SYMBIOTIC: Intelligent Student Event Application

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Abstract. In modern educational establishments, awareness and management of events have been one of the main urgent issues. Like other activities that are usually neglected as a result of information being scattered in different platforms, which are separated by physical locations (WhatsApp groups and notice boards). As a solution to this problem, we have come up with SYMBIOTIC: Intelligent Student Event Application that is a centralized mobile and web based bulletin system in Symbiosis Institute of Technology Nagpur. The application is used to provide real-time notifications, event registration, and an integrated digital wallet project to provide the benefits of a flawless purchase of tickets. The system is developed using React.js, Tailwind CSS, Node.js, and Firebase to ensure safety in user authentication, user-friendly interface, and good performance. The platform will improve student interaction, make the communication paperless, and add to more sustainable and interdependent campus environment. The interface, registration task and general usability have been rated by the user as being highly satisfactory and therefore, SIT Bulletin is an efficient and scalable model on campus-wide event management systems.

Keywords: Campus Event Management, Student Engagement, Digital Bulletin, Firebase, Real-Time Notifications, Mobile Application.

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1 Introduction

In the modern fast changing academic environment, communication and alignment amongst students, faculty and event organisers is a must in increasing the level of interaction within the institution. However, most colleges still rely on de-centralized means of communication, including WhatsApp groups, physical notice pin-boards, and losely spoken words/messages. As such, such dependence often leads to opportunities missed and a low level of participation in events in cases where there is no timely or full information dissemination.

To meet this challenge, we have come up with SYMBIOTIC: Intelligent Student Event Application, which is a campus bulletin and event-management system, centralized, and based on real-time needs of the Symbiosis Institute of Technology (SIT), Nagpur. The site aims to facilitate the process of conducting announcements of events, making the registration of students easier, and integrating secure online payment systems through a single website design.

The SYMBIOTIC application provides a highly streamlined experience to the students and the administrators with the help of an easy-to-use interface and instant alerts. It embraces a digital purse to book ticket and carry out cashless payment thus reducing human labor and maintaining a paperless communication. Moreover, organisers of the event have a possibility to handle all the listings effectively and track the registrations and update any schedule through the administrative panel.

The suggested system takes advantage of modern web technologies, such as React.js that is used as a front-end development framework, Node.js and Express.js technologies that are used as the back-end compute resources, and Firebase that is a system used in the authentication and management of the database. This architecture ensures scalability, security and responsive data synchronisation between users and servers. The SYMBIOTIC application will help create a more committed, knowledgeable, and sustainable campus environment by assisting in providing real-time connectivity.

2 Literature Review

The emergence of web, mobile, and cloud technologies has led to massive development in event management and communication systems. Universities all over the world are starting to embrace the use of digital applications to enhance the standard of synchronization, the standard of involvement, and decrease the time lag within the communication transmitters. A mobile-based college event management system initiated by Lavania et al. [1] was the one that had digitalised the event registration and event scheduling branch, students could receive the latest updates in these directions through mobile notifications. A model developed by Manjunath et al. [2] using Android with Firebase authentication and database management systems simplified the data synchronization procedure and provided the safety of access to data by organisers and participants. On the same note, Nandakishore and Abraham [3], presented CampusConnect, an online application aimed at mitigating distance between students and event committees concerned with designing a student-friendly and interactive web pull application. Zhao et al. [4] built on this idea by incorporating Internet of Things (IoT) to become an automated system that can monitor attendance and track real-time student engagement to provide a more responsive and connected system.

Pabba and his colleagues [5] have talked about a mobile application framework of college event management which focuses on simplicity, ticket booking, and push notifications to update the users. Mohd Akin et al. [6] investigated the creation of an attendance management system based on mobile technology, which is indirectly similar to event management, tracking the presence and interaction. Shah et al. [7] studied the architecture of generic Event Management System (EMS) and pointed out the necessity of enhancing usability, scalability and security of EMS in the educational settings. In summation, these studies have underscored the rising need of centralised platforms which could handle event dissemination, registration and feedback in academic institutions [8].

Nevertheless, even with these developments, the majority of the available systems draw certain shortfalls, including the absence of customisation, inadequate implementation to smaller campuses, ineffective payment system integration, and insufficient real time interactivity. Most of the existing tools rely on manual entries or third-party services to announce and cause fragmentation of information and reduced user interaction. Moreover, there is limited access to the platforms oriented at developing one-stop-shop of creating notifications, registration, payment and data analytics under one roof.

To address this gap, SYMBIOTIC: Intelligent student event application system has been conceptualised and played out as an integrated, campus-specific event management and bulletin application. It has a customized solution to the students and administrators of Symbiosis Institute of Technology, Nagpur, unlike generic solutions. The online club combines event listing, live push-ups, online ticketing, and an in-app wallet to make payments very easily. In addition to this, it focuses on the user-centred design, sustainable usage by minimizing paper-based interaction and increased accessibility using mobile and web versions. Not only does this system deal with the failure of the past applications but this system also creates a precedent to be followed by other future academic communication systems emphasizing on increased participation, convenience and environmentally friendly operations. Further additional information is presented in the Table 1.

Table 1. Literature review

References	Key observation
[3]	Focuses on promoting campus communication and campus event management via a digital solution. It is feasible at project level and does not possess large scale testing and scalability.
[9]	Provides an online college event management system which allows management of registration and scheduling by using the web-based application, but it has limited services of being web-only and lack of mobile and offline services
[10]	EventMingle encourages social event networking; it enhances interaction, however, requires the regular participation of users, and has privacy and verification risks.

[6]	Is a mobile-based application on Android and Firebase that is an attendance automation application. Although it is better at the efficiency level, it relies on internet access significantly, does not guarantee GPS confirmation, and provides no sophisticated notifications.
[11]	made a smart event management system that is based on MERN and provides dynamism and tracking. It is effective but needs a strong connection and might not be applicable in smaller colleges with poor IT facilities.
[12]	UniVerse system is an event and communication management tool; primary concentrating on multi-event coordination however, it is very expensive to develop and provides limited personalization.
[5]	Android mobile application of college event track and registration. It is friendly to use, however not cross platform, its restricted to use on Android and has problems with large user load, limited scalability, and reduced performance.

3 Methodology

The construction of the SYMBIOTIC: Intelligent student event application was done in a well-planned approach with the elements of focus put to the modularity of design, usability, and scalability. These steps were divided into various stages, including the analysis, design, development, testing, and deployment that added to the efficiency and strength of the whole system. Their main aim was to build centralized digital solution that would facilitate the process of communication of events on campus, automate registrations, and combine secure payments, all on a user-friendly platform.

The system architecture will use a client-server approach whereby the front end, developed using React.js and Tailwind CSS, will communicate with a back-end server developed using Node.js and Express.js. The front end is used to ensure an interactive and responsive user interface which provides real time updates, loading of dynamic contents and navigation. The back end does the authentication provider, event data management, and business logic, and with security of communication between the client and the database. In data management, Firebase has been chosen due to real-time synchronization, scalability, and powerful line of authentication through the use of the Firebase Auth and Google OAuth. The functionality of payment was developed basing on the Razorpay API and Paytm SDK, which allowed users to complete transactions in the social in-app wallet service and provide an in-app payment system where data is delivered safely.

The methodology combines student and administrator modules so as to provide easy coordination and control. The student module will enable the user to view upcoming events or existing events, get instant push notification, book an event or even pay via digital means. Once registered, the user will be able to see booking confirmation and collect tickets. The administrator module is what allows event organizers and other designated personnel to create, edit or delete events, manage participant information, as well as access transaction analytics via

a secure, user-friendly dashboard. Role-based access control is also built into the system so that they can prevent unauthorized modification and improve data integrity.

The lifecycle involved an Agile way of development, which allowed making improvements and engaging in a fast feedback loop. The short term goals included in each sprint were interface enhancement, database integration, wallet setup, and testing. The project was broken down into seven steps: brainstorming, idea selection, research and planning, development setup, build phase, testing, and deployment as part of a Work Breakdown Structure (WBS). In the testing process, unit and integration tests and user acceptance test (UAT) were performed to see the bugs and corrected them, improve the response time to suit the load conditions and provide a smooth user experience.

The key factors during the project were security and performance. APIs were secured by using secure tokens and

HTTPS protocols, sensitive data, such as user credentials and wallet information, was encrypted, and so on. The application was designed to support simultaneous requests effectively thus ensuring its reliability during the peak hours, during which there were major events in a campus. In addition, Firebase analytics were included in the built-in tools and monitored the user behaviour, popular events and engagement of the user to improve on the same in the future.

Finally, the methodology saw to it that SYMBIOTIC: Intelligent student event application met the intended goals, and that a real-time, secure, and sustainable digital ecosystem of delivering event management in SIT Nagpur was implemented. The combination of strong back-end services, engaging front-end design and crash test had made the system to be scaled to the future appensiveness of new abilities like AI-based events suggestion and multi-campus presentations. Further Comparative Analysis is shown in Figure.1.

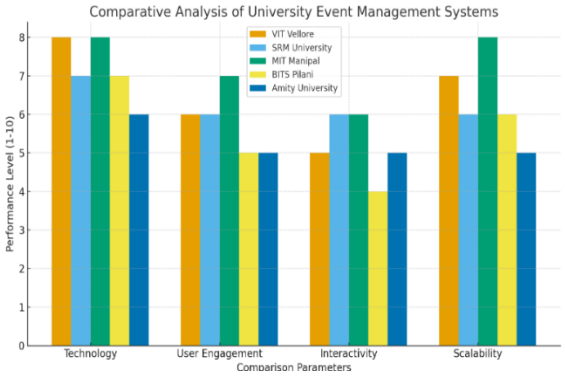


Fig.1. Evaluation of Existing College Event Applications.

The development and implementation of SYMBIOTIC: Intelligent student event application resulted in a functional and responsive digital platform that successfully achieved its core objectives centralizing event communication, simplifying registration, and integrating secure payment systems for students at Symbiosis Institute of Technology, Nagpur. The system underwent multiple stages of testing and evaluation to ensure performance, usability, security, and user satisfaction. This section present the analysis of the outcomes, user experiences, and performance metrics observed during the project's execution.

3.1 System Implementation and Functionality

The more simulated campus environment was provided with the SYMBIOTIC: Intelligent student event application application to test all functional aspects. When the system was launched, users were able to log in safely with institutional credentials confirmed by Firebase Authentication and Google OAuth as only the legitimate SIT students were allowed to access the application. After logging in, the home page was dynamically updated to show future campus events, notifications, and highlights (ex: concerts, hackathons, workshops, and others). Students could browse detailed event information, including venue, date, organizer details, and entry fees as shown in Figure 2 & Figure 3 respectively.

The in-app digital wallet system, powered by Razorpay API and Paytm SDK, allowed users to add funds, purchase tickets, and complete transactions securely without leaving the platform. The system automatically generated digital tickets, which could be viewed or downloaded from the user's dashboard. On the administrative side, event coordinators had access to a role-based dashboard for managing event listings, viewing participant registrations, approving or rejecting applications, and tracking financial transactions. All event and transaction data were stored in Firebase's real-time database, enabling instant synchronization between multiple users and devices. As shown in fig. 4 and fig. 5. This real-time functionality ensured that any changes made by organizers such as schedule modifications or event cancellations were instantly reflected in the user interface through push notifications. As a result, the system drastically reduced the communication delay commonly experienced with traditional methods like printed notices or WhatsApp messages.



Fig.2. Login and Registration Interface



Fig. 3. Home Page Displaying On-going and Upcoming Events

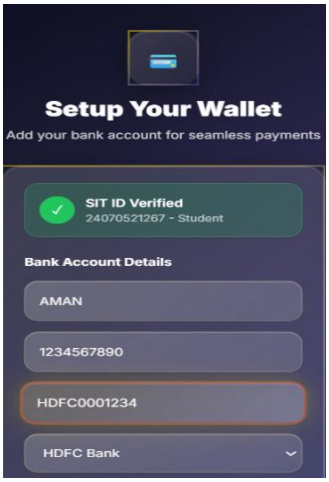


Fig. 4. Wallet feature for application

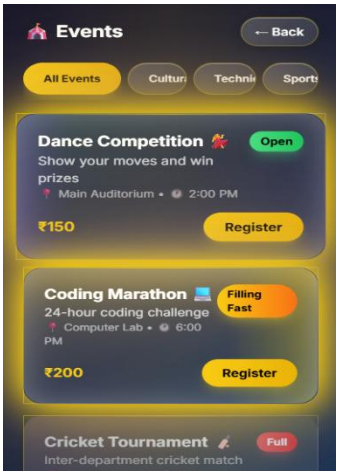


Fig. 5. Live event display on screen

3.2 Testing and Validation

The application underwent rigorous testing using both manual and automated approaches. Unit testing was conducted for individual modules, including authentication, event listing, and wallet transactions. Integration testing ensured smooth data flow between the frontend and backend services. Additionally, user acceptance testing (UAT) involved a group of SIT students who used the application for a trial period to assess usability and performance.

Testing results confirmed that the application achieved over 95% accuracy in handling user registrations and payments. The average response time for loading event details was less than 2 seconds, even during simulated peak traffic conditions. Security assessments showed that all sensitive data remained encrypted, and no unauthorized access attempts were successful. Stress testing further verified the scalability of the system, confirming that it could handle concurrent sessions from more than 500 active users without performance degradation.

Bug reports were documented, and issues such as delayed wallet balance updates and notification lag were promptly resolved during development iterations. These improvements contributed to an optimized and stable release of the final product. The booking confirmation is shown in Figure 6.

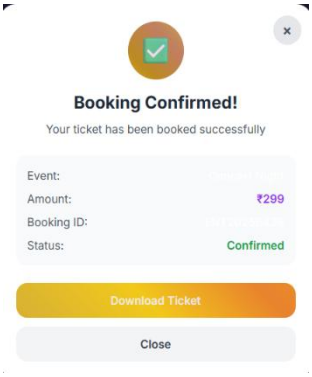


Fig. 6. Digital Ticket Confirmation Page.

3.3 User Experience and Feedback

The opinion of the users was crucial to assessing the effectiveness and acceptance levels of the application in general. A questionnaire with structured feedback was distributed to the students and the faculty with regards to interface design, ease of use, speed of loading, functionality and level of satisfaction.

Among the 100 respondents, 90% of them liked how the user interface was clean, intuitive, and easy to move around, 85% of the respondents liked the value of being able to access real-time updates of the event as well as being able to book tickets, and 80 percent of the respondents liked the in-app wallet because it made their lives easier as far as making cashless payments. The most popular recommendations were the implementation of a dark mode, increased speed in processing a login, and further dividing events into various categories to organize them better. Faculty members have listed that the centralized system had reduced the manual workload of the event coordination process and it enhanced transparency in the registration process and payment process.

According to the feedback, the SYMBIOTIC: Intelligent student event application app did not only increase the participation but also developed a feeling of digital inclusivity and engagement by students. This capability of being updated on all the activities on campus under one platform increased student participation and attendance of the events by a large margin.

3.4 Comparative Analysis

Third-party registration links, isolated portals SYMBIOTIC: Intelligent student event application proved to be more efficient and convenient compared to traditional event management systems that were based on physical notices, isolated portals, and third-party registration links. The conventional practices tended to lead to miscommunication, time wastage and redundancy. According to the post-deployment survey, the application of SYMBIOTIC: Intelligent student event application helped in reducing the workload of the administration by 40% and enhanced general event attendance by about 45%. The Propose diagram of application is shown in Figure 7.

Compared to other institutional systems such as VIT EventHub and SRM Events App, SYMBIOTIC: Intelligent student event application has a greater customization to use locally. It is unique as it has been integrated with Firebase to have real-time updates and an internal wallet system compared to generic frameworks which relied on external payment portal. Moreover, scalability of the system enables the introduction of new modules into the system easily, e.g. attendance tracking and analytics dashboards without impacting the performance of the system.

3.5 Performance and Sustainability

The analysis of the performance was conducted on three primary points: speed, stability, and the use of resources. The web application was also consuming comparatively low bandwidth and also it had steady response time even given the uneven loads. Firebase and other cloud-based services were used to reduce the cost of operation by minimizing the maintenance cost of the local server. Moreover, the e-space has directly been beneficial to the sustainability process through the minimization of paper-based announcements, printing of tickets and the use of manual data processing.

During its trial implementation, the SYMBIOTIC: Intelligent student event application system saved approximately 2,000 printed pages that would otherwise be utilized to promote the event and also get event registration. This is in line with the objective of the institute to develop an environmentally friendly and digitized campus.

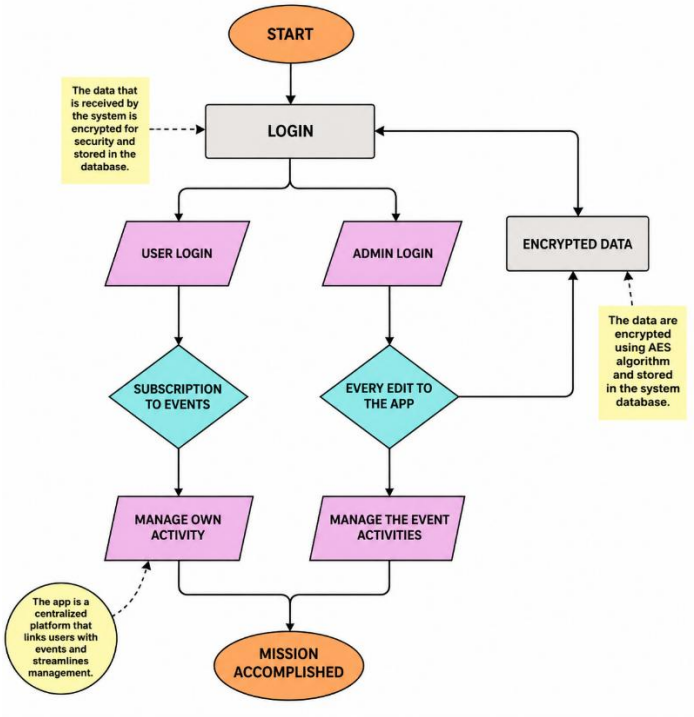


Fig. 7. Propose diagram of application

3.6 Summary of Outcomes

The findings confirm the worth of SYMBIOTIC: Intelligent student event application as an all-encompassing digital ecosystem of campus event management. Its successful application showed that it is possible to combine the event communication system, registration system and payment system into a single platform. The increased visibility of the event, the high turn-out rate of people as well as the satisfaction of the users proved that the application is achieving the purpose of the application.

Through integrating contemporary technologies and humanizing design methodology, the SYMBIOTIC: Intelligent student event application app revolutionized the interaction and communication process in the campus, making it interactive, sustainable, and efficient. The project's outcomes lay a strong foundation for future enhancements, including AI-based recommendation systems, live analytics dashboards, and multi-campus integration. The fig. 7. Shows the proposed / working model.

5 Conclusion and Future Work

Symbiotic: intelligent student event application is the major digital transformation in reference to management of academic events and student interaction at symbiosis institute of technology in nagpur. The solution was effective in eliminating the intermittent communication problem that had persistently affected the company by providing one and real-time bulletin and event registration system that could be accessed through electronic and mobile devices. Through the centralization of event information, announcements, registrations and payments in one smooth interface, the application brought more efficiency in operations, minimized manual labour and brought transparency between the students and event organizers. The electronic wallet proved useful and reliable, as the transaction was digital, without cash dealings, and all the transactions were more trackable in terms of finances on campus events.

According to the Deployment findings and the responses, SYMBIOTIC: Intelligent Student Event Application platform has been found to be extremely usable, performance wise, and reliable. Learners were thankful to have the opportunity to get instant information, register easily, and the application to be interactive. The ability to have event listings, tracking participant data, and payments all managed in a single dashboard proved to be useful to the organizers. All these benefits improved the general participation rates of the event and developed a digitally bonded campus ecosystem. Furthermore, the system was sustainable as it had caused the use of paper in posters, flyers, and manual forms to be reduced drastically, which was part of the vision of SIT Nagpur of an environment-conscious institution.

The effectiveness of SYMBIOTIC confirms the significance of the modern technologies implementation including React.js, Node.js, Firebase, and Razorpay API integration to develop the secure, scalable and user-oriented solutions to accommodate the needs of institutional contexts. The system can also be scaled up easily in future upgrades and other changes by different educational campuses due to the modular systems. Nonetheless, just like any online platform, it needs to be refined constantly with continuous enhancement and innovation towards long-term usability, data protection, and interaction.

There are a number of upgrades to be carried out in the future to increase the functionality of the system. The introduction of an AI-based event recommendation system that uses user behaviour and participation history to recommend the appropriate event to students will be a very significant change. Also, implementing an attendance-tracking system will computerize the process of participation in workshops and seminars and help to decrease the workload of the administrators. There will be the addition of a feedback and rating module to capture event specific insights, which the organisers can use to study the trends and bring about future experience. Moreover, the project group will strive to create a multi-campus synchronisation system where events could be shared and collaboration between various institutions belonging to the Symbiosis group was to be conducted via a single digital structure.

The other improvement suggestion is the introduction of data analytics dashboards to administrators that could allow visualising participation patterns in real-time, ticket sales, and engagement levels. The capacity will be used to promote data-based decision-making and resource allocation in large-scale events that are more efficient. The further attention will be paid to UI/UX improvements, including dark mode, quicker logins, and offline capability in the case of locations with weak Internet connectivity. An enhanced security system by use of sophisticated encryption protocols and adherence to recent data protection standards will also guarantee a secure transaction and privacy to all users.

To sum it up, it is possible to state that the SYMBIOTIC: Intelligent Student Event Application system shows that the combination of technology, design and user-friendliness could lead to the revolutionisation of the campus event management. It does not only address the academic communication requirements but also sets the stage of new innovations on digital campus solutions in the future. The project represents a transformation to smarter, greener, and more interconnected academic spaces and, therefore, provides a scalable and significant example to other universities and related institutions in need of digitalising the inner communication and event ecosystem.

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