



## Mountain climbing guide application for beginners

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### ABSTRACT

Mountaineering has become a popular activity in Indonesia, but many beginner climbers are still unprepared, making them vulnerable to accidents. This study aims to design and develop a web- and mobile-based mountaineering guide application for beginners that provides comprehensive information related to physical and mental preparation, as well as survival techniques. This application is equipped with a guide to climbing rules, necessary equipment, first aid procedures, and survival based on Mapala standards. In addition, this application offers recommendations for safe and suitable climbing routes for beginners on various mountains in Indonesia. The research methods used include data collection, business rule analysis, and implementation of easy-to-understand user interface design. The result of this research is an application that helps climbers prepare for their trips in a safer and more structured manner. User trials show that the application greatly benefits beginner climbers, with a high success rate in increasing their readiness and knowledge. Recommendations for improvements for further development are also presented to improve the quality of the application in the future.

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## 1. INTRODUCTION

Indonesia's diverse and picturesque mountains, such as Rinjani, Semeru, and Kerinci, attract a growing number of climbers, both local and international. This increase in mountaineering activities has significantly impacted local economies, particularly in regions with popular mountains, through tourism revenues such as accommodation, transportation, guiding services, and entrance fees. For instance, the government of East Lombok reported a 20% rise in local income from tourism activities around Mount Rinjani between 2019 and 2023 (Beno et al., 2022; Mustaniroh et al., 2023). However, the growing interest in mountaineering has also brought heightened safety concerns, particularly for beginner climbers who often lack adequate preparation and safety knowledge (Dawami, 2023; Primanda & Maftuh, 2022; Rohman, 2020)

Data from the National Search and Rescue Agency (BASARNAS) illustrates the scale of this problem, showing an annual increase in climbing-related incidents. In 2023

alone, BASARNAS handled over 300 rescue operations, with approximately 65% involving beginner climbers. Surveys indicate that 70% of these incidents stemmed from insufficient physical preparation, lack of survival skills, or inadequate understanding of mountain safety (Azis, 2022; Gustina, 2020; Nugroho et al., 2020). These statistics highlight the critical need for accessible and comprehensive guidance tailored to beginner climbers.

Despite the proliferation of digital technology, existing web-based and mobile applications fall short of addressing the safety education needs of novice climbers. Most platforms provide basic information, such as trail maps and weather updates, but fail to integrate critical features like safety guidelines, physical and mental preparation instructions, and survival techniques. This gap leaves beginners unprepared for the challenges of mountain climbing, increasing the risk of preventable accidents (Gultom, 2021; Karunia, 2020; Riana & Retnoningsih, 2022; Yunanto et al., 2021).

This study aims to develop a beginner mountain climbing guide application that provides holistic guidance through web and mobile platforms. The proposed application will include equipment guides, first aid instructions, survival techniques, and safe climbing practices. Additionally, it will offer beginner-friendly mountain recommendations and a ticket booking system. These integrated features will bridge the current informational gap, ensuring that beginner climbers are better equipped for safe and enjoyable ascents (Azimah & Wijaya, 2021; Gumilang, 2022; Maulana, 2021; Pasau tangdisosang & R Widiyasari, 2022; Purnama Harahap STMIK Raharja et al., 2021; Romadhon et al., 2021).

In addition to addressing safety concerns, the application is expected to contribute to sustainable tourism by promoting responsible climbing practices and environmental stewardship. Enhancing safety awareness among climbers can also strengthen Indonesia's position as a premier global mountaineering destination while fostering economic growth in local communities (Harsadi & Nugroho, 2020; Nurwiningtyas, 2024).

Focusing on education and preparedness, this research emphasizes the dual importance of enhancing climbers' safety and supporting the broader development of sustainable and responsible mountain tourism. It addresses the urgent need for a solution that reduces accidents, mitigates risks, and provides beginner climbers with the tools to enjoy their mountain climbing experiences (Alfinnas, 2024; Nuryamin, 2020; Pinilih et al., 2023; Shofiyulloh, 2024; Sujud, 2020).

## 2. RESEARCH METHOD

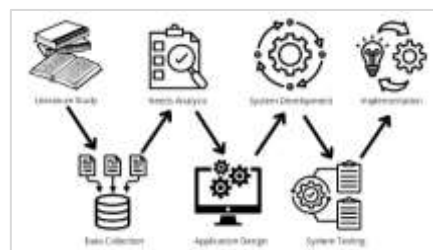


Figure 1. Research Stage

This research is divided into several interrelated main stages. The stages of this research include:

### a. Problem Identification

Problem identification in this study was conducted through direct observation of novice climbers. Many novice climbers still do not understand important aspects such as climbing routes, safety techniques, and equipment to be brought, which have the

potential to endanger their safety. This was found based on observations of climbing conditions often faced by novice climbers, where lack of information is the main factor causing difficulties and accidents.

b. Literature Review and Related Research

In the literature review stage, a search for relevant literature was conducted to support application development, both in terms of climbing safety and mobile application development. Based on previous research, mountain climbing applications must include detailed safety guidelines, including safe climbing techniques, first aid protocols, and information on equipment and physical preparation that must be carried out. Application testing and integration between web and mobile platforms are also important to ensure the application functions properly on both platforms.

By referring to these standards, the development of this application aims to provide clear, practical, and easily accessible guidance for novice climbers, while ensuring their safety and comfort while climbing.

c. Data Collection

Data collection for the development of this application involved several relevant and reliable sources. The main source is the Mapala UTY (Nature Explorer Students of Yogyakarta University of Technology) module which provides basic guidance on equipment, safety, and climbing procedures. In addition, the beginner's climbing guide e-book offers more in-depth information on physical and mental preparation, as well as survival techniques. Mountain climbing guidebooks are also used to enrich the material, while articles, journals, and other online references provide up-to-date and research-based information. The combination of these sources ensures that the application provides comprehensive, practical, and accessible content for beginner climbers from various backgrounds.

d. System Design and Prototype

After the user needs data is collected, the next stage is system design and prototype creation. This stage includes creating a user interface design (UI/UX), creating flowcharts, and flow diagrams that show how the application will work. The initial prototype is then tested by the development team and several beginner climbers to obtain feedback on design and functionality.

e. Application Development

After the system design is complete, the application development stage continues using React Native for the mobile platform and Node.js for the backend server. The database uses Firebase which allows cloud-based data storage and facilitates synchronization between the web and mobile versions of the application. Application development is carried out in stages, where each application module is tested internally before being integrated into the main system.

f. System Testing

System testing is done using the black-box testing method to check the application's functionality without looking at its internal code. For functional testing, a scenario-based approach is used, where each feature is tested separately based on the designed function, such as login, access to climbing information, and ticket booking.

This method ensures that each input produces output that is by the specifications. No special framework or automated tools are used; testing is done manually to ensure the application functions according to user needs. The results of this test are used as a basis for improvements before the application is released.

After implementation, the application will be distributed through popular digital platforms such as the Google Play Store for Android users and the App Store for iOS

users. These platforms were chosen because of their wide reach, ease of access, and ability to support automatic updates so that users always get the latest version.

Alternatively, the application installation file (.apk) will be provided through the developer's official website. This aims to make it easier for users who do not have access to the Play Store. In addition, promotions through social media and the climbing community will be carried out to increase awareness and use of this application. Application distribution focuses on easy access to reach more novice climbers in various locations.

### 3. RESULTS AND DISCUSSIONS

#### 3.1 System Architecture

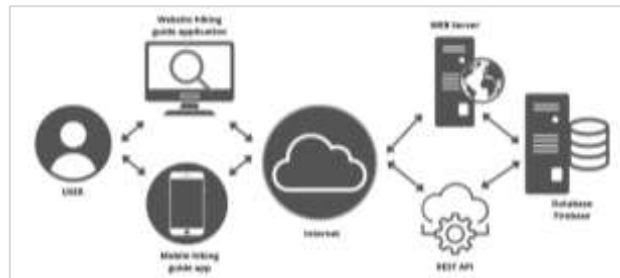


Figure 2. System Architecture

The system architecture image above shows the workflow of the hiking guide application available in web and mobile forms, which can be accessed by users via the Internet. Users can open the hiking guide application, either via a computer device for the web version or via a mobile phone for the mobile version. Both versions of the application are connected to the internet to send data requests which are then forwarded to the server. This application server acts as the center of the system logic manager and processes requests from the application using the REST API, an interface that allows communication between the application and the server in a structured manner. Furthermore, this server will interact with Firebase as the main database to store and retrieve the necessary data, such as Equipment, Supplies, Survival, First Aid for Accidents (P3K), Beginner Mountain Recommendations, and Hiking Ticket Orders. Firebase was chosen to support real-time data storage so that the application can provide information that is always updated. This architecture relies on the internet as a connecting medium, so that users can access application services from anywhere as long as they are connected to the internet network, and every request or response data will pass through the REST API which ensures safe and efficient communication between the application, server, and database.

#### 3.2 Use Case Diagram

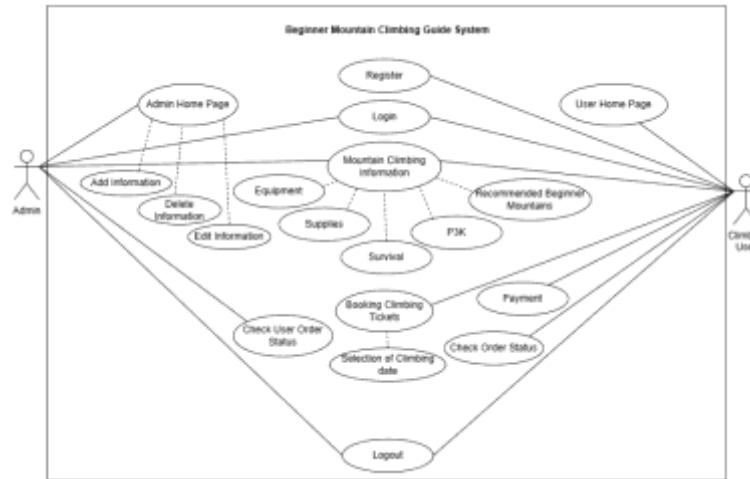


Figure 3. Use Case Diagram

This Use Case Diagram of the Beginner Mountain Climbing Guide system involves two main actors: the Admin and Climber User. Admin has access to add, delete, and edit information related to climbing, such as equipment, supplies, survival, and mountain recommendations for beginners. Admin can also check the status of user ticket orders. Meanwhile, Climber Users can register, log in, and access various climbing information, including Equipment, Survival, and First Aid for Accidents (P3K). Users can also order tickets, choose a climbing date, make payments, check the order status, and log out after finishing using the application.

3.3 Entity Relationship Diagram (ERD)

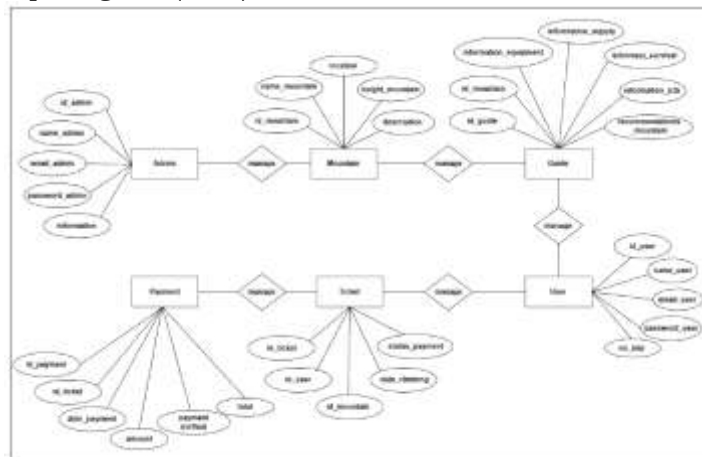


Figure 4. Entity Relationship Diagram (ERD)

This diagram shows the entity-relationship model for a beginner hiking guide system. The main entities include Admin, Mountain, Guide, User, Ticket, and Payment. (a) Admin manages all system data, including mountain data, guides, tickets, and payments. (b) The mountain contains available mountain information, while the Guide provides hiking information such as equipment and survival. (c) The user is a hiker who can book a Ticket to hike, while Payment records ticket transactions.

### 3.4 Program Implementation

In the design of the Beginner Mountain Climbing Guide Application based on the Web and Mobile, there are several pages that have the function of displaying information to Users who need information about climbing, especially beginner climbers. These pages are as follows:

#### a. Web-based Application Results

##### 1) Main Page Display



Figure 5. Main Page Display

This page is the main page of the web-based beginner mountain climbing guide application, on this page, there is information including menus, mountain recommendations, about us, and contacts.

##### 2) Menu Display



Figure 6. Menu Display

This page is an information menu page, there are 5 information menus, Namely Equipment, Supplies, Survival, and First Aid for Accidents (P3K).

##### 3) Beginner Mountain Recommendation Display



Figure 7. Beginner Mountain Recommendation Display

This page is the Beginner Mountain Recommendation display page, making it easier for climbers to find out about mountains, especially for beginner climbers.

##### 4) Our Contact Display



Figure 8. Our Contact Display

This page is our contact display page, for users who have problems or to provide messages and suggestions for the beginner mountain climbing guide application to make it even better.

## b. Mobile-based Application Results

### 1) Main Page Display



Figure 9. Main Page Display

The first-page display appears when opening the mobile-based beginner mountain climbing guide application.

### 2) Register Display



Figure 10. Register & Login Display

When a new user downloads the application, the user can first register their account by typing their email and password. If successful in registering, they will be directed to the Login page. If they fail, they will be given information about the failure made by the user.

When the user has successfully registered their account, the user can type the email and password that were previously registered to carry out the login process. When successful, the user will enter the main page and if they fail, information will be displayed as to why the failure occurred.

### 3) Profile Display



Figure 11. Profile Display

This page is the profile display page when the User has registered and logged in, then the User will get a profile with the data that has been filled in previously.

### 4) Menu Display



Figure 12. Menu Display

On the first page after logging in, the user can select the existing menu such as Equipment, Supplies, Survival, First Aid for Accidents (P3K), Recommendations for Mountains in Indonesia for beginner climbers, and Online ticket reservations.

#### 5) Information Display



Figure 13. Information Display

Here is the information page for beginner mountain climbing guides, there are 5 pieces of information, Namely Equipment, Supplies, Survival, First Aid for Accidents (P3K), and Beginner mountain recommendations. When the user selects one of the application menu options, the user will enter the page to start the information.

#### 6) Ticket Order Display



Figure 14. Ticket Order Display

Here is the information page for beginner mountain climbing guides, there are 5 pieces of information, Namely Equipment, Supplies, Survival, First Aid for Accidents (P3K), and Beginner mountain recommendations. When the user selects one of the application menu options, the user will enter the page to start the information.

### 3.5 Application Testing

The results of testing the application program that has been running, it can be concluded that the program that has been running can run normally and according to what is expected: The following are the results of the program testing:

Table 1. Application Testing

Features	Input	Expected Output	Desired Outcome	Status (Pass/Fail)
Main page	Open the application.	The main page appears for a few seconds before moving to the login or main page.	The main page appears and disappears at a specified time.	Pass
Register	Enter your name, email, and password.	The account is successfully created if the data is valid, or an error message appears if the data is invalid.	The user successfully registers and is directed to the login or main page after successful registration.	Pass
Login	Enter email and password.	The user successfully logs in if the data matches or an error message appears if the data does not match.	The user successfully logs in and is redirected to the main page, or a notification appears saying "wrong email or password".	Pass

Profile	Open user profile page, edit data.	Displays user profile data, and can be updated if there are data changes.	Profile data is displayed correctly, and data updates are saved when the user presses the save button.	Pass
Information: Equipment, Supplies, Survival, and First Aid for Accidents (P3K).	Open the information page.	Displaying Information.	All related information is displayed with proper details.	Pass
Recommended Beginner Mountains.	Open the mountain recommendation page.	Displays a list of mountains with difficulty level, distance, and other info.	A list of mountains appears with the relevant data, and users can view further details or book tickets.	Pass
Climbing Ticket Reservation.	Select a mountain, fill in the date and ticket info.	The order is successfully created if the data is valid, or an error message if the data is invalid.	Ticket booking successful, user gets booking confirmation.	Pass

#### 4. CONCLUSION

This study contributes to the literature and best practices in developing digital-based tourism applications by proving that the designed application can improve the readiness of novice climbers, both in terms of information and safety. The trial showed that the available features, such as equipment guides, climbing techniques, and safety, have a positive impact on user knowledge and confidence. In addition, the application is designed inclusively by supporting the use of local languages and including information about mountains in various regions in Indonesia, so that it can be accessed by climbers from various backgrounds. The application also includes an online ticket booking feature, making it easier for climbers to plan their trips. For further development, the application will be expanded by adding an international mountain database and community-based features that allow users to share experiences and information. This step is expected to make the application more relevant, not only for local climbers but also for international climbers, while promoting Indonesian mountain tourism on the global stage.

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