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PROTOTYPE SISTEM INFORMASI DAN PENERAPAN MEDIA GPS TRACKING PADA APLIKASI AKTIVITAS PENDAKIAN GUNUNG

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ABSTRACT

In mountain climbing, safety and security are highly important factors. By utilizing GPS Tracking technology, climbers can track their location and notify others in case of an emergency. The prototype design of this information system includes four main elements: a mobile application, a database, a server, and a GPS system. The mobile application is used by climbers to access information such as climbing routes, weather conditions, and trail conditions. Additionally, this application serves as a GPS Tracking medium that provides the climber's real-time location to relevant parties, such as fellow climbers, family, or authorities, in the event of an emergency. There is also a database used to store critical data, including climbing information, location details, and user information. Furthermore, there is a server responsible for processing and managing data from the application and GPS. The GPS system is utilized to track the climber's location in real time. After designing the information system, testing was conducted on the application and GPS Tracking. The testing involved simulating a mountain climb and comparing the tracking results with the actual climbing location. The test results showed that the application and GPS Tracking functioned well and were able to provide accurate location information. It is hoped that with the implementation of this information system prototype and GPS Tracking feature in the mountain climbing application, it will help improve the safety and security of climbers. Moreover, this prototype can serve as a foundation for further development of an information system in the future.

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1. INTRODUCTION

Essentially, climbers need to gather information beforehand before engaging in their climbing activities. This is because climbers must prepare themselves adequately before embarking on a mountain climb. Such preparation includes both physical readiness and logistical arrangements, such as food and equipment required for the climb. This is particularly important for novice climbers, as they usually plan meticulously in advance regarding what needs to be prepared and will be needed during the journey. In addition to this, several issues have been identified in this study. One issue is that some climbers are unaware of the actual climbing route since the route often passes through dense forests where paths do not resemble regular roads. Another issue is that authorities find it difficult to determine the exact location of climbers due to the lack of devices that can function without an internet connection.

To address these problems, the researcher proposes a solution by developing an information system that climbers can access to identify key points along the climbing route. This is achieved using maps available within the application, which can be downloaded in PDF format. These maps can then be viewed offline while traversing the climbing route. The maps also include various symbols along with detailed information about each point encountered during the climb.

Additionally, there is a separate application designed for officials: a GPS device monitoring application. This application is built into the GPS device, which is used to monitor the climber's position according to the route being followed. However, one limitation of the GPS device is that it requires an internet connection to function. Beyond that,

climbers must rely on the downloaded trail maps for navigation.

2. METHOD

The following are the implementation steps for this research, following the outlined sequence:

2.1 Research Methodology

Research methodology, in essence, is a scientific approach to obtaining data with specific goals and purposes. According to Sugiyono (2015), the Qualitative Method is considered a relatively new method because it has only recently gained popularity. It is also referred to as the post-positivist method because it is based on post-positivist philosophy. This method is sometimes called the artistic method because the research process is more akin to art (less structured) and is also referred to as the interpretive method since the research findings are closely related to the interpretation of data collected in the field. The Qualitative Research Method is often called the naturalistic method because the research is conducted in natural conditions. Initially, this method was predominantly used for cultural anthropology studies. It is referred to as the qualitative method because the data collected and its analysis are primarily qualitative in nature.

The Qualitative Method is a research approach based on post-positivist philosophy, used to study objects in their natural conditions (as opposed to experimental conditions). In this method, the researcher acts as the key instrument, data collection techniques are carried out through triangulation (a combination of methods), data analysis is inductive/qualitative, and the results emphasize meaning rather than generalization. Based on the explanation above, the research technique employed by the author in this study is the Qualitative Method.

2.2 Data Collection Methods

The following are the data collection techniques employed by the researcher in this study:

1. Observation : This involves directly observing the ongoing system. During observation, validation of the information provided during interviews can also be conducted. Data is collected by directly observing existing sources. In this study, observations were carried out at the Mount Gede Pangrango National Park Main Office.
2. Interviews : This technique is used to gather and collect data directly from the technical staff at the Mount Gede Pangrango National Park. The aim is to obtain accurate data so that the design of the information system aligns with the initial objectives.
3. Literature Review : This involves collecting data from other sources such as journals, theses, guidebooks, and books related to this research. Additionally, it incorporates knowledge gained during academic studies that are relevant to the research problem being addressed..

2.3 System Development Method

The SDLC (Software Development Life Cycle) Prototype Method is a software development approach that enables interaction between system developers and system users, thereby addressing inconsistencies between developers and users (Pressman, 2012: 50). The prototype development process is illustrated as follows :

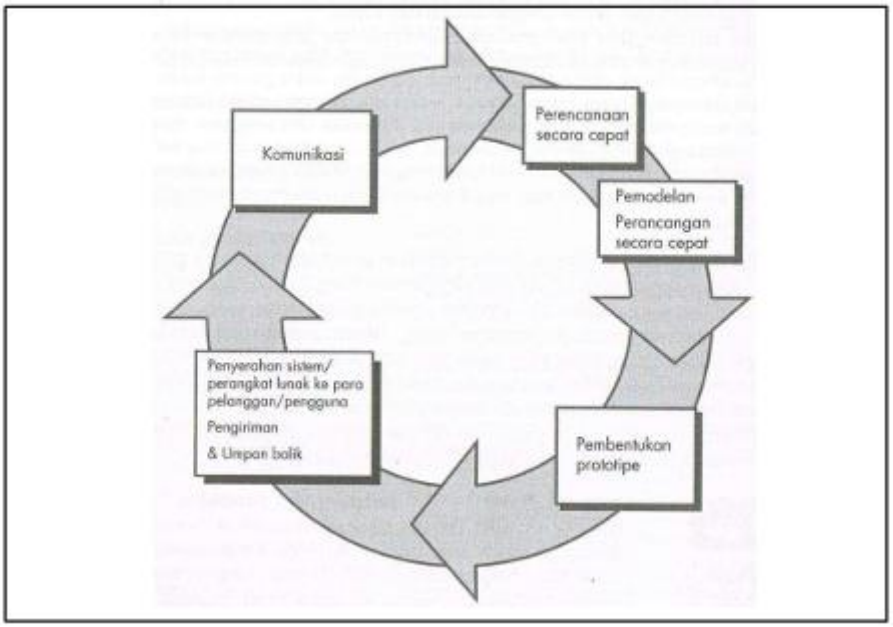

Image 3.1 Model SDLC Prototype

Customers often define a number of software goals in general terms but may not be able to identify detailed requirement specifications for the functions and features that the software to be developed will eventually have. In other cases, software developers may feel uncertain about the efficiency of an algorithm that will be used in the software development process or may also be unsure about the software's ability to adapt to human-computer interactions. In situations like these, as well as in many others, the Prototype paradigm may offer the best approach (Pressman, 2012: 50). The process begins with communication between the software development team and the customer.

The software team holds meetings with stakeholders to define the overall objectives for the software being developed, identify any currently known requirement specifications, and outline areas where further definition in subsequent iterations is necessary. Prototype iterations are planned quickly, and modeling (in the form of rapid design) is carried out. A rapid design focuses on representing all aspects of the software that will be visible to end-users (for example, the user interface design or display formats). This quick design initiates the contribution to prototype creation.

The prototype is then handed over to the stakeholders, who evaluate it and provide feedback that will be used to refine the requirement specifications. Iterations occur as the prototype is refined to meet the stakeholders' needs while simultaneously allowing us to better understand what requirements need to be addressed in the next iteration (Pressman, 2012: 50). Ideally, the prototype acts as a mechanism for identifying software requirement specifications. If a usable prototype is to be developed, we can utilize existing programs or apply available tools, such as report generators or window managers, which allow functional programs to be created quickly and easily (Pressman, 2012: 52). Below are the stages of the system development method used in this research :

1. Communication : The initial stage of the prototype model is used to identify existing problems and gather other necessary information for building the system.
2. Planning : This stage involves determining resources, specifications for development based on system requirements, and goals derived from the results of communication conducted to ensure that the development aligns with expectations.
3. Modeling : The next stage involves representing or illustrating the system model to be developed, such as processes designed using Unified Modeling Language (UML) . In this stage, the prototype is built with a temporary system design and then evaluated by the customer to determine whether it meets their expectations or needs further evaluation. Once the system is deemed to align with the customer’s expectations, the next step is application development (coding), where the system design is translated into the PHP programming language using the Laravel Framework and integrated with a MySQL database.
4. Construction : This stage is used to build the prototype and test the system being developed. Installation processes and user support are also provided to ensure the system operates correctly.
5. Delivery : This stage is necessary to obtain feedback from users as a result of the previous evaluation and to implement the developed system.

2.4 System Testing Method

Software testing constitutes the largest percentage of technical effort in the software process. Regardless of the type of software being developed, a strategy for systematic test planning, execution, and control begins by considering the small elements within the software and progressively moves outward toward the entire program. The goal of software testing is to uncover errors (Pressman, 2010:580). The testing method used is Black Box Testing .

Black Box Testing , also referred to as behavioral testing, focuses on the functional requirements of the software. This means that black box testing techniques allow for the creation of sets of input conditions that fully exercise all functional requirements of the program. Black box testing aims to uncover errors in the following categories: (1) Incorrect or missing functions, (2) Interface errors, (3) Errors in data structures or external database access, (4) Behavioral or performance errors, and (5) Initialization and termination errors (Pressman, 2010:597).

2.5 Research Steps

The following is the conceptual framework for the research stages in designing the web-based Mountain Climbing Activity Information System. In this study, several stages were carried out, as illustrated in the following figure :

Image 3.2 Research Steps

3. RESULTS AND DISCUSSION

At this stage, it is the implementation of the research method or the planned application development.

3.1 System Analysis and Design

The Pendaki Application aims to assist and become one of the supporting systems at the Mount Gede Pangrango National Park in an effort to improve the effectiveness of registering permits to enter conservation areas, developing a climbing system using GPS technology, and preventing irresponsible parties. In designing this application, planning is required for analyzing needs and determining the system development schedule to estimate when the application will be completed. The next stage after planning is design , where system analysis and design are determined at this stage. Following that is coding , which involves the application's coding and testing. Finally, the last stage is testing , which involves distributing the application to users and gathering feedback from users about the application that has been created.

3.1.1 Planning

a. Functional Requirements
   1. Users can view articles about Mount Gede Pangrango.
   2. Users can view tips and tricks for climbing mountains.
   3. Before booking tickets, users can read the general requirements.
   4. Users can select climbing dates and times based on available quotas.
   5. Users can register once they have determined the climbing date and time.
   6. Users can obtain information about climbing routes on the provided map, whether it's an online or offline map (in PDF format).
   7. Users can obtain information about the climbing entry points.
   8. Climbers can use GPS devices to track their climb.

b. Non-Functional Requirements
   1. User-Friendliness : With this system, users can easily understand the functionality of each feature available within it. In addition to the clear naming of each feature, the author has designed this information system with a symmetrical layout, ensuring user comfort during use.
   2. Ease of Implementation : This system was developed using a web-based application, the Laravel Framework, and the PHP programming language.

3.1.2 Design

The results of the previous functional requirements analysis are then designed using UML (Unified Modeling Language) . The design created in this paper is the first iteration design, namely the alpha version .

a. Use Case Diagram

Based on the results of the analysis that has been completed previously, the author creates a modeling from the user's perspective using a Use Case Diagram . In this modeling, users are made to feel as if they are involved in the system analysis and design phase. The author chose the Use Case Diagram because this modeling makes it easier to determine the system's behavior.

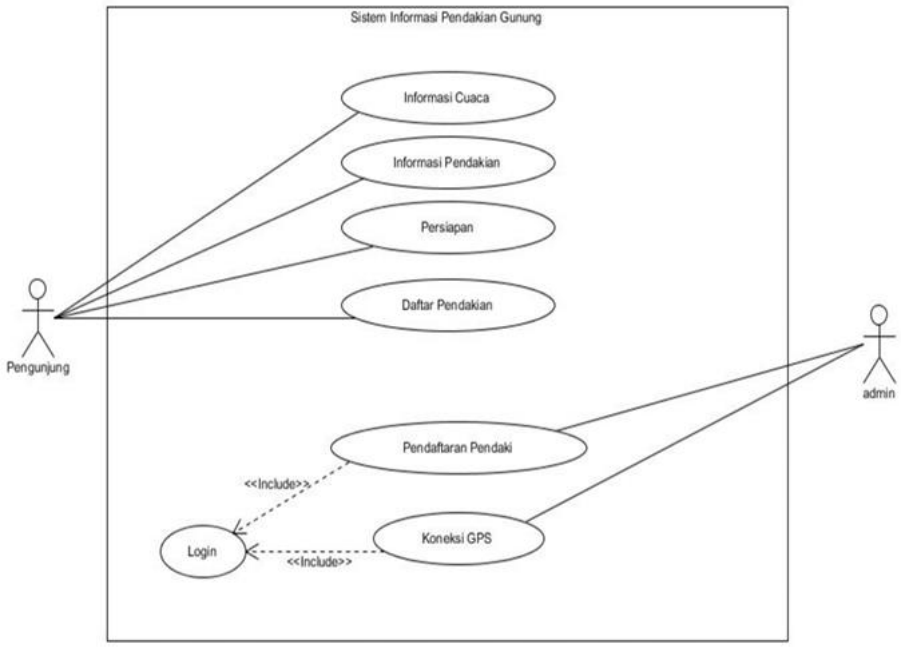

Image 4.1 Use Case Diagram

The Use Case Diagram has two actors: Pengunjung (Visitor) and Admin Pengelola (Admin Manager) , where these two actors have different activities. The Pengunjung actor can access Weather Information , Climbing Information , Climbing Tips , and Climbing Registration . On the other hand, the Admin actor has access to Login , and after logging in, they can manage Climber Registrations and Activate the GPS media connection with the coordinate points available on the climber's smartphone.

3.1.3 Activity Diagram

Consists of: Activity Diagram for Login , Activity Diagram for Admin Page , Activity Diagram for Climber Registration , Activity Diagram for GPS Device Connection , Activity Diagram for Weather Information:

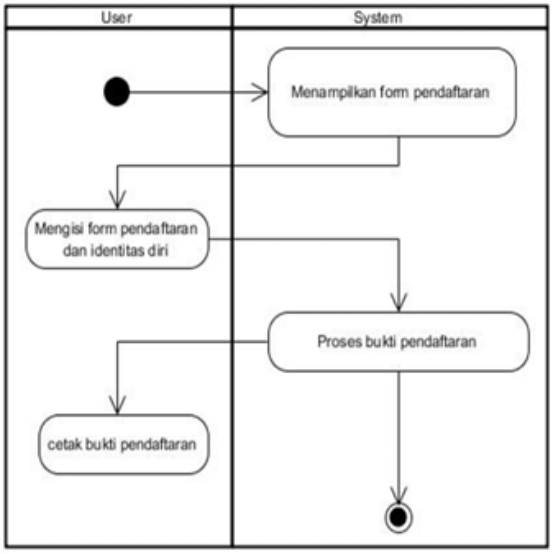

Image 4.4 Activity Diagram Pendaftaran Pendaki

In the Activity Diagram for Climber Registration , users will be directed to fill out a registration form, including providing their personal information and the details of the group members who will participate in the climb. After the registration is successfully completed, the system will provide a registration receipt in the form of a printed SIMAKSI (Climbing Permit), which will later serve as a requirement for conducting the climb.

3.1.4 Sequence Diagram

Consists of: Sequence Diagram for Login , Sequence Diagram for Admin Page , Sequence Diagram for Climber Registration , Sequence Diagram for GPS Device Connection ..

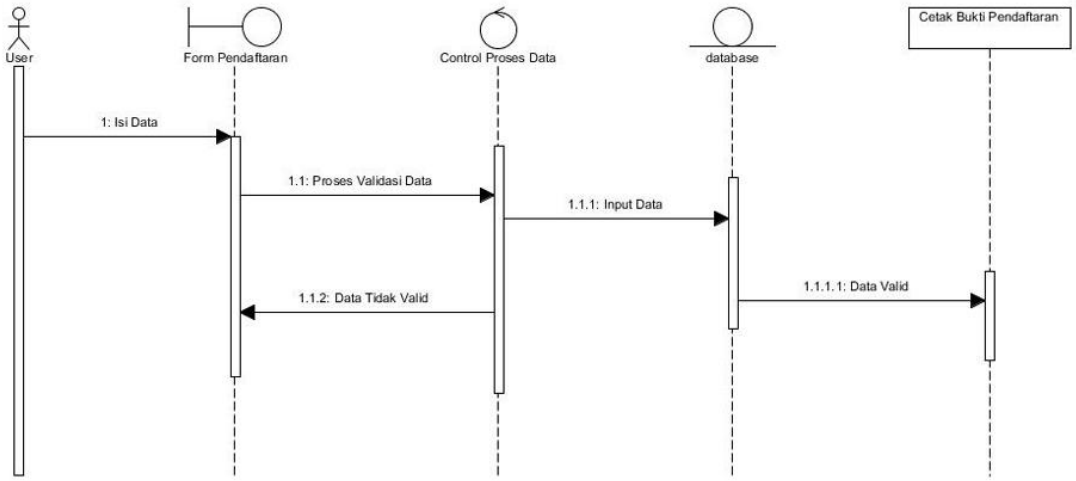

Image 4.9 Sequence Diagram Pendaftaran Pendaki

In the Sequence Diagram for Climber Registration , the user/prospective climber will be required to fill in some data first as part of the prerequisites before undertaking the climb. After the user completes the data entry, the system will provide a registration receipt, which can then be printed by the applicant.

3.1.5 Class Diagram

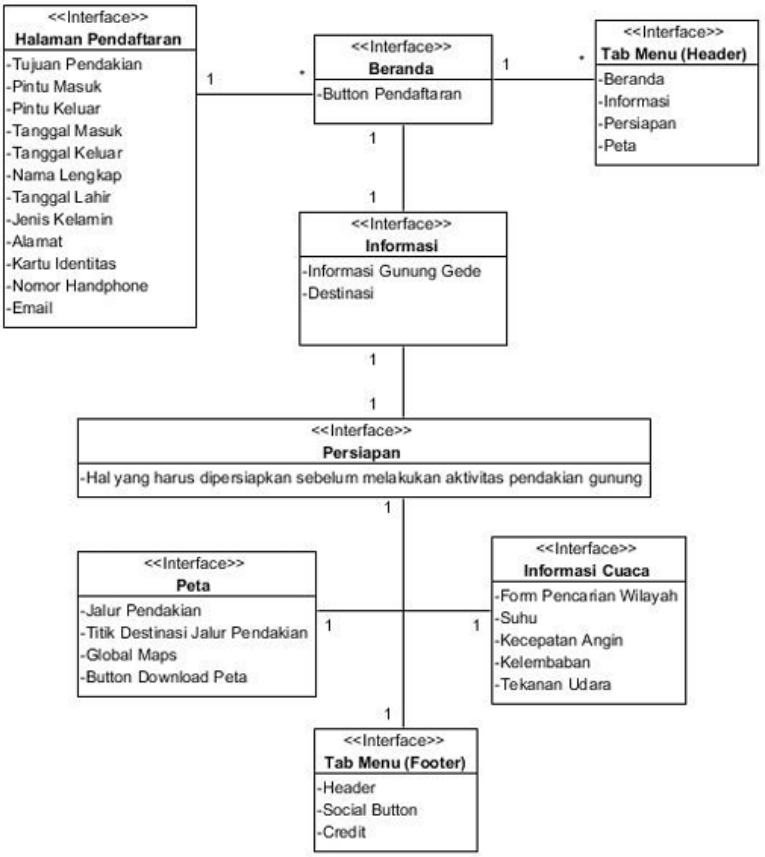

Image 5.2 Class Diagram Web Application

3.1.6 MockUp

In the process of designing and developing a product, a mockup is a visualization of a design concept. According to Keenethics, mockups are mid-fidelity or high-fidelity representations that depict color choices, layout, typography, iconography, visual navigation, and the overall appearance of the designed product. The following are some of the interfaces (mockups) used in the development of this application; Website Mockup : Main Menu, Registration Page, Information Page, Preparation Page, Climbing Route Map, Weather Information; Mobile App Mockup : User Login, Admin Dashboard, Monitoring.

Image 5.4 Menu utama

In the Welcome Mockup , there are several menu structures. At the top (header), there are tab menus that users can click on, which will direct them to specific pages based on the selected menu. In addition to the tab menus, there is also a button that, when clicked, will direct the user to the registration page.

Image 6.2 Mockup Dashboard Admin

The Admin Dashboard is the next display after the user logs in. On the Admin Dashboard page, there are several components, including a navbar (navigation bar) located at the very top of the application, images, menu options, and at the very bottom of the application, there is a tab menu.

3.2 System Implementation and Testing

System Implementation and Testing is a developmental stage that involves the design of a program's source code. In the initial part, the software and hardware specifications that will be implemented in the program will be explained. The main component of program implementation is the breakdown of the design into classes, which are written in the HTML programming language syntax . Subsequently, CSS and JS are applied to the Mountain Climbing Activity Application program.

3.2.1 Software Implementation

In applying and implementing the previously designed system, several software tools are required to create the Mountain Climbing Activity Information System website. These include the following: a. Visual Studio Code b. Programming Languages : HTML, CSS, and JS. c. Google Chrome. d. Laravel Framework. e. Github. f. Operating System : Windows 10 Pro 64-bi.

3.2.2 Hardware Implementation

In implementing the previously explained design, several hardware components are required to properly run the Mountain Climbing Activity Information System website and mobile application. The following are the hardware components used: a. Laptop HP Elitebook Folio 9480m, b. Processor : Intel Core i5 (4th generation), c. RAM : 12 GB, d. Storage : HP SSD S700 500 GB, e. Graphics : Intel HD Graphics.

3.2.3 Interface Implementation

The following is the interface implementation for the Mount Gede Pangrango Mountain Climbing Activity Information System :

a. Website

Below is one of the page displays on the developed website. The example implementation shown below represents the main menu page of the system.

Image 6.4 Halaman Utama

On the main page above, several navigation menus are displayed, namely: Beranda (Home) , Informasi (Information) , Persiapan (Preparation) , Peta (Map) , and Informasi Cuaca (Weather Information) . These navigation menus will remain visible at the top even when the user navigates to another page. In addition to the navigation menus, there is also a Daftar Pendakian (Climbing Registration) button, which, when clicked, will directly redirect the user to the official registration page at booking.gedepangrango.org .

b. Mobile app

The mobile app interface consists of: a login form , the admin dashboard page , and a map showing the location of the GPS device . Below is the map showing the location of the GPS device .

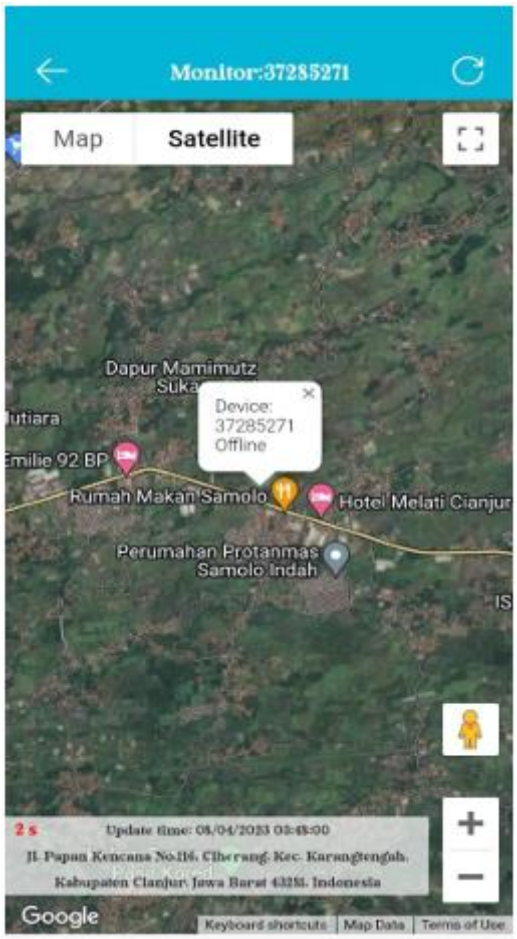

Image 7.2 GPS Device Monitoring Map Interface

On the Monitor menu previously selected on the Admin Dashboard page, a map will be displayed showing the location of the GPS device.

3.3 System Testing

This stage is the final stage of this research. The testing of the Mountain Climbing Activity Information System uses the Black Box testing technique. This technique is a testing method that focuses on the system's functionality as the main point of the test, while also ensuring the smooth performance of the system in accordance with expectations.

Tabel 5.1 Pengujian Black Box Web App

No	Testing	Data Testing	Results
1	Home	Functions as a button that, when pressed, will redirect to the main page .	True
2	Information	The navigation functions as a button that, when pressed, will redirect to the Information page , which has two sections.	True
3	Preparation	The navigation functions as a button that, when pressed, will redirect to the Preparation page .	True
4	Map Navigation	The navigation functions as a button that, when pressed, will redirect to the Map page , which displays two contents: an online map and a weather information form .	True
5	Home	There is a Daftar Pendakian (Climbing Registration) button that, when clicked, will directly redirect to the online registration page.	True
6	Map	Displays the Climbing Route Map , which contains several symbols indicating climbing route points.	True
7	Map Button	There is a button that, when clicked, will directly display the climbing map and also allow it to be downloaded.	True
8	Weather Information	Displays detailed weather information such as Temperature , Wind Speed , Humidity , and Air Pressure .	True
9	Menu Navigation	If one of the menus is clicked, it will redirect to the corresponding page.	True
10	Social Button	Includes several social media icons that can be clicked, and each will directly redirect to the respective social media account.	True

Tabel 5.2 Pengujian Black Box Mobile App

No	Testing	Data Testing	Results
1	ID	A field to be filled with the Serial Number / ID that was previously registered.	True
2	Password	A field to be filled with the Password that was previously registered.	True
3	Login	A button that, when clicked, will redirect the user to the dashboard page if the ID & Password are registered.	True
4	Menu Category	Focuses on the monitoring menu to detect the location of the GPS device.	True
5	Bottom Navigation Tab Menu	Includes buttons for Home , GPS Status , Help , and Others .	True

2. DISCUSSION

Based on the research by Gresha Bhatia (2023), titled "Android-based Mobile Application Development to Connect Local Vendors with Customers," this study compares different habits, cultures [15], and technological understandings of its subjects.

3. CONCLUSION

Based on the analysis and discussion in the research and prototype design of the application, the following conclusions can be drawn: 1. In the Prototype Design of the Information System and Implementation of GPS Tracking Media in the Mountain Climbing Activity Application: A Case Study of Mount Gede Pangrango , the application was developed using the Laravel Framework and supported by IoT GPS GF07 to monitor climbers by officials. In this application, climbers can access the website to view information about Mount Gede Pangrango, and the website explains how to use the GPS Tracking devices provided by officials for climbers. 2. The climbing routes in this application were created using resources from G-maps, which were provided by the Mount Gede Pangrango authorities, ensuring that the system adheres to the rules and conditions of Mount Gede Pangrango. For the weather system, jQuery Weather is used, which displays real-time weather updates on the website based on the user's or climber's location. 3. For novice climbers, the necessary preparations for climbing can be viewed on the website. The website provides explanations of several things that need to be prepared before engaging in mountain climbing activities, allowing new climbers to obtain this information. 4. In the implementation of GPS Tracking for climbers, if a climber deviates from the designated route, a warning or response will be sent from the GPS device..

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