TrailXplorer: A Web-Based Hiking Companion Community Sharing System -Design and Preliminary Usability Evaluation Study

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ABSTRACT

Currently, hikers in Malaysia rely on scattered sources such as blogs, social media, and community forums to find trail information. This approach is inefficient, as it lacks centralized, verified data and preparation tools. Users face difficulties in planning trips, accessing accurate trail conditions, and tracking their hiking plans. Administrators also struggle to manage trail data, user reviews, and community content efficiently, leading to delays and inconsistencies. These limitations highlight the need for a centralized system like TrailXplorer to streamline trail discovery, trip planning, and community engagement. The development of TrailXplorer: A Web-Based Hiking Companion System is important as it addresses the challenges faced by hikers in Malaysia in accessing reliable and centralized trail information. The system provides a structured platform that allows users to search for trails, view detailed trail information, plan trips, share tips, and interact with the hiking community in a single, unified space. This enhances safety, simplifies trip planning, and encourages active engagement among hikers. The system is developed using PHP, MySQL, HTML, CSS, and JavaScript, with Visual Studio Code and XAMPP used as development tools. UI/UX principles were applied to ensure usability and accessibility for both users and administrators. Online documentation, tutorials, and official API references such as Google Maps API were also consulted during development and testing, contributing to the system's reliability, effectiveness, and overall quality. Testing result show 100% of test modules have passed the Unit Testing, while result for User Acceptance Test (UAT) shows majority of the respondents are happy with this hiking sharing platform. The system offers benefits to multiple stakeholders, hikers gain convenient access to accurate trail data, safety alerts, and community-driven tips and reviews, administrators can efficiently manage trail records, user accounts, tips, reviews, feedback, and homepage content, and the wider hiking community benefits from shared experiences, promoting outdoor activities that are safe, well-informed, and effectively coordinated throughout Malaysia.

Keywords- Web-based Community; Hiking Trail Companion; Database Design; Graphical User Interface (GUI); User Acceptance Test (UAT)

INTRODUCTION

TrailXplorer is developed based on a combination of academic research, system analysis, and best practices in web-based application development. References from studies related to information systems, community platforms, and outdoor safety systems were used to guide system functionality and design.

The purpose of the TrailXplorer project is to create a centralized hiking companion website that integrates multiple functions including trail listings and a user community.

The expected outcomes of this project include a fully functional website with verified hiking trail information, an interactive community module that encourages communication and sharing among hikers, a user-friendly interface that allows users to easily search, plan, and track hiking experiences and measurable results such as improved user satisfaction, increased system usage rates, and positive feedback from hiking communities.

In summary, TrailXplorer aims to provide a complete digital solution for hikers enhancing safety, accessibility, and connectivity through technology while promoting the spirit of outdoor exploration across Malaysia.

The objectives for this system are outlined as follows: (1) To develop a web platform that provides detailed information about hiking trails in Malaysia, including location, difficulty and distance, (2) To allow hikers to share experiences, reviews, and safety updates through a review form, (3) To create an admin panel for managing trail listings, user reviews, and updates efficiently.

The overall workflow of the system is illustrated in Figure 1.

Fig. 1 Workflow of the system

Related Work

Web-based applications have become central to modern lifestyle management. From petrochemical support (Ruiz & Moscardelli, 2023; Srikritsanarat & Kwonpongsagoon, 2020) to medical and health monitoring (Akrungsri, et al., 2024; Chrysi, et al., 2023; Lazar, et al., 2023; Rana, et al., 2025), digital platforms provide structured solutions for organizing daily activities.

Web-based information systems have evolved into scalable, interactive environments that support user-generated content, social interaction, and collaborative knowledge sharing (Ivanova & Klushina, 2021; Schuster et al., 2021; Sidorov et al., 2025). From a systems engineering perspective, such platforms integrate front-end presentation layers with server-side processing and relational databases to ensure persistence, security, and performance.

A conceptual framework has been recommended based on the needs for this activity (Hamza et al., 2025). The study analyses how the systems operate in hiking and mountaineering applications such as Kommot, Outdooractive, Strava, Wikiloc and AllTrails.

The assistance of technology widely used to assist on the hiking activities. The real-time monitoring and alert system for hikers was designed to continuously observe, track, and analyze activities in real-time, which will trigger alerts if something happened (Baderol et al., 2026).

HIKE, which is a mobile-based tracking system have been developed to provide climbers undergoing hiking training at Taman Eko Rimba Bukit Nanas, equipped with a mobile tracking system (Fauzi etal., 2025). It aims to deliver details on the locations of hikers to ensure that any undesirable situations will be notified to dedicated agencies.

The usage of technology focusing to the hiking activity have been studied to utilize the technology so that the safety of the hiking activity reaches the optimum. A design intervention has been proposed which was an IoT based system that implement integrated wearable a mobile application with features such as real time data, location tracking and sharing. (Khan et al. 2025).

The architectural model adopted in this project aligns with the conventional three-tier web architecture (presentation, application, and data layers), which has been widely recognized for its modularity and maintainability (Kazemi et al., 2024).

User-generated content (UGC) platforms, particularly in lifestyle domains such as fitness and social activities, rely heavily on participatory design principles and social interaction mechanisms.

Research indicates that online communities thrive when platforms support contribution, feedback, and visibility of peer engagement (e.g., likes, comments, ratings) (Zhang et al., 2010). These interactive affordances enhance perceived usefulness and foster continued engagement, consistent with constructs from the Technology Acceptance Model (TAM) (Davis, 1989).

Usability is a critical determinant of web application success. In a system, hiking companion systems, clarity in form inputs (e.g., trail information lists, hiking tips, image uploads) is essential to minimize user errors and enhance task completion rates. Research further indicates that responsive design — ensuring compatibility across devices — improves accessibility and perceived quality of web systems.

User Acceptance Testing (UAT), as applied in this project, is consistent with established software validation methodologies (Tan, 2025). The Systematic execution of unit testing and UAT aligns with software quality assurance frameworks recommended in software engineering literature.

Online knowledge-sharing communities depend on both intrinsic and extrinsic motivational factors. Social exchange theory suggests that users are more likely to contribute content when they perceive reciprocal benefits such as recognition or social capital (Blau, 1964). Empirical research on electronic word-of-mouth (eWOM) further confirms that visible engagement metrics (ratings, comments, likes) significantly enhance trust and influence behavioral intentions (Cheung & Thadani, 2012).

analysis

A. Software Requirements

TrailXplorer is developed using PHP for backend logic, which provides a flexible and efficient way to handle server-side operations, user authentication, and database interactions. Its compatibility with MySQL ensures smooth integration with the database, allowing reliable management of critical data such as user accounts, trails, planned trips, tips, reviews, and feedback.

The frontend is built using HTML5, CSS3, and JavaScript, enabling a responsive, interactive, and user-friendly interface for hikers to explore trails, plan trips, and share community-driven content.

Development is carried out using Visual Studio Code, a versatile Integrated Development Environment (IDE) that supports code editing, debugging, and project management efficiently. Tools like XAMPP are used for local server hosting during development, and phpMyAdmin is employed to design and manage the database schema effectively.

Additional tools such as Google Maps API for trail mapping and Chart.js for data visualization further enhance the system's functionality. By leveraging this software stack, TrailXplorer can be developed with scalability, high performance, and maintainability, fulfilling both user and administrator requirements efficiently.

B. Hardware Requirements

The hardware requirements refer to the physical devices needed to run the software tools and test the system. The minimum specifications used for the development are:

a) Processor: Intel Core i5 or equivalent

b) Memory (RAM): Minimum 8GB

c) Storage: At least 256GB SSD or HDD

d) Internet Connection: Stable broadband connection

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Design

This section describes the design of TrailXplorer in terms of system modules, user interfaces, and database structure.

A. System Design

The system design process was conducted using a structured analysis approach to ensure clarity and consistency in development. Relational database management systems (RDBMS), such as MySQL, remain foundational technologies for structured data storage in web applications.

Data Flow Diagrams (DFDs) and context diagrams are classical system modeling tools used in structured analysis and design. They facilitate visualization of data ms The use of DFDs in this project supports transparent documentation of system interactions, particularly between users, administrators, and backend databases.

To clearly represent the system's processes and data flow, visual tools such as the Data Flow Diagram (DFD) context diagram and flowcharts are used. These diagrams help illustrate how information moves through the system, how users interact with different features, and how the system processes requests like browsing, sharing, and organizing recipes. This analysis ensures that the design of this project meets user needs effectively and supports smooth, practical functionality.

First, a decomposition diagram was developed to break down the overall system into major functional modules, providing a high-level view of system components. Refer Figure 2.

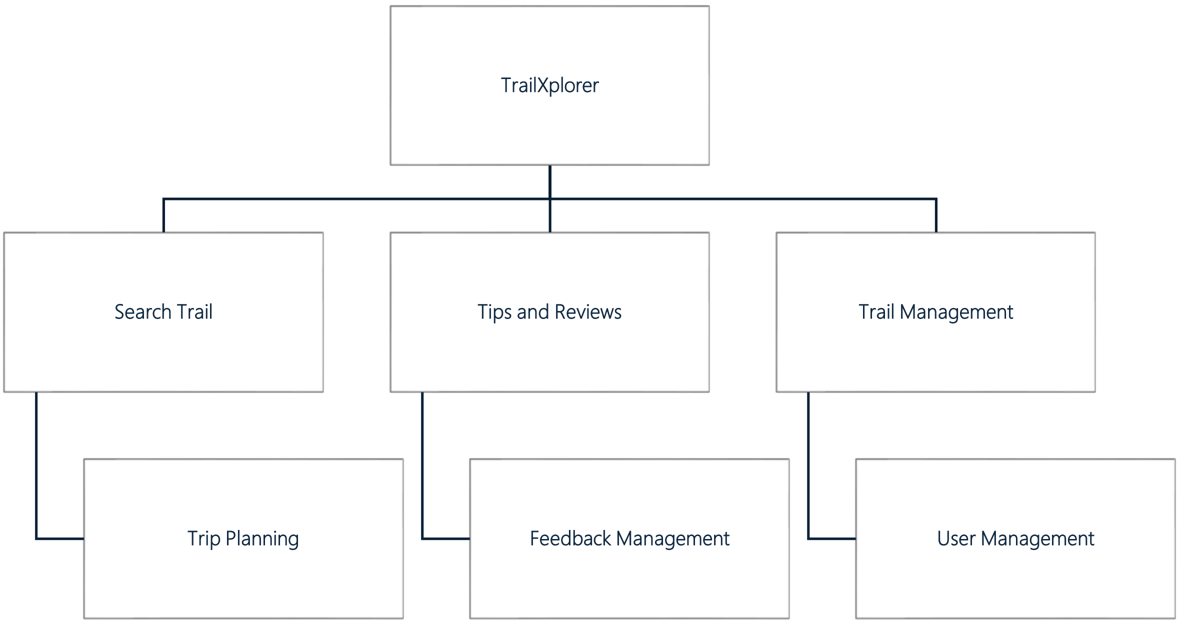

Fig. 2 Decomposition Chart

Next, a context diagram was constructed to define the system boundary and illustrate interactions between the system and external entities. Refer Figure 3.

This was followed by the development of Data Flow Diagrams (DFD), which detailed the internal data movement and process logic within the system. Refer Figure 4.

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Finally, an Entity Relationship Diagram (ERD) was designed to model the database structure by defining entities, attributes, and their relationships, ensuring proper data organization and integrity. Refer Figure 5.

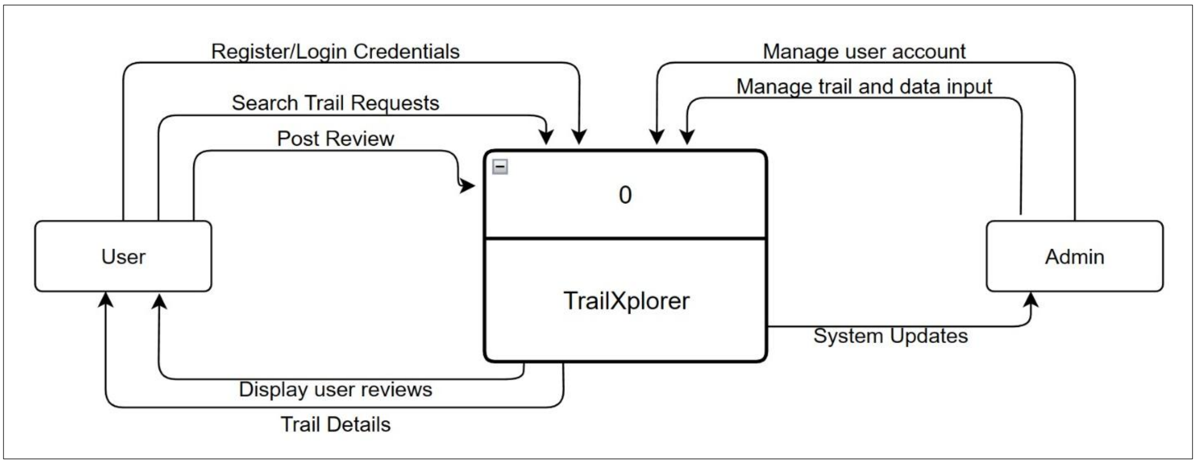

Fig. 3 Context Diagram

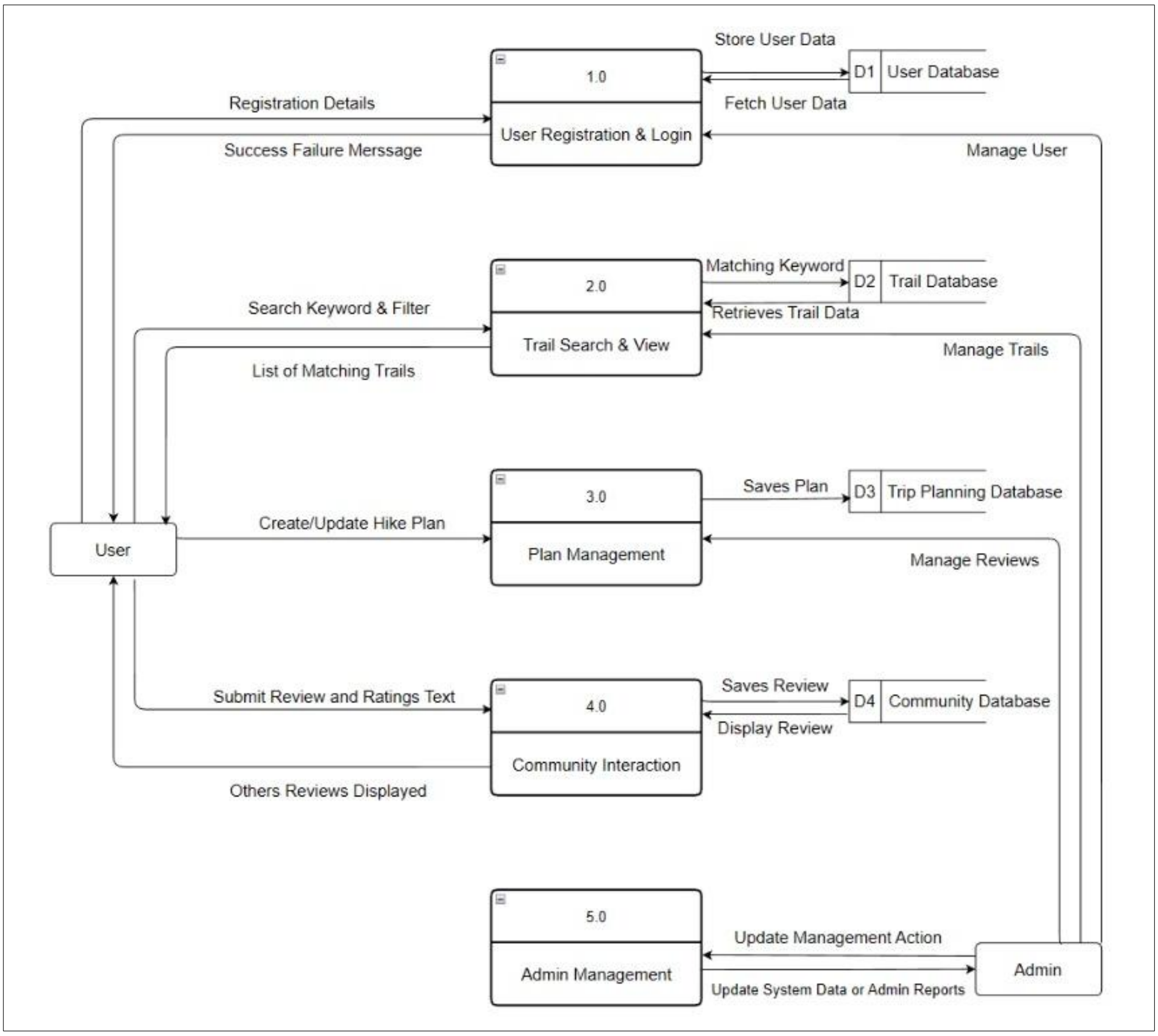

Fig. 4 Data Flow Diagram (DFD)

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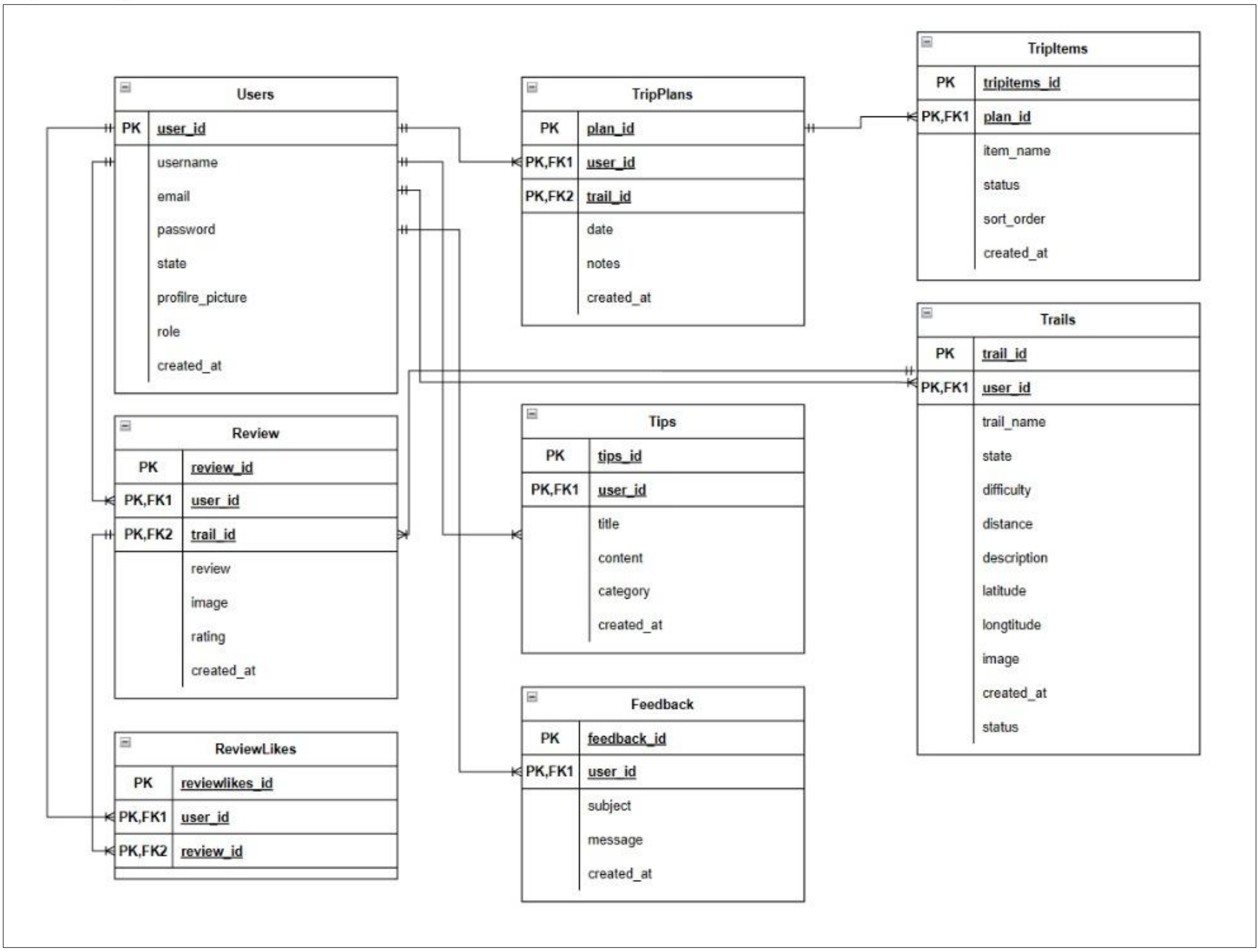

Fig. 5 Entity Relationship Diagram (ERD)

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B. Graphical User Interface Design (GUI)

1) Sign Up – (Figure 6).

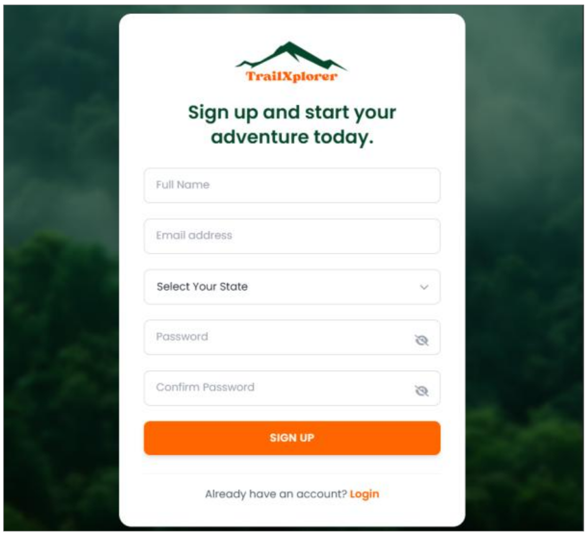

Fig. 6 GUI -Sign Up

2) Log In – Admin and User (Figure 7).

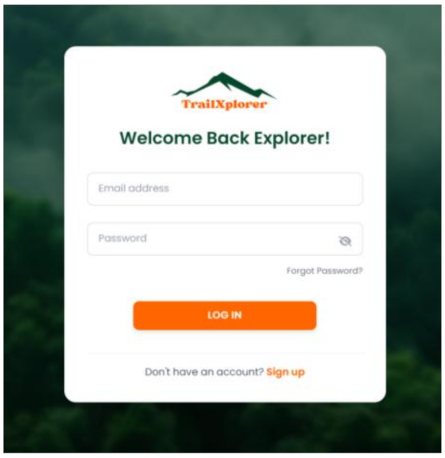

Fig. 7 GUI -Log in for Admin and User

3) User Homepage (Figure 8).

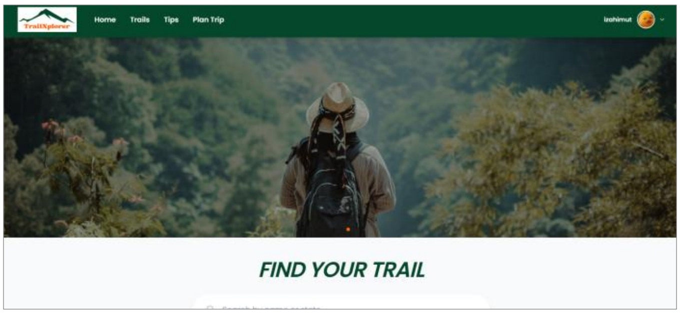

Fig. 8 GUI -User Homepage

4) Search Trail (Figure 9).

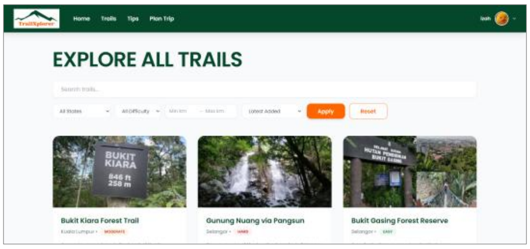

Fig. 9 GUI -Search Trail

5) Hiking Tips (Figure 10).

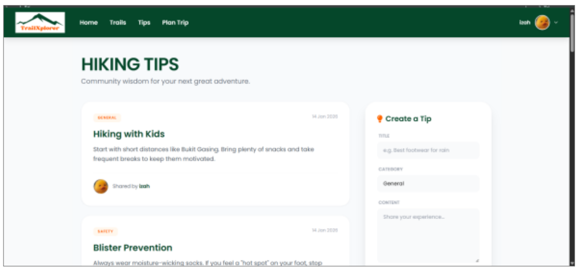

Fig. 10 GUI -Hiking Tips

6) Plan Trips (Figure 11).

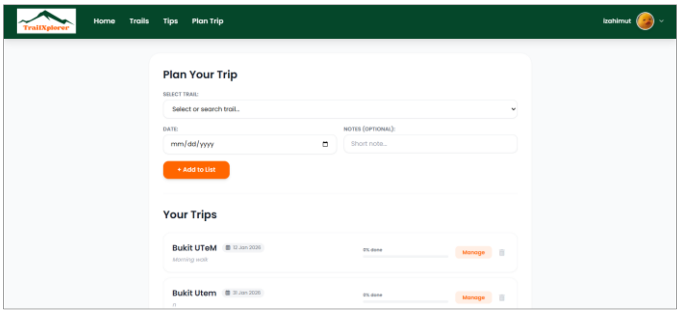

Fig. 11 GUI -Plan Trips

7) User Profile (Figure 12).

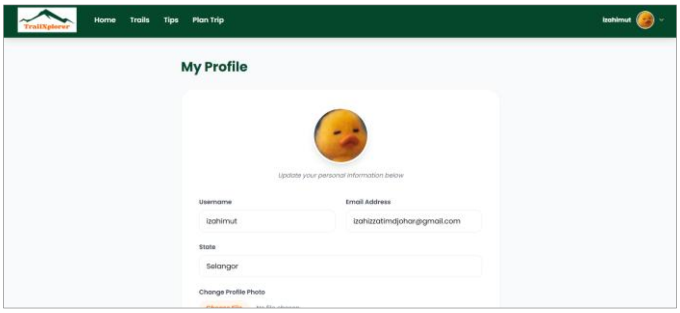

Fig. 12 GUI -User Profile

8) User Add Trail (Figure 13).

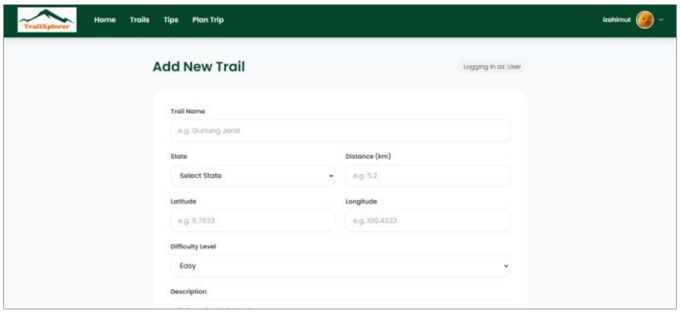

Fig. 13 GUI -User Add Trail

9) Feedback (Figure 14).

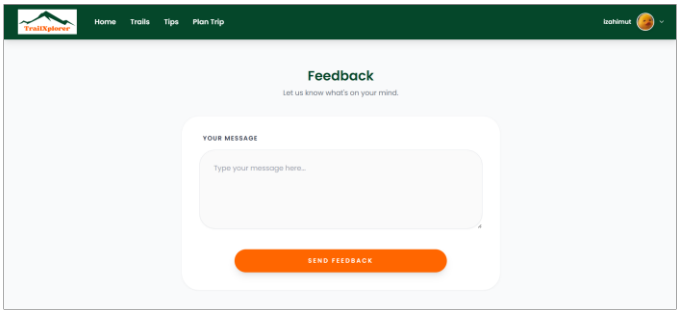

Fig. 14 GUI -Feedback

10) Admin -Dashboard (Figure 15).

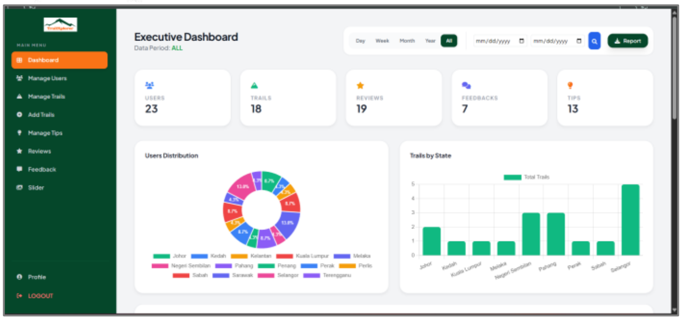

Fig. 15 GUI -Admin Dashboard

11) Admin -Manage User (Figure 16).

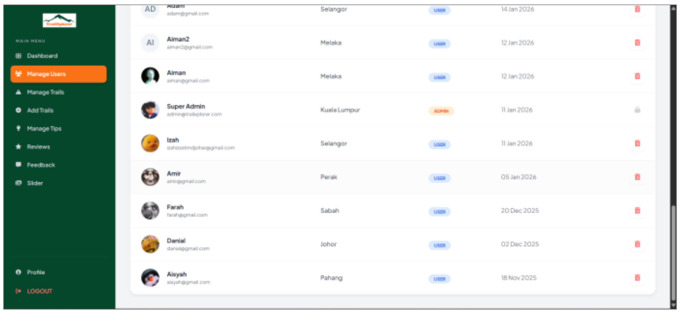

Fig. 16 GUI -Admin -Manage User

12) Admin -Manage Trail (Figure 17).

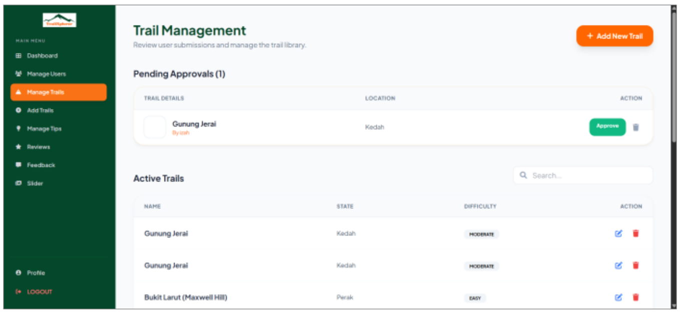

Fig. 17 GUI - Admin -Manage Trail

13) Admin -Manage Hiking Tips (Figure 18).

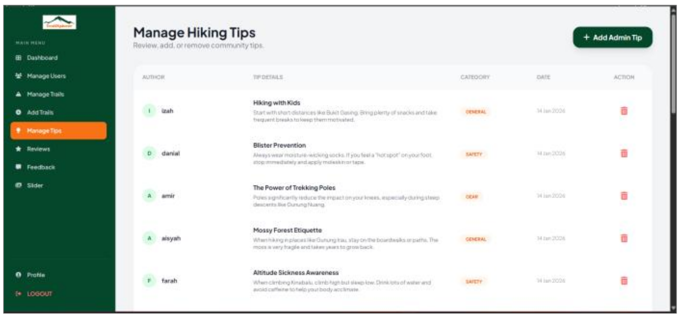

Fig. 18 GUI -Admin -Manage Hiking Tips

14) Admin -Manage User Review (Figure 19).

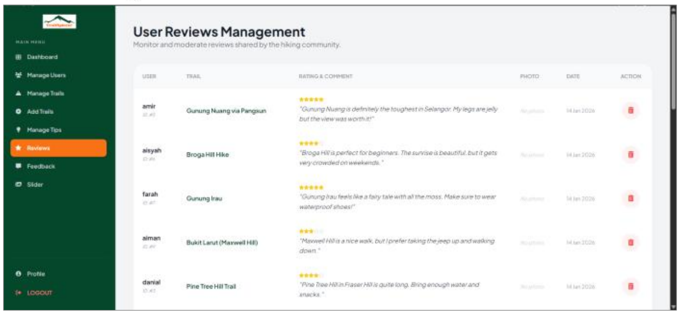

Fig. 19 GUI -Admin -Manage User Review

15) Admin -Manage User Feedback (Figure 20).

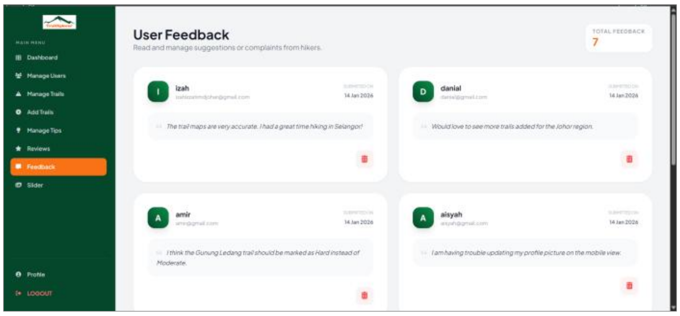

Fig. 20 GUI -Admin -Manage User Feedback

16) Admin -Manage Slider (Figure 21).

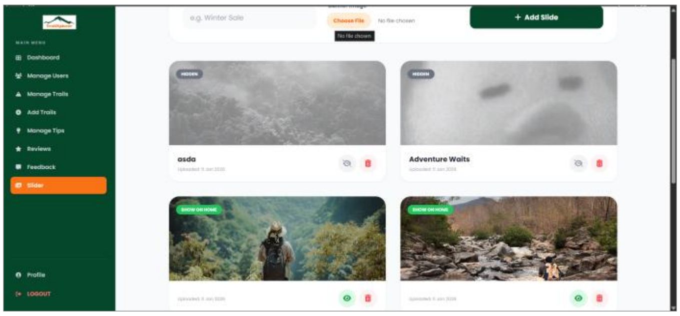

Fig. 21 GUI -Admin -Manage Slider

System Testing

After the system was developed, testing was conducted to ensure that all modules function correctly and are free from errors. Software reliability is closely linked to systematic testing strategies. Testing methodologies including unit testing, system testing, and User Acceptance Testing (UAT) are essential to validate system reliability before deployment.

A. Unit Testing

Unit testing ensures individual modules function according to specifications, while system testing verifies integration across components. Empirical studies confirm that structured testing protocols significantly decrease defect density and improve maintainability (Nagappan et al., 2008).

Any errors identified during testing were corrected before retesting was carried out. Testing continued until all modules met the specified requirements. The main objective of testing was to verify that the system implementation aligns with the system design and fulfils user and administrator needs.

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The unit testing results presented in Tables 1–7 demonstrate that all core system modules functioned according to their specified requirements. Each functional component, including login, logout, user registration, trail search, trip planning, tip sharing, and the admin dashboard, successfully passed all defined test cases. The results indicate that the validation mechanisms, input handling, and system responses operate correctly without functional errors. The absence of failed test cases suggests that the system logic, authentication processes, and data interactions were implemented reliably. These findings confirm that the TrailXplorer platform achieved full functional compliance at the module level prior to integration and user-level evaluation Each module is tested individually to ensure every feature works as intended. The tests are as follows:

1) Log In – Details refer Table 1.

Table 1. Unit Testing -Log In

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Enter valid credentials	User/Admin is redirected to respective dashboard	PASS
T2	Enter invalid credentials	Error message "Invalid email or password" displayed	PASS
T3	Leave input fields empty	"Please fill out this field" message displayed	PASS

2) Log Out – Details refer Table 2.

Table 2. Unit Testing -Log Out

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Click Log Out button	User/Admin is redirected to login page	PASS
T2	Access system after logout	Access denied, login required	PASS

3) Sign Up – Details refer Table 3.

Table 3. Unit Testing -Sign Up

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Enter valid registration data	User registered successfully	PASS
T2	Enter invalid email format	Error message displayed	PASS

T3	Password less than 8 characters	Error message displayed	PASS
T4	Leave required fields empty	Validation message displayed	PASS
T5	Register using existing email	“Email already registered” displayed	PASS
T6	Password mismatch	“Passwords do not match” displayed	PASS

4) Search Trails – Details refer Table 4.

Table 4. Unit Testing -Search Trails

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Search using valid criteria	Relevant trails displayed	PASS
T2	Search with no matching data	“No trails found” displayed	PASS

5) Plan Trips – Details refer Table 5.

Table 5. Unit Testing -Plan Trips

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Add a new trip	Trip saved successfully	PASS
T2	Delete planned trip	Trip removed from list	PASS

6) Share Tips – Details refer Table 6.

Table 6. Unit Testing -Share Tips

Test Case ID	**Action**	**Expected Result**	**Result**
T1	Submit valid tip	Tip displayed to all users	PASS
T2	Submit empty content	Error message displayed	PASS

7) Admin Dashboard – Details refer Table 7.

Table 7. Unit Testing -Admin Dashboard

Test Case ID	**Action**	**Expected Result**	**Result**
T1	View admin dashboard	Statistics and charts displayed	PASS

The unit testing results presented in Tables 1–7 demonstrate that all core system modules functioned according to their specified requirements. Each functional component, including login, logout, user registration, trail search, trip planning, tip sharing, and the admin dashboard, successfully passed all defined test cases.

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B. User Acceptance Test (UAT)

This User Acceptance Testing (UAT) involved 12 respondents who evaluated the usability, clarity, and functionality of the TrailXplorer system.

Some questions and responses from the UAT are presented in Table 8 – Table 14 which majority of responses give positive rating towards the system usability experience. The responses use Likert scale, 1, Strongly Disagree, 2=Disagree, 3=Neutral, 4= Agree, 5=Strongly Agree. In total, there are 12 responses for each question.

1) Register & Login – Details refer Table 8.

Table 8. Questions and responses from UAT -Register & Login

No.	Question	1	2	3	4	5
Register & Login						
1	The text and input fields are easy to read	-	-	0	2	10
2	The password requirements are clearly explained	-	-	0	2	10
3	I understand this page is for existing users to sign in	-	-	0	2	10

2) Dashboard – Details refer Table 9.

Table 9. Questions and responses from UAT -Dashboard

No.	Question	1	2	3	4	5
Dashboard						
4	The dashboard looks attractive and well-designed	-	-	1	3	8
5	Menu options are clearly labeled	-	-	1	3	7
6	Profile menu options are clear	-	-	1	3	8
7	“Top Rated Trails” section is useful	-	-	0	3	8
8	The map helps visualize trail locations	-	-	1	3	8

3) Trail Page – Details refer Table 10.

Table 10. Questions and responses from UAT -Trail Page

No.	Question	1	2	3	4	5
Trail Page						

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VII July 2026

9	This page helps discover hiking trails in Malaysia	-	-	-	2	10
10	Search bar helps find trails quickly	-	-	-	3	9
11	Filters are useful and relevant	-	-	-	2	10
12	Trail description provides sufficient information	-	-	-	3	9
13	Star rating system is clear	-	-	-	1	11
14	Reviews are easy to read and well-formatted	-	-	-	2	10
15	Writing and selecting a review is straightforward	-	-	-	2	10
16	I can edit/delete only my own reviews easily	-	-	-	2	10

4) Plan Trip – Details refer Table 11.

Table 11. Questions and responses from UAT -Plan Trip Page

No.	Question	1	2	3	4	5
Plan Trip Page						
17	Searching for a trail works as expected	-	-	-	2	10
18	Planned trips are displayed clearly	-	-	-	2	10
19	Marking checklist items is easy and intuitive	-	-	-	1	11
20	Adding custom checklist items is straightforward	-	-	-	2	10
21	Deleting items or plans is easy	-	-	-	1	11

5) Plan Trips – Details refer Table 12.

Table 12. Questions and responses from UAT -User Profile Page

No.	Question	1	2	3	4	5
User Profile Page						
22	Profile update form is easy to use	-	-	-	1	11
23	I can easily find my submitted reviews	-	-	-	2	10
24	I can see all trails I have created	-	-	-	2	10

6) Plan Trips – Details refer Table 13.

Table 13. Questions and responses from UAT -Build Trail Feedback

No.	Question	1	2	3	4	5
Build Trail & Feedback						

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VII July 2026

25	Form fields are clearly labeled	-	-	-	2	10
26	Feedback placeholder text is clear	-	-	-	1	11
27	Feedback dates and formatting are easy to read	-	-	-	1	11

7) Admin Page – Details refer Table 14.

Table 14. Questions and responses from UAT -Admin Page

No.	**Question**	**1**	**2**	**3**	**4**	**5**
Admin Page						
28	Navigation bar is easy to use	-	-	-	2	10
29	Graphs are clear and informative	-	-	-	2	10
30	Recent reviews and feedback are easy to access	-	-	-	2	10
31	Table layout is easy to read	-	-	-	2	10
32	Action buttons are clear and intuitive	-	-	-	2	10
33	Pending and approved trails are clearly distinguishable	-	-	-	2	10
34	Review text is clear and readable	-	-	-	2	10
35	Delete button is clearly visible	-	-	-	2	10

Tables 8–14 present the results of the User Acceptance Test (UAT) conducted with 12 respondents to evaluate the usability and functionality of the TrailXplorer system. The majority of responses fall within the categories of Agree and Strongly Agree, indicating a high level of user satisfaction with the system interface and features.

Participants reported that key functions such as registration, trail discovery, trip planning, profile management, and administrative tools were intuitive and easy to use. The consistently positive responses across multiple modules suggest that the system design successfully supports user interaction, information accessibility, and task completion.

These findings provide empirical evidence that the system meets user expectations in terms of usability and functionality.

FINDINGS & RESULTS

A. Unit Testing

The unit testing results indicate that all system modules functioned correctly according to their specified requirements. The summary of test results after system testing is shown below:

- PASS: 18 Test Cases
- FAIL: 0 Test Cases

All tested modules functioned as expected and met the system requirements. A total of 18 test cases were executed across 7 user and administrator modules, and all achieved a 100% pass rate with no recorded failures.

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This confirms that the developed web-based hiking companion system is functionally stable and reliable at the unit level prior to further testing stages.

The details of the test module can be found in Figure 22(a) until Figure 22(g).

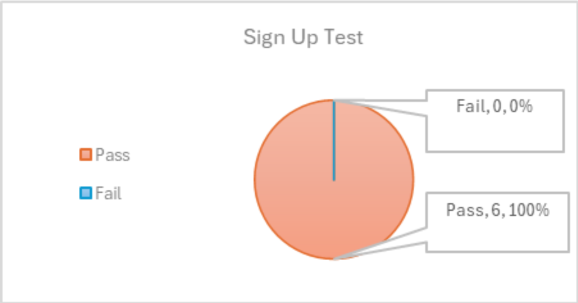

Fig. 22(a) Unit Test -Sign Up

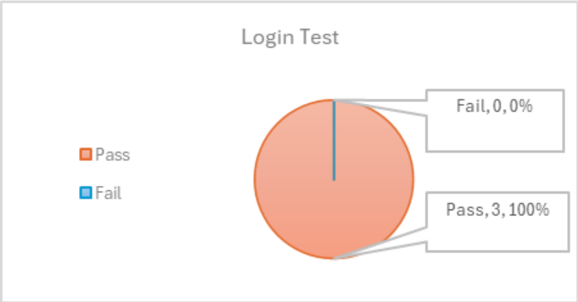

Fig. 22(b) Unit Test -Login

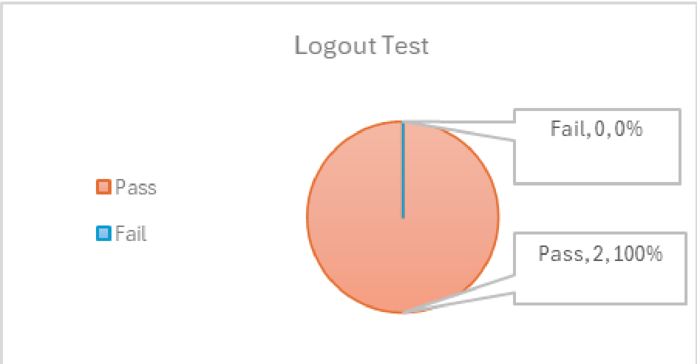

Fig. 22(c) Unit Test -Logout

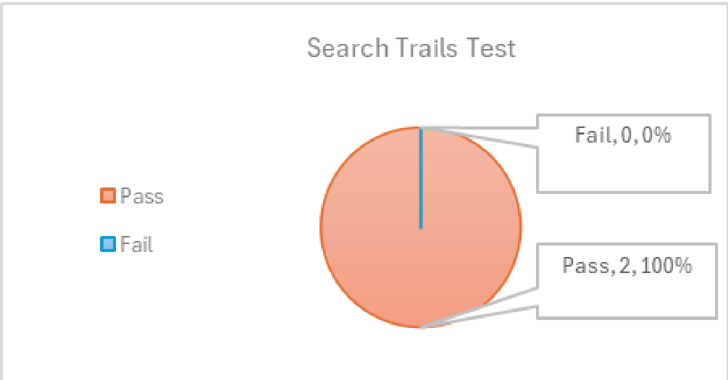

Fig. 22(d) Unit Test -Search Trails

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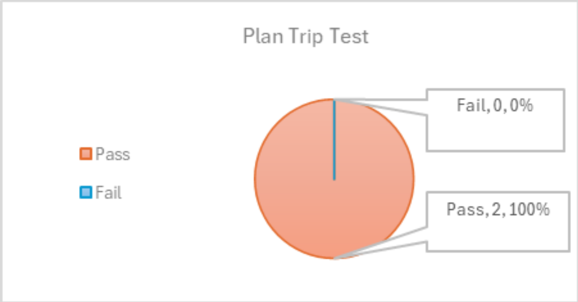

Fig. 22(e) Unit Test -Plan Trip

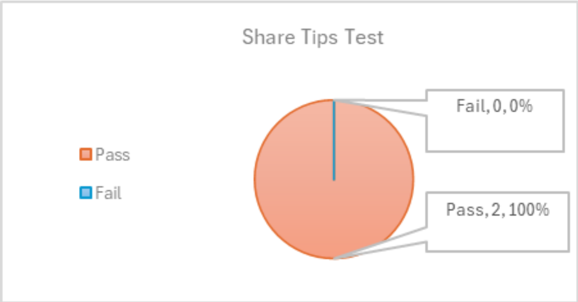

Fig. 22(f) Unit Test -Share Tips

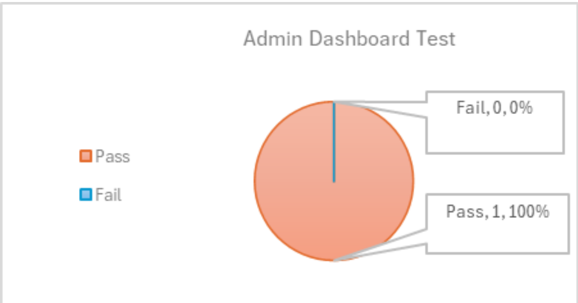

Fig. 22(g) Unit Test -Admin Dashboard

B. Unit Acceptance Test (UAT)

This User Acceptance Testing (UAT) involved 12 respondents who evaluated the usability, clarity, and functionality of the TrailXplorer system. Overall, the feedback indicates strong user acceptance, with most respondents agreeing or strongly agreeing that the system meets their expectations.

In summary, majority of responses are Strongly Agree with the ability and easiness of the features in the module. The details can be found in Figure 23(a) until Figure 23(g).

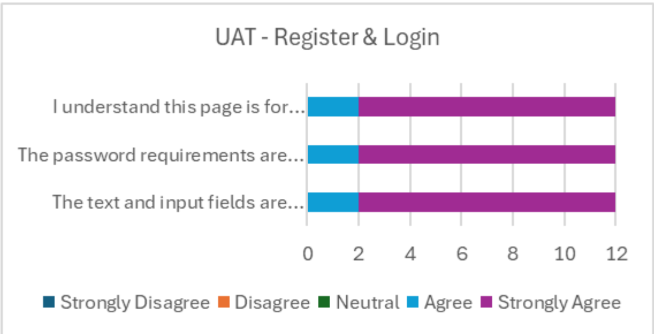

Fig. 23(a) UAT – Register & Login

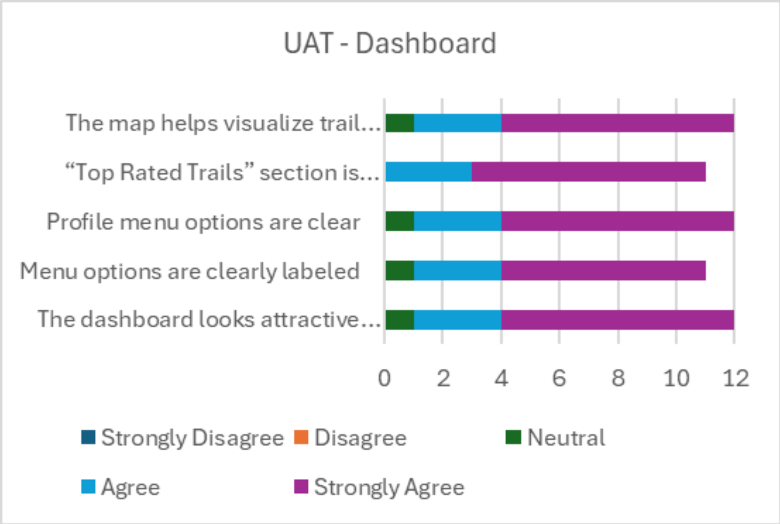

Fig. 23(b) UAT – Dashboard

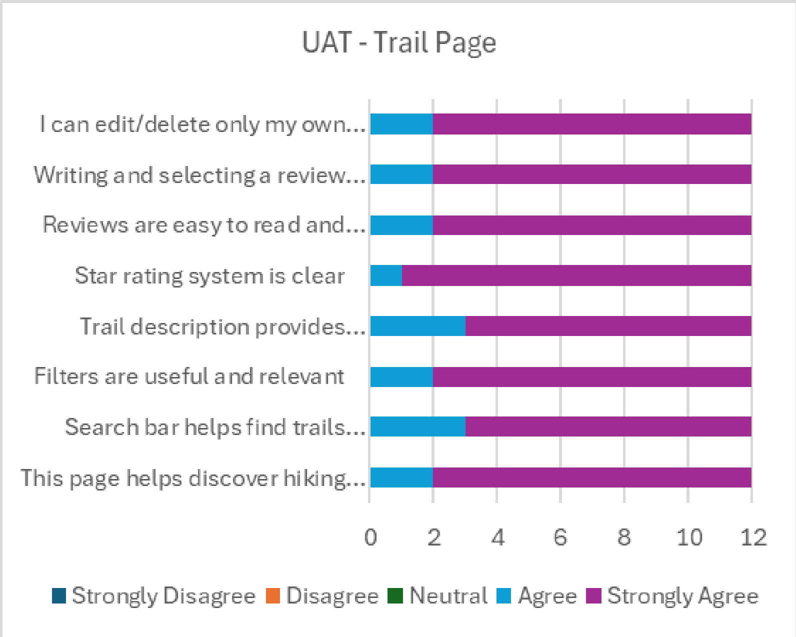

Fig. 23(c) UAT – Trail Page

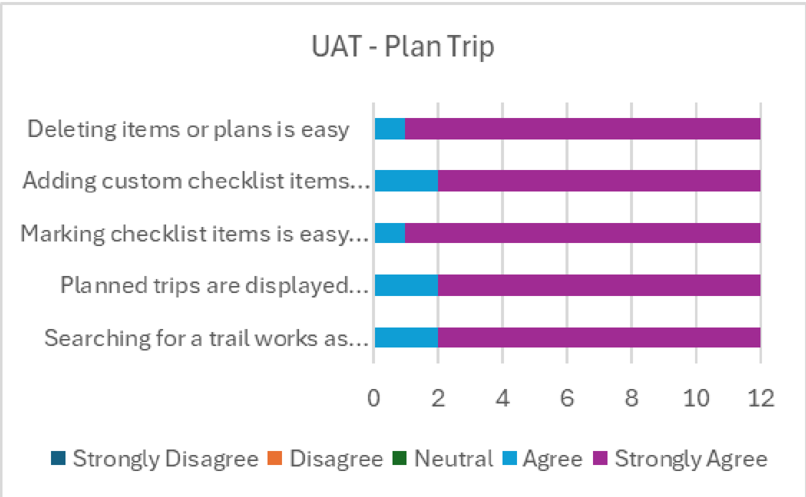

Fig. 23(d) UAT –Plan Trip

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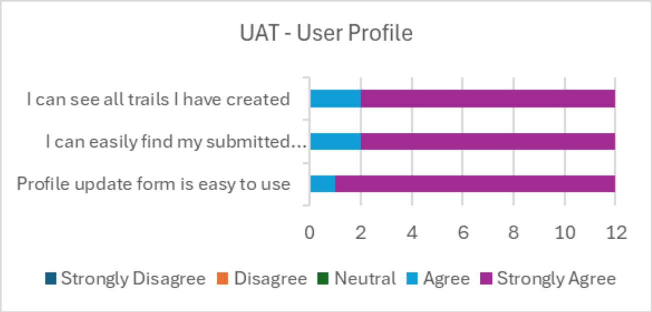

Fig. 23(e) UAT – User Profile

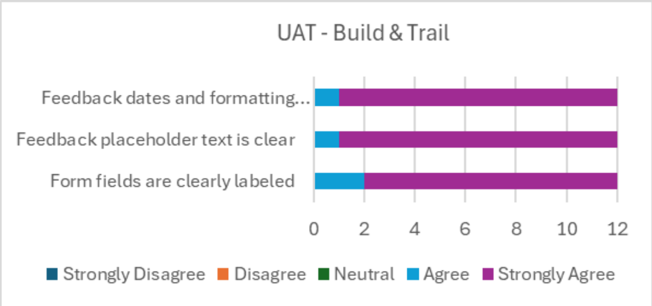

Fig. 23(f) UAT – Build & Trail

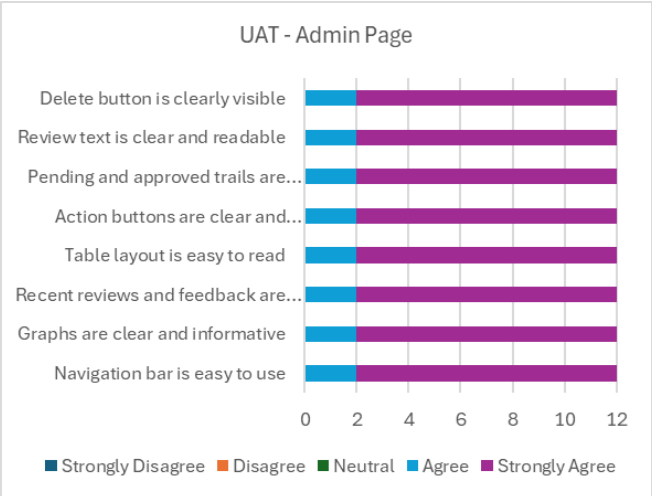

Fig. 23(g) UAT – Admin Page

Figures 23(a)–23(g) illustrate the graphical distribution of responses collected during the User Acceptance Testing (UAT).

The visual results clearly show that most respondents selected Strongly Agree across the evaluated modules, including registration and login, dashboard interface, trail exploration, trip planning, user profile management, feedback submission, and the administrative interface.

Only a small proportion of responses fall under the Agree category, while no responses were recorded for Disagree or Strongly Disagree. This distribution indicates a strong positive perception of the system’s usability, interface clarity, and functional effectiveness.

The graphical analysis further supports the quantitative findings presented in the tables, demonstrating that users generally perceive TrailXplorer as a useful and user-friendly hiking companion platform.

STRENGTH, WEAKNESSES, SUGGESTION, AND CONCLUSION

TrailXplorer was developed to streamline the process of exploring, planning, and managing hiking trips for users while providing administrators with tools to manage trails, user activities, and community contributions. The system automates trail searching, trip planning, user feedback, and community tip sharing, reducing administrative workload and enhancing user engagement. By offering real-time trail information, personalized trip planning, and detailed reporting for administrators, TrailXplorer provides a centralized platform for both users and administrators to efficiently manage hiking activities. The system improves transparency, minimizes errors in trip planning, and supports better decision-making for trail maintenance, community engagement, and system improvements.

A. System Strengths and Weaknesses

TrailXplorer offers significant advantages by automating trail searching and trip planning, providing users with real-time updates on trail conditions, availability, and community tips, while allowing convenient remote trip planning, trail selection, and personalized trip lists. Administrators benefit from efficient trail monitoring, approval of community content, and report generation, supporting better decision-making and resource management.

The system also enhances transparency by letting users view detailed trail information, reviews, and ratings before planning trips. However, the platform has some limitations, including the lack of an automatic reminder system for upcoming trips or community events, which could improve engagement, and its primarily web-based design, which may limit mobile accessibility.

Additionally, advanced features such as interactive trail maps and offline trail access are not yet implemented, which, if included, could further enhance usability and the overall user experience.

B. Suggestion for Improvement

To enhance TrailXplorer, several improvements are suggested. Implementing a notification system would provide automatic reminders for upcoming trips or important community events, helping users stay informed and engaged.

Developing a mobile application would allow users to access trails, trip plans, and tips directly from their smartphones, improving convenience and accessibility. Simplifying the user interface and navigation would reduce the learning curve for both new users and administrators, making the system more intuitive.

Adding offline map functionality would enable users to download trail maps and guides for use without an internet connection, ensuring seamless access in remote areas. Finally, integrating a user feedback system would allow the collection of experiences and suggestions directly within the platform, supporting continuous refinement of features and overall usability.

C. Conclusion

In conclusion, TrailXplorer significantly improves the management and exploration of hiking trails by automating trail searches, trip planning, and community interactions. The system reduces administrative burden, enhances user convenience, and promotes community engagement. While there are areas for improvement, such as implementing reminders, mobile accessibility, and offline features, these can be addressed in future updates.

Overall, TrailXplorer has the potential to streamline trail management, improve efficiency, and create a more organized, user-friendly experience for both hikers and administrators, making outdoor exploration safer, more enjoyable, and better coordinated.

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