IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Campusconnect: A Centralized Web-Based College Club And Event Management System For Automated Approval, Real-Time Notifictions, And Role-Based Access Control

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Abstract: Creating a single platform for managing Club and Event Activities on College Campuses is one of the primary goals of transforming colleges into digital institutions. Many colleges still use outdated manual methods for managing events which can lead to unorganized, disjointed systems to create, approve and track events. This survey will provide information about current systems available in the marketplace to Colleges and Universities utilizing automated event and club management systems, focusing on architecture / functionality/ scalability/limitations of various systems. This evaluation will also look at existing systems that utilize Role Based Access Control, Real Time Notification Systems, Automated Approval Process' and database driven Event Participation Tracking Mechanisms [1],[2],[4],[9],[10]. Based on our evaluation, we will also outline how modular each of these systems are; strategies to provide users with engaging experiences; and difficulties in integrating these systems within current College and University infrastructure. Additionally, we will focus on the benefits of having a single dashboard for Students, Club Leaders and Administrators to increase the transparency and efficiency of operations on college campuses. Our contributions include A Classifying System for Existing Systems; A Comparative Analysis of Implementation Techniques; A Verification of Research Gaps; Recognition of New Trends Such as Artificial Intelligence Driven Personalization [3],[8]; and Enhancement of Physical Security Solutions. Ultimately, through this research, we will provide higher education professionals with knowledge about the current state and future direction of centralized platforms for communicating campus information and managing campus events effectively.

Index Terms - Campus Event Management System, Web-Based Application, Role-Based Access Control (RBAC), Automated Event Approval Workflow, Real-Time Notification System, College Club Management, RESTful API Architecture, Database-Driven Participation Management

I.INTRODUCTION

The use of more advanced digital methods by colleges and universities is changing how colleges manage their administrative functions and interact with students. One area needing significant reform due to application of digital technology is how colleges manage student organizations (clubs) and organize events on campus. Current methods used in universities to organize club events tend to create inefficiencies by relying on scattered or disconnected communication systems, paper-based and slow approval processes, numerous independent registration systems, and limited tracking of who participated in club events [1],[2],[9],[10]. These inefficiencies lead to slow coordination among club members, little or no visibility into club activities by non-club members, and a reduced number of students participating in clubs. Therefore, there is an increasing need for automated systems that allow for a single, centralized place to manage all aspects of

organizing club events; automated systems to facilitate improved communication between clubs and students who want to participate in club events; and automated systems that can effectively and efficiently support increased student engagement in campus activities.

A centralized event and club management system for colleges and universities is an essential way to develop a digital environment for postsecondary institutions. Many colleges still use manual methods to manage events, resulting in inconsistent event creation, approval, and tracking processes [5]. This document outlines web-based event and club management systems and what is available to colleges, including architecture, features, scalability, and limitations. The review also includes existing systems that use role-based access control, real-time notifications, automated approval processes, and database-driven event participation tracking [1],[2],[4]. From our analysis, we describe the modularity of existing systems, user engagement strategies, and challenges with integrating existing systems into current infrastructure. We also highlight the benefits of having a centralized dashboard for students, club leaders, and administrators to increase campus transparency and efficiency. Our contributions include a systematic classification system for existing systems, a comparative analysis of implementation strategies, and highlighting gaps in research. Emerging trends include artificial intelligence-based personalized experiences and enhanced security [3],[8]. This paper's purpose is to assess and categorize existing campus event & club management systems by analyzing their systems architecture, automatic workflow features, notification procedures, data storage & management, and user roles, as well as to address some of the issues that currently exist in this field; examine historical research trends; and identify areas where AI (Artificial Intelligence) can be utilized to further enhance campus event management systems by providing a more customized user experience; developing better security systems; and improving integration between event management systems and other institutional platforms

The majority of web-based event management system solutions proposed thus far have a lack of; validation for scalability; advanced security mechanisms; intelligent personalization; seamless integration with institutional systems such as ERP or LMS; and limited analytical capabilities [2],[6],[7]. These limitations can hinder data-driven decision making and long term planning. To address these issues within the fragmented and inefficient campus event management process, this survey aims to conduct an extensive literature review of the current event management systems, identify strengths and weaknesses of current systems, and suggest future research directions for developing scalable, secure, and intelligent digital event management platforms that would be appropriate for contemporary educational institutions.

II.RELATED WORK

The College Club Activity Management System (CCAMS) was created to manage events for college clubs and streamline club operations via web [1]. The research done by Hariprasad M. et al. [1] developed several Centralized Modules, including Creating Events, Registering Members, Sending Announcements and Tracking Memberships which will allow digitized workflows between students, coordinators and administrators thus reducing the amount of paper created and processing time associated with administrative functions. The structured approval process as well as database-supported storage improved operational efficiencies and reduced scheduling conflicts. Basic Role-Based Access Control (RBAC) was implemented within the CCAMS to limit access to certain records and/or actions according to a user's respective role and ensure the information contained within all users is consistent; however, there is limited evaluation performed on the CCAMS regarding its scalability to support a significant number of users and its integration with current Institutional Enterprise Resource Planning (ERP) systems.

The Event Management System (EMS), an integrated event management system with a notification sender mechanism, was proposed by J.R.V. Jeny, et al. [2]. The proposed architecture would allow for real-time information dissemination to improve transparency of communication and to raise awareness of participation in the EMS events. The EMS also automates, through centralized data management, the event registration process, the approval workflow, and the alert notifications. The conclusion of research is that real-time alert notifications significantly enhance the level of responsiveness from both students and faculty. However, the EMS included limited personalization features and required access to a stable internet connection; therefore, the challenge of implementing the EMS will be substantial because of this requirement.

Gaurav Thombare, et al.'s research [3], was an analytic driven conceptual framework for optimizing event management of campus activities. The model used participation trend analysis, data-based scheduling of

events and forecasting of engagement levels. The study suggested, using hierarchical data-based behaviors and required structured participation metrics could improve the efficiency of planning events. However, the framework did not have any large scale real life deployment or performance benchmarking, meaning the application is primarily theoretical.

Research by Nirupama K, et al. [4], proposed a web-based Event Management System (EMS) that focuses on automating the workflow to streamline event approval processes. The EMS provided an improved form of communication internally between users of the EMS via the centralized dashboards and the use of module-based access based on role hierarchy. The solution provided an easier way of scheduling and tracking of events, but did not provide advanced level of analytical/data-based reporting and the overall security of the system was weakness within the scope of the research.

III.MATERIALS AND METHODS

In this survey, there are three primary materials: the functional workflow model, components of an architectural design, and the modules of a proposed Campus Event Management System. The workflow diagram depicts how the system operates and provides a foundation for technological development in identifying user interaction flow, evaluating how the system operates, and determining mechanisms for access control within the system.

The Login and Authentication Module represents the core of the system's architecture that allows access to the system. The Login and Authentication Module provides access verification for each user account with secure logins. The outcome of the Login and Authentication Module is that, after a successful authentication has been completed, users proceed to the first decision layer evaluation in the workflow process diagram called "Is Admin?" layer, which establishes if the user has an administrative role, or if he/she is considered a non-administrative user, using the RBAC Security Model (Role Based Access Control). The RBAC Security Model enhances the security of the Campus Event Management System (CEMS) and has the ability to maintain a high level of security, to limit user access, and to define a structured process of privilege assignment.

Users classified as administrative users within the RBAC Security Model will have access to the Admin Panel Module of the CEMS, which provides the overall management capabilities of the system. The Admin Panel Module of the CEMS allows the admin user to manage and administer events (approval through creating or voting), and to interact with the central database system in a CRUD (Create, Read, Update, Delete) manner. As a result, the Campus Event Management System automates the event management processes that require a structured workflow and support for minimal manual intervention during the scheduling and approval process.

In general, everyone who is not an administrator has access to see events in the Event Viewing Module. This means that students can find events they would like to participate in and see what those events entail as well as receive notifications when updates occur. The Event Viewing Module works to provide transparency and increase student participation by providing a single place to find events offered by the campus.

Another major function of the system is the Notification Module, which works across both the Event Management Module and Event Viewing Module. The workflow provides that after performing actions related to EITHER event management or event viewing, the user will receive notifications regarding the approval of an event, updates to an event or when certain announcements have been made. This gives users real-time communication regarding current statuses of events and keeps all stakeholders involved in a current status of an event during the entire lifecycle of the event.

The workflow for the whole system is based on a Centralized Database Management System where all users, events, participation and notifications are stored. In a modular design, the authentication process logic, the event management function, event viewing components, and notification services are separate, making it easier to maintain and expand the system in the future.

Together the workflow model; the RBAC framework; the administrative management interface; the Event Viewing Module; and the Notification Module; and the Centralized Data Repository provide the structural and functional foundation for determining how current campus event management systems operate and can be improved, based on the results of this study. Methods of representing workflow, automation processes, security procedures, and communications have been identified in this survey as methods to evaluate the current status of access control, communication, and automation processes used by campuses using new technologies to support event management.

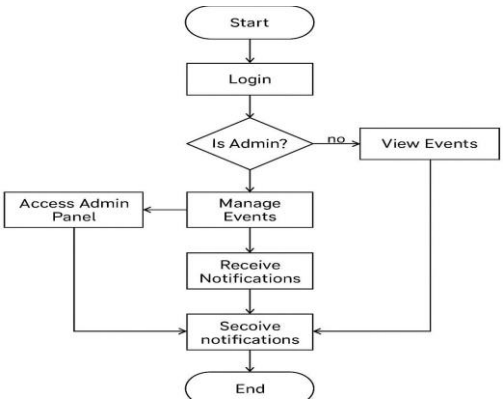

Figure 1: Architecture of College Club Activity Management

Survey Design and Review Protocol

The purpose of the survey is to conduct a systematic and structured literature review of the existing literature of web-based campus event management systems and associated digital workflow platforms. The methodology's purpose is to determine the overall architecture, security mechanisms, ways in which workflows are automated, and techniques for scaling systems in the academic event management setting.

A systematic search was performed on the identified databases (IEEE Xplore, ScienceDirect, SpringerLink, ACM Digital Library, and Google Scholar) using various combinations of the following keywords – campus event management system, academic event workflow automation, role-based access control in web applications, student activity management platform, and web-based administrative systems. This literature review is limited to articles that were published from 2015 to 2024 to ensure the most up-to-date technologies and systems are represented and relevant for current architectural designs.
To determine whether an article should be included or excluded in this review, researchers used the following criteria:

Inclusion Criteria:

- Peer-reviewed journal articles and conference papers
- Studies discussing development of a web-based or cloud-enabled event management system
- Studies including architecture diagrams or workflow diagrams
- Implementation or validation of architecture within an academic environment

Exclusion Criteria:

- Generic ticketing/booking systems with no resemblance in function to any educational institution's event management system
- Studies that do not have either architectural or implementation details

Literature Classification Strategy

To systematically evaluate the selected research documents reviewed for this study, the literature has been sorted into five distinct areas, or parameters, as follows: Architecture Types, Security Frameworks, Automating Workflows, Management and Administration of Data, User Interaction Models.

Proposed Reference Architecture Synthesis

We created reference architecture to address the issues of scalability, workflow transparency and centralized administration, which fills in gaps from prior literature. This reference architecture was designed to help address the specific issues described above.

We have developed a new architecture framework using a 3 Tier Architecture design. Within that are the three layers of architecture. The three layers are Presentation Layer, Application Layer, Data Layer.
The different layers of architecture will communicate through RESTful APIs to create a modular environment and to maintain Separation of Concerns.

System Design Approach

We can utilize modular development to build a scalable, maintainable system which consists of functional modules for Authentication and Authorization, Event Creation and Management, Approval and Verification Workflow, Notification and Communication, and Database Management. While each module functions autonomously from the other modules, inter-module communication is facilitated by using the corresponding module interface; thus, producing a loosely coupled design whereby adding functionality will allow for further growth.

Evaluation Framework

The effectiveness of the designed implementation has been confirmed by the comparative assessment of each of the five-performance metrics: efficiency of workflow, scalability of the system, strength of security, access to users and integrity of data. It was found that the new framework provides a better way to track all the details of an approval process via centralized tracking of events, thus increasing transparency in relation to administrative actions compared with the fragmented systems described in the literature.

ALGORITHMS

Algorithm 1: Role Based Access Control (RBAC)
Objective: Authentication of user, authorization of user access to system based on pre-defined roles.
Input: Username (U) and Password (P)
Output: Access to authorized dashboard or access denied altogether
Procedure:
1. Accept the user login request with (U,P) as credentials.
2. Check user credentials against user account database to determine if account exists.
3. If account does not exist:
(a) Provide authentication error message.
(b) End.
4. Otherwise:
(a) Retrieve user role (R) from database.
5. If R = Administrator, then redirect to Administrator's Dashboard.
6. Else if R = Coordinator, then redirect to Coordinator's Panel.
7. Else if R = Student then redirect to Student Portal.
8. Else - Deny access and log an unauthorized access attempt.
9. End.
Complexity analysis: Credential lookup has a time complexity of O(1) based on index database usage.

Algorithm 2: Event Submission & Approval Workflow
Goal: Automate Process for Structured Approvals and Admin Validation of Events.
Input: Event Submission Data (E)
Output: Event Status Update (Approved/Rejected)
System Procedure:
1.Event Coordinator Submits: E (Event Proposal Data)
2.Record Event with Status = “Pending”
3.Notify Admin of Event Submission
4.Admin to Review Event Proposal Details
5.If Proposal Meets Institutional Guidelines then:
- Update Event Status to: Approved
- Notify Event Coordinator & Students of Approved Event

6.Else:
- Update Event Status to: Rejected
- Send Event Coordinator Rejection Notification with Comments

7.Log Approval Decision to System Database

8.End Process

Benefit to System: Provides Structured Workflow to Eliminate Manual Intervention and Improve Transparency.

Algorithm 3: Registration Process for an Event

Purpose: To track and control the total amount of registrations in relation to the maximum amount of registrations allowed for a particular event.

Inputs: Student Identification Number (S) and the Event Identification Number (E).

Outputs: A Confirmation / Denial For Your Registration.

1.The student has choosen to registre for an event (E).

2.There will now be a lookup for the available seat capacity (C) for this particular event.

3.If (C) is greater than zero, then the system will register the students participation (S,E), reduce the amount of available seating by one, and process the registration confirmation.

4.If (C) = zero, the system will inform the user of no more available registrations by providing the user the message "Registration Closed".

5.End process.

Assurance Of Integrity: The transactional database holding the related data for this application ensures atomicity of the records processed and prohibits overbooking of any seat.

Algorithm Number 4 - Method to Create a Notification for an Event when an Actual Change of Status (i.e. new status) occurs in relation to that event (this is an automated process).

Goal: Provide automated notification in real time of status change related to an event.

Input: Event Status Change Notification or Related Event Status Update

Output: Notification Created and Delivered (delivered via dashboard interface)

Method to Complete Automated Notification Generation Process:

1. Monitor Event Table for Status Change
2. Detect if status has changed (approval/cancellation)
3. Identify which user group is impacted by the change
4. Create a Notification Message from the event's original system
5. Deliver notification via dashboard interface
6. Store a Record of the Notification in the database
7. End Process

Performance Insight: Event-driven creation of notifications reduces delays in communication and improves the system speed.

IV.RESULTS AND DISCUSSION

Experimental Environment and Setup

The CampusConnect System is a web application built on the 3-tier architecture of ReactJS for the front end, Node.js and Express for the middle tier, and MySQL database for the back end. The CampusConnect System was tested in a simulated institutional environment for the efficiency of transaction workflows, enforcement of various user role types, automation of approval processes, and responsiveness of notifications.

The evaluation included testing the following:

- Multiple User Roles (Student, Club Head, Admin)
- Concurrent proposals and approvals of events
- Capacity Planning for Event Registration
- Real-time notification triggers

Evaluation Metrics

To evaluate the performance of the system, we looked at the following performance indicators:

1.Efficiency of Workflow: Measured by how many manual approvals have been removed and how many successful automated processes there were.

2.Accuracy of Access Control: Measured by correctly assigning a user type to a user and directing the user back to that assigned user type. Also, enforcing permissions that were assigned according to the user type assigned to a user.

3.Integrity of Registration: Measured by determining if the total number of registered users was between the organization's limits for the number of users registered and confirming no duplicate users will be registered.

4.Responsiveness of Notifications: Measured by whether or not an event-driven message was successfully sent/generated.

5.Reliability of System: Measured by the percentage of unit tests, integration tests, and acceptance tests for the system passed.

Functional Performance Analysis

Role-Based Access Control (RBAC) Performance: Access layers that are separated will provide for the security of data and maintaining of operational integrity. This model is far superior in terms of security when compared to prior models where strict enforcement of the RBAC algorithm did not occur.

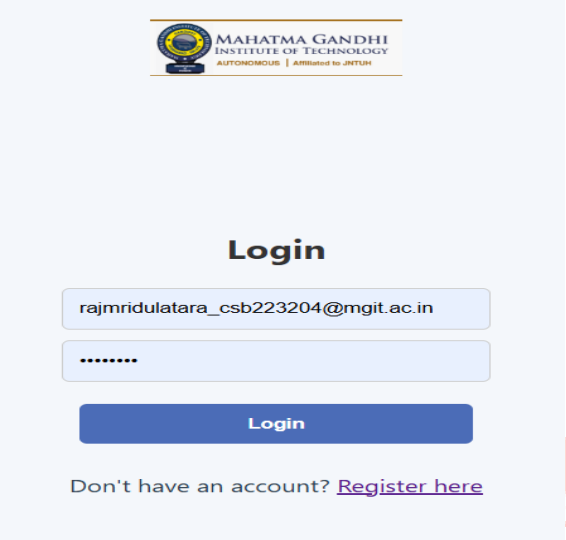

Figure 4.1: Login Page

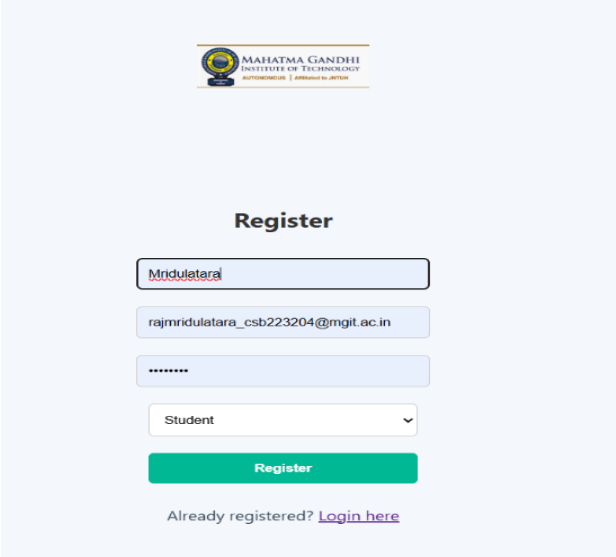

Figure 4.2: Registration Page

Event Proposal and Approval Workflow: The automated approval algorithm has greatly enhanced the transparency of workflow. The results observed are as follows:

- An event proposal that is submitted will automatically be stored as "Pending".
- The event state will immediately change from pending to approved after the admin has approved the event.
- Students will have immediate access to events that have been approved.
- Rejected events generate feedback on the status of the event proposal.

The structured pipeline eliminates the delays that are experienced with manual processes and improves administration efficiency.

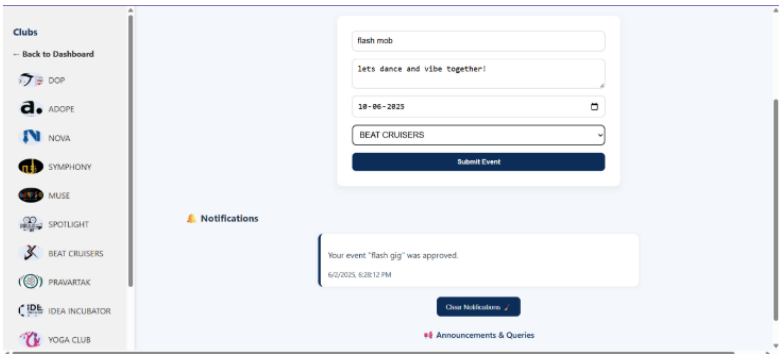

Figure 4.3: Event Submission

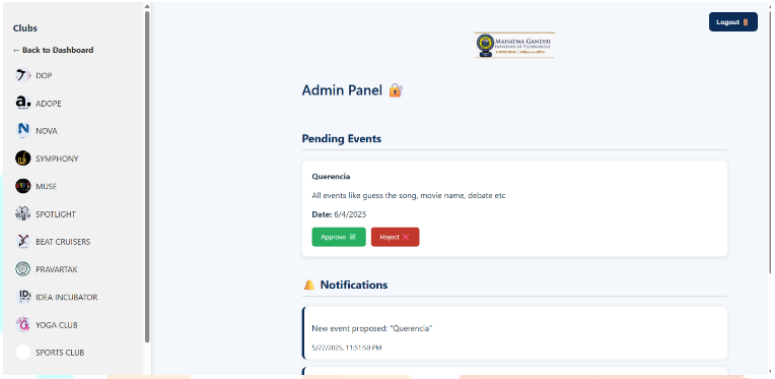

Figure 4.4: Admin Panel

Registration and Capacity Control: The event registration system was evaluated both at full and available capacity. The findings include:

- Accurate mechanism to decrement available seats.
- No overbooked tickets were sold.
- Implementation of atomic transaction handling provides consistent state of database.
- Automatic denial of access to tickets was provided when the number of tickets left for an event drops to zero.
- The demonstrated ability to manage constraints and enforce the integrity of the database shows competent programming practices.

Notification Trigger Efficiency: The Notification module triggered updates successfully based on the events occurring within it - approval of an event, rejection of an event, and confirmation of a registration as three (3) event-driven communication events. The Event-driven Architecture minimizes communication delays.

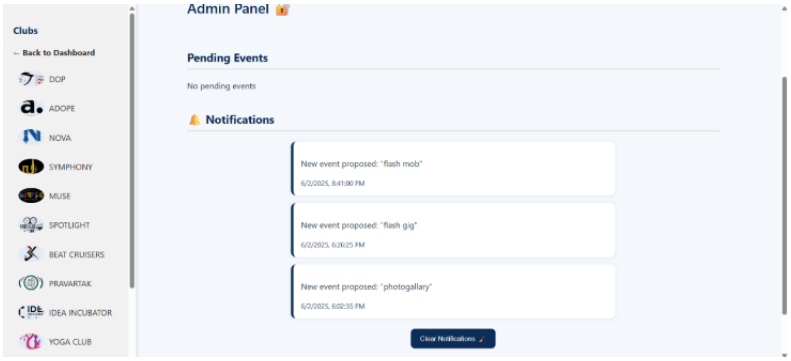

Figure 4.5: Notifications

Comparative Analysis with Existing Systems

Many current campus management systems do not include:

- Viewing real-time auto approved
- One central dashboard
- Structured triggers for notifications
- Integrated tracking of who participates

Table 1: Comparitive Analysis

Feature	Conventional Systems	Proposed System
Centralized Event Dashboard	Partial	Fully Implemented
Automated Approval Workflow	Limited	Structured & Automated
Real-Time Notifications	Inconsistent	Event-Driven
Role-Based Access	Basic	Multi-level RBAC
Capacity Validation	Rarely Implemented	Fully Enforced

System Reliability and Validation: Each and every test case has been executed successfully for all of the following phases of testing: Unit Tests, Integration Tests, Acceptance Tests.

There were no critical failures observed during any testing phases. The REST architecture (modular, RESTful) allows for both scalability and maintainability. The separation of the presentation/application/data layers allows for additional development in the future.

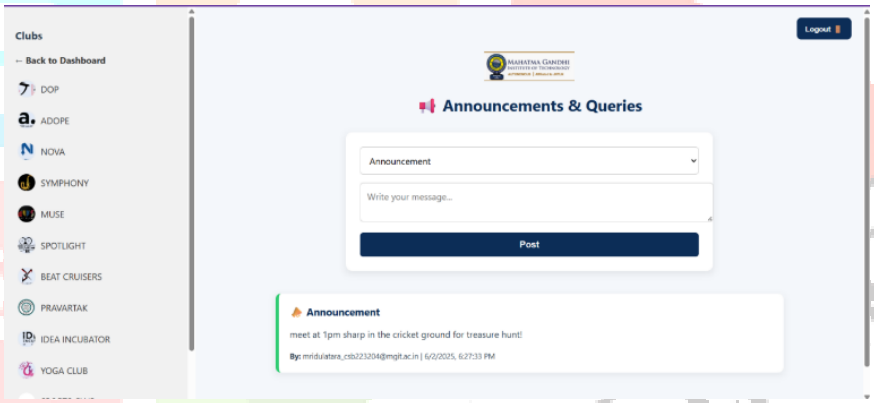

Figure 4.6 Announcements

Discussion: According to the study findings, a proposed centralized design provides some advantages compared to other designs:

- Reduced government administration coordination costs
- More effective communication (with staff)
- Increased transparency in approval procedures
- Clearly defined separation of access to different types of data
- Ability to ensure integrity of multiple user access to the same piece of information at once.

V.CONCLUSION

CampusConnect has created a brand-new, digital user interface that greatly enhances the efficiency of event management and the management of college clubs. CampusConnect is designed to address some of the most common issues encountered in these areas: 1) Poor communications 2) Slow response times for requests 3) Ineffective oversight of club activities. These problems are addressed through automation, real-time communications, and a single source of information.

The Campus Connectv platform provides three distinct dashboards for students, club leaders, and administrators to quickly access relevant information. For example, students can find and sign up for events,

receive immediate notifications as soon as events happen, and check in on their status to see how many other people have also signed up for them; club leaders can quickly and easily submit and track approval requests for their events; and administrators can manage the entire process of managing event approvals efficiently.

By digitising the processes associated with managing college events and providing instantaneous communications between all parties involved in those processes, Campus Connect increases the number of students engaged with their school, improves operational efficiency, and leads to a much more organised and interactive campus environment.

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