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Vedaz Event Management Booking System with TOTP

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Abstract

Modern event management demands efficient digital solutions due to evolving customer expectations and technological advancements. Vedaz currently lacks its own system and relies on social media and traditional methods for bookings, leading to inefficiencies. To solve this, the Vedaz Event Management Booking System (VEMBS) was developed using the Object-Oriented System Design (OOSD) methodology. This web-based platform offers secure user authentication with Time-Based One-Time Password (TOTP) via Google Authenticator, email verification, session management, role-based access, strong passwords, data encryption, and secure payment, enabling real-time viewing and booking of events.

1. Introduction

The Vedaz Event Management Booking System (VEMBS) was developed to overcome key limitations faced by the company in managing event bookings. Previously, Vedaz relied heavily on social media platforms and traditional communication methods, which led to scattered information, inefficient coordination, and inconsistent payment handling. The absence of a centralized system posed challenges in maintaining accurate records, managing customer interactions, and ensuring timely updates. To address these issues, VEMBS was designed as a secure, web-based platform using the Object-Oriented System Design (OOSD) methodology. The system integrates modern features such as Time-Based One-Time Password (TOTP) authentication, email verification, session control, role-based access, strong password policies, AES-256 data encryption, and secure payment gateways.

A key security enhancement in this system is the implementation of TOTP authentication, which significantly reduces the risk of unauthorized access, particularly during payment transactions and sensitive user actions. By requiring a time-sensitive code generated through Google Authenticator, TOTP ensures that only verified users can perform high-privilege tasks such as confirming bookings, managing user roles, or accessing confidential data. This additional verification step enhances overall system security, protects customer information, and prevents fraud. Moreover, by streamlining the entire booking process into a single, user-friendly interface, VEMBS helps improve operational efficiency, strengthens Vedaz's digital presence, and delivers more professional and secure experience for both staff and clients.

2. Related Work

This section explains the literature reviews conducted for the Vedaz Event Management Booking System with TOTP. It covers various aspects of authentication and security, studies of existing systems, and comparative analysis. The section is organized into sections that discuss authentication methods, secure payment gateways, and existing online event management systems. This structured approach ensures a comprehensive understanding of the project's context and foundation.

2.1 Authentication

The process of determining a user's identity or entity prior to interacting with the software or system is known as authentication. The three most crucial components of cybersecurity are secrecy, security, and authentication. Authentication protocols are the basis of security in many distributed systems, and it is therefore essential to ensure that these protocols function correctly [1,2] the authors provide a further discussion on password entropy, and the feasibility of such attacks on passwords.

2.1.1 AES-256 Encryption

Sensitive data can be safely encrypted using the extremely secure AES-256 (Advanced Encryption Standard with a 256-bit key) technique. It uses symmetric encryption, which entails using the same key for decryption as well as encryption. The first step in the procedure is to create a 256-bit key. Next, the data is padded to make 128-bit blocks fit. The data is encrypted by the AES-256 method using several rounds of substitution, permutation, and XOR operations, which produce ciphertext. The original plaintext is recovered through decryption, which employs the same 256-bit key to reverse the encryption processes. During decryption, padding that was added during encryption is taken out. Due to its complexity and key length, AES-256 is a highly secure protocol that is frequently used for data storage, secure communication, and the protection of sensitive data, including financial and personal records.

2.1.2 Two-Factor Authentication – Time-Based One-Time Password

To improve account security with two-factor authentication (2FA), users are required to give two kinds of authentication: a password and a time-based one-time password (TOTP) produced by a device. HMAC-SHA1 (Hash-based Message Authentication Code with Secure Hash Algorithm 1) is the algorithm that is used. The user inputs their password, username, and the TOTP that their authenticator app produced during login. Using the secret key and the current time, the service confirms the TOTP. The user is authenticated and given access if the TOTP matches the expected value. By requiring the user's password and the authenticator device, 2FA with TOTP greatly improves security and lowers the possibility of unauthorized access brought on by credential theft or phishing attempts.

2.1.3 Password Management

A crucial component of cybersecurity is password management, which includes using, storing, and processing passwords securely to prevent unauthorized access to user accounts and sensitive data. For both individuals and organizations, adopting strong password management practices is essential to mitigating the risks associated with compromised or weak passwords, such as identity theft and data breaches [3].

Initially, users should be encouraged to create unique, strong passwords that combine uppercase and lowercase letters, numerals, and special characters to thwart guessing or cracking attempts. Password complexity rules that set minimum requirements for password length and complexity should be implemented to reduce the likelihood of a successful brute-force attack. By implementing these safeguards, VEMBS improves its security and guarantees a dependable and safe booking system by shielding private information and user accounts from intrusions and attacks.

2.2 Session Management

Session management is essential for securing online applications, as it involves overseeing and maintaining user sessions to protect sensitive information and uphold the integrity of web applications [4]. A session starts when a user logs in and concludes either upon logout or when it times out due to inactivity. Effective session management protects sensitive user data, such as authentication credentials and session tokens, from tampering and unauthorized access [5].

2.3 Role Based Access Control

Role-Based Access Control (RBAC) is a useful tool used by the Vedaz Event Management Booking System to effectively manage user rights and access levels. As a result, there is less chance of sensitive data being accessed by mistake. RBAC facilitates granular permissions and secure role management, further enhancing the system's security. Role-Based Access Control (RBAC) restricts user access to specific data and functionalities based on their roles, thereby improving security and operational efficiency [6].

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2.4 Secure Payment Gateways

The integration of secure payment gateways is crucial for ensuring the safety and integrity of financial transactions on the Vedaz Event Management Booking System. Secure payment gateways employ advanced encryption techniques to protect sensitive payment data, such as credit card numbers and personal information, during internet transmission [7]. VEMBS incorporates Stripe as its payment gateway, which further enhances security by offering fraud prevention tools, end-to-end encryption, and PCI DSS compliance, ensuring the secure handling of all financial transactions.

By integrating secure payment gateways, VEMBS can protect customer information from unauthorized access and harmful third-party interception, thereby enhancing user confidence and the platform's legitimacy. The secure handling of financial transactions demonstrates the company's commitment to safeguarding client information and ensuring a reliable and secure online shopping experience [8].

2.5 Study of Existing System

To evaluate and enhance the proposed Vedaz Event Management (VEM) Booking System, two existing systems with similar functionalities, WhiteBox and In Town Events, are analyzed. This analysis is crucial to identify the strengths and weaknesses of these systems. Leveraging the strengths of these systems allows for the integration of advantageous features into the proposed system, while any identified drawbacks can be avoided. As a result, the proposed system can be improved and developed more effectively. The VEM Booking System aims to surpass these existing platforms by incorporating features such as login, registration, TOTP authentication, online payment, and enhanced usability, ensuring a more secure and user-friendly experience.

2.5.1 WhiteBox

WhiteBox offers basic booking options through email, phone, WhatsApp, and a live queue. However, it lacks login, registration, authentication tools, online payment, and review features.

2.5.2 In Town Events

In Town Events provides booking only via WhatsApp and supports viewing services and reviews. It lacks login, registration, authentication, and online payment functionalities. The VEM Booking System includes advanced features like login, registration, forgot password, TOTP authentication, online payment, and review and rating options, providing a more user-friendly and secure experience compared to both existing systems.

Table 1 *Comparison between existing systems and proposed system*

Features	WhiteBox	In Town Events	VEM Booking System (proposed system)
Registration	No	No	Yes
Forgot Password	No	No	Yes
Booking	Yes – Email, Phone, WhatsApp	Yes – WhatsApp	Yes - Online
TOTP authentication	No	No	Yes
View provided services	No	Yes	Yes
Online Payment	No	No	Yes
Review & Rating	No	Yes - Review	Yes
Usability platform	Web-based	Web-based	Web-based

3. Methodology

The Object-Oriented System Development Life Cycle (OOSDLC) was adopted to develop the Vedaz Event Management Booking System (VEMBS), aligning with its modular structure and reusability goals. The methodology consists of five main phases: analysis, design, implementation, testing, and maintenance.

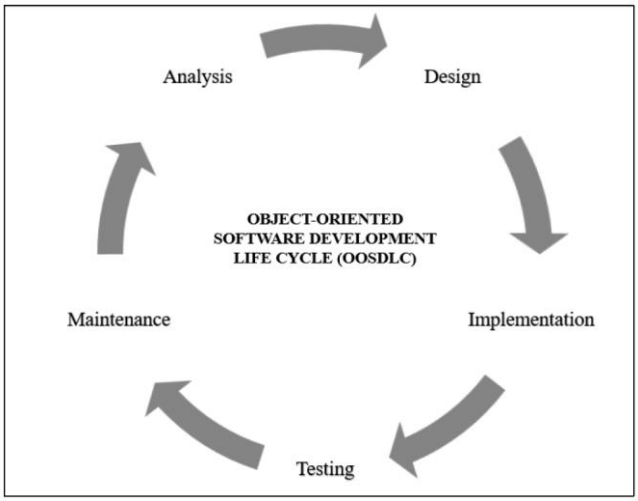

Fig. 1 *OOSD Model [9]*

According to Colbert (1989) [10], Object-Oriented Software Development (OOSD) enables problem-solving through decomposition into distinct entities, promoting a clearer understanding of relationships and interactions. This enhances system scalability and maintainability, which is crucial for a platform like VEMBS. Haythorn (1994) also emphasizes the reusability advantage of OOSD, while [11] highlights its strong emphasis on rigorous testing throughout development to ensure reliability and performance.

3.1 Object-Oriented Analysis

In the analysis phase, the goal was to understand Vedaz's operational issues—primarily its reliance on social media and traditional booking methods, which resulted in disorganized event management. Interviews with the business owner and observations of current practices were conducted. Based on this, system requirements were documented, and functional scopes such as event listing, customer booking, admin approval, and secured login were identified. Use case diagrams and class diagrams were developed to represent system actors and behaviors clearly [12].

3.2 Object-Oriented Design

The design phase focused on converting the requirements into a detailed architectural plan tailored for Vedaz's operations. Using UML diagrams, ERDs, and class diagrams, the components of the booking system were structured. Design outputs included modules for event management, booking workflows, authentication (including TOTP), and admin control. Each class was carefully designed with attributes and methods representing real-world behaviors such as event creation, user roles, and session handling. The design ensured that the system supported both customer-facing and administrative tasks efficiently [13].

3.3 Object-Oriented Implementation

The implementation involved translating the design into a fully functional Laravel-based web system. Laravel handled backend logic, session control, and routing, while Vue.js was used for a dynamic user interface. MySQL was used to manage structured data for events, users, and bookings. TOTP-based authentication was integrated using Google Authenticator APIs to secure sensitive operations such as login and payment. Development was version-controlled using GitHub. The result was a responsive and secure platform tailored to Vedaz's booking needs.

3.4 Object-Oriented Testing

VEMBS underwent a comprehensive testing process to ensure system correctness and robustness. Unit testing was performed on individual components such as event creation, booking approval, and login functions. Integration testing ensured that these components worked together seamlessly. User Acceptance Testing (UAT) was conducted with the business owner to validate real-world usability. Specific attention was given to testing the TOTP module to confirm that only verified users could proceed with payments or access protected areas. Performance testing was also conducted using simulated loads to ensure the platform could handle concurrent bookings [14].

3.5 Object-Oriented Maintenance

After deployment, the system entered the maintenance phase, with regular updates and improvements based on user feedback. Adaptive maintenance included modifying features to suit business growth, such as adding new event categories or promotional tools. Corrective maintenance addressed any bugs or issues encountered post-deployment. Perfective maintenance involved enhancing user interfaces and improving user experience based on customer feedback. Continuous documentation updates and administrator training ensured smooth, long-term operation [15].

4. Analysis and Design

This section describes the design of the Vedaz Event Management Booking System (VEMBS), focusing on its functional and non-functional requirements, along with system analysis and design. VEMBS was developed to replace Vedaz's manual and social media-based booking approach with a secure, structured platform. Key functional features include user registration with TOTP authentication, event listing, booking management, and admin controls. Non-functional requirements emphasize data security, system reliability, and user-friendliness. The analysis identified issues like unverified payments and scattered information, which were addressed through structured design models such as class and entity-relationship diagrams.

4.1 Functional Requirement

Functional requirements define the data that must be kept track of to accomplish the user tasks. Vedaz Event Management Booking System (VEMBS) needs to meet the following functional requirements in Table 2.

Table 2 Functional Requirements

ID	Functional Requirements	Description
FR1	User Registration	Users will be able to register on the system by entering their name, email address, phone number, and password.
FR2	Email Verification	User will be able to verify their account by clicking a link sent to their email as soon as registered.
FR3	TOTP Authentication	The system will create and deliver a Time-based One-Time Password (TOTP) to the registered authenticator app for secure login.
FR4	User Login	Users will be able to access the system by entering their email address, password, and TOTP.
FR5	Password Recovery	Users can reset their passwords by email verification by using the password recovery option that the system offers.
FR6	Profile Management	Users will be able to access and modify their personal profile data on the system including change name, update password, manage browser sessions, delete account, manage two factor authentication.
FR7	Event Booking	Users will be able to book events using the system by choosing the event they want to attend and confirming their reservation.
FR8	Booking Confirmation	Following a booking, the system will let the user download invoice upon successful payment.
FR9	Booking History	Users will be able to access their booking history through the system.
FR10	Search Events	Users will be able to search for events in the system using keywords, dates, or locations.
FR11	Rating and Review	Users will be able to submit rating through the system and post reviews about the service received.
FR12	Secure Payment	User will be able to make booking payment through the system.

4.2 Non-Functional Requirement

Non-functional requirements specify the criteria that are essential for the system's success but are not related to specific functionalities. Non-functional requirements describe a variety of system characteristics: operational, performance and security. For the VEMBS, non-functional requirements in Table 3.

Table 3: Non-Functional requirements

ID	Non-Functional Requirement	Description
NFR1	Security	The system needs to use secure communication channels (like HTTPS) and encryption to guarantee the security of user data. To stop unwanted access, TOTP authentication needs to be used.
NFR2	Performance	Up to 100 concurrent users should not cause performance issues for the system. Under typical load circumstances, page load times shouldn't be longer than five seconds.
NFR3	Usability	Users should be able to explore and complete activities with ease thanks to the system's intuitive user interface. All user demographics should be able to easily navigate and use the user interface.
NFR4	Reliability	A 99.9% uptime rate would guarantee that users may use the system at all times save for planned maintenance.
NFR5	Scalability	The system must be expandable to handle future development, enabling the inclusion of additional features and support for a higher volume of users and events.
NFR6	User Support	To help users with any problems, the system should offer thorough user assistance, which should include FAQs, user manuals, and a support contact option.
NFR7	Security	Ensure the confidentiality and privacy of user information through security measures.

4.3 Unified Modelling Language (UML)

Unified Modeling Language (UML) is a standardized visual modeling language widely utilized in software engineering to depict and communicate complex systems throughout the software development life cycle. g. UML includes a set of graphic notation techniques to create visual models of object-oriented software systems [16].

4.3.1 Use Case Diagram

Fig. 2 shows admin beginning by account login with TOTP. Once logged in, admin manage several dashboards which are event dashboard, services dashboard, bookings dashboard, role dashboard, staff dashboard, manage timeslot and homepage images. Admin also can respond to reviews and ratings by customers.

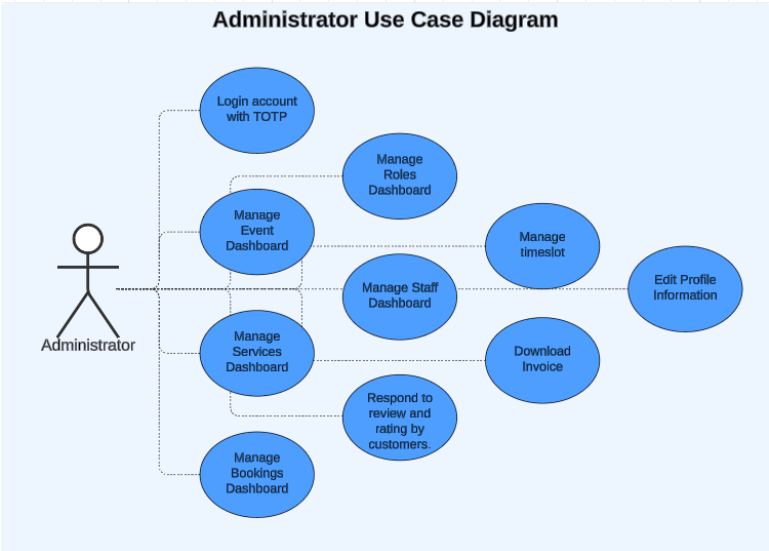

Fig. 2 *Administrator Use Case Diagram*

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Fig. 3 shows Client Use Case Diagram. Customers can register an account, verify it via email, and log in with optional 2FA for added security. They can update their profile information, view all service details, and explore event details linked to specific services. Customers can book services, process payments, and manage their bookings through "My Bookings." Additionally, they can rate services and reset their password if forgotten, ensuring a secure and user-friendly experience.

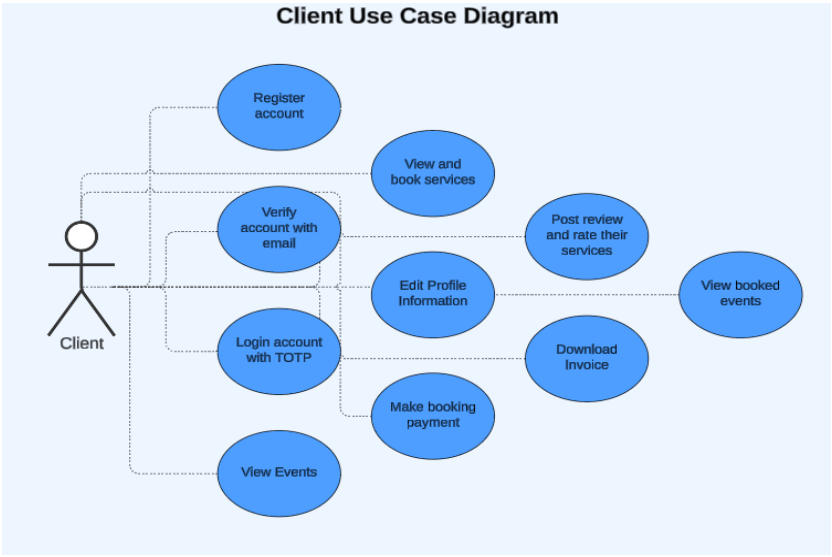

Fig. 3 *Client Use Case Diagram*

Fig. 4 shows Staff Use Case Diagram outlines staff responsibilities in the Vedaz Event Management Booking System, where they can log in, access a dashboard, and manage bookings, services, events, and ratings based on their role permissions. While their tasks overlap with the admin's, their actions are limited to their assigned scope.

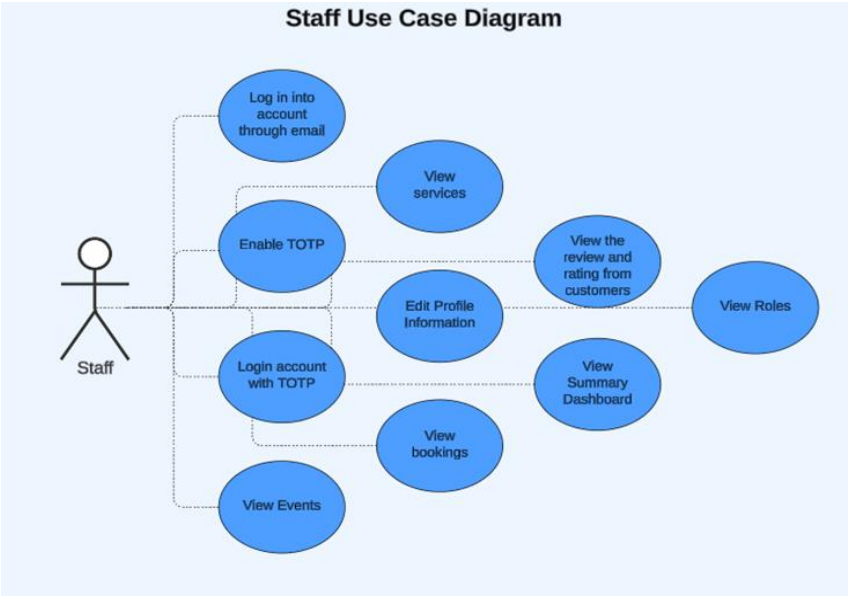

Fig. 4 *Staff Use Case Diagram*

4.3.2 Sequence Diagram

Fig. 5 shows the admin Sequence Diagram illustrates the flow of administrative tasks in the system. The admin logs in with TOTP, accesses the dashboard, and manages content, including adding images and configuring timeslots. The admin can confirm or reject bookings while leaving a response, respond to ratings, create or delete services and events, and update roles and permissions. The admin also uses a staff dashboard to create staff accounts and assign roles, overseeing all system operations and ensuring efficient management.

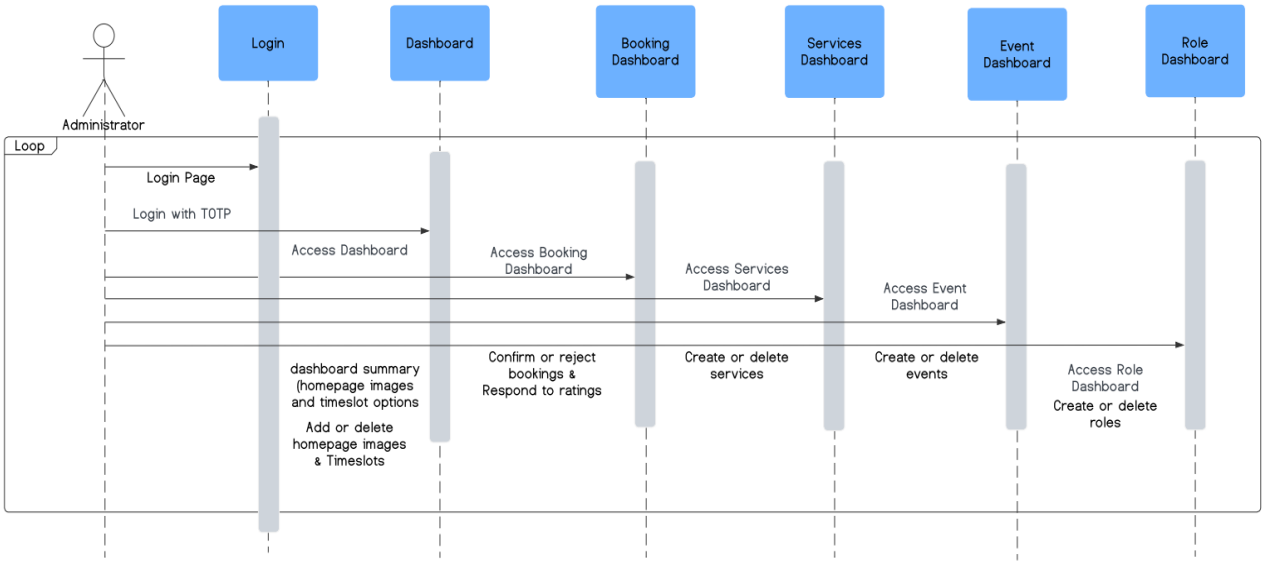

Fig. 5 *Admin Sequence Diagram*

Fig. 6 shows the customer sequence diagram outlining the customer's interaction with the Vedaz Event Management Booking System. It starts with account registration, email verification, and optional two-factor authentication (2FA). After logging in, the customer can view services, book them, complete payments, and manage bookings. They can also submit ratings and reset their password. The diagram highlights a smooth and intuitive customer experience through clear, step-by-step interactions with the system.

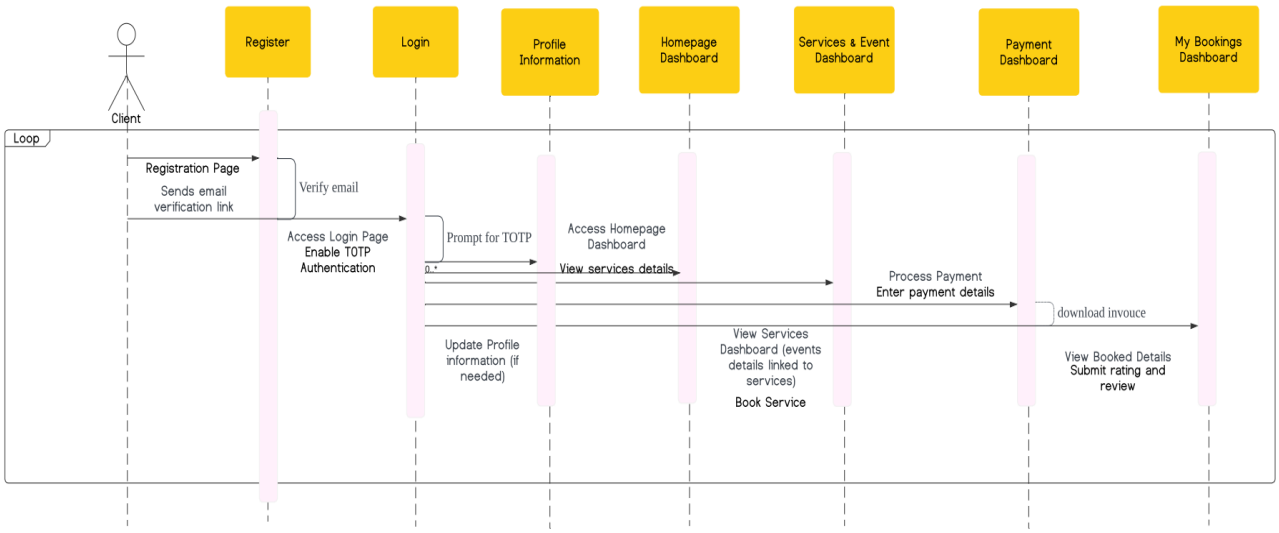

Fig. 6 *Customer Sequence Diagram*

Fig. 7 shows the staff sequence diagram where the staff interact with the system, highlighting role-based permissions. Staff log in, access a personalized dashboard, and perform tasks such as viewing or editing bookings, services, events, and ratings, based on admin-assigned roles. The diagram emphasizes role-based access control, ensuring secure and efficient task management.

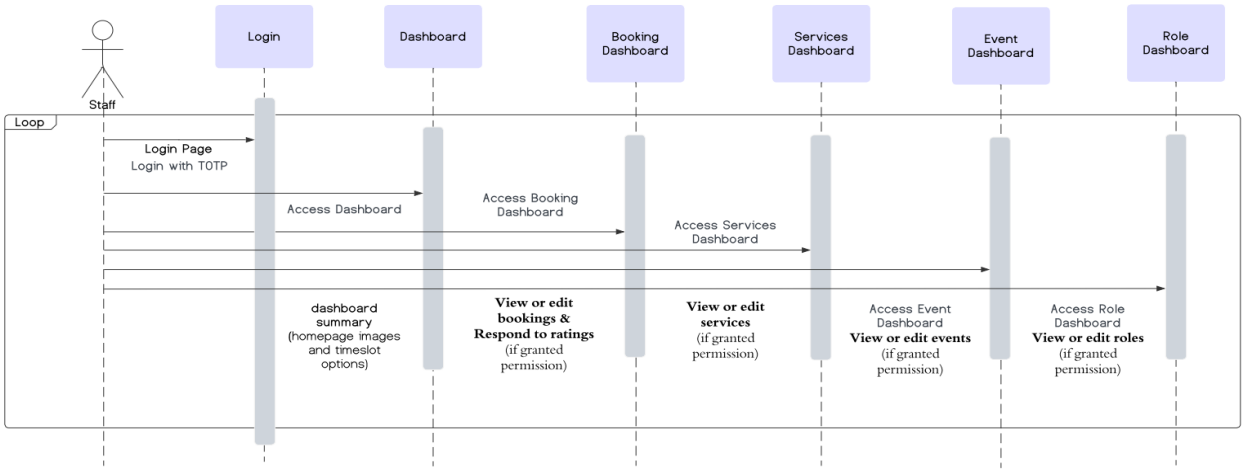

Fig. 7 *Staff Sequence Diagram*

4.3.3 Activity Diagram

Fig. 8 and Fig. 9 in Appendix A illustrates activity diagrams that depict the flow of control between two or more class objects during the execution of an activity. Activities are connected by transition lines or decision points.

4.3.4 Class Diagram

The class diagram in Fig 10 illustrates the structure and relationships between key entities in the Vedaz Event Management Booking System with TOTP, including user, admin, event, booking and payment.

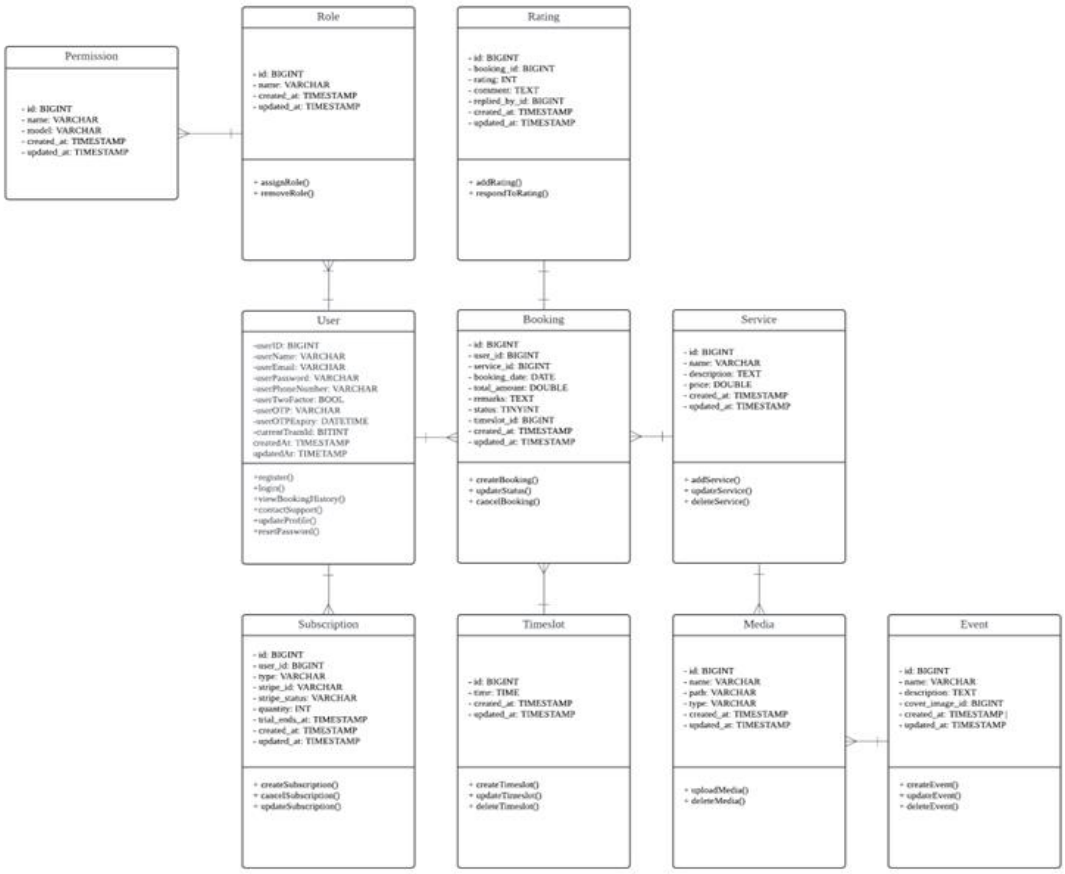

Fig.10 *Class Diagram*

4.4 Database Design

Database design is a crucial step in the database development process that involves analyzing the problem definition (specifications and requirements) to gather the necessary insights for creating a logical data structure. The primary objective of database design is to develop a database schema that accurately represents the logical structure of the database system while fulfilling the needs of both users and the application [17].

4.5 Implementation of Module

This section covers the implementation of various modules in the Vedaz Event Management Booking System (VEMBS) application. Each module is designed to perform specific functions and improve the overall user experience [18].

4.5.1 Implementation of Register Module

This module allows users to create a personal profile to register as customers of Vedaz Event Management. During registration, users provide their name, email, mobile number, password, and password confirmation as in Fig. 11. Once the form is submitted, the system sends a verification email to the user to confirm their account. This process ensures that only valid and verified users can access the platform, enhancing both user authenticity and system security.

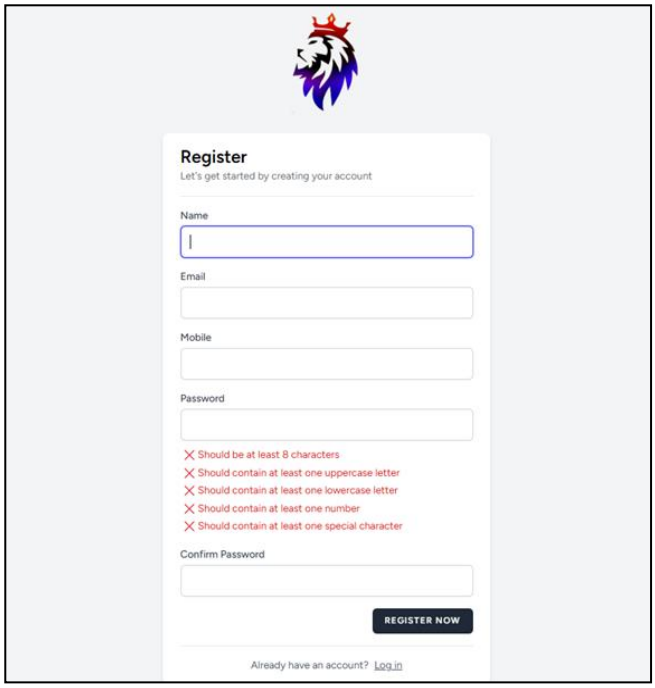

Fig. 11 *The Interface of Register Module*

4.5.2 Implementation of Login Module

Fig. 12 shows the first step of the Login Module in the Vedaz Event Management Booking System involves users entering their registered email and password into a secure login interface. This step ensures that only authenticated accounts proceed further, forming the foundation of account security. With real-time validation, the system verifies the credentials and prompts an error message if the details are incorrect, guiding users to re-enter the information correctly. This initial step is streamlined for ease of use while maintaining high-security standards.

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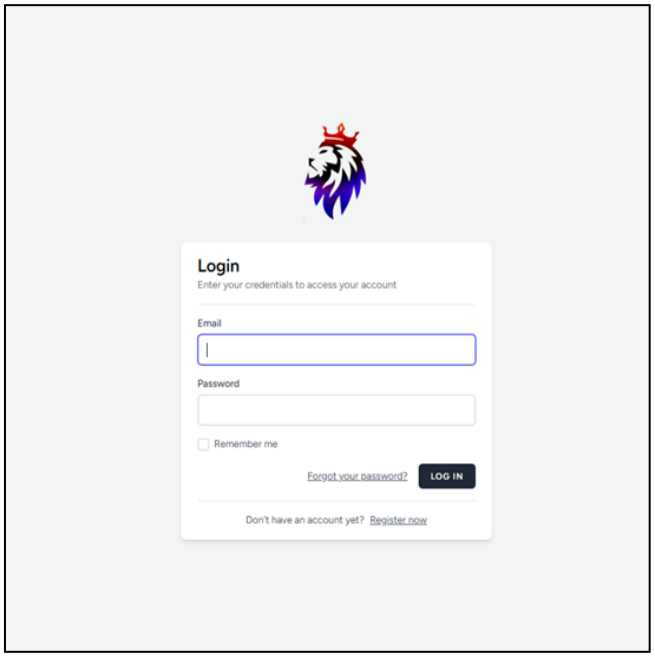

Fig. 12 *Login Module*

4.5.3 Implementation of Enable TOTP Module

TOTP in the Vedaz Event Management Booking System (VEMBS) is implemented using Google Authenticator to provide an additional layer of login security. Upon first-time login, the system generates a unique secret key and displays a QR code, which the user scans using the Google Authenticator app as display in Fig. 13. This links the app to the user's account, allowing it to generate a 6-digit one-time password every 30 seconds based on the shared secret and current timestamp. During each login, the user must enter this time-sensitive code along with their password. The system then verifies the entered code against its own TOTP calculation to confirm identity. For example, a TOTP generated from the secret key JBSWY3DPEHPK3PXP might be 482039, valid only for that 30-second window, ensuring that only authorized users gain access even if a password is compromised.

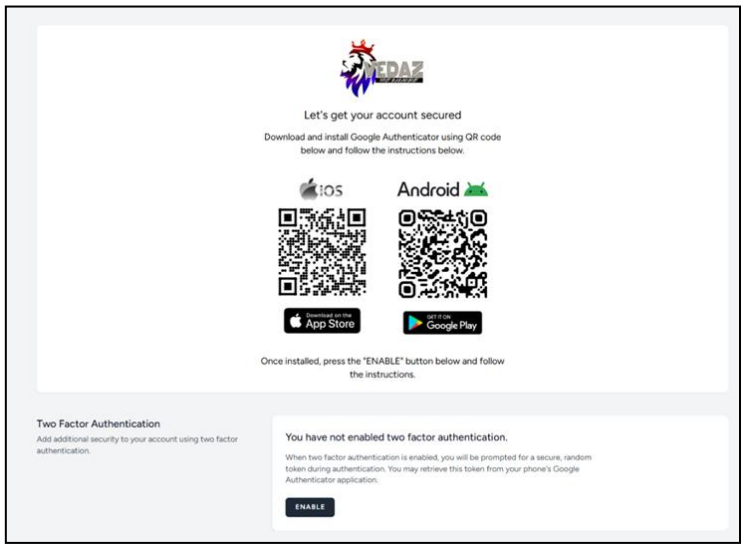

Fig. 13 *Enable TOTP Module*

4.5.4 Implementation of Service Booking Module

The User Booking Module in Fig. 14 shows the Vedaz Event Management Booking System which allows clients to browse events, select services, and make secure bookings with real-time availability updates. It provides an intuitive interface for reviewing booking details, tracking upcoming events, and accessing past reservations, ensuring efficient scheduling and payment management.

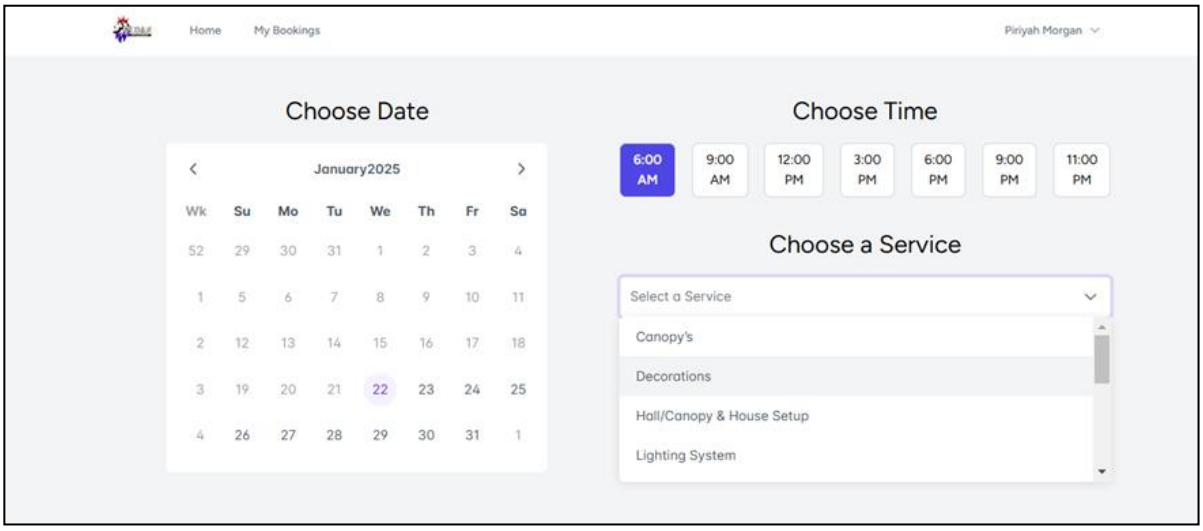

Fig. 14 *Service Booking Module*

4.5.5 Implementation of Payment Module

The User Payment Module in Fig. 15 of the Vedaz Event Management Booking System (VEMBS) integrates with Stripe to provide a secure and efficient payment process. This module allows users to complete their event bookings through trusted payment channels, automatically updates the booking status upon successful payment, and generates downloadable invoices for user records. By handling transaction verification and status updates in real time, the system ensures a smooth, reliable, and secure payment experience that enhances user trust and operational efficiency.

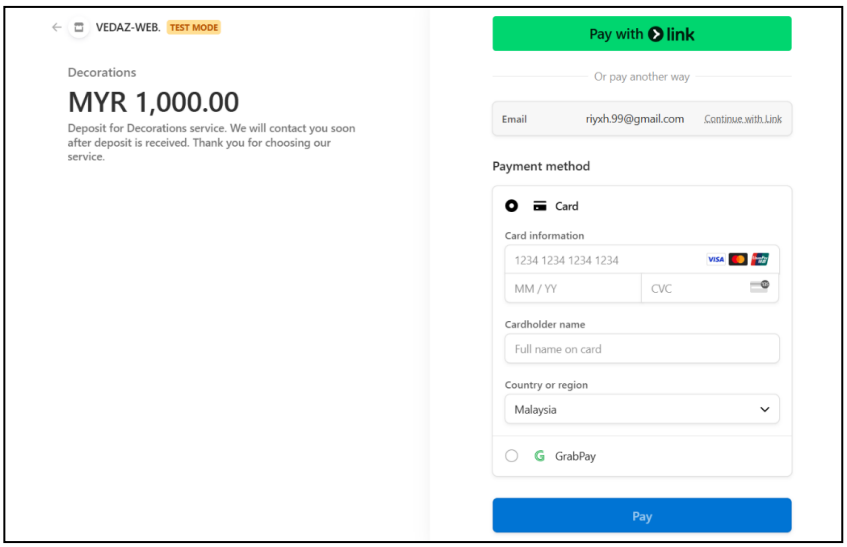

Fig. 15 *Payment Module*

4.5.6 Implementation of User Profile Module

The User Profile Module in Fig. 16 and Fig. 17 of the Vedaz Event Management Booking System (VEMBS) ensures secure management of user information, including profile updates, password changes, two-factor authentication (2FA), session management, and account deletion. It uses Laravel's Fortify package for authentication and profile management, enforces secure password updates, handles 2FA setup and recovery, and stores session data securely. The system also ensures data privacy by deleting all user information upon account deletion, maintaining security and compliance with modern standards.

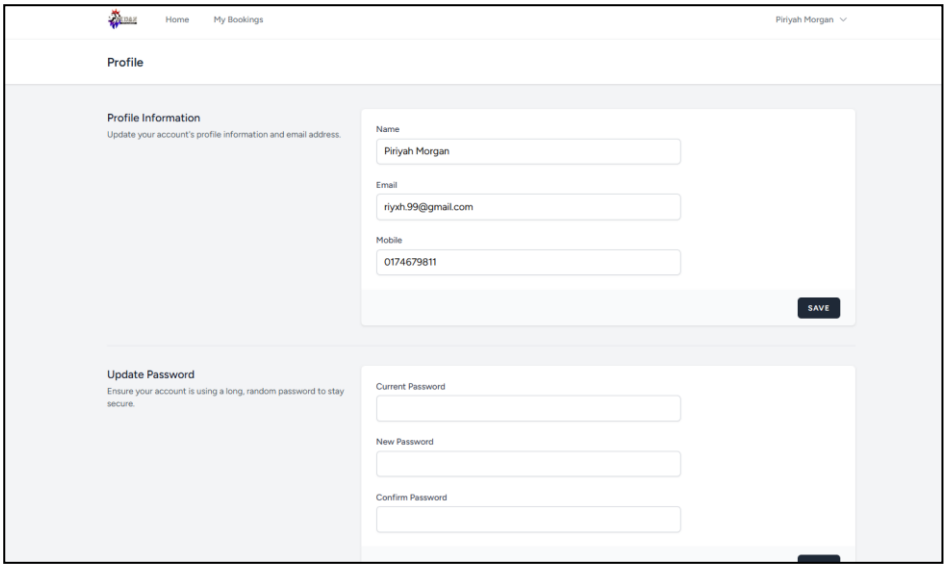

Fig. 16 *User Profile Module I*

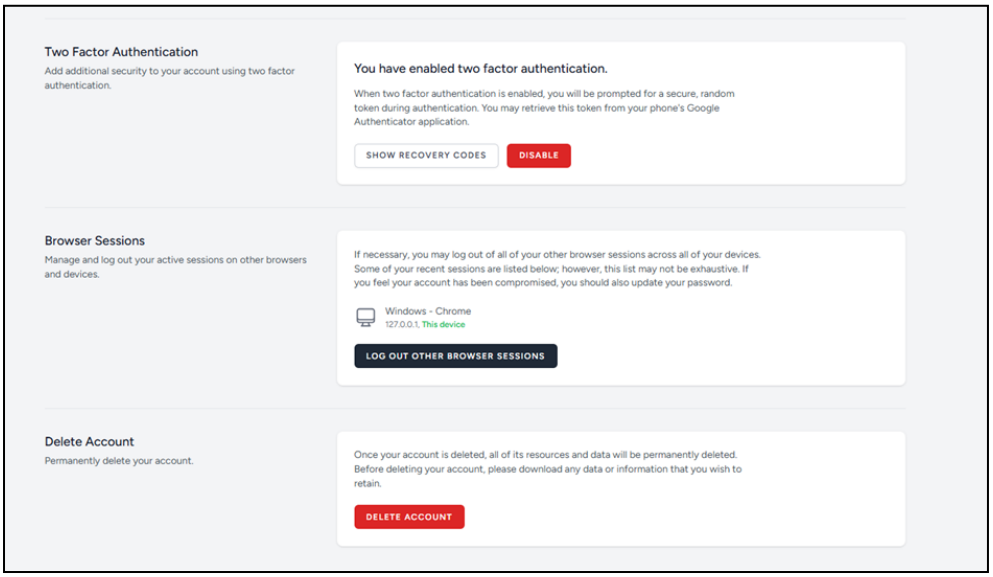

Fig. 17 *User Profile Module II*

4.6 Testing

Once the system has been fully developed, it enters the testing phase to evaluate its functionality. This phase is essential for detecting any bugs or errors that may have arisen during development. Identifying and addressing these issues is crucial to ensuring that the system meets its intended scope and objectives. Table 4 provides a summary of the functional testing results, detailing the system's performance and any necessary improvements made to rectify identified issues.

Table 4 *The test plan and result for administrator, client and staff*

Test Plan (Modules)	Expectation	Result
User Registration	User registers successfully with valid data.	Registration successful, confirmation email sent.
Login	User logs in with valid credentials.	Login successful with valid credentials, error for invalid ones.
Enable TOTP 2FA	User enables Time-Based One-Time Password (TOTP) for added security.	2FA enabled and successfully used.

Table 4 *(Cont.)*

Test Plan (Modules)	Expectation	Result
Booking System	User books services/events and receives confirmation.	Booking confirmed with correct service details.
Payment Integration	User completes secure payment and receives confirmation.	Payment processed, confirmation sent.
Forgot Password	User can request a password reset link.	Reset link sent to the user's registered email.
Logout	User successfully logs out of the system.	Logout works, redirects to login page.
Delete Account	User deletes their account from the application.	Account deleted, redirected to home page.
Service Dashboard - Create/Edit Services	Admin creates and edits services.	Admin successfully creates and edits services.
Event Dashboard - Create New Event	Admin creates new events.	Admin creates new events successfully.
Booking Dashboard - Accept/Reject Booking	Admin accepts or rejects bookings with comments.	Admin can accept/reject bookings and leave comments.
Admin Profile - Enable 2FA	Admin enables Two-Factor Authentication.	Admin enables 2FA successfully.
Admin Profile - Delete Account	Admin deletes their account.	Admin deletes account with confirmation.

4.7 User Acceptance from Result

The User Acceptance Testing (UAT) results in Fig. 18 for the Vedaz Event Management Booking System (VEMBS) indicate high user satisfaction, particularly with its reliability, booking management, payment integration, and user interface. Users praised the ease of registration, login, and navigation, along with the system's efficiency and speed. The dashboard was considered user-friendly, and the booking process was highly rated. However, there were suggestions for improving the clarity of information and the comprehensiveness of certain features. Overall, users expressed confidence in the system's security and accuracy, with most recommending it, though opinions on its overall value varied. The feedback highlights VEMBS as a strong platform, with room for improvement to enhance the user's experience.

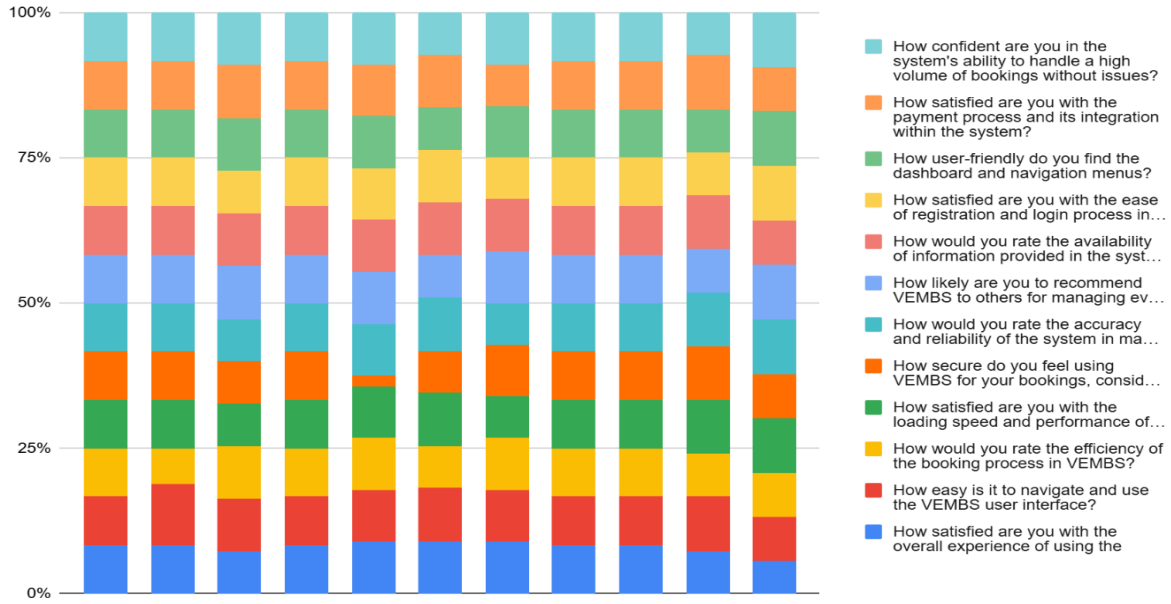

Fig. 18 *User Acceptance Testing Result*

5. Conclusion

The Vedaz Event Management Booking System (VEMBS) effectively addresses the needs of event management, offering a seamless and secure platform for booking and managing events. Through its robust features, including real-time event availability, secure payment integration, and user-friendly interfaces, VEMBS ensures a smooth experience for both clients and administrators. The system's thorough testing phase, including functional and user acceptance testing (UAT), confirmed its reliability, ease of use, and high security standards. The positive user feedback highlights VEMBS as a highly efficient solution for event management. In conclusion, VEMBS sets a new standard in event booking systems, providing an innovative, reliable, and secure platform for both users and administrators, with continued potential for future improvements.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** *P. Morgan, S.F. Md Salleh*; **data collection:** *P. Morgan, S.F. Md Salleh*; **analysis and interpretation of results:** *P. Morgan, S.F. Md Salleh*; **draft manuscript preparation:** *P. Morgan, S.F. Md Salleh*. All authors reviewed the results and approved the final version of the manuscript.

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Appendix A

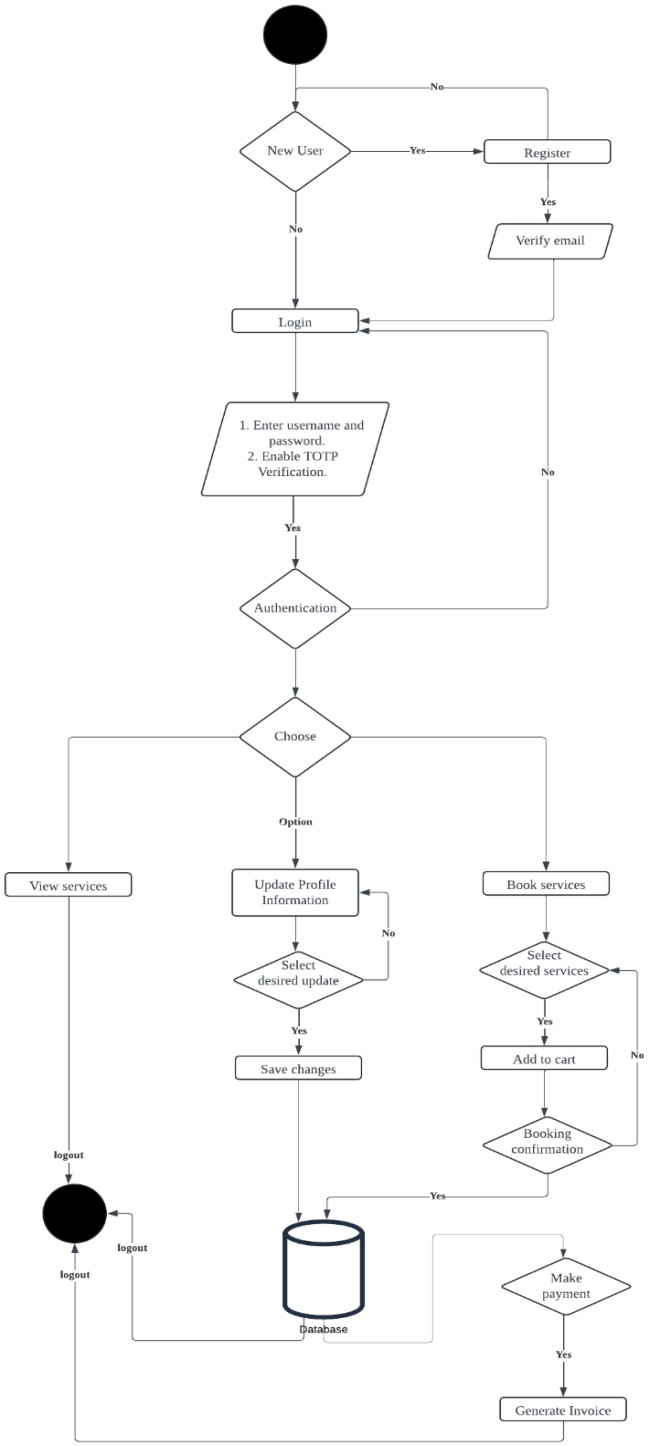

Fig 8 *Customer Activity Diagram*

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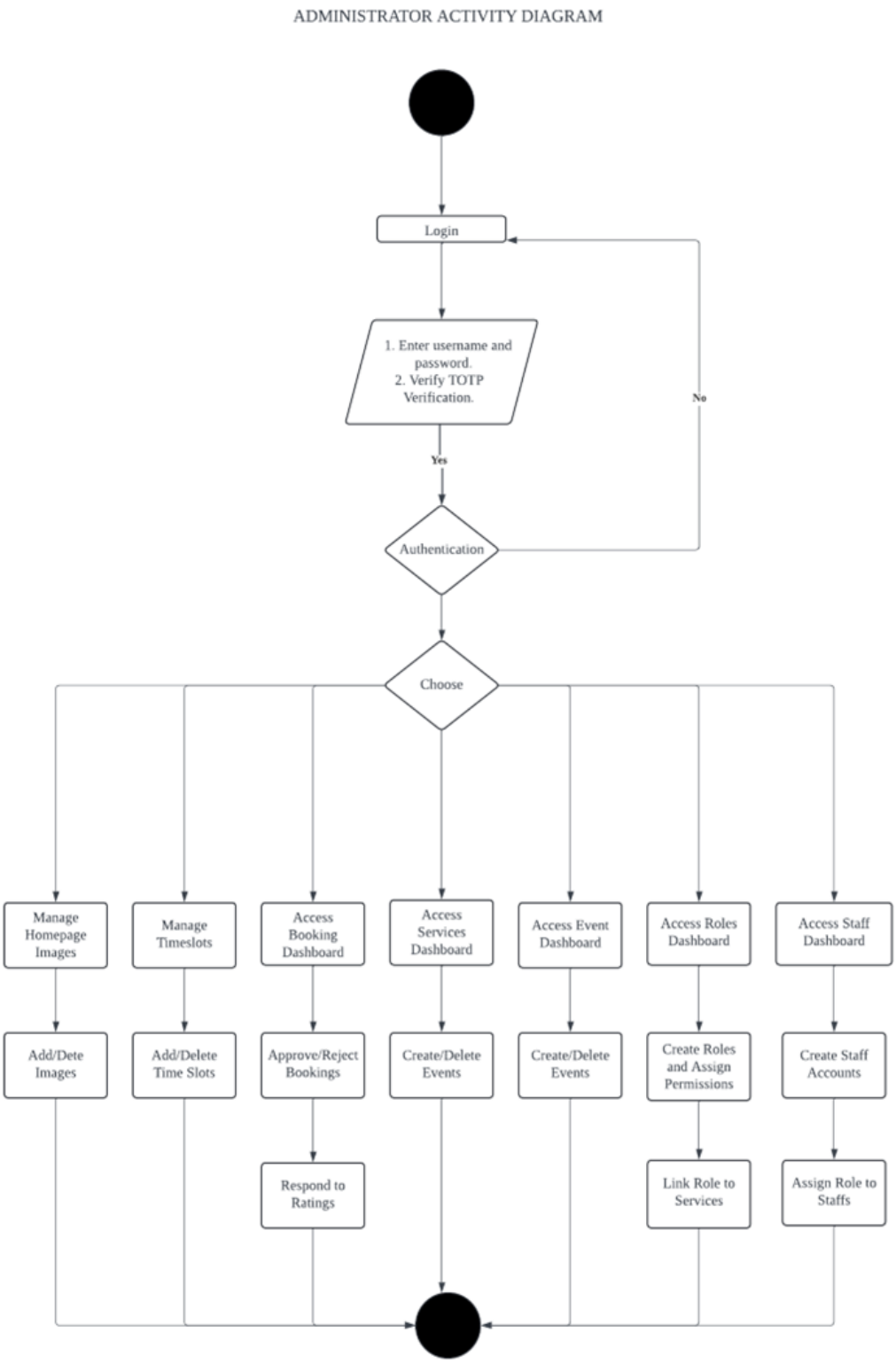

Fig. 9 Ad*ministrator Activity Diagram*