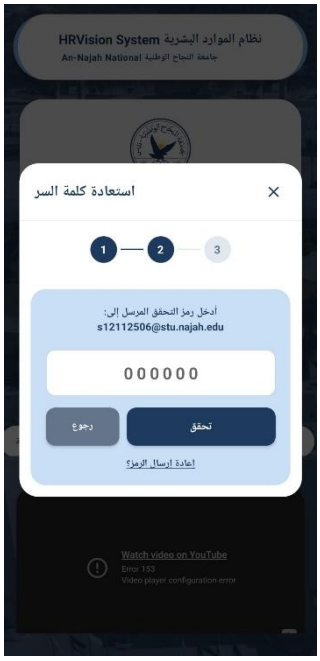


Figure 15 Password stage 2 (mobile)

Figure 14 Password stage 3 (mobile)

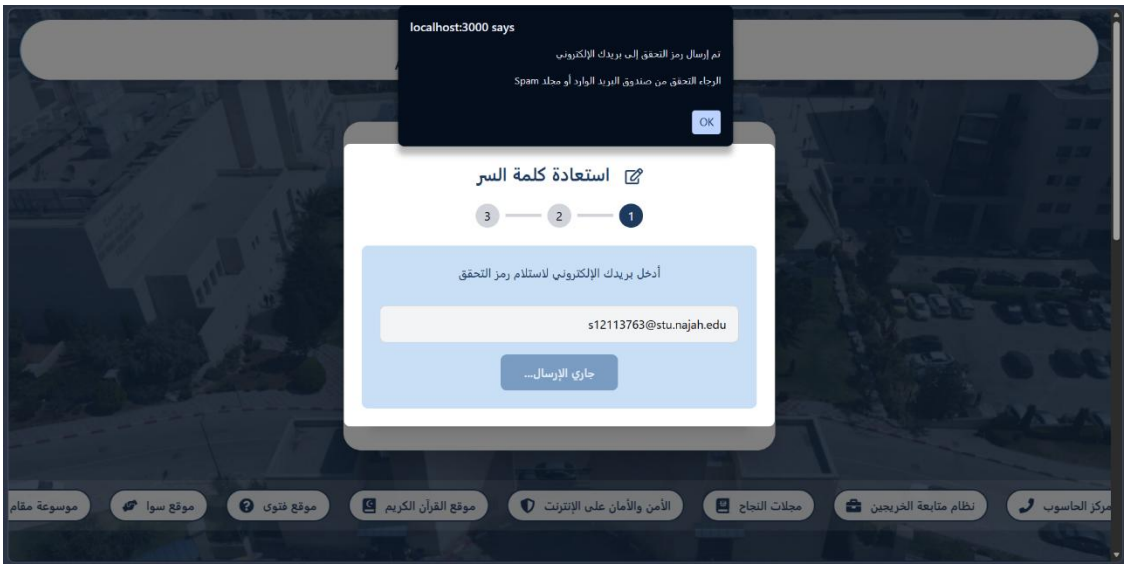


Figure 13 Password reset stage 1 (web)

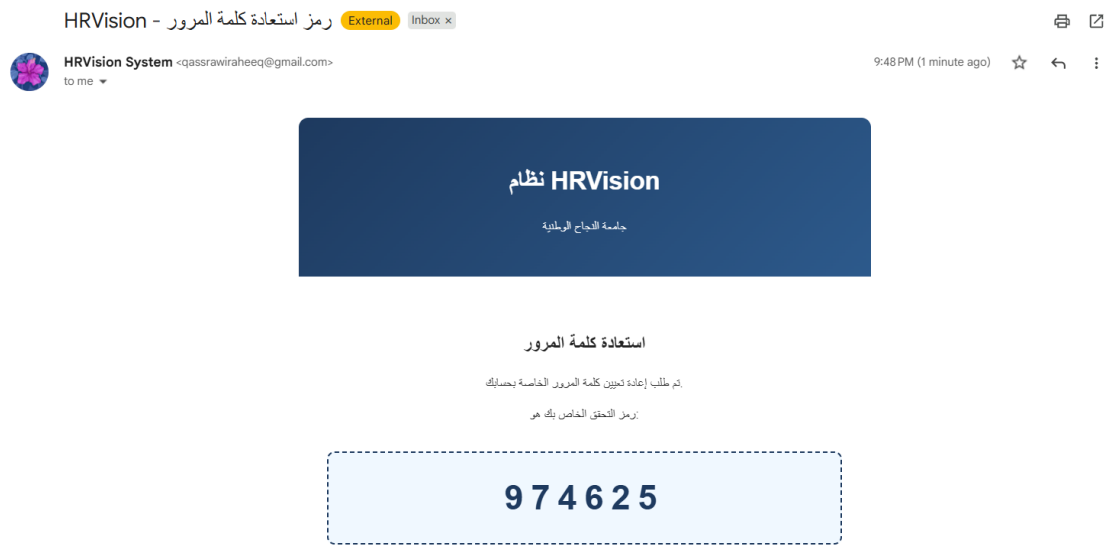


Figure 17 Receive encrypted code (web)

Figure 18 Password reset stage 2 (web)

Figure 19 Password reset stage 3 (web)

4.3 Department management

Departments are set of majors that are related to each other, with single professor who in charge of managing that department's TAs' schedules and workload, and managing courses and sections missions, projects and hours of preparation. In our system, TA are assigned to the department, admin can add new department, edit existing ones' head of departments, as well as delete departments. on the other hand, HR can only view departments information, with no other privilege.

Figure 21 Admin departments page

Figure 22 Add new department

Figure 20 Sort departments

Figure 24 Admin department info

Figure 23 HR departments page

Figure 25 HR department info

Figure 28 Admin departments page

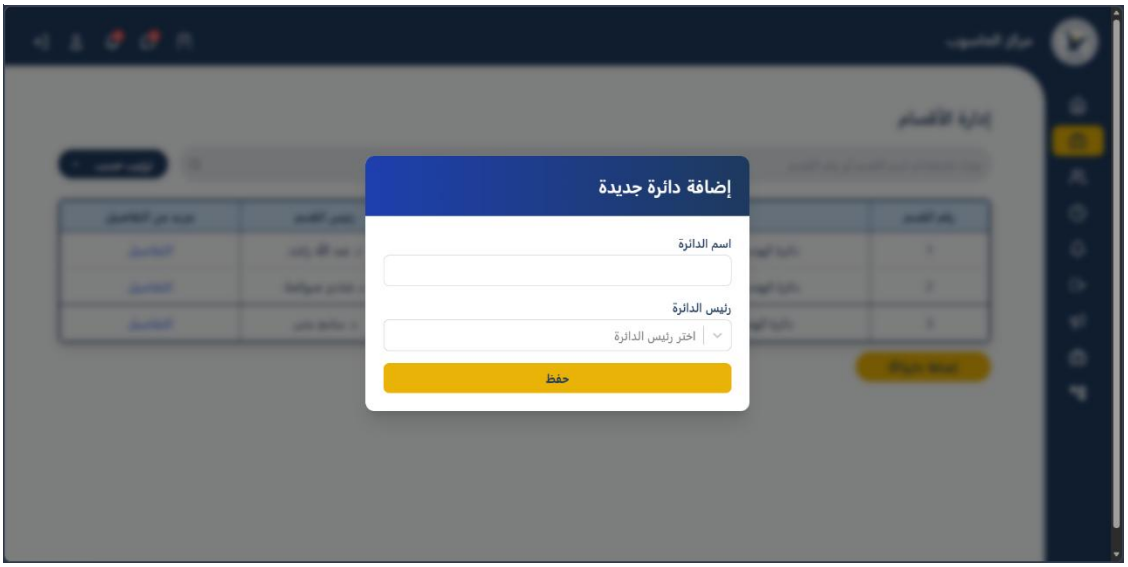


Figure 27 Admin adds departments

Figure 26 sort department

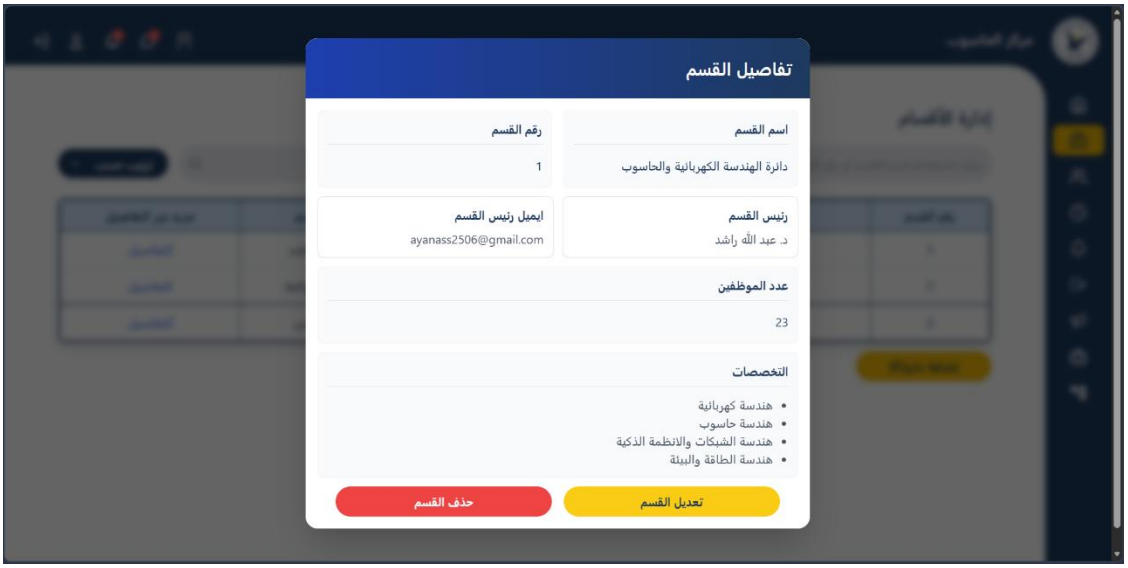


Figure 31 Admin department info

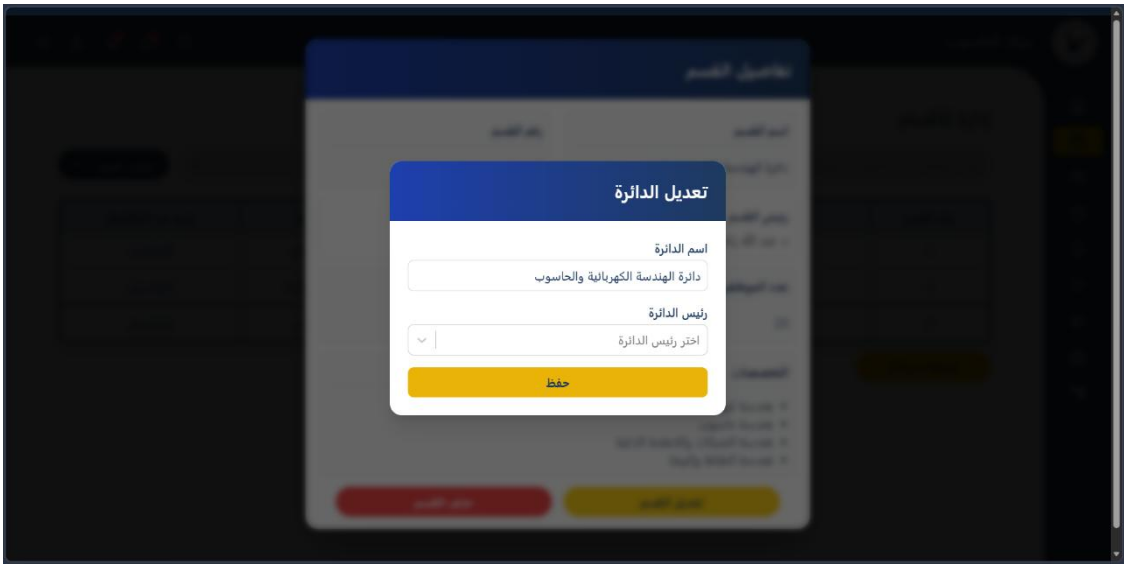


Figure 30 Admin edits departments

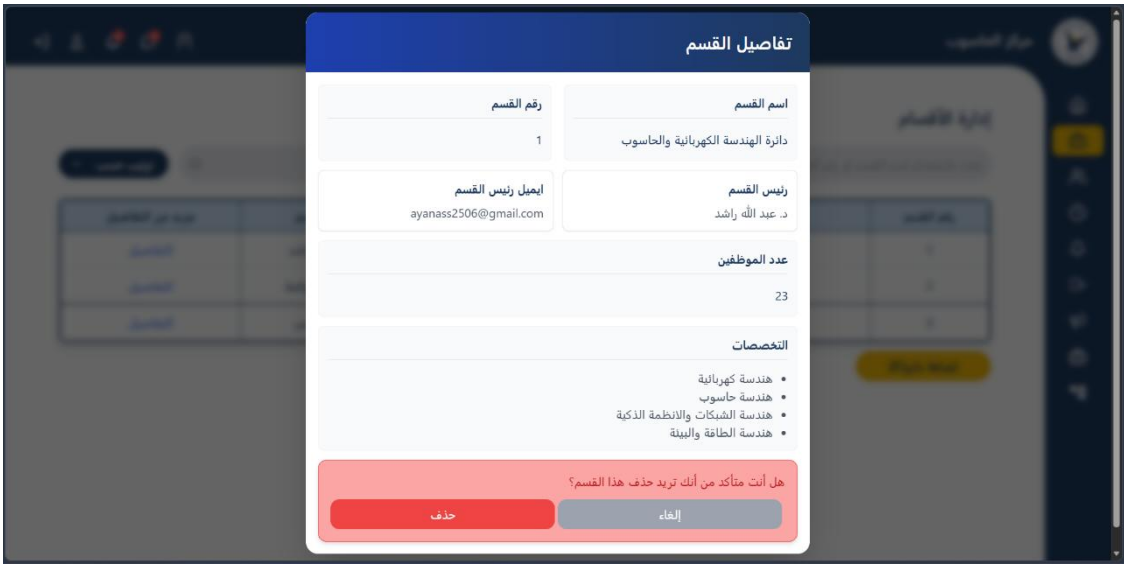


Figure 34 Admin deletes departments

Figure 33 HR departments page

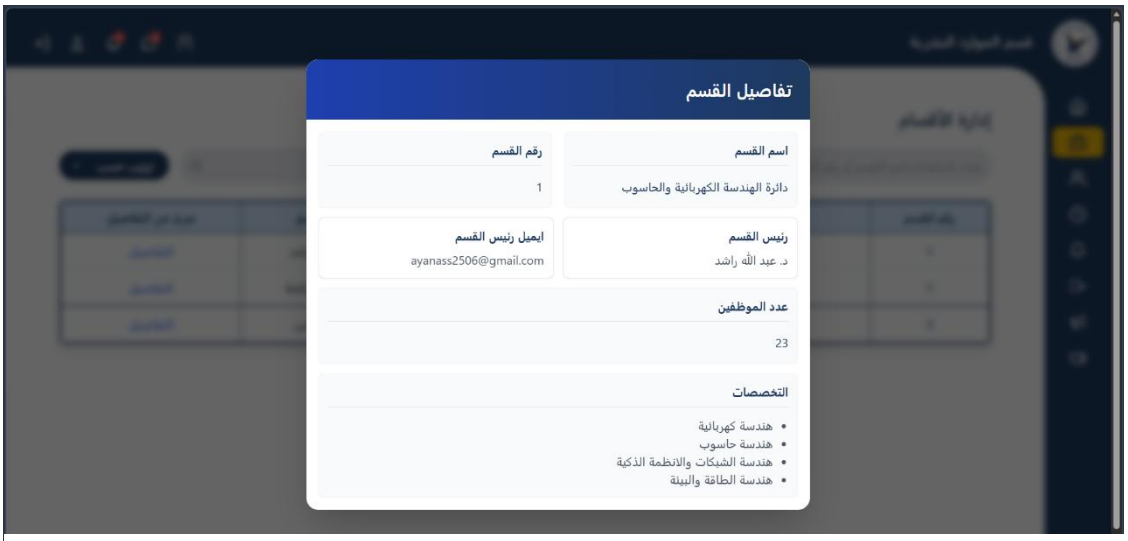


Figure 32 HR department info

4.4 Leaves management

In HR Vision System we keep track of TAs leaves requests, each TA has a balance of each type of leaves, he cannot exceed that balance, when TA send new leave request, the request pass through two-stages of acceptance starting from head and ending with HR. If the head reject the request the HR cannot do anything and notification will be sent to TA, however if head accept the leave, then TA will be notified that the request has been accepted from head, waiting for HR acceptance.

Both head and HR do not have any privilege except accept or reject the request. On the other hand, the admin has full privileges from adding, editing and deleting only pending requests in case of reversion of decision. As well, admin can add new leave types to the system, or edit existing ones.

Figure 35 TA leaves page

Figure 37 TA add new leave request

Figure 36 Leave request info

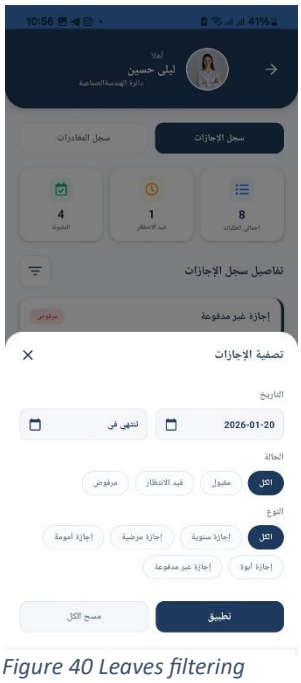


Figure 40 Leaves filtering

Figure 39 HR and HOD leaves page

Figure 38 Admin add new leave request

Figure 43 Leave balance exceed

Figure 42 Leaves overlapping

Figure 41 Edit leave request

Figure 46 Admin leaves types page

Figure 44 Add new leave type

Figure 45 Edit existing leave type

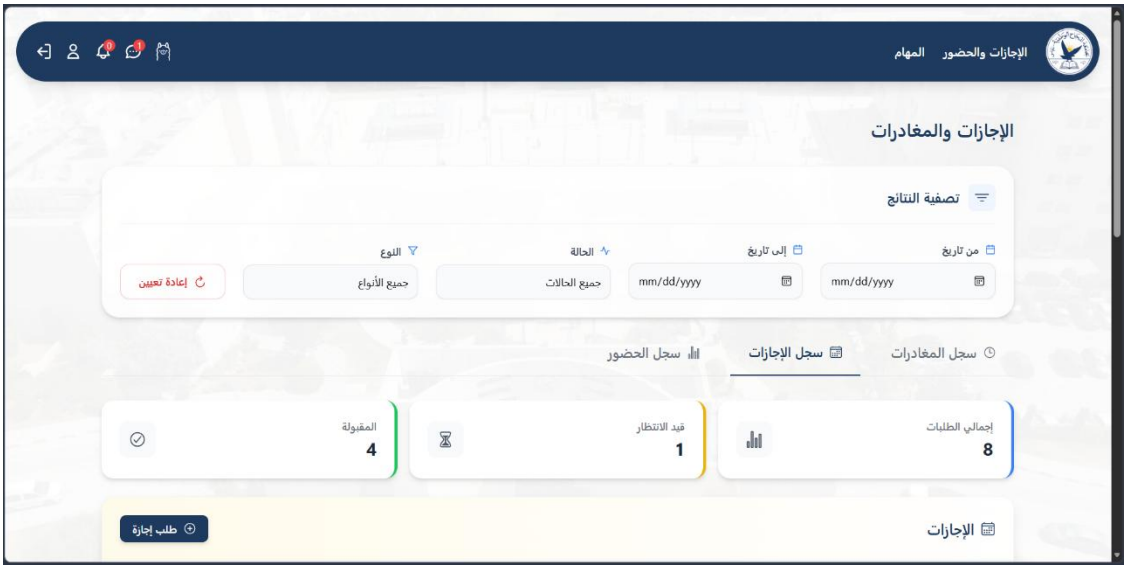


Figure 49 TA leaves page

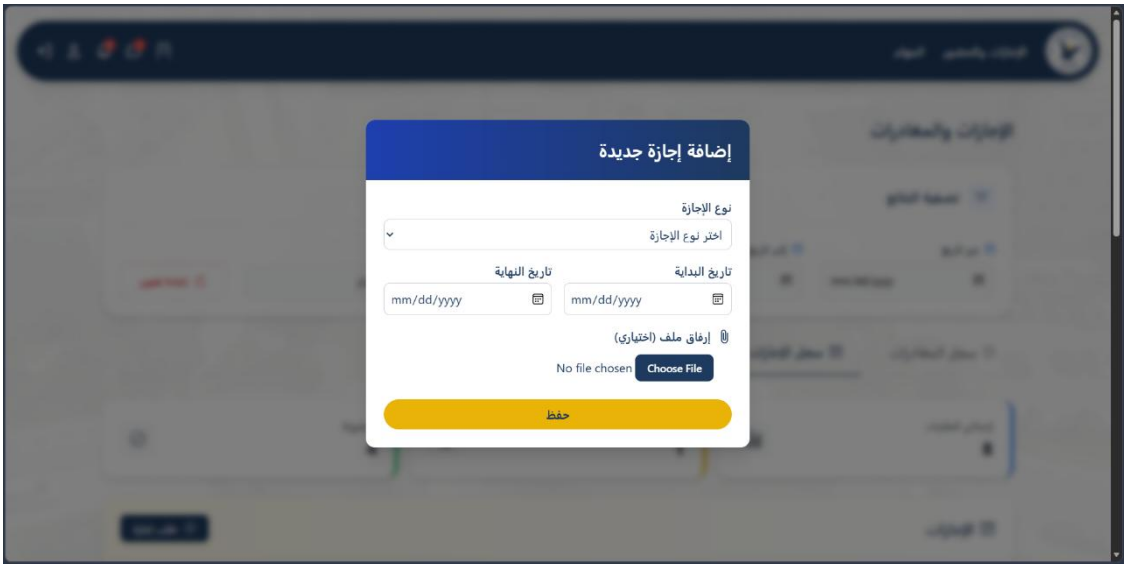


Figure 48 TA add new leave request

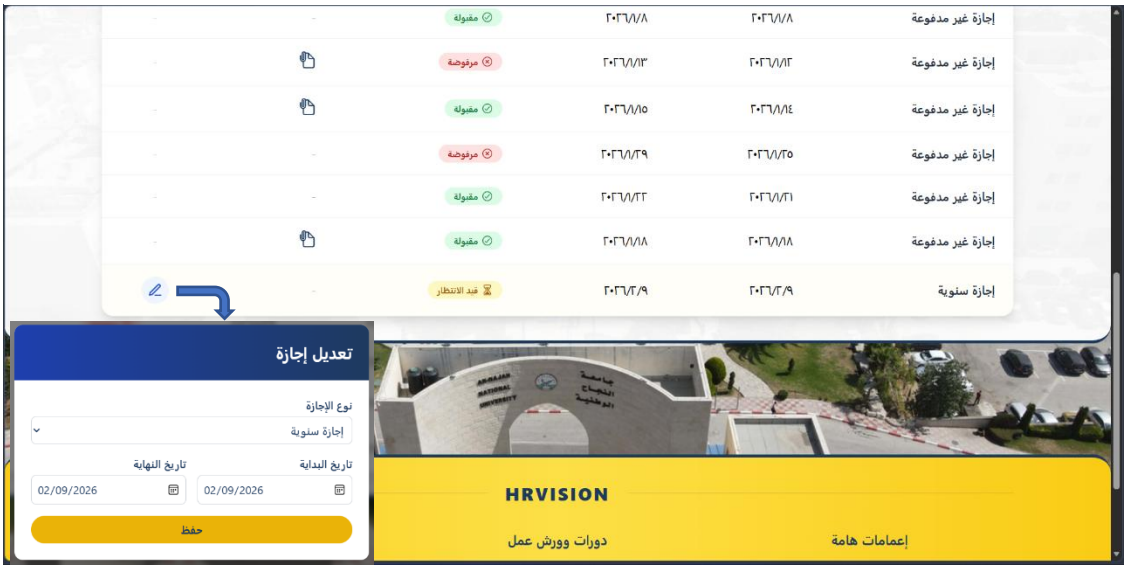


Figure 47 TA edits waiting leave request

Figure 52 Admin leaves page

Figure 51 HR leaves page

Figure 50 HOD leaves page

Figure 55 Leaves filtering

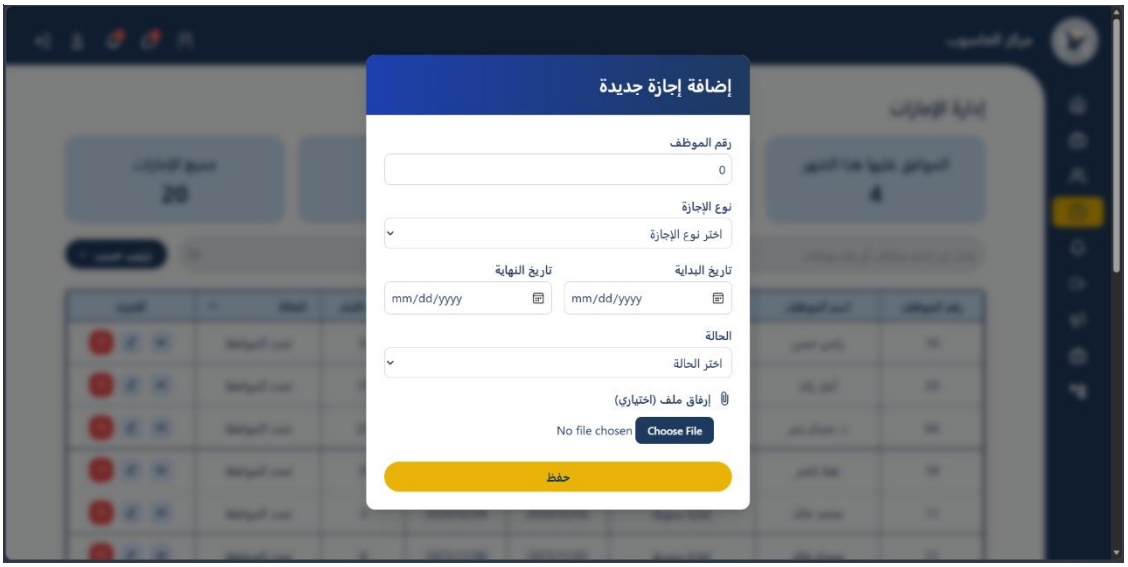


Figure 54 Admin add new leave request

Figure 53 Admin manages leave types

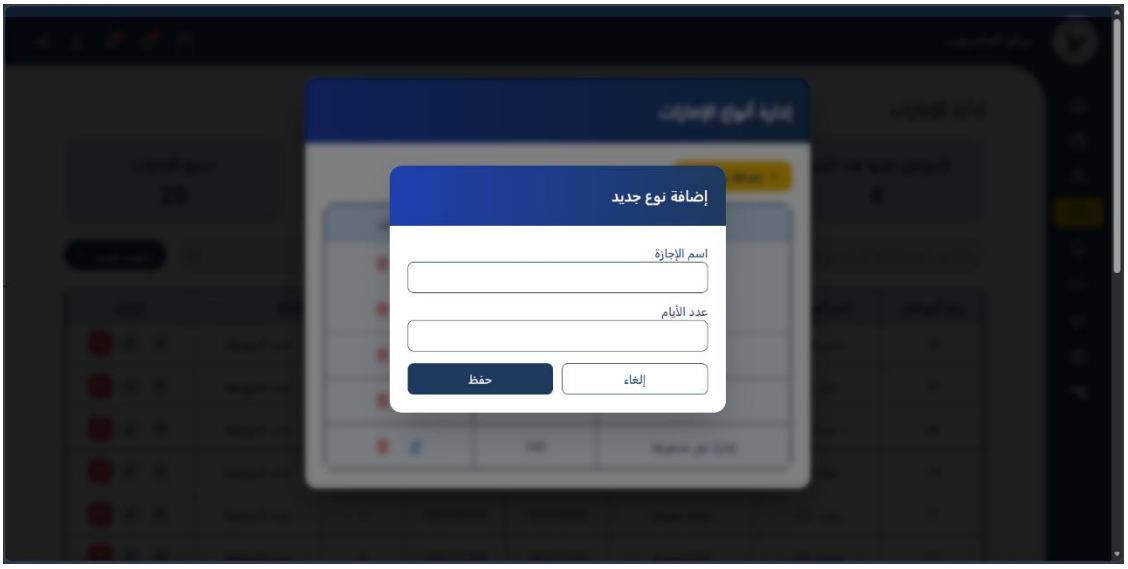


Figure 58 Admin adds new leave type

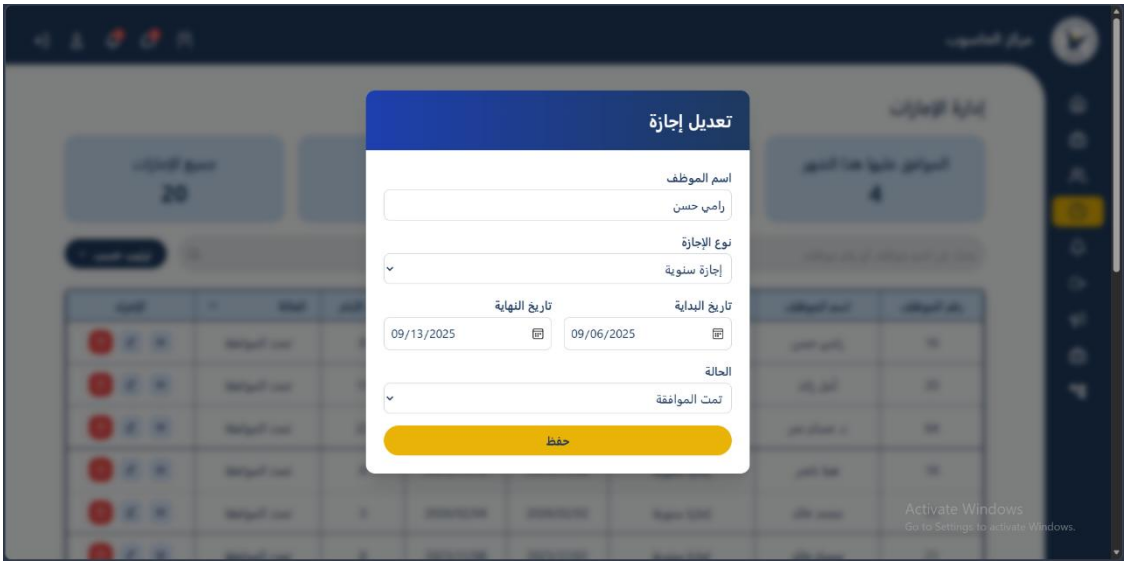


Figure 57 Admin edits existing leave type

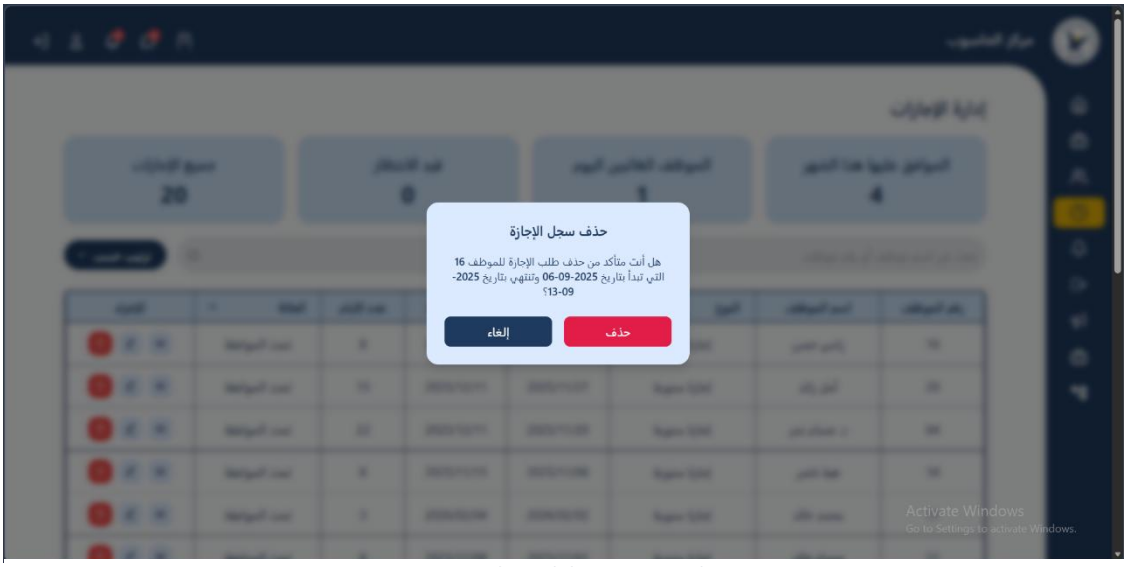


Figure 56 Admin deletes existing leave

4.5 Exits management

Exits are short-term leaves taken during working hours. In the system, exits are classified into predefined types, and teaching assistants are allowed a maximum of four exit hours per day. The system also tracks cumulative exit hours, and when a TA reaches 7.5 exit hours, one day is automatically deducted from the annual leave balance.

Teaching assistants can submit exit requests and receive notifications about their status through a two-stages approval process, starting with the HOD and ending with the HR. System administrators have full control over exit requests and exit types.

The system also tracks late arrivals and early departures, by comparing check-in and check-out times to the weekly schedule of that TA, when TA check-in to the system after the scheduled time of that day by 15 minutes, the system records this as a late arrival and will be cumulated to exit hours. Early departures also treated the same as late arrivals.

Figure 59 TA exits page

Figure 60 TA add new exit

Figure 61 TA exit information

Figure 62 Edit pending exits

Figure 64 Exits filters

Figure 63: HOD and HOD exits

Figure 65 Admin exits page

Figure 67 Admin late arrivals page

Figure 66 Admin add new exit request

Figure 70 Admin exit types page

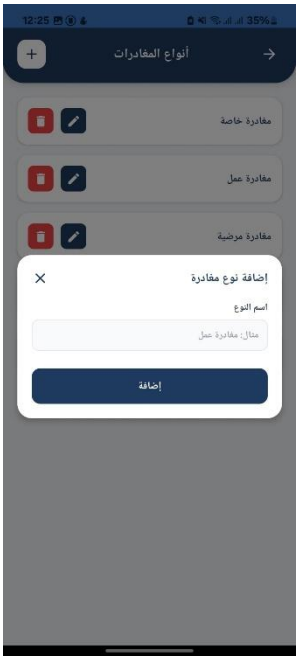


Figure 68 Add new exit type

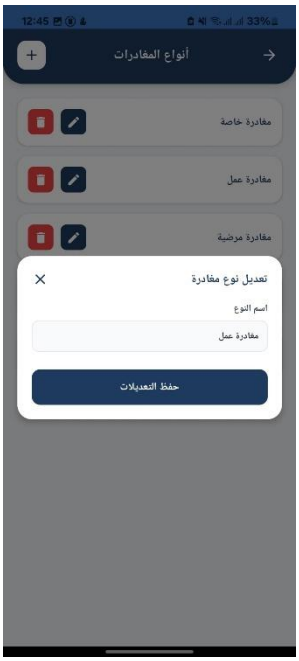


Figure 69 Edit existing exit type

Figure 71 TA exits filtering

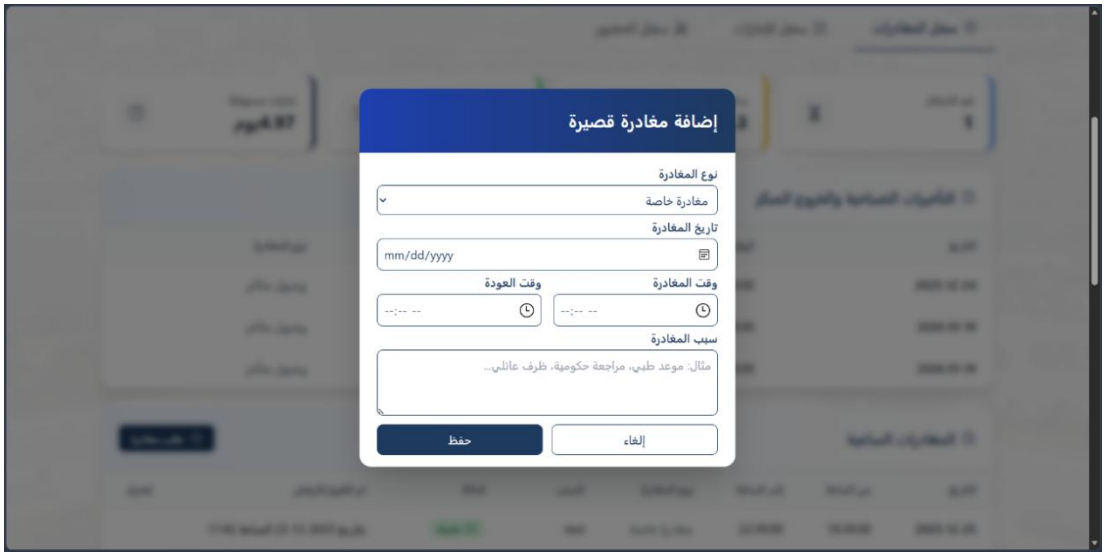


Figure 72 TA add new exit request

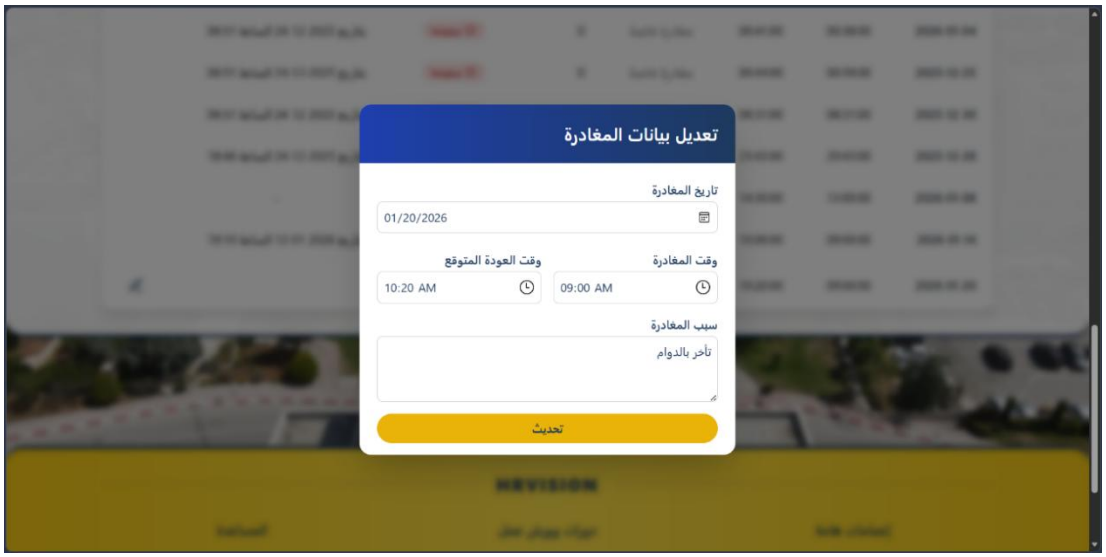


Figure 73 TA edit pending exit request

Figure 74 TA exits page

Figure 75 HR exits page

Figure 76 HOD exits page

Figure 77 Admin exits page

Figure 78 Admin late arrivals page

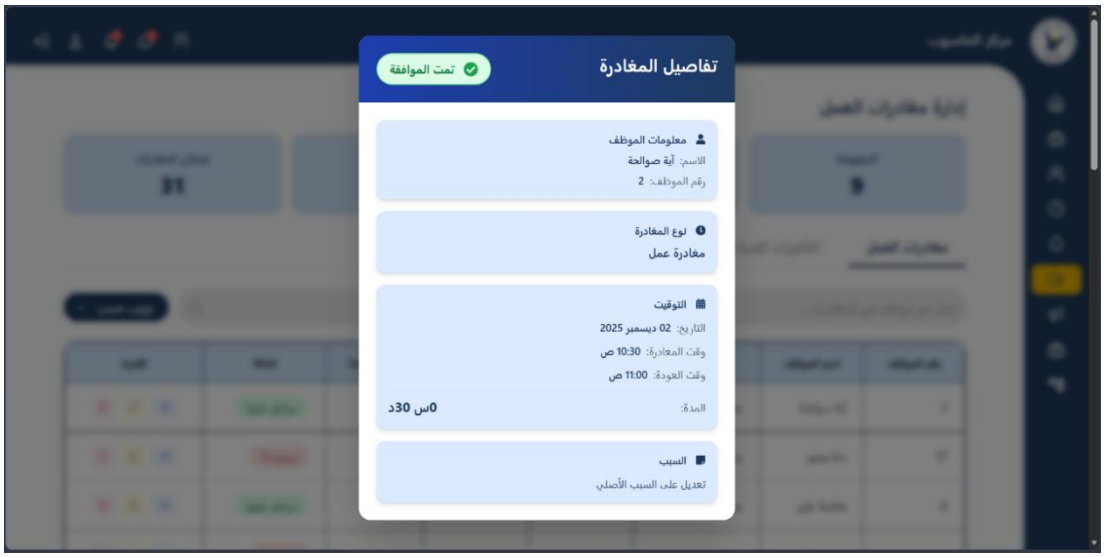


Figure 79 HR & admin exit details tab

Figure 80 Admin add new exit request

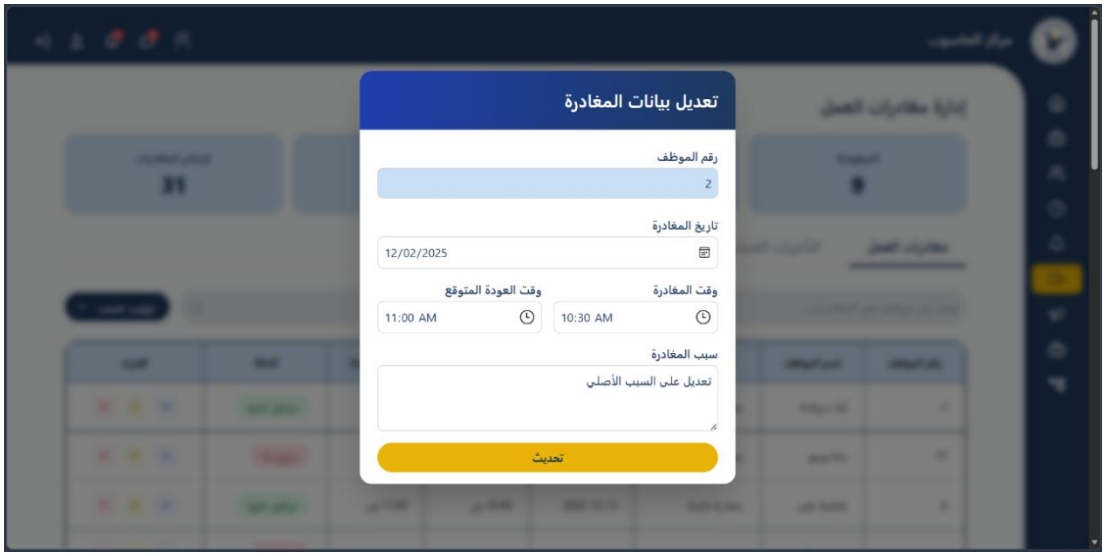


Figure 81 Admin edit existing exit request

Figure 82 Admin exit types management

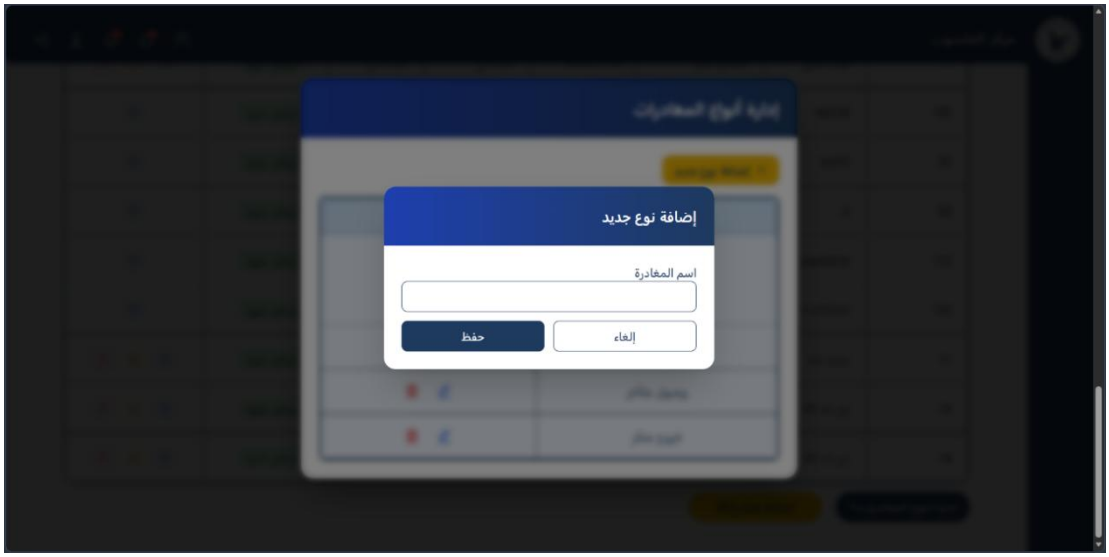


Figure 83 Admin add new exit type

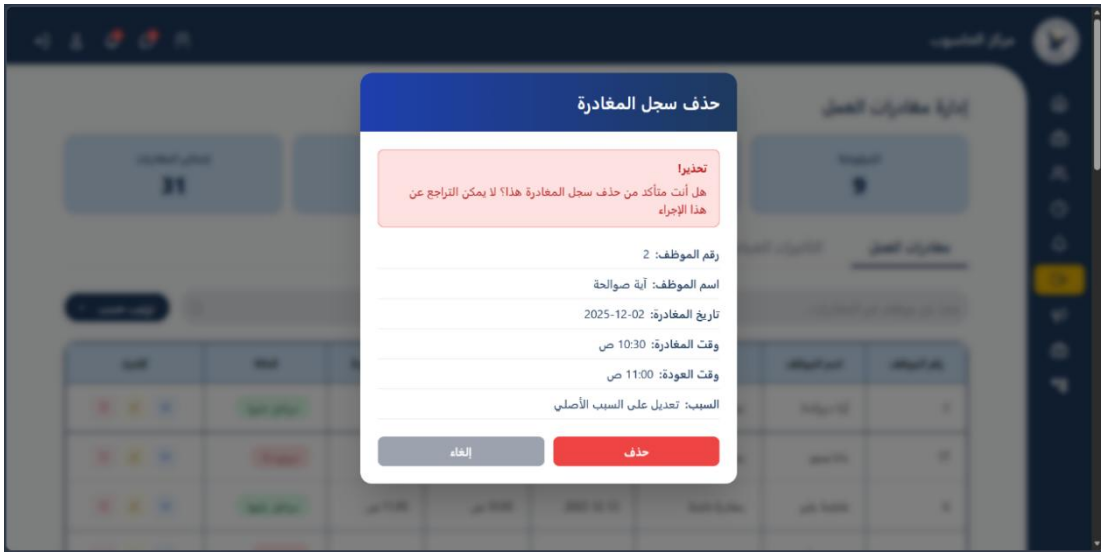


Figure 84 Admin delete existing exit type

4.6 Attendance management

It represents when the TA came to the university and when left it. In this feature, the TA enters check-in and check-out times while he is in the campus. To avoid plagiarism, the system does not record the attendance if TA location is outside the faculty borders, in addition, it requires to take TA biometrics to prevent unintended checks-in or check-outs. Admin can edit or delete attendance records when requested, HR can only view the records to analyse TA commitment.

Figure 87 TA home page

Figure 86 TA attendance records

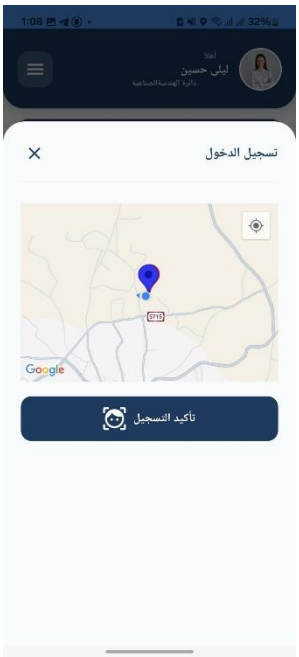


Figure 85 TA check-in page

Figure 88 Incorrect biometrics

Figure 89 Incorrect location

Figure 94 Admin attendance page

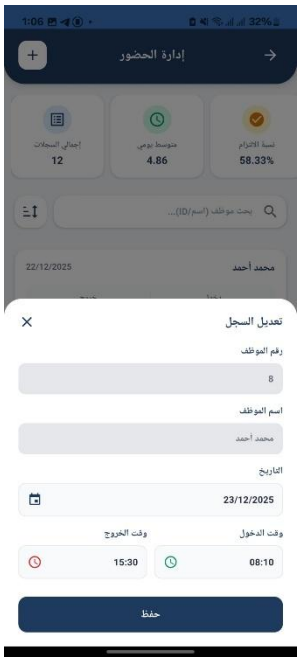


Figure 93 Edit record

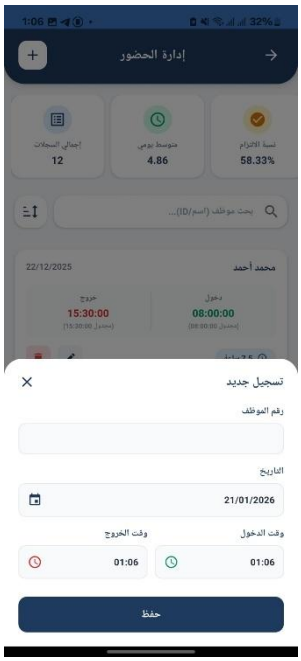


Figure 92 New attendance record

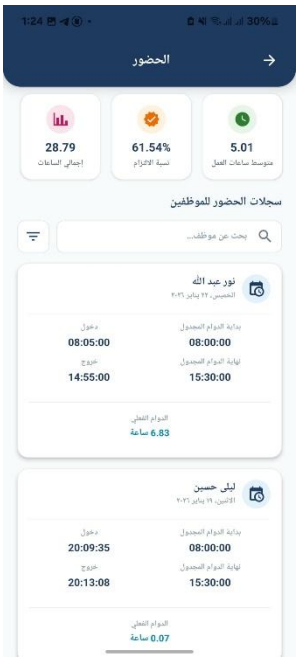


Figure 91 HR attendance page

Figure 90 Attendance filters

Figure 95 HR attendance page

Figure 96 TA attendance page

Figure 97 Admin attendance page

Figure 98 Admin edit existing attendance record

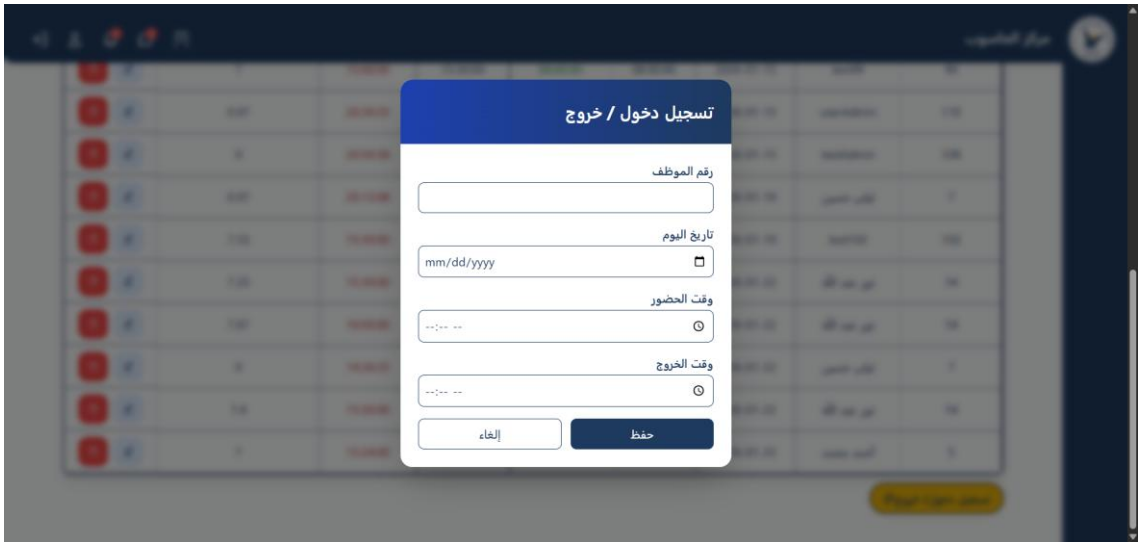


Figure 99 Admin add new attendance record

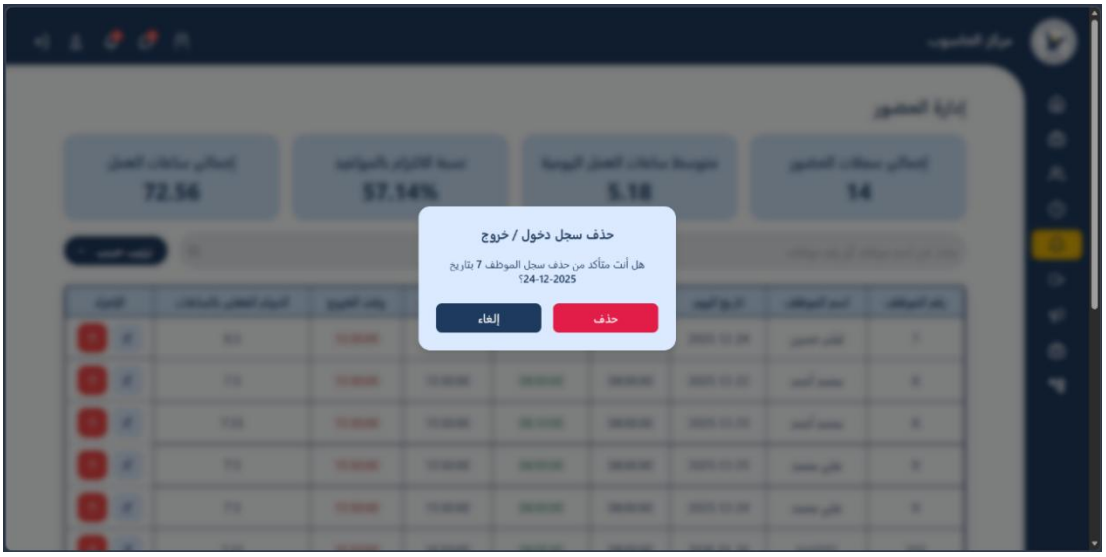


Figure 100 Admin delete attendance record

Figure 101 Attendance filters

4.7 Announcements management

HR vision system allows administrator and HR to send announcements to all departments or a specific department. The announcement has different categories, and sent to users depending on the topic. HR and admin can pin announcements or unpin them, pinned ones appear in dashboards, while unpinned do not. As well, they can edit or delete existing announcements. Users can add comments to the announcements, edit or delete them. In addition, admin has ability to delete improper comments when needed.

Figure 105 Announcements page

Figure 104 Add announcement

Figure 103 Edit announcement

Figure 102 Announcements filters

Figure 108 Announcement info

Figure 107 Add comment

Figure 106 Edit comment

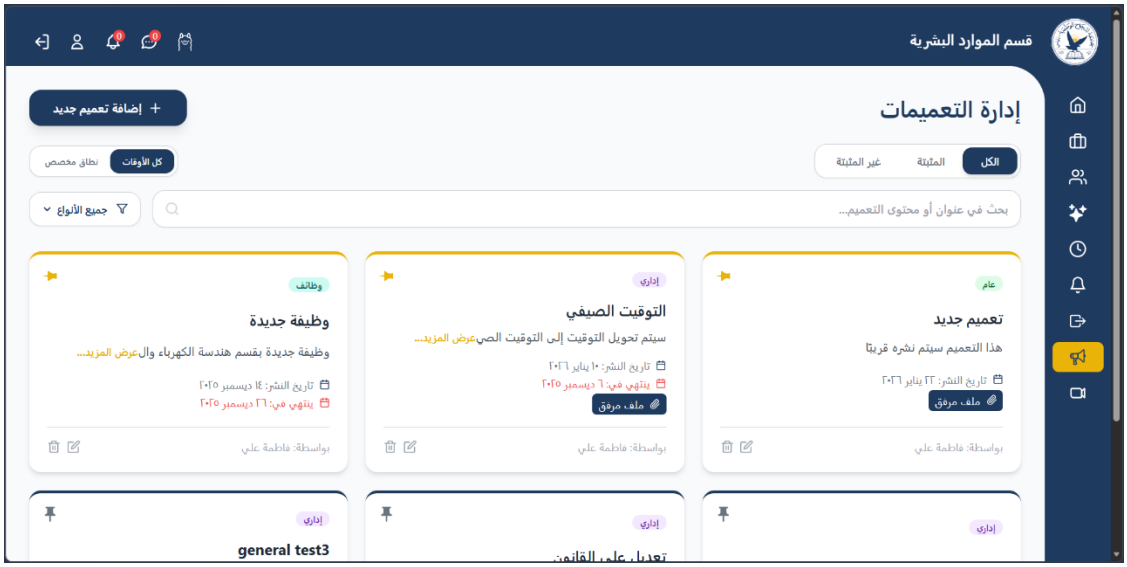


Figure 109 Admin and HR announcements page

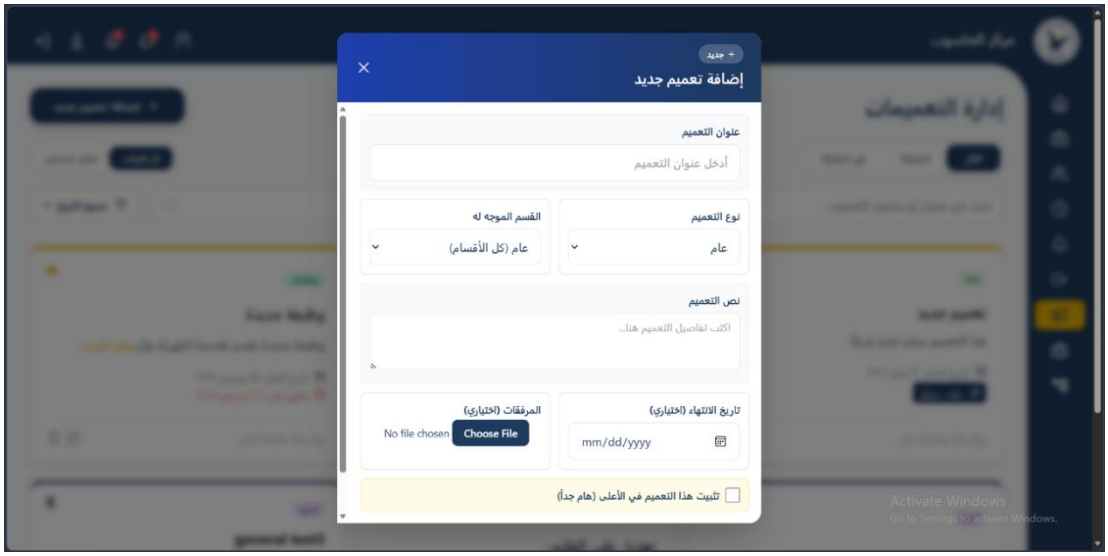


Figure 110 Add new Announcement

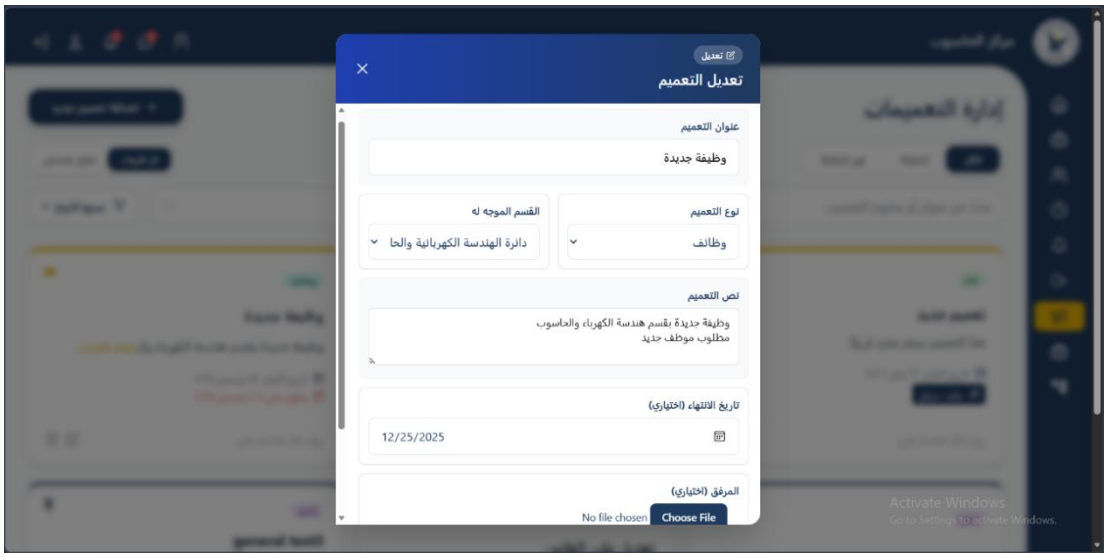


Figure 111 Edit announcement

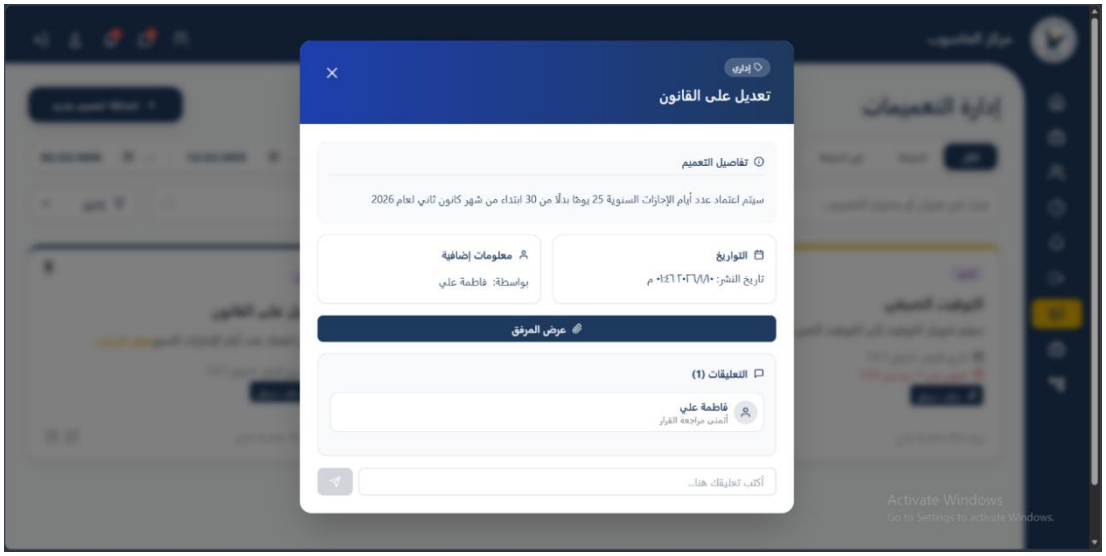


Figure 112 Add comment

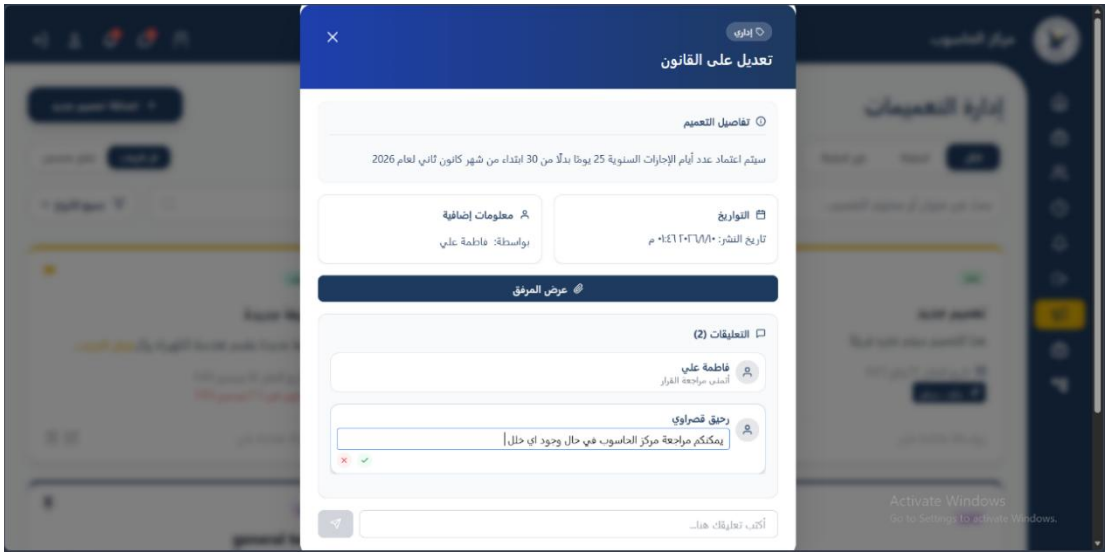


Figure 113 Edit comment

4.8 HR meetings

In HR vision, HR can create new zoom meeting and send the invitation via emails, meetings can target specific department or all departments, and can be done with HODs only or with all employees in the targeted department. When HR cancel a meeting, then cancellation email will be sent to all employees assumed to attend that meeting.

Figure 115 HR meetings page

Figure 116 create new meeting

Figure 114 Filter meetings

Figure 119 Invitation email

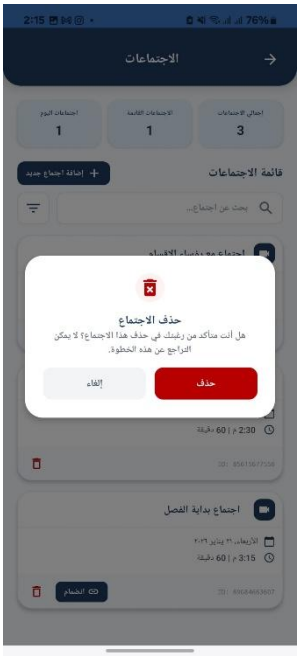


Figure 118 Delete a meeting

Figure 117 Cancellation email

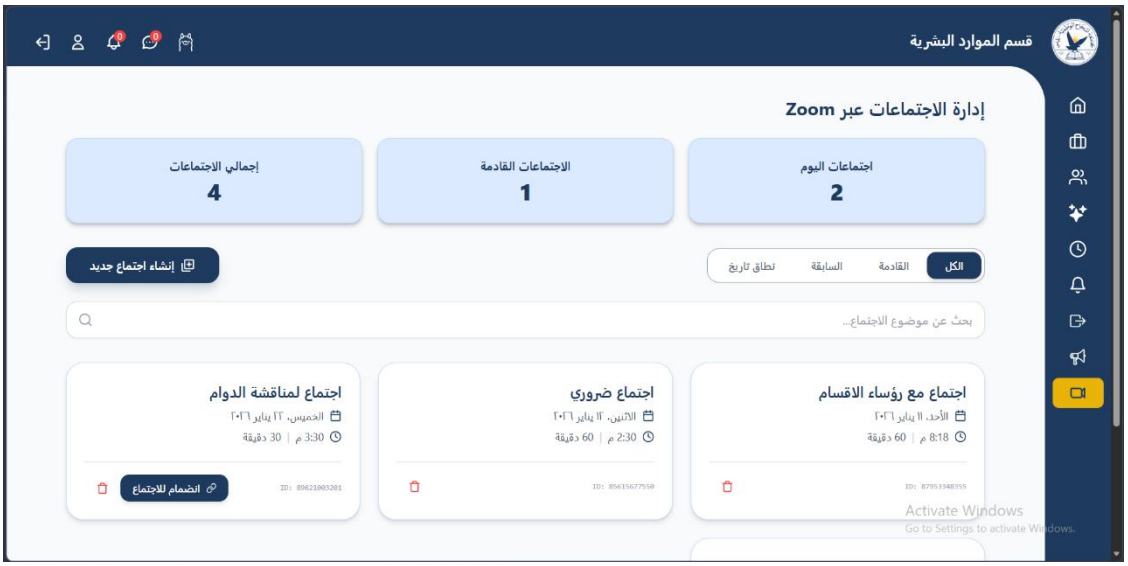


Figure 120 HR meetings page

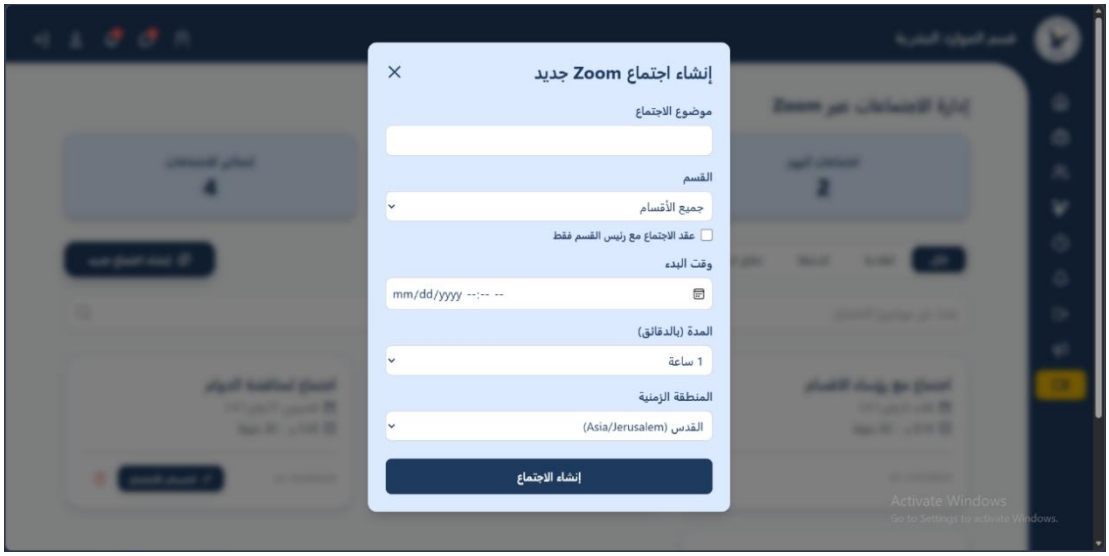


Figure 121 Create new meeting

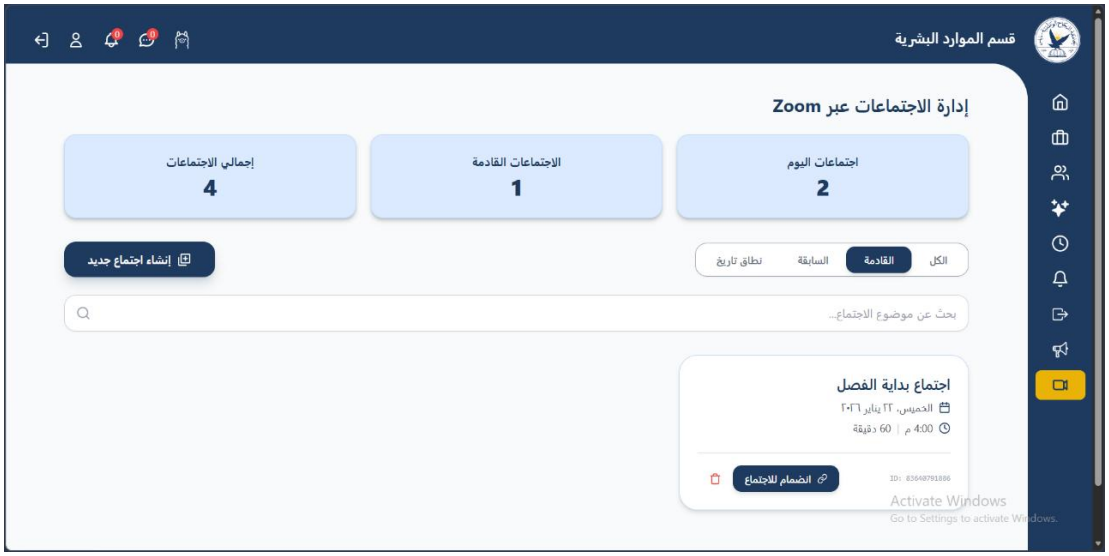


Figure 122 Filtering meetings

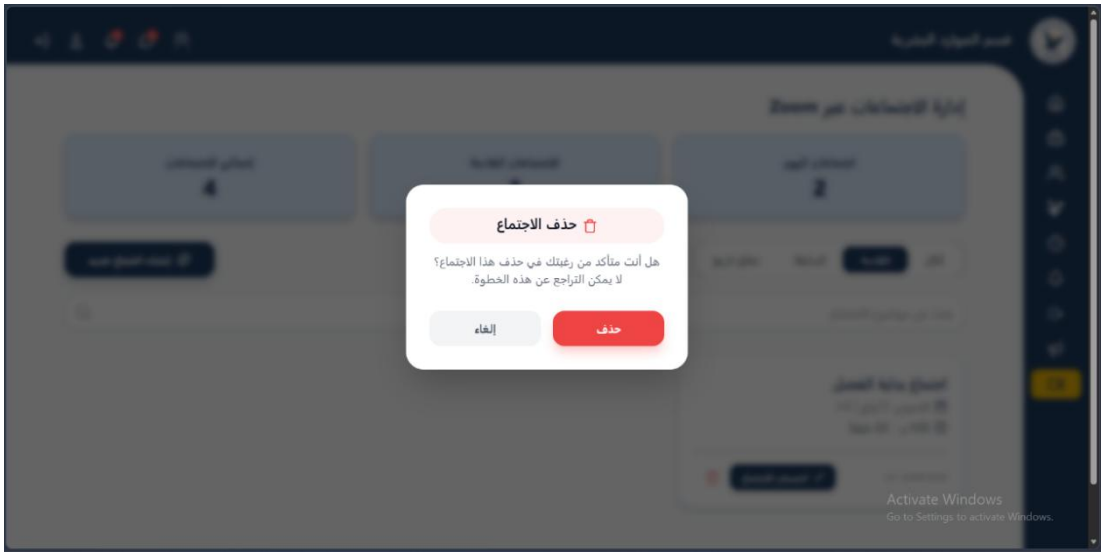


Figure 123 Delete meeting

4.9 TA management

The Teaching Assistant (TA) Management system in HRVision is a comprehensive module designed to manage teaching assistants' workload, schedules, performance, and administrative tasks at An-Najah National University. The system provides tools for both administrators and TAs to track assignments, calculate workloads, and manage academic responsibilities.

- TA Workload Management
  Features:

  - Automatic Workload Calculation: Calculates weekly hours based on lab assignments, preparation time, missions, and projects
  - Additional Load Management: Allows manual addition of extra workload hours
  - Bulk Operations: Update all TAs' workload simultaneously
  - Semester-based Tracking: Tracks workload per academic semester
  - Workload Calculation Formula:
    const weeklyHours = totalLabHours +
    (LabPreperationHours / 60) +
    (MissionAndProjHours / (60 * 15)) +
    (officeWorkload / 60) +
    additionalLoad;

Figure 126 HOD TAs page

Figure 125 TA profile

Figure 124 TA sections time

Figure 128 TA weekly schedule

Figure 127 Admin TAs page

Figure 129 TA workload info

Figure 130 AI workload analysis

Figure 131 HOD TAs management

- TA Dashboard & Management Interface
  Features:
    - Comprehensive TA List: Display all TAs with detailed workload information
    - Sorting & Filtering: Sort by various criteria (ID, name, workload components)
    - Individual TA Profiles: Detailed view of each TA's assignments and schedule
    - AI-Powered Analysis: Integration with AI system for performance analysis
      Display Components:
        - ✓ Lab Hours: Total laboratory teaching hours
        - ✓ Preparation Hours: Time spent preparing for labs (15 min per lab hour)
        - ✓ Mission & Project Hours: Time for grading assignments and projects

- ✓ Office Workload: Administrative tasks (60 min per lab hour)
- ✓ Additional Load: Manually added extra responsibilities

Weekly Hours: Total weekly working hours

Figure 132 HOD TA profile management

Figure 133 HOD adds additional workload

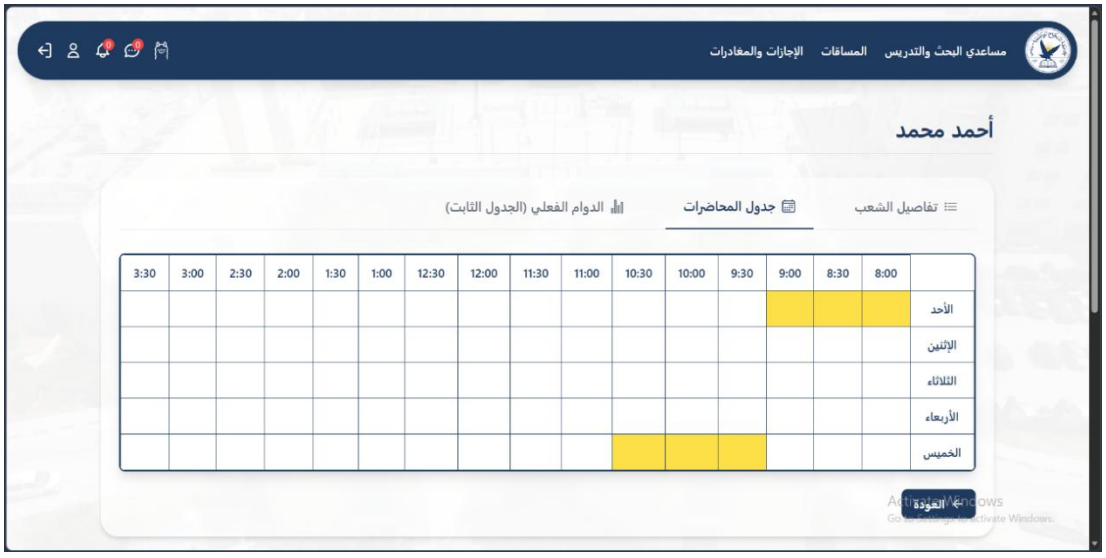


Figure 134 TA sections schedule

Figure 135 TA weekly schedule

Figure 136 Admin TAs management

4.10 Course Management

The Courses Management system in HRVision is an integrated system for managing academic courses and course sections at An-Najah National University. The system includes course management, section management, teaching assistant distribution, and workload calculation.

Courses features:

- Course Display: Fetch all courses or courses for a specific department
- Major Filtering: Filter courses by academic major
- Sorting & Ordering: Sort courses by number, name, credit hours, and section count
- Role-Based Access: Display courses based on user role (Department Head, Admin)

Figure 139 Admin course management

Figure 137 Course sections

Figure 138 TA-section assignment

رقم المساق	اسم المساق	جميع التخصصات	رقم التخصص	عدد الساعات	عدد الشعب
1	البرمجة 1	هندسة حاسوب	2	3	3
2	مختبر البرمجة 1	هندسة حاسوب	2	1	3
3	البرمجة 2	هندسة حاسوب	2	3	2
4	مختبر البرمجة 2	هندسة حاسوب	2	1	2
5	الدوائر الكهربائية	هندسة كهربائية	1	3	2
6	مختبر الدوائر الكهربائية	هندسة كهربائية	1	1	2
7	الالكترونيات	هندسة كهربائية	1	3	2
8	مختبر الالكترونيات	هندسة كهربائية	1	1	2
9	تصميم الدوائر المنطقية	هندسة حاسوب	2	3	2
10	مختبر تصميم الدوائر المنطقية	هندسة حاسوب	2	1	2
11	بنية البيانات	هندسة حاسوب	2	3	2
12	مختبر بنية البيانات	هندسة حاسوب	2	1	1

Figure 140 HOD courses management

Scheduling System features:

- Course Schedule: Display time schedule for theoretical courses (3 hours)
- Lab Schedule: Display time schedule for labs (1 hour)
- TA Distribution: Direct assignment of TAs from schedule
- Conflict Detection: Prevent schedule conflicts for TAs

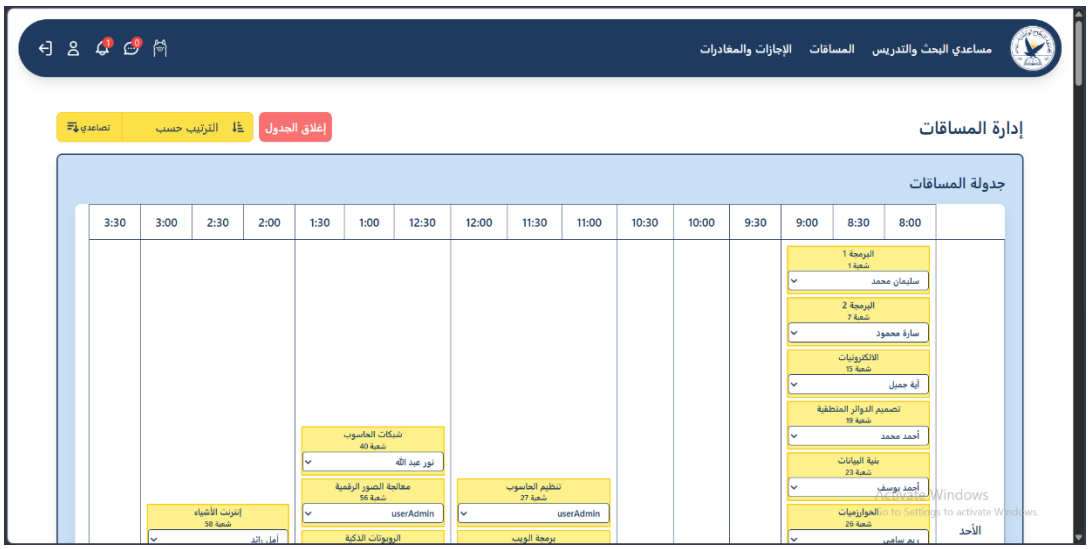


Figure 141 HOD TA-section assignment

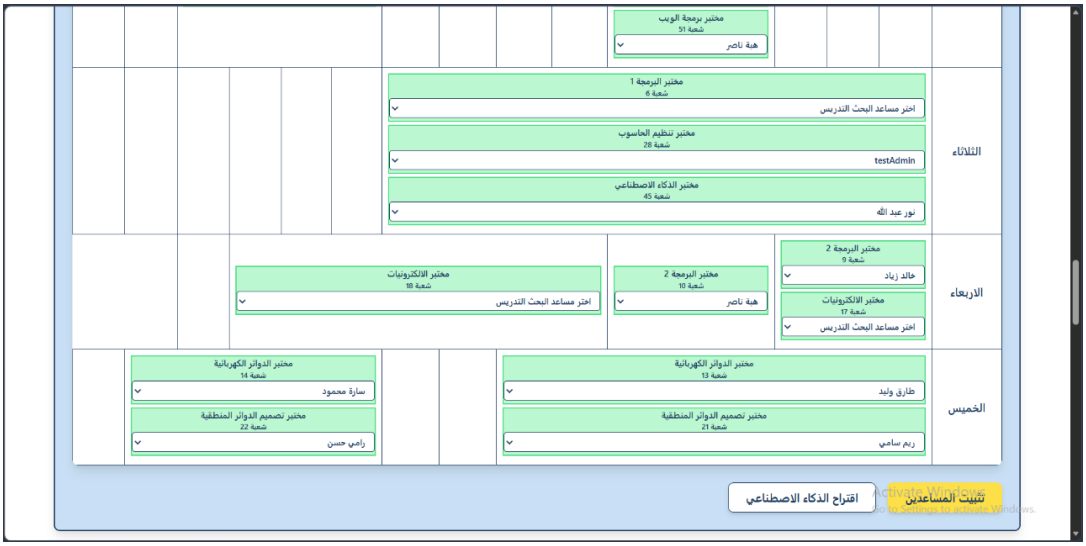


Figure 142 HOD TA-section assignment

رقم المساق	اسم المساق	جميع التخصصات	رقم التخصص	عدد الساعات	عدد الشعب
1	البرمجة 1	هندسة حاسوب	2	3	3
2	مختبر البرمجة 1	هندسة حاسوب	2	1	3
3	البرمجة 2	هندسة حاسوب	2	3	2
4	مختبر البرمجة 2	هندسة حاسوب	2	1	2
5	الدوائر الكهربائية	هندسة كهربائية	1	3	2
6	مختبر الدوائر الكهربائية	هندسة كهربائية	1	1	2
7	الالكترونيات	هندسة كهربائية	1	3	2

Figure 143 error message if there is any conflict

Sections features:

- Section Display: Fetch sections for a specific course with all details
- Data Updates: Modify number of missions, projects, and lab hours
- TA Assignment: Assign teaching assistants to sections with conflict detection
- Workload Calculation: Automatic calculation of work hours

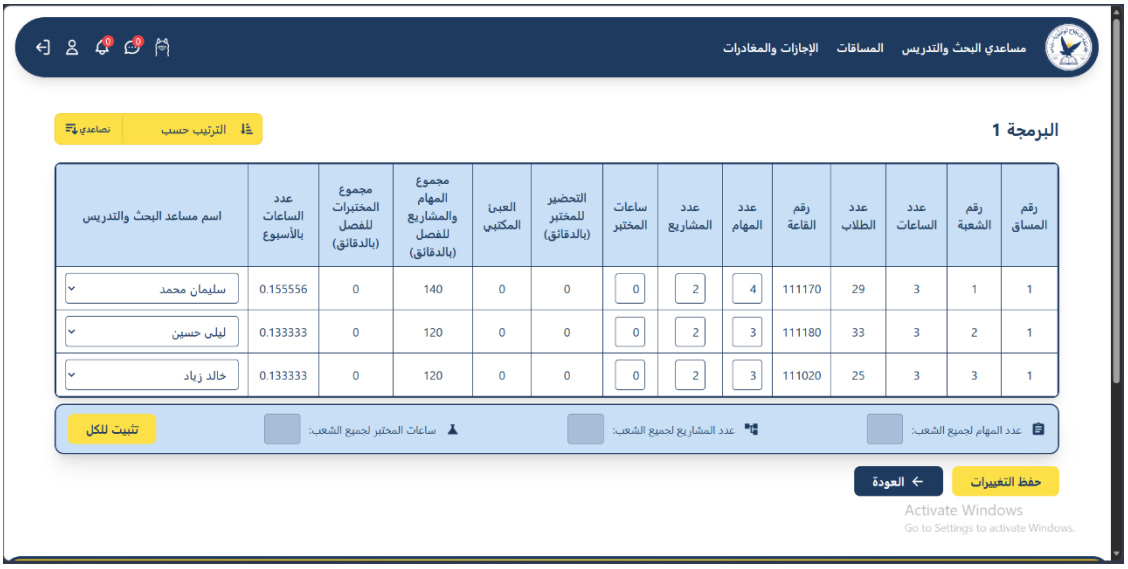


Figure 144 HOD section management

TA Workload Calculation:

Features:

- Automatic Calculation: Calculate workload based on missions and projects
- Bulk Update: Update all TAs at once
- Additional Load: Add manual additional workload

Calculation Formula:

```
const weeklyHours = totalLabHours +
        (LabPreperationHours / 60) +
        (MissionAndProjHours / (60 * 15)) +
        (officeWorkload / 60) +
        additionalLoad;
```

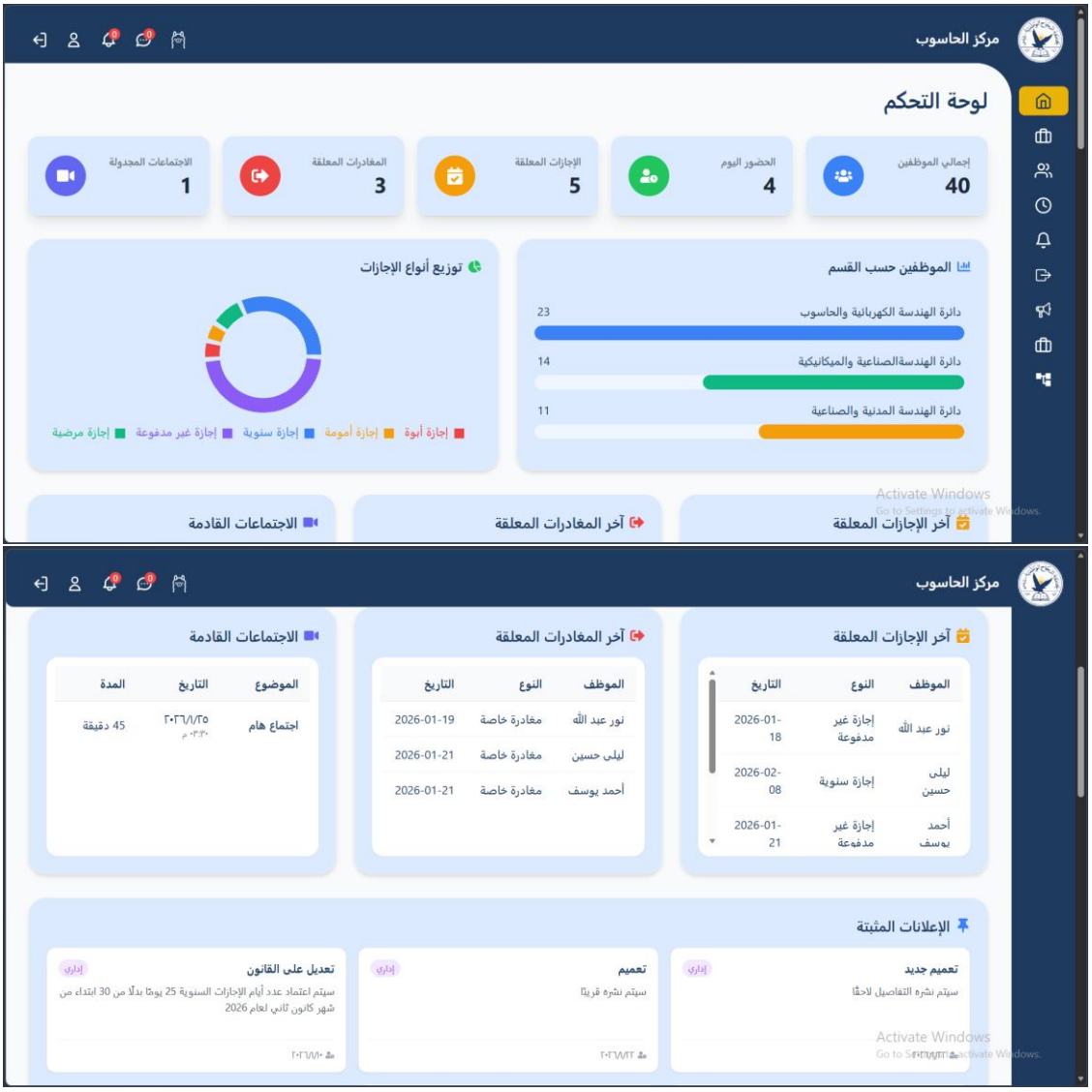
Detailed Calculations

- Lab Hours Calculation
  - Actual Lab Hours: Number of teaching hours in lab
  - Preparation Time: 15 minutes per lab hour
    `const labPrepration = labHours * 15;  // minutes`
  - Office Workload: 60 minutes per lab hour
    `const officeWorkload = labHours * 60;  // minutes`
- Missions & Projects Calculation
  - Missions: 20 minutes per student per mission
  - Projects: 30 minutes per student per project
  - Total: (mission count × 20 + project count × 30) × student count
    `const sumOfMissionAndProjects = ((numOfMissions * 20) + (numOfProjects * 30)) * numOfStudents;`
- Minutes to Hours Conversion
  - `const sumOfLabs = 15 * labHours * 60;  // minutes`
  - `const weeklyMissionProjectHours = sumOfMissionAndProjects / (60 * 15);`
  - `const weeklyPrepHours = labPrepration / 60;`
  - `const weeklyOfficeHours = officeWorkload / 60;`

4.11 Users Dashboards

Customized dashboards were developed for each user role:

- HR Dashboard: Aggregates university-wide statistics and event distributions.
- Admin Dashboard: Comprehensive university-wide oversight of all academic resources and teaching loads.
- HOD Dashboard: Provides real-time metrics on department load and staff attendance.
- TA Dashboard: Offers a personal view of schedules, remaining hours, and upcoming tasks.



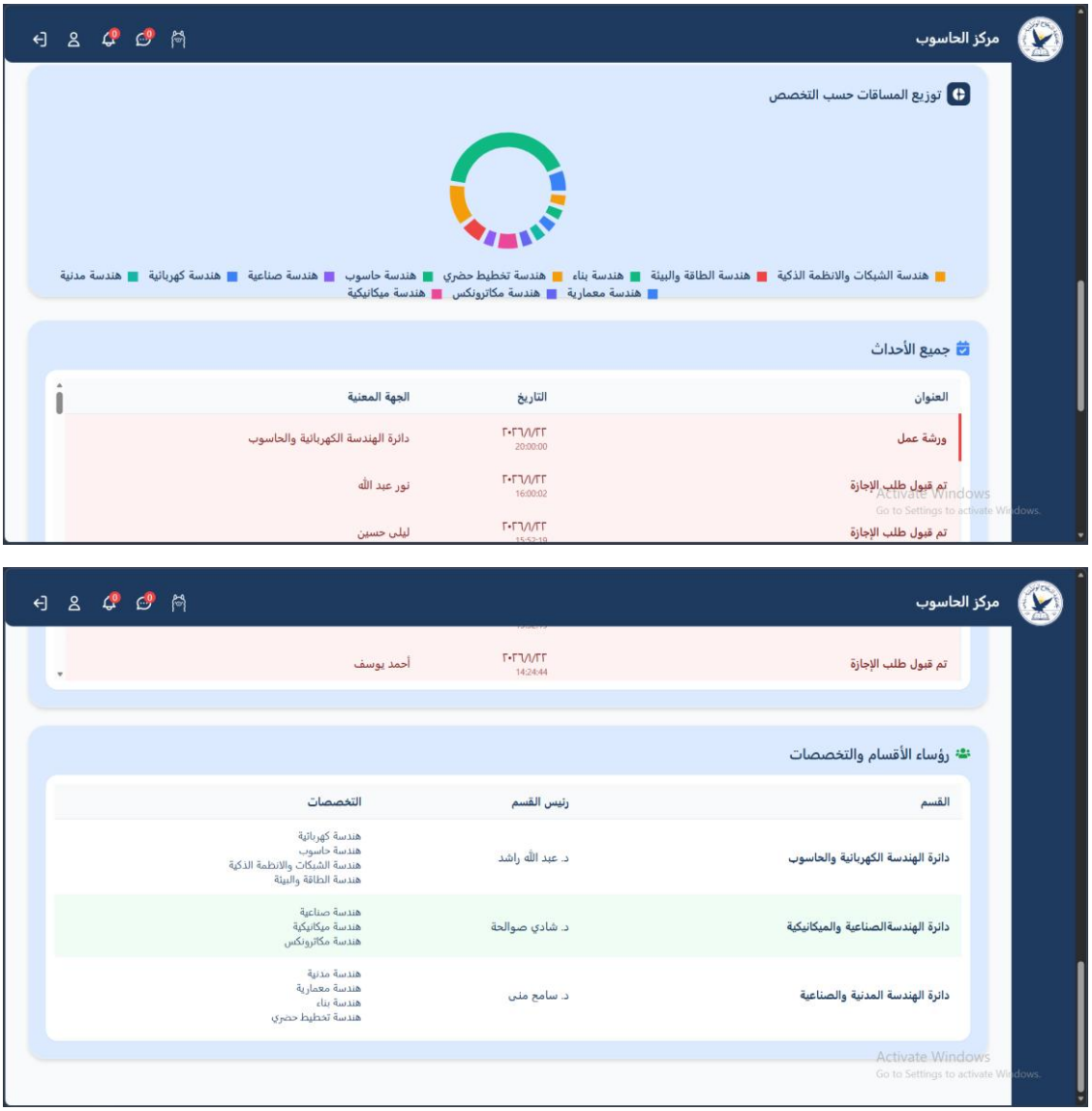


Figure 145 Admin dashboard

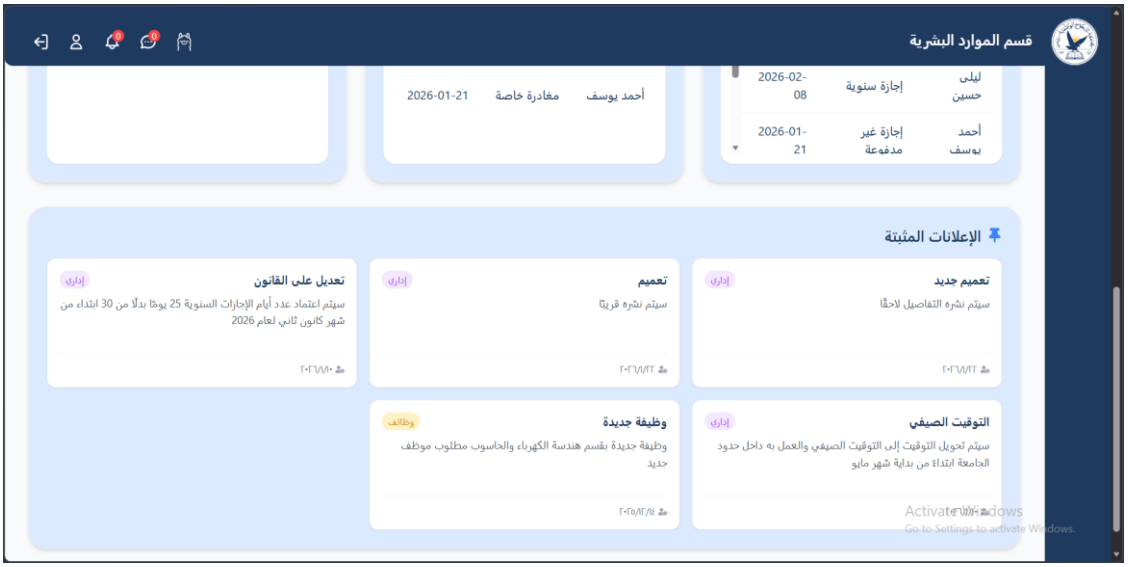


Figure 146 HR dashboard

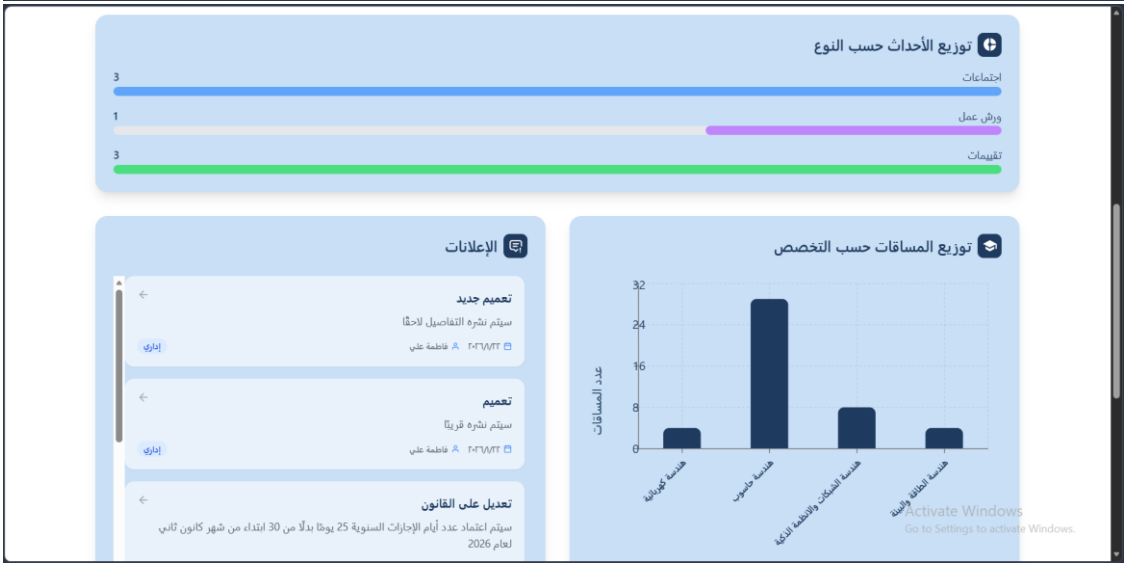
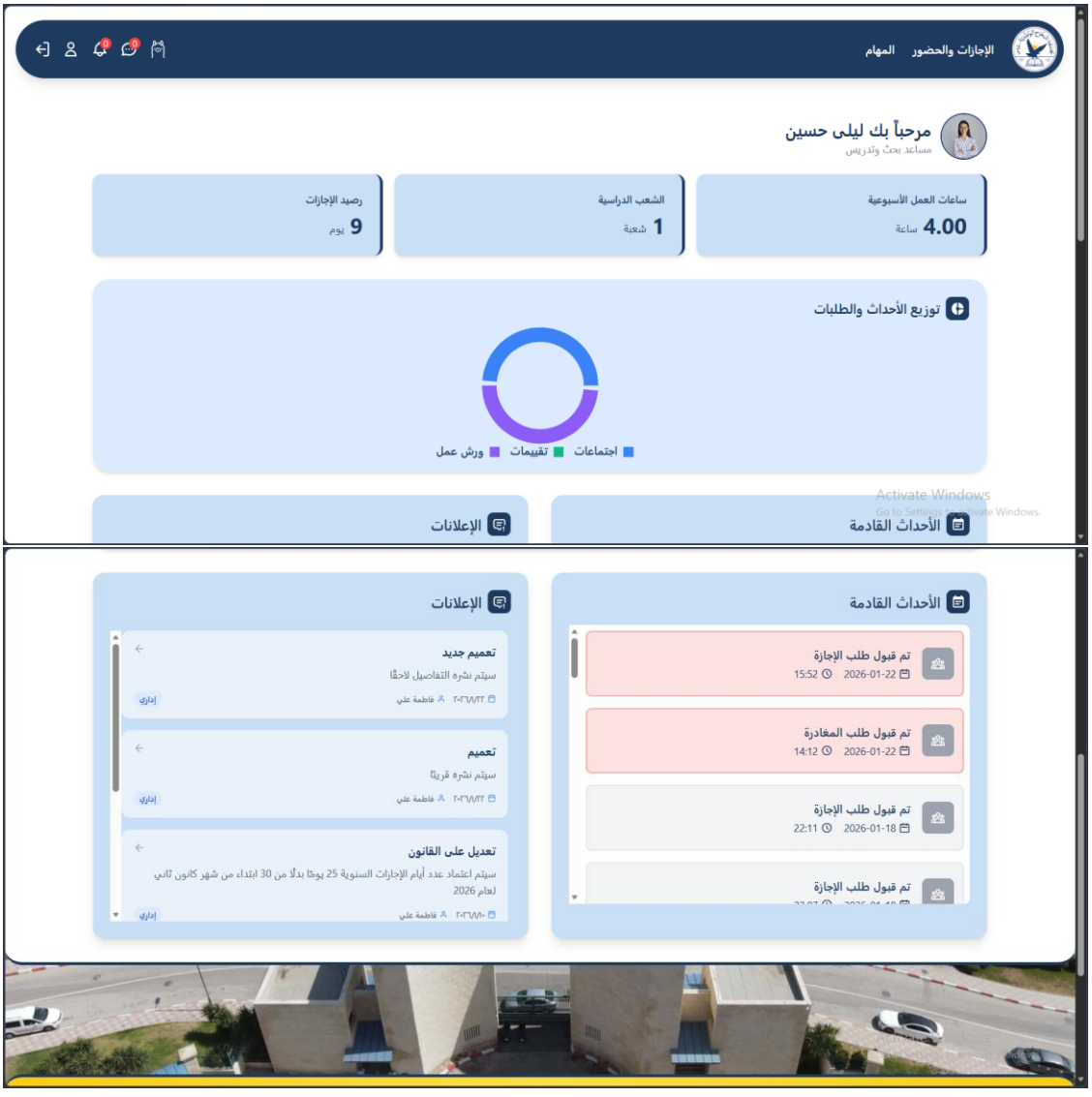


Figure 147 HOD dashboard



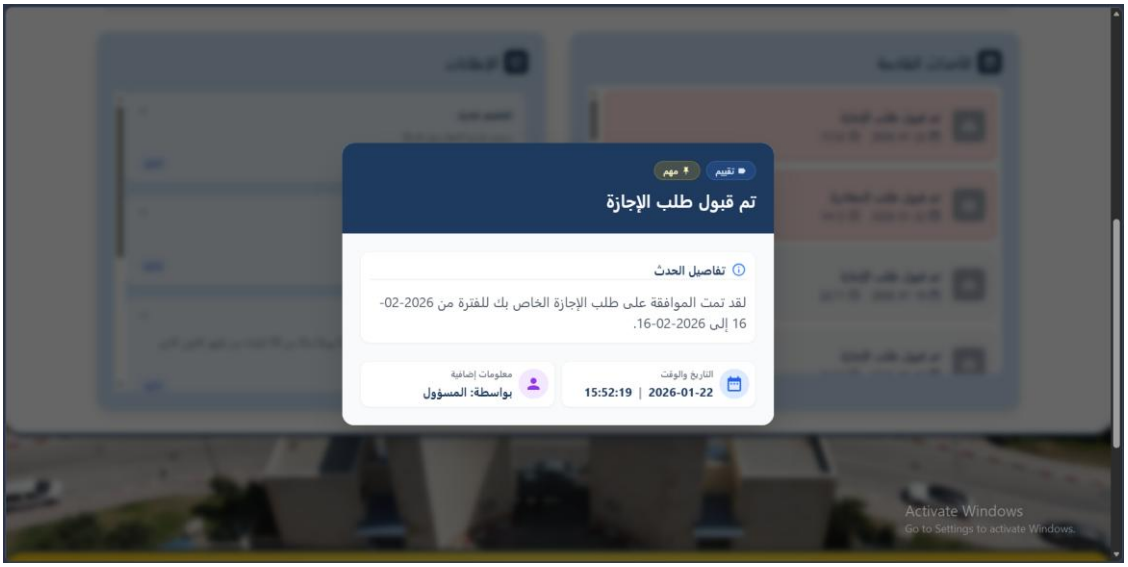


Figure 148 TA dashboard

4.12 Notification Management

The system features a real-time notification layer that alerts users of critical actions, such as the approval of a leave request, the posting of a new announcement, or an upcoming meeting. This reduces the "Response Time" between staff and administration.

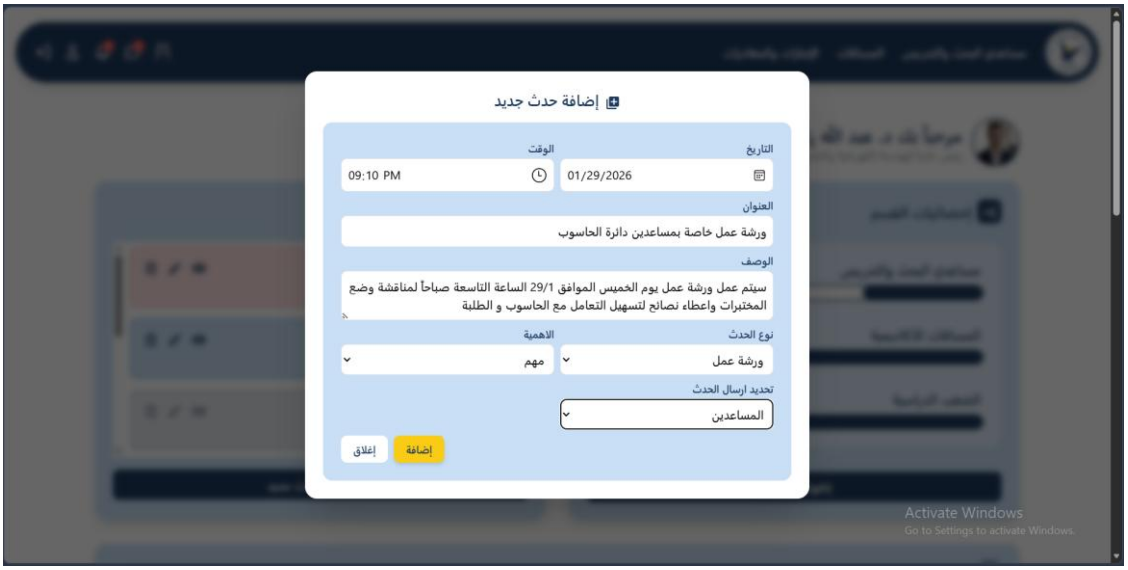


Figure 149 HOD adds a new event

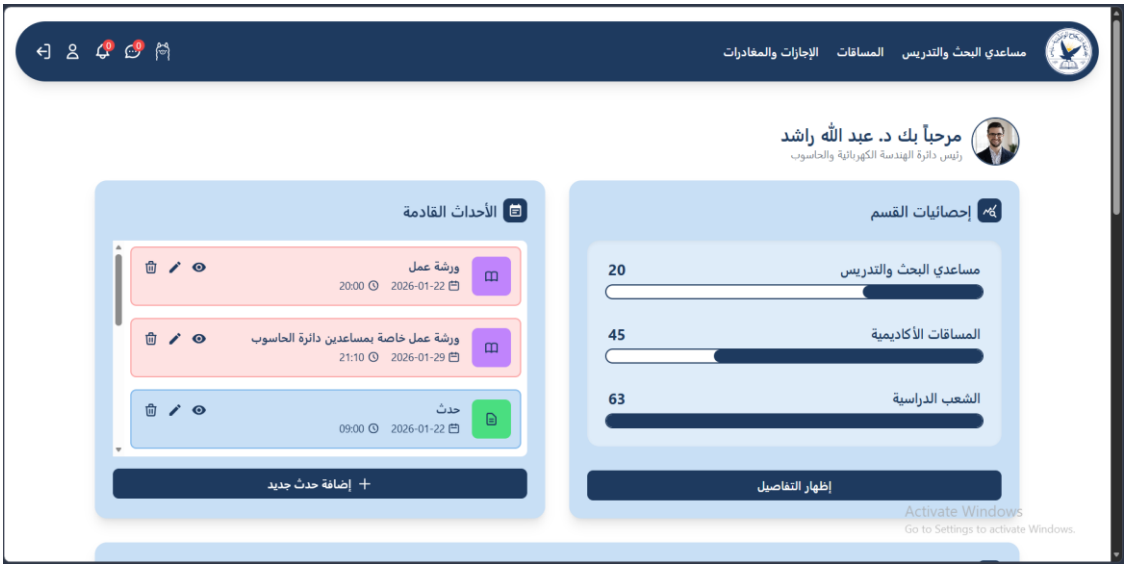


Figure 150 Event appears on dashboard

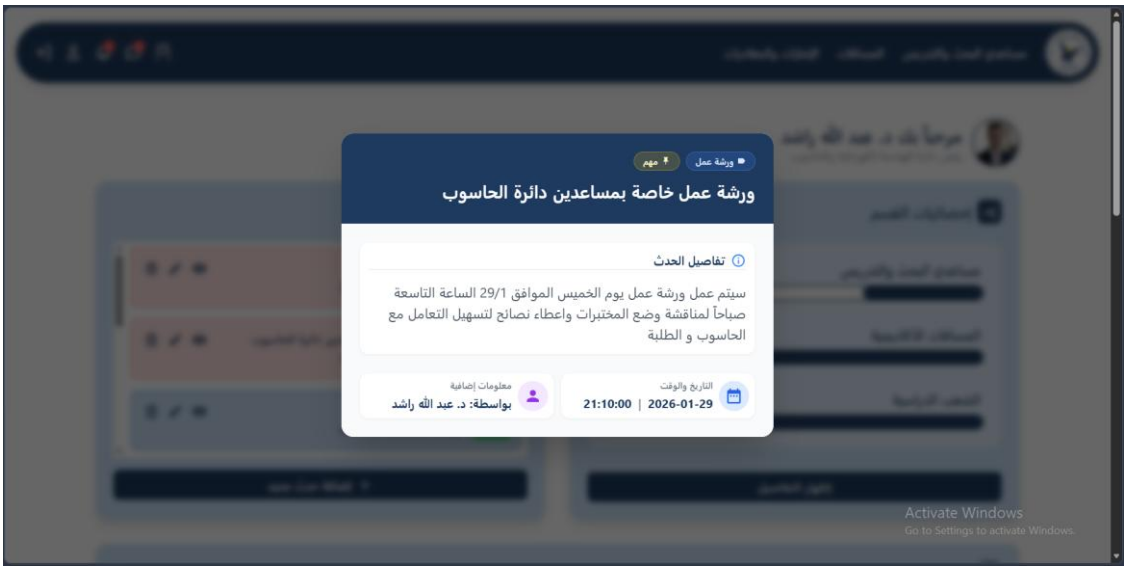


Figure 151 Event details

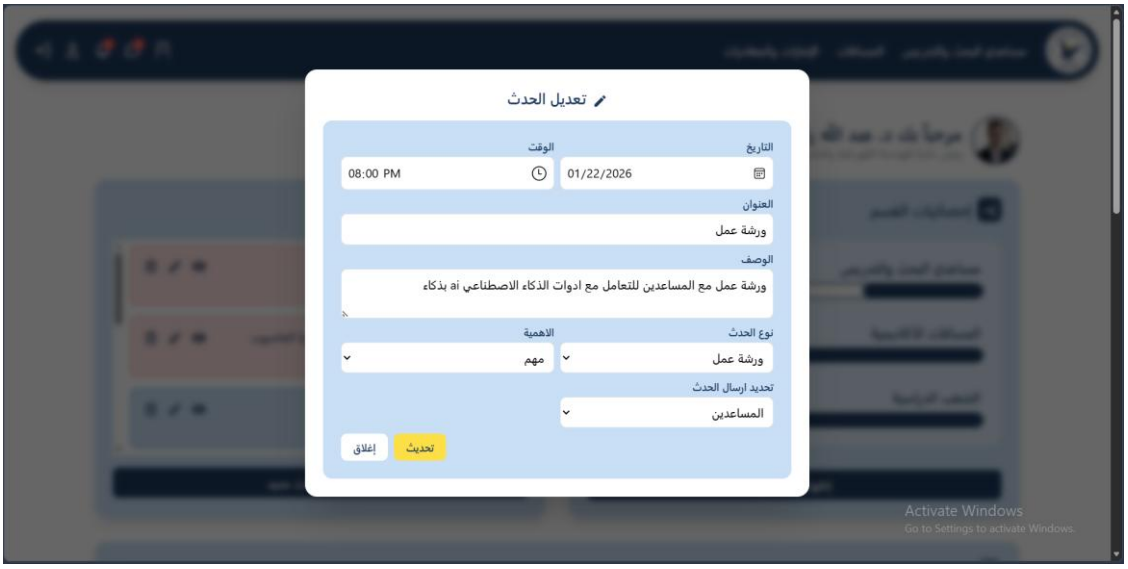


Figure 152 HOD edits event

Figure 153 HOD deletes event

Figure 154 Event deleted successfully

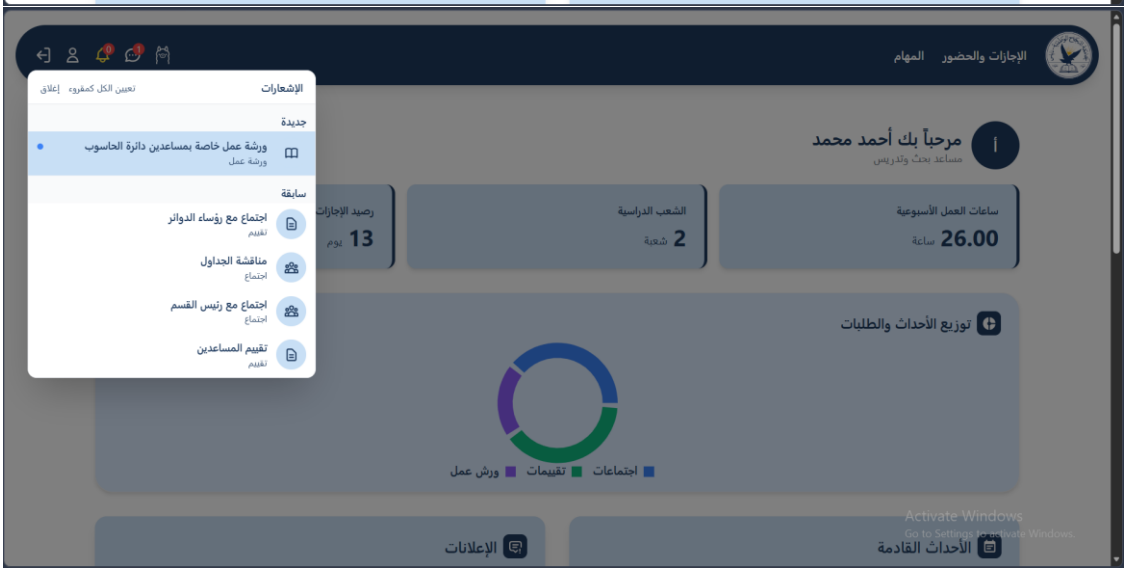


Figure 155 Notification popup

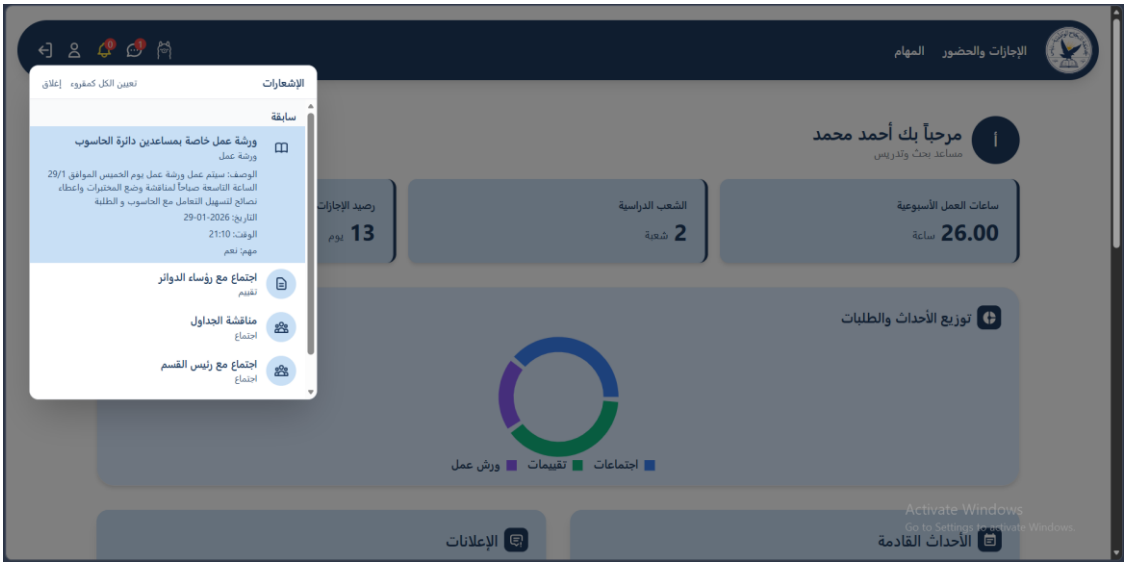


Figure 156 Notification details

4.13 Chatting System

A real-time communication module was implemented using Socket.io (or comparable real-time technology). This allows for direct, instant messaging between staff members within the system, facilitating quick inquiries and academic coordination without the need for external communication apps.

Figure 157 User sends messages

Figure 158 Messages received

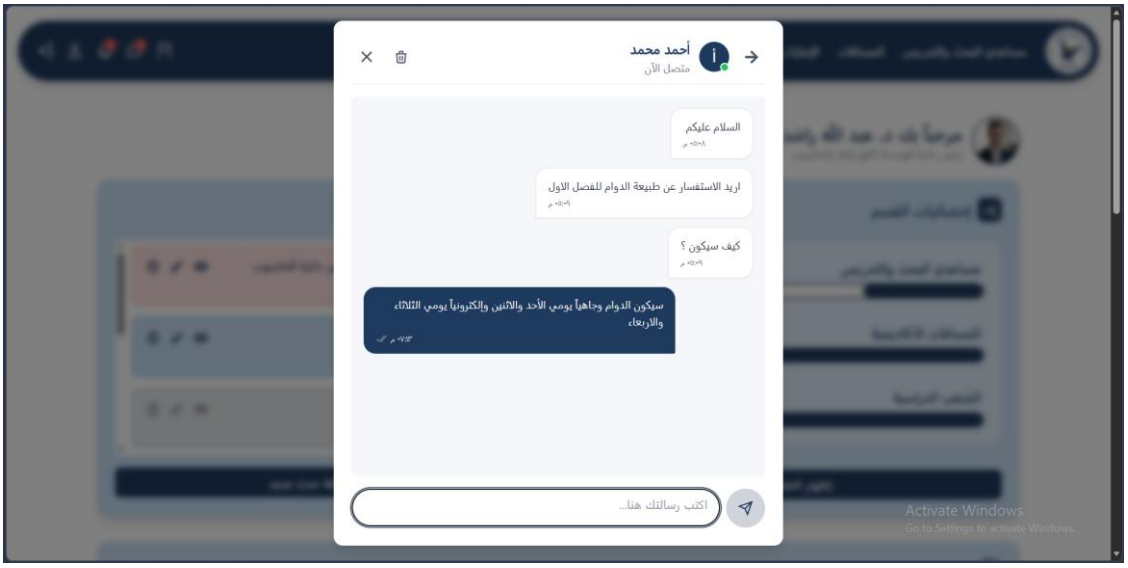


Figure 159 User replies on message

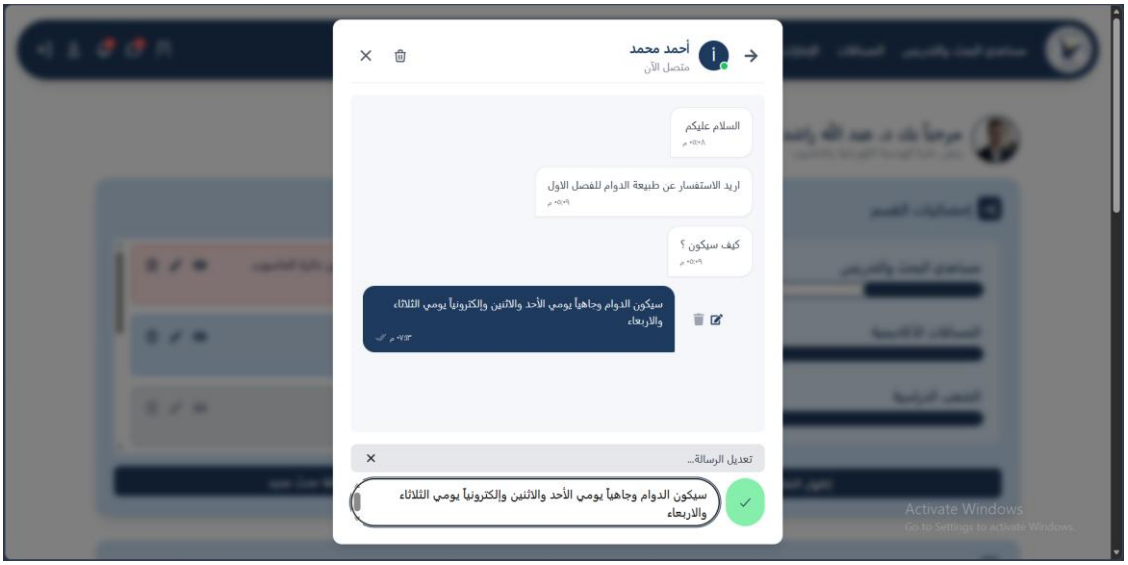


Figure 160 User edits message

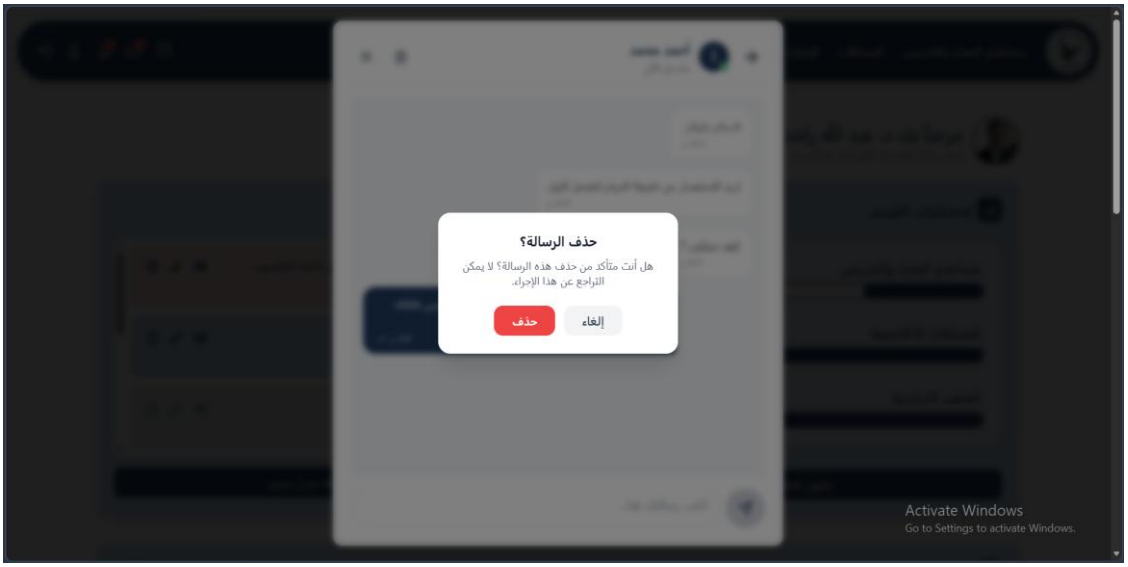


Figure 161 User deletes message

4.14 AI Analysis

The hallmark of the project, the AI Analysis section, delivered several key outcomes:

- Smart Chat Assistant (AI Chatbot)
  Features:
  - Context-Aware Conversations: Understands user roles (Department Head, TA, Admin) and provides tailored responses.
  - Database Integration: Accesses TA data, schedules, and department information based on user permissions.
  - Arabic Language Support: Professional Arabic responses.
  - Fact Verification: Uses pre-calculated data for accurate answers.

  If we ask the AI chatbot about the HOD privilege (sections without TA):

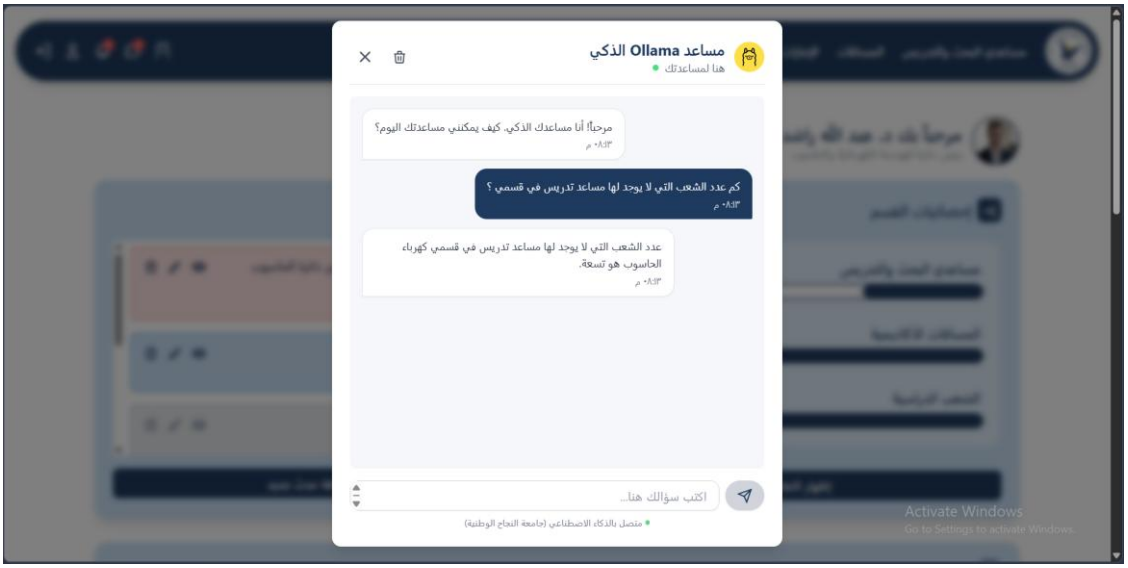


Figure 162 HOD smart chat assistant answer

Figure 163 TA smart chat assistant answer

- Employee Performance Analysis (AI Performance Analysis)
  Features:
  - Comprehensive Performance Evaluation: Assesses employees based on 5 key criteria:
    - ✓ Attendance (30%)
    - ✓ Punctuality (25%)
    - ✓ Leave Management (20%)
    - ✓ Exit Patterns (15%)
    - ✓ Workload (10%)
  - AI-Powered Insights: Provides AI analysis and practical improvement recommendations
  - Interactive Visualizations: Displays results with charts and graphs
  - Scoring Algorithm:
    const overallScore = (
    (attendanceScore * 0.30) +
    (punctualityScore * 0.25) +
    (leaveScore * 0.20) +
    (exitScore * 0.15) + (workloadScore * 0.10));

Figure 164 Duration options for analysis

Figure 165 Overview analysis

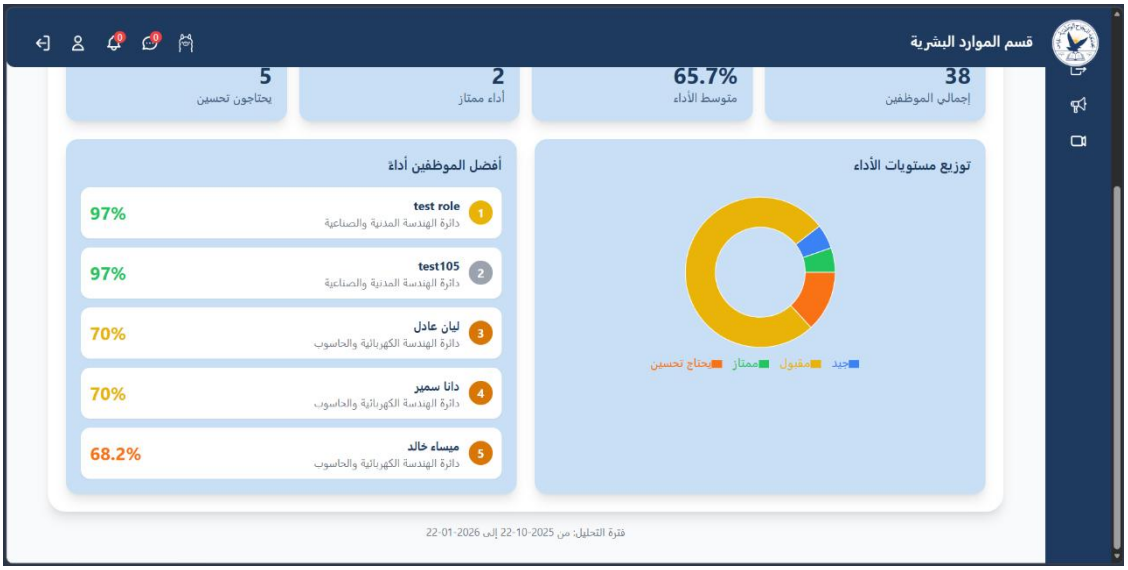


Figure 166 Chart of performance analysis

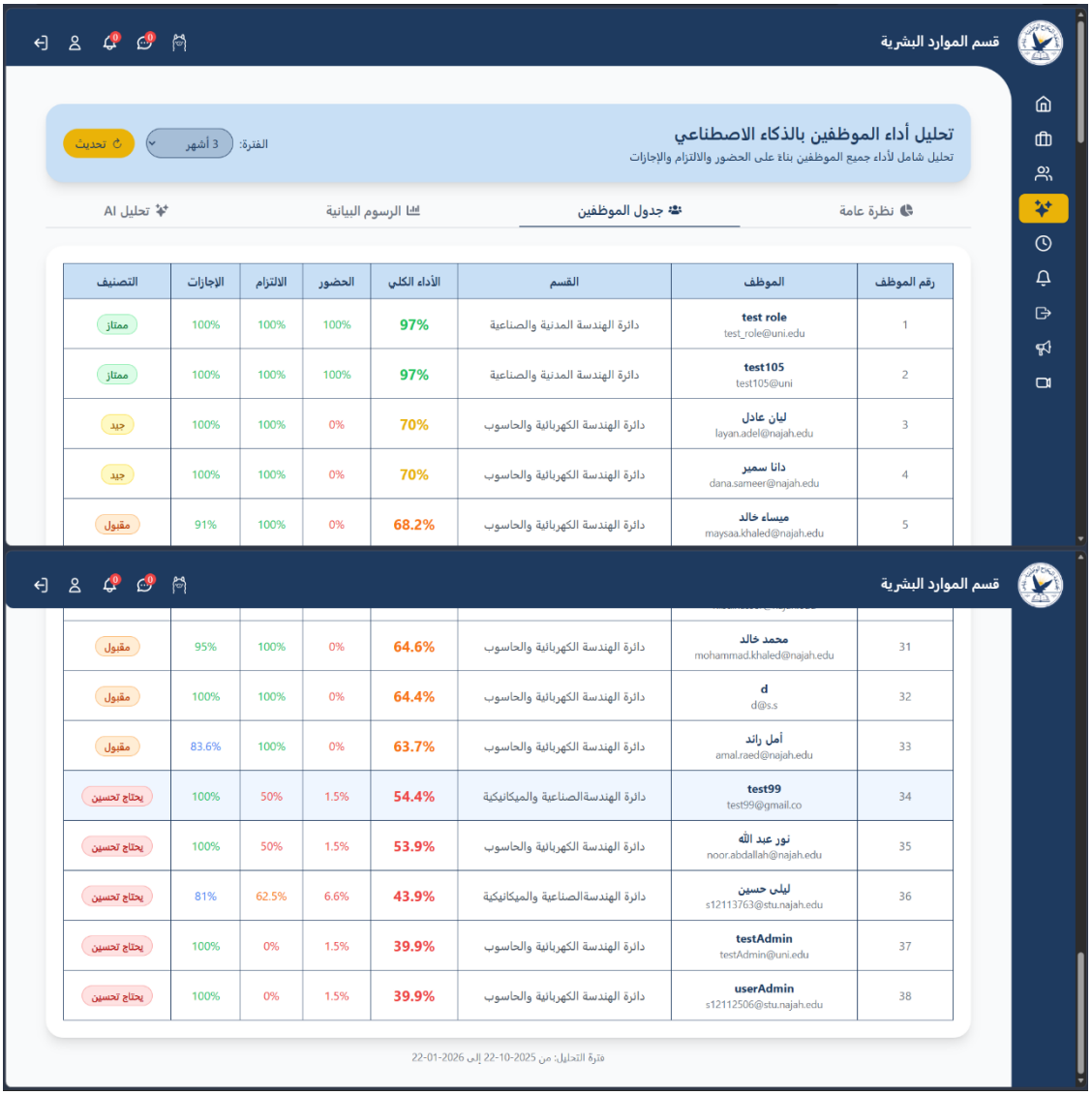


Figure 167 Order employees according to performance

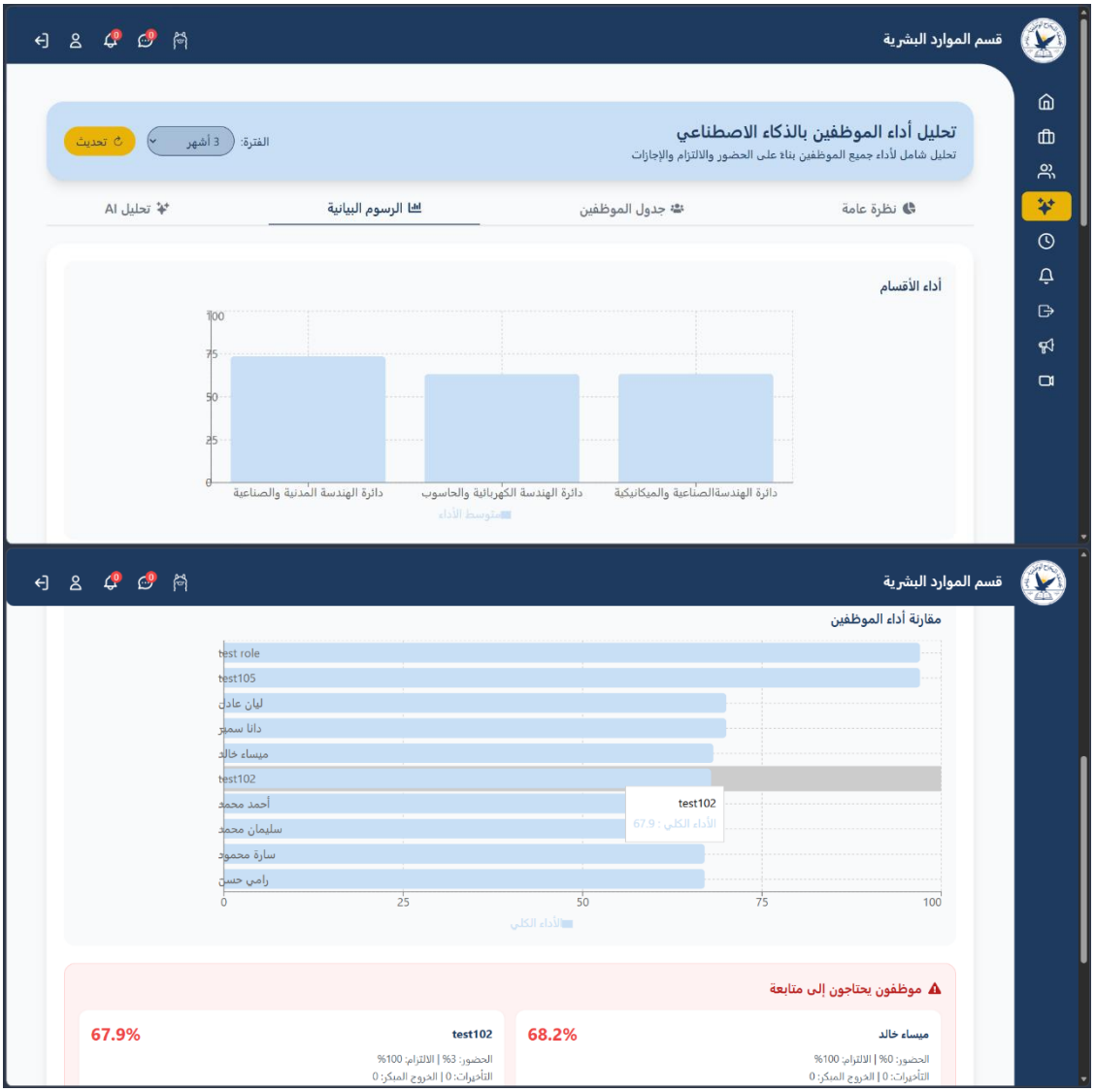


Figure 168 Additional charts

Figure 169 Employees who need follow-up

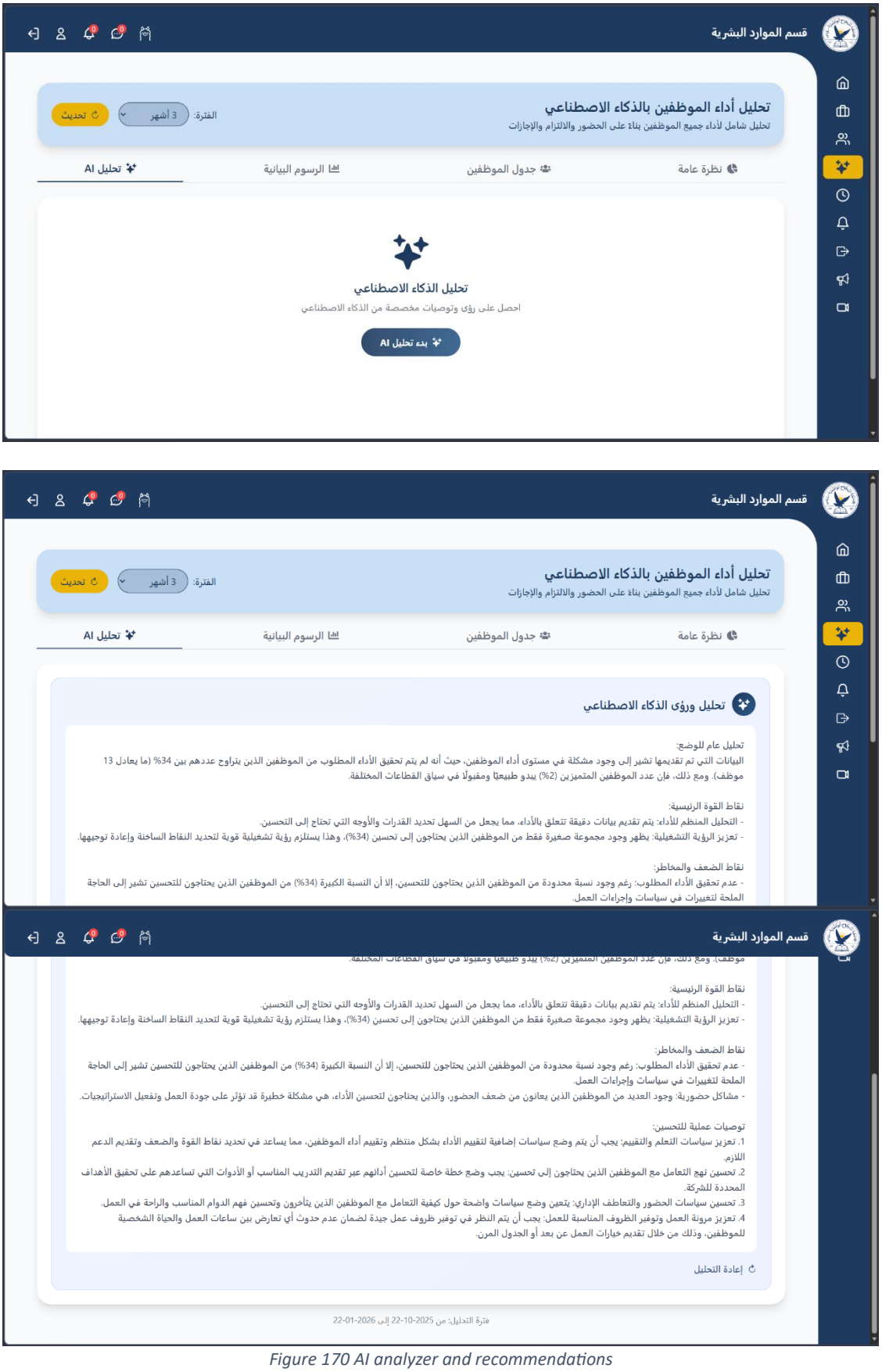


Figure 170 AI analyzer and recommendations

- Teaching Assistant Schedule Suggestion (AI Schedule Suggestion)
  Features:
  - Intelligent TA Distribution: Suggests optimal TA assignment to course sections
  - Professional Criteria:
    - ✓ Mandatory department matching
    - ✓ Student load balancing
    - ✓ No schedule conflicts
    - ✓ Equal work hour distribution
  - Smart Fallback: Uses backup algorithm if AI fails

Figure 171 AI schedule suggestion

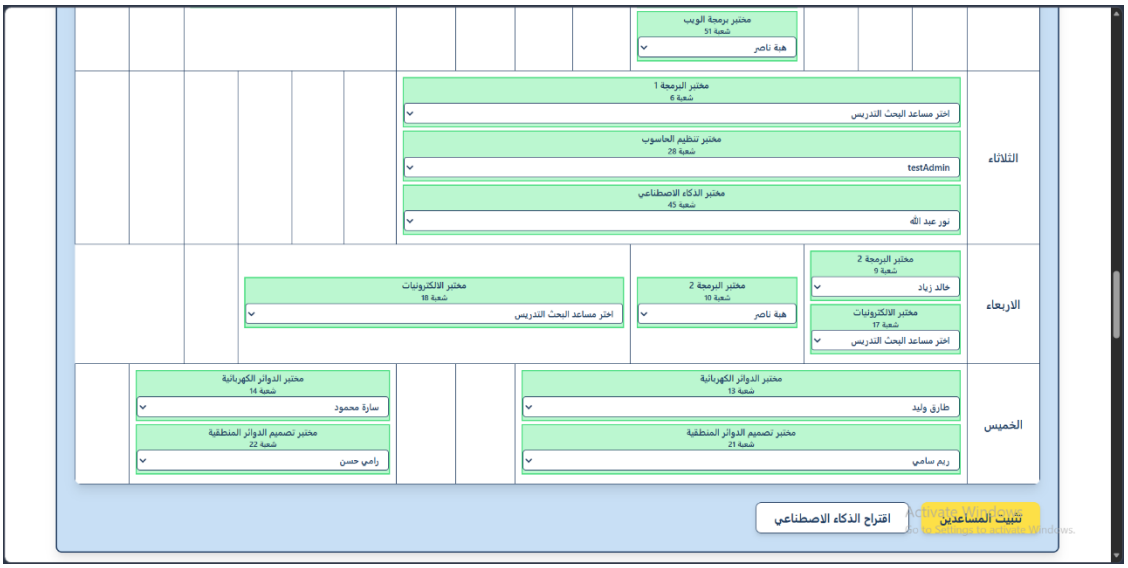


Figure 172 HOD rejects or approves the AI suggestion

- TA Data Analysis (TA Data Analysis)
  Features:
  - Comprehensive TA Analysis: Provides administrative recommendations based on TA data
  - Workload Assessment: Analyzes work hour balance and tasks

- Customized Recommendations: Offers performance improvement suggestions

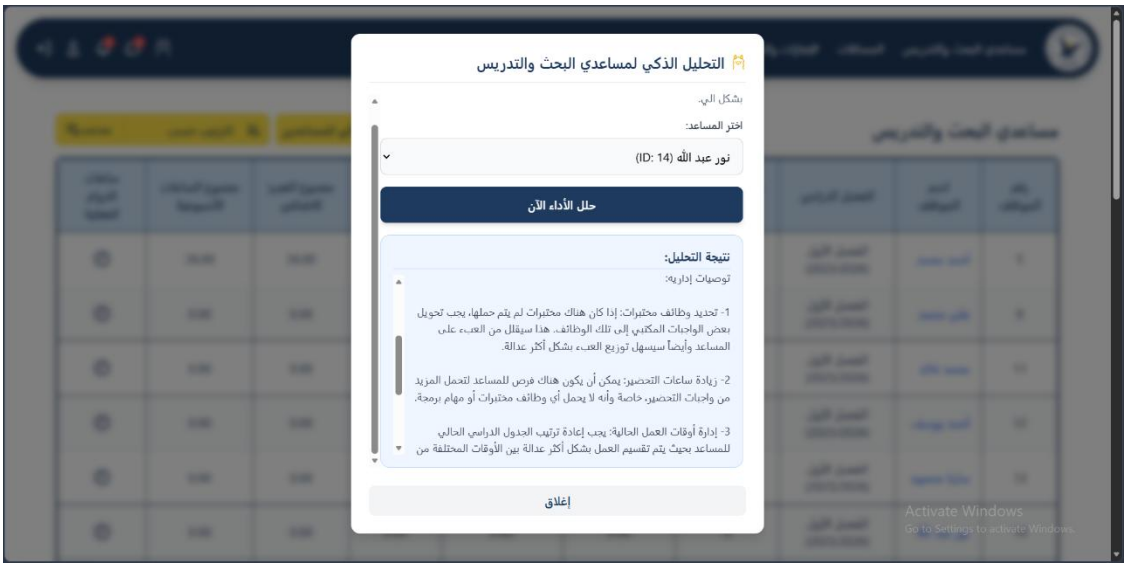


Figure 173 AI workload analysis

Chapter 5: Discussion

5.1 Problem Resolution

The primary objective of this project was to resolve the inefficiencies and lack of transparency in the manual management of Teaching Assistants and HR processes at the university.

Previously, TA schedules, workloads, and leave requests were likely managed across disparate systems or paper records. The developed system successfully centralizes this data into a single, role-based "HRVision" platform.

One of the critical problems was the difficulty in manually tracking and balancing TA workloads. The integration of the AI-driven "TA Load Analysis" and "Schedule Suggestion" tools provides HODs with previously unavailable data-driven insight.

5.2 Project Contributions

This project makes several important contributions. First, it delivers a fully integrated HR and TA management system tailored to the academic environment, addressing real operational needs within the university. Unlike generic HR systems, HRVision is designed specifically to support teaching assistant workflows, approval hierarchies, and academic scheduling constraints.

Second, the project introduces artificial intelligence techniques into workload management. The AI-based load analysis enhances fairness and efficiency by objectively evaluating TA workloads and

supporting HODs in assignment decisions. This represents a practical application of AI in academic administration rather than a purely theoretical contribution.

Third, the system provides both web and mobile platforms with real-time notifications, improving user engagement and responsiveness. TAs can track their requests transparently, while administrators gain full control over approvals, records, and system configurations.

5.3 Limitations

1. The accuracy of AI-based recommendations depends on the quality and completeness of the input data.
2. The current AI implementation relies on a local Ollama server. This requires the host server to have sufficient RAM and processing power.
3. Direct access to official university APIs for courses, sections, and faculty data was not available. therefore, a virtual API was developed to represent this information within the system.
4. Official workload calculation mechanisms were not accessible, which required implementing custom workload calculation logic based on available requirements and assumptions.

Chapter 6: Future Work

1. Implement AI-driven forecasting to predict future TA requirements based on historical registration trends.
2. Transition to cloud-based LLMs (e.g., GPT-4 or Claude) for enhanced reasoning and performance, while maintaining a local fallback.
3. Generate comprehensive PDF/Excel reports for departmental reviews and accreditation purposes.
4. Integrate direct access to official university APIs for courses, sections, and faculty data once they become available, eliminating the need for the current virtual API.
5. Replace the custom workload calculation logic with officially approved workload calculation mechanisms to improve accuracy and alignment with university policies.