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PALEMBANG CITY TOUR GUIDE APPLICATION WITH SHORTEST ROUTE SEARCH USING A* METHOD

Naris Kirana[1], Aryanti[2], Sarjana[3]
[1]Program Studi Teknik Telekomunikasi, Politeknik Negeri Sriwijaya
[1,2]Dosen Studi Teknik Telekomunikasi, Politeknik Negeri Sriwijaya
Corresponding Email: Narisputri13@gmail.com, aryanti@polsri.ac.id, sarjana@polsri.ac.id

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Abstract

In the current digital era, technology has become an essential tool in planning travel experiences. Tourists often face challenges in determining efficient travel routes amidst the numerous available tourist attractions. A map-based application that provides recommendations for the shortest routes can help optimize tourists' time and experience. Palembang, as a tourist destination rich in history and culture, faces challenges in accommodating first-time visitors, particularly in finding efficient travel routes. To address this issue, the development of a tourist guide application based on mapping technology and route-search algorithms, such as the A* method, can serve as an effective solution. This application can offer guidance on the fastest and shortest routes, avoid traffic congestion, and enhance the overall tourist experience. Furthermore, it supports the tourism sector by promoting local attractions and making it easier for tourists to plan their trips. By implementing this technology, the quality of the tourism experience in Palembang can be improved, in line with the global trend of digitalization in the tourism industry.

Keywords: ***Website, A* Algorithm, Shortest Route, Palembang City Tourist***

INTRODUCTION

In today's digital age, travelers are increasingly relying on technology to plan their trips. With so many choices of tourist attractions, culinary delights, and souvenirs available, travelers often find it difficult to determine an efficient travel route. An application that can provide recommendations based on the shortest distance will greatly assist travelers in optimizing their time and experience. By utilizing mapping technology and route finding algorithms, this application can provide an effective solution for travelers who want to enjoy the best experience during their vacation.[1]. Palembang City as the capital of South Sumatra Province, is one of the cities rich in history and culture. As a city that continues to develop, Palembang is not only known as a center of economy and trade, but also as a tourist destination that offers various interesting tourist attractions. Several iconic places such as the Ampera Bridge, the Grand Mosque, the Sultan Mahmud Badaruddin II Museum, and the Musi River are some of the tourist attractions that have been widely known by the public. Along with the increasing number of tourists, both domestic and foreign, the tourism sector in Palembang has become one of the main drivers in the economic development of this city.[2].

Although the city has a lot of tourism potential, first-time tourists often face difficulties in planning their trip. One of the main challenges faced by tourists is finding the best route to visit the various tourist attractions spread throughout the city. The many choices of tourist attractions and locations that are not always easy to reach, especially for those who are not familiar with the terrain or location, can make tourists feel confused and lose time. To overcome this problem, a technology-based solution is needed that can guide tourists to explore the city of Palembang efficiently and enjoyably. One solution that can be implemented is to develop a map-based tour guide application that provides information related to tourist attractions in Palembang while providing guidance on the fastest and shortest route to the intended tourist attraction.[3]. One method that can be used to create the shortest route search feature is the A* (A-star) method. The A* method is a path search algorithm that has proven effective in various mapping and navigation applications. This algorithm works by combining the concept of path search that optimizes travel costs and estimates the

distance to the final destination through a heuristic function. The application of the A* method in the shortest route search on the Palembang city tour guide will allow tourists to choose the best route with a shorter and more efficient travel time, avoid congestion, and maximize the time available to enjoy the various tourist attractions they are visiting.[4]. In addition, the development of this tour guide application will help improve the experience of tourists visiting Palembang. This application can also be an effective tool for the tourism sector and the government in promoting tourist attractions in Palembang in a more interactive and organized way. By using this application, tourists not only get information about tourist destinations, but can also plan their trips in a more structured way and save time.

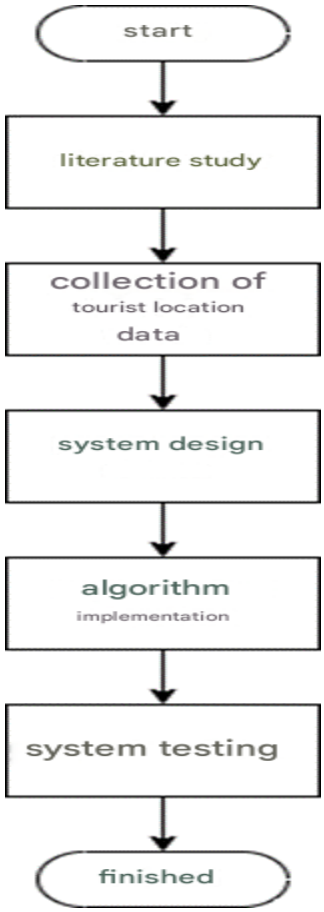
With the technology that supports navigation and route searching like this, the city of Palembang can improve the quality of the tourism experience offered to visitors. The application of this technology is also in line with the global trend in the tourism industry which is increasingly moving towards digitalization, where tourists are expected to get faster, easier, and more efficient services through technology-based applications.[5]. Through this application, tourists will find it easier to determine the best route, save time, and make their travel experience more enjoyable. The development of this application is expected to increase the number of tourists visiting Palembang and help the government and tourism industry players in promoting the city's tourist destinations.

LITERATURE REVIEW

Table 1 Previous Research Table

Author (Year)	Title	Method	Results
The Meaning of the Word1 Aryanti Aryanti (2020)	The Shortest Path Search Application for Base Transceiver Station (BTS) Using A* Algorithm[17]	A* Algorithm	Shortest path finding application for Base Transceiver Station (BTS) using A* algorithm has been successfully designed.
Ida Bagus Gede Wahyu Antara Dalem(2018)	Implementation Of A* (Star) Algorithm Using Graph To Calculate Shortest Distance[18]	using the A* Algorithm with heuristic function.	Determining the best route can be done using the A* Algorithm so that it can be implemented properly.
Heni Sulistiani, Danang Ari Wibowo(2018)	Comparison of A* and Dijsktra Algorithms in Searching for Sub-districts and Urban Villages in Bandar Lampung[19]	Prototype method	Based on the test results, the A* and Dijkstra algorithms produce the same distance during testing. However, there is a difference in the process time for finding the shortest route between the A* and Dijkstra algorithms.
Imam Ahmad, Wahyu Widodo(2017)	Implementation of A Star (A*) Algorithm in Android-Based Maze Adventure Game[20]		The implementation of the A* (A Star) algorithm for the help menu in the labyrinth adventure game has been running using the Euclidean heuristic.
Yusra Fernando 1) , Muhammad Ativ Mutsaqov 2) , Dyah Ayu Megawaty3) (2020)	Application Of A-Star Algorithm In Android-Based Photography Location Search Application In Bandar Lampung[21]	A-Star Method	Based on this research, an application was successfully developed that contains information on photo spots in Bandar Lampung with detailed information that can be easily accessed by users.

METHOD



Picture 1 Research Framework

The image above is a research framework in the form of a block diagram that shows the relationship between the steps in sequence as well as the work unit itself. This research framework is designed to facilitate the research process with the aim of achieving the desired results.

Literature study

Literature study is the initial step in research that aims to understand the concepts and theories that support the development of a Palembang City tour guide application with the shortest route search using the A* method. In this stage, various references such as journals, books, and previous studies are reviewed to find out how the tour guide system has been developed previously, as well as how the A* method is applied in calculating the shortest route.

Data collection

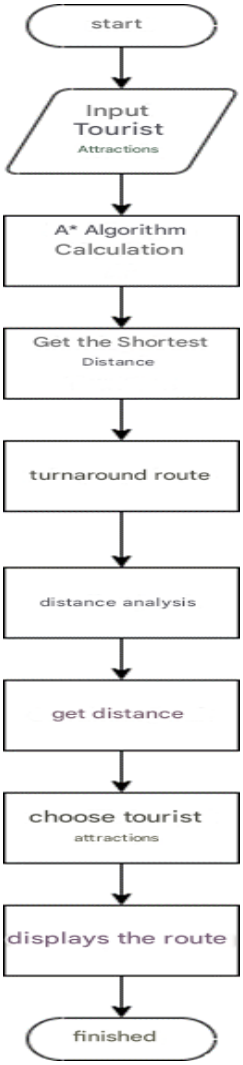
This stage aims to collect information about tourist locations in Palembang City that will be included in the application. The data collected includes the name of the tourist attraction, a brief description, geographical coordinates

(latitude and longitude), available facilities, and tourism categories such as historical, cultural, culinary, or nature tourism. Data collection can be done through direct surveys to tourist locations to obtain accurate information, interviews with tourist attraction managers, and the use of secondary data sources such as the official Palembang City tourism website and local government publications. In addition, at this stage, a mapping of the road network connecting one tourist location to another is also carried out, which will later be input in calculating the shortest route using the A* method. The data obtained must be ensured to be valid and relevant so that the system can provide accurate travel recommendations to users.

System Design

System design is done to determine how this tour guide application will be built, starting from system architecture, database design, to user interface. The following is a flowchart of the system to be built and the application user interface design.

System Flowchart



Picture 2 *flow chart*system

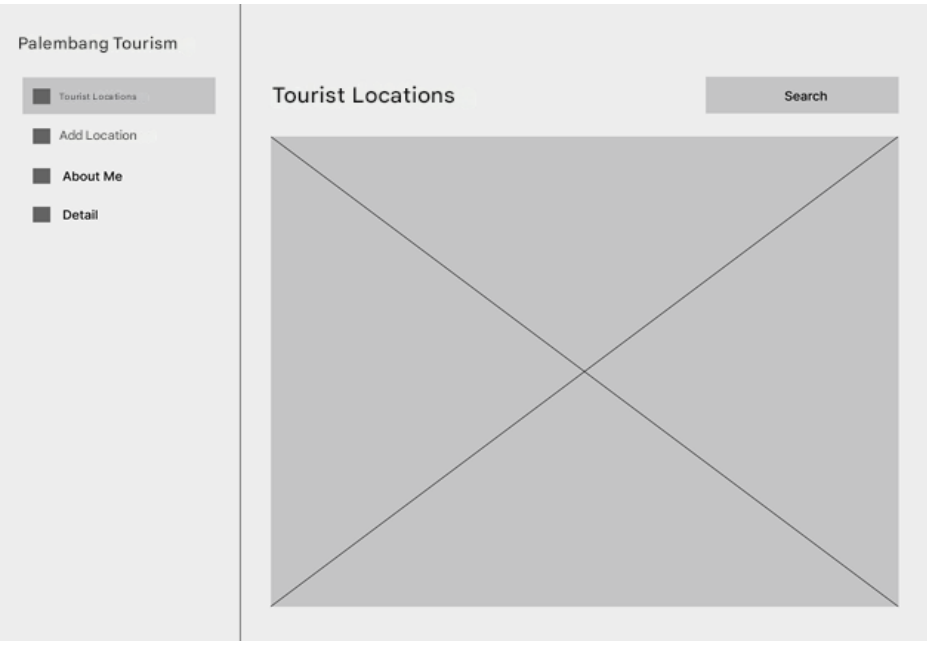
The flowchart above illustrates the process flow of finding the shortest route using the A* algorithm in the Palembang City tour guide application. Here is an explanation of each step in the flowchart:

Start : The route search process begins when the user wants to find the best route to a tourist attraction.

Tourist Place Input: Users enter the tourist locations they want to visit. This input can be the starting point of the trip and the tourist destination.
A* Algorithm Calculation:The system runs the A* algorithm to find the optimal route. This algorithm works by calculating the weight of the distance from the starting point to the destination by considering heuristic factors.
Get Closest Distance : After the algorithm calculation, the system determines the location with the shortest distance from the starting point.
Turnaround Route: The system checks whether there is a need to consider alternative routes or if there are obstacles such as impassable roads.
Distance Analysis: The system analyzes the total distance from the starting point to the tourist attraction, taking into account factors such as traffic jams or road conditions.
Get Distance : After analysis, the system determines the best possible distance to travel.
Choosing a Tourist Destination: Based on the results of the distance analysis, the system ensures that the selected tourist spot is in accordance with the optimal route.
Show Route : The system displays route search results to the user in the form of a map or a list of travel instructions.
Finished : The route search process ends after the optimal route is displayed.
This flowchart generally illustrates how the A* algorithm is used to find the best route to a tourist attraction by considering the distance and possible alternative routes.

User Interface (UI)
Tourist Location Page Design

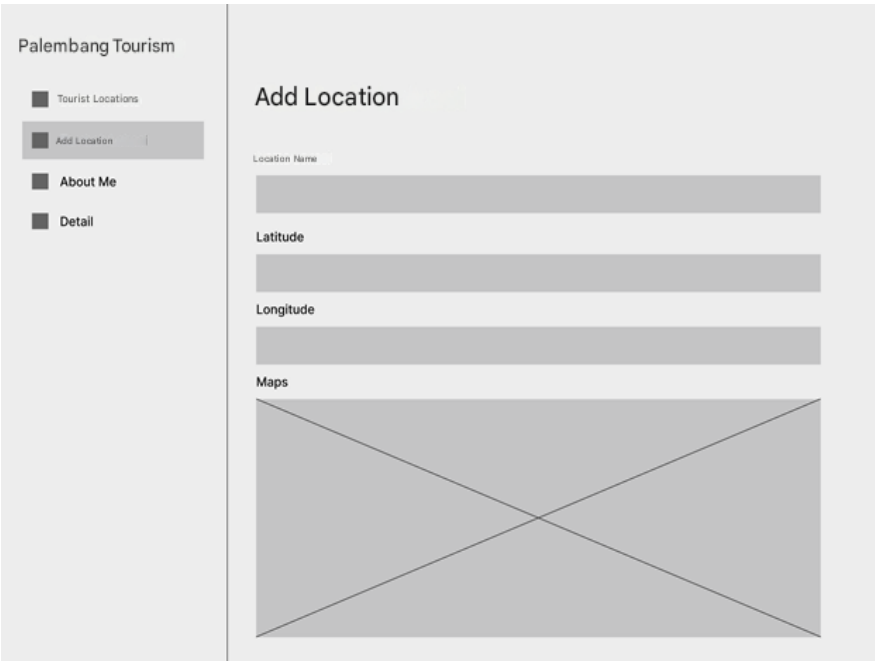
Tourist Locations page is a page design for guests to search for nearby tourist locations. This page will implement the A* algorithm to provide the nearest route for tourist locations. With a well-structured tourist location page design, this tour guide application can provide a pleasant experience for tourists and help them plan their trip more efficiently.



Picture 3 Tourist Location Page Design

Add Location Page Design

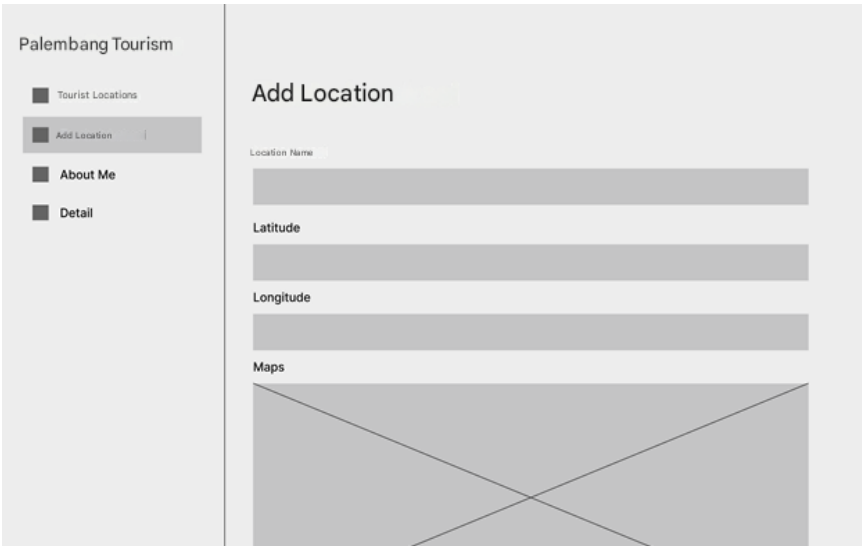
The Add Location page is a page design for admins to add tourist attraction data. This data includes the location name, latitude, and longitude of the tourist attraction. With an efficient add location page design, managers can easily update or add information about the tourist attraction, which will ultimately enrich the user experience in planning their trip.



Picture 4 Add Location Page Design

About Me Page Design

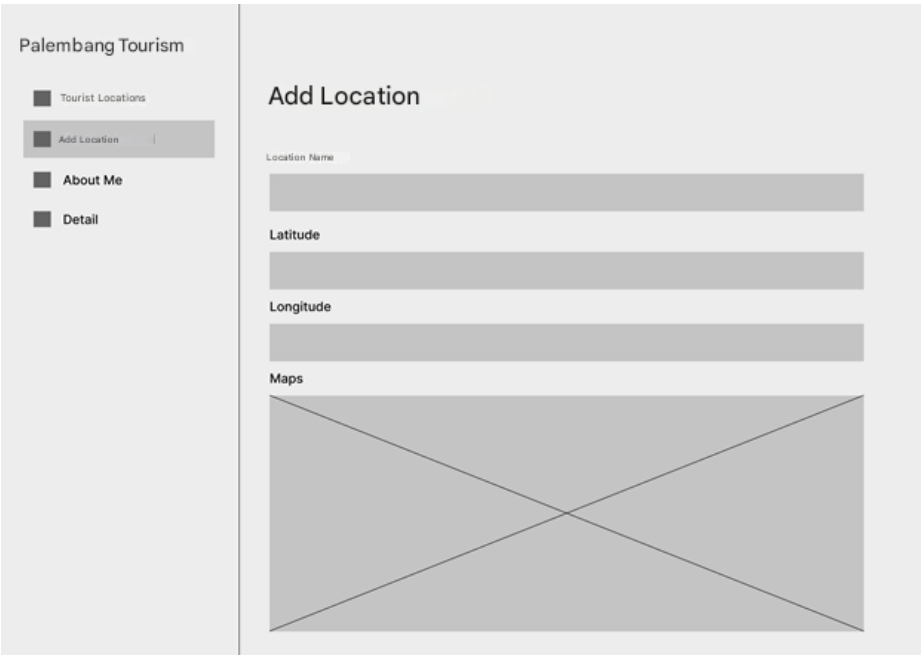
The about me page is a page design that functions to display information about the application creator. This page contains the author's biodata and author contact. With an informative "About Me" page and an attractive design, this application can build a closer relationship with its users and provide a clear picture of who created the application and what they stand for. This can also increase user trust in the application and show the developer's commitment to providing the best experience.



Picture 5 About Me Page Design

Application Detail Page Design

The application detail page is a page design that functions to provide information about the Palembang city tourism application. This page contains detailed information about the application. With a complete and informative Application Detail page, users will get a comprehensive picture of what the application offers, how to use it, and the benefits they can get. This also helps in increasing user understanding and satisfaction with the applications they use.



Picture 6 Application Detail Page Design

Algorithm implementation

The algorithm implementation stage is an important part of this research, because it determines how the A* method is applied in the system to find the shortest route between selected tourist locations. The A* algorithm works by finding the optimal path based on a combination of the actual distance from the starting point to a certain point (g-cost) and the estimated distance to the destination (h-cost). At this stage, the A* algorithm is implemented in the programming language used in application development, namely using the JavaScript programming language. Previously collected tourist location and road network data are entered into a graph in the form of nodes and edges, where the A* algorithm will find the path with the smallest weight based on the heuristics used.

System Tester

Testing is done to ensure that the developed tour guide application can run well and provide accurate results. This stage includes functional testing and algorithm testing. Functional testing aims to ensure that every feature in the application works as it should, such as searching for tourist locations, displaying tourist information, and searching for

the shortest route. Algorithm testing is done by comparing the route search results provided by the A* method with routes calculated manually or using other tools, to ensure the accuracy and effectiveness of the algorithm. From the test results, if deficiencies or bugs are found, system improvements and refinements are made before the application is completely ready for use.

RESULTS AND DISCUSSION

System Overview

The Palembang City tour guide application is designed to help tourists find the fastest and shortest routes to various tourist attractions in the city. This application is developed using Android Studio with the support of Google Maps API and Kotlin-based programming. This system is able to receive input from the user's initial location and the tourist destinations they want to visit, then calculate and display the optimal route using the A* algorithm.
The main features of this application include:

- Search for tourist attractions by category (culture, culinary, history, and nature)
- Interactive map showing user locations and tourist attractions
- Calculation and display of the shortest route using the A* algorithm
- Detailed information about tourist attractions (description, photos, location coordinates)

By using this application, users can plan their trips efficiently without having to feel confused in determining the right route.

Best Route Determination Process

The route determination process in the application begins when the user selects a starting point and a tourist destination. The starting point can be the user's current location which is automatically detected via GPS or can be entered manually. After that, the user selects one or more tourist locations as a destination. The system will validate the location input, then process the available road network data in the form of a graph. Nodes in the graph represent vertex points (intersections or tourist locations), and edges represent roads connecting nodes with weights in the form of distances between two points.

Implementation of Algorithm A*

The A* (A-star) algorithm is used as the core of the route search process in the application. This algorithm is a shortest path graph algorithm that combines the actual cost from the starting point to a node (g(n)) and the estimated cost from that node to the destination (h(n)).
The working steps of the A* algorithm in this system are as follows:

1. The system builds a graph based on location data and road networks.
2. Determine the starting node (user's starting point) and the destination node (tourist location).
3. Calculate the value of f(n) = g(n) + h(n), where:
    - g(n) is the actual distance from the start to node n
    - h(n) is the estimated distance from node n to the goal using the Euclidean heuristic.
4. The system selects the node with the smallest f(n) value to expand.
5. The process continues until the goal node is found or all nodes have been evaluated.

Location data and road network are encoded in a weighted graph data structure, and the algorithm is run in Kotlin. The found route is then displayed to the user via Google Maps.

Case Study and Route Search Simulation

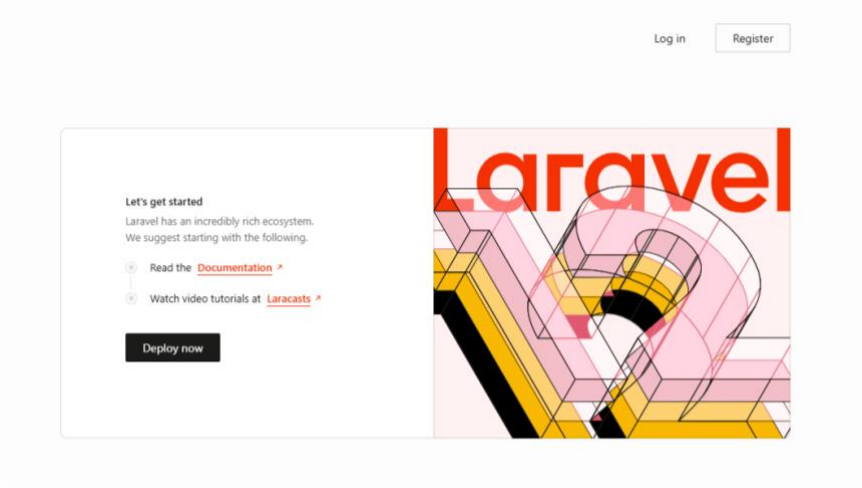
As a simulation, the user wants to go from "Sultan Mahmud Badaruddin II Museum" to "Ampera Bridge". The application will:

- Determine the GPS coordinates of both locations
- Finding the shortest path using A* based on the road network
- Displaying routes on an interactive map

The simulation results show that the application successfully finds the shortest route quickly, displays the estimated distance and provides clear directions. Compared to manual search on Google Maps, the results are similar but with a more focused display and features on the tourism context.

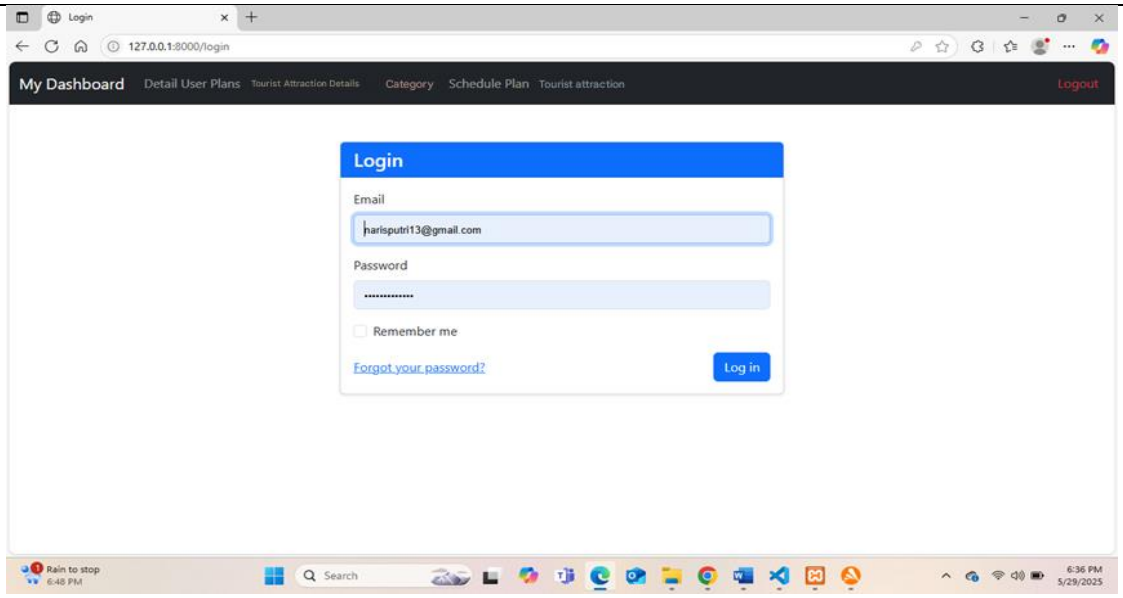
To support the explanation, here are some screenshots of the developed application:

1. **Laravel Home Page**



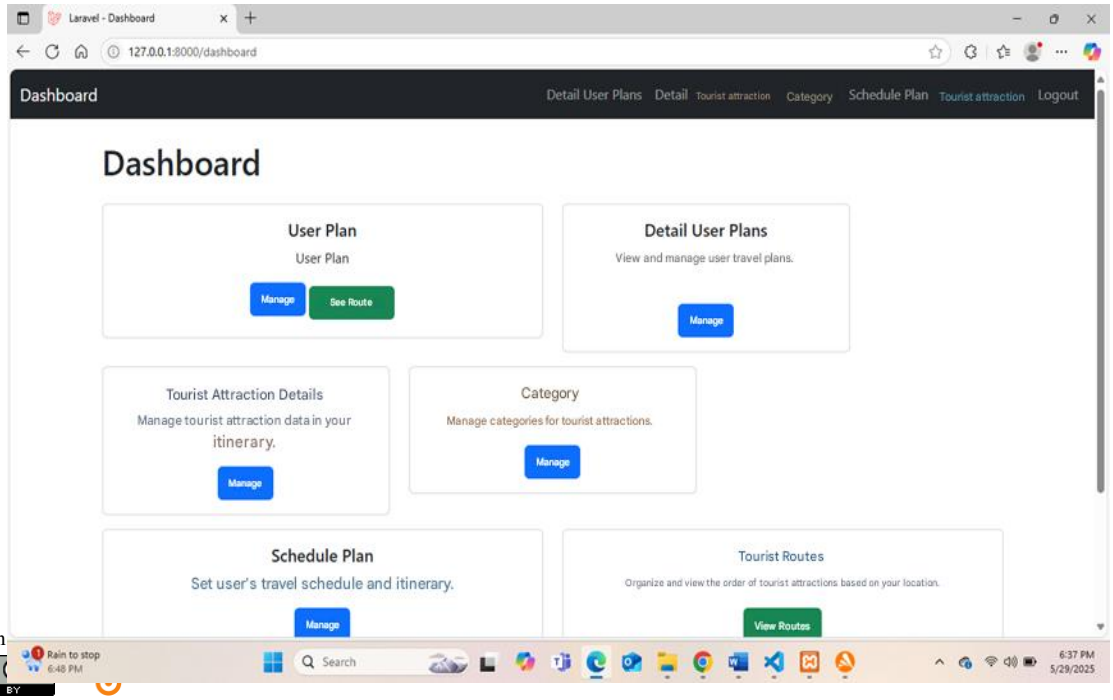
This initial view shows that the Laravel framework has been successfully run on the local server (localhost) on port 8000. This is the default Laravel view which indicates that the backend development environment has been set up correctly. This page also provides links to the official Laravel documentation and tutorials via Laracasts.

2. **User Login Form**



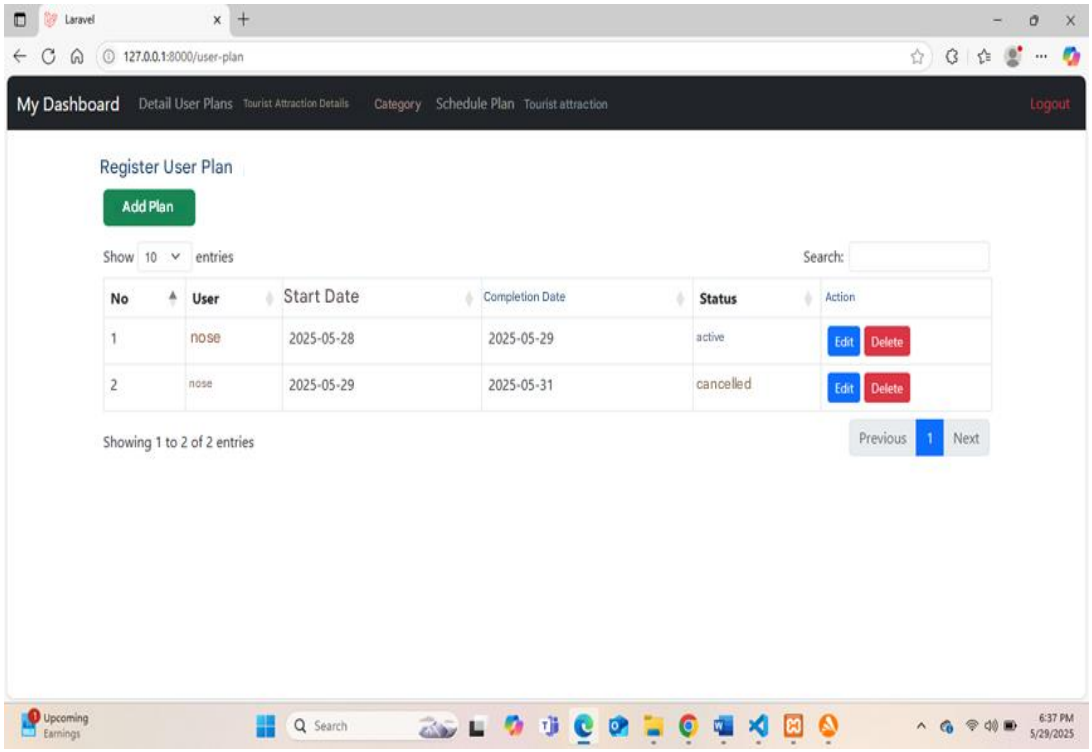
On the login page, users are asked to enter an email address and password to access the system. This login form also has a "Remember me" option to save the user's session and a link to recover the password if forgotten. This login is part of the user authentication system that limits access to registered users only.

3. **Main Dashboard**



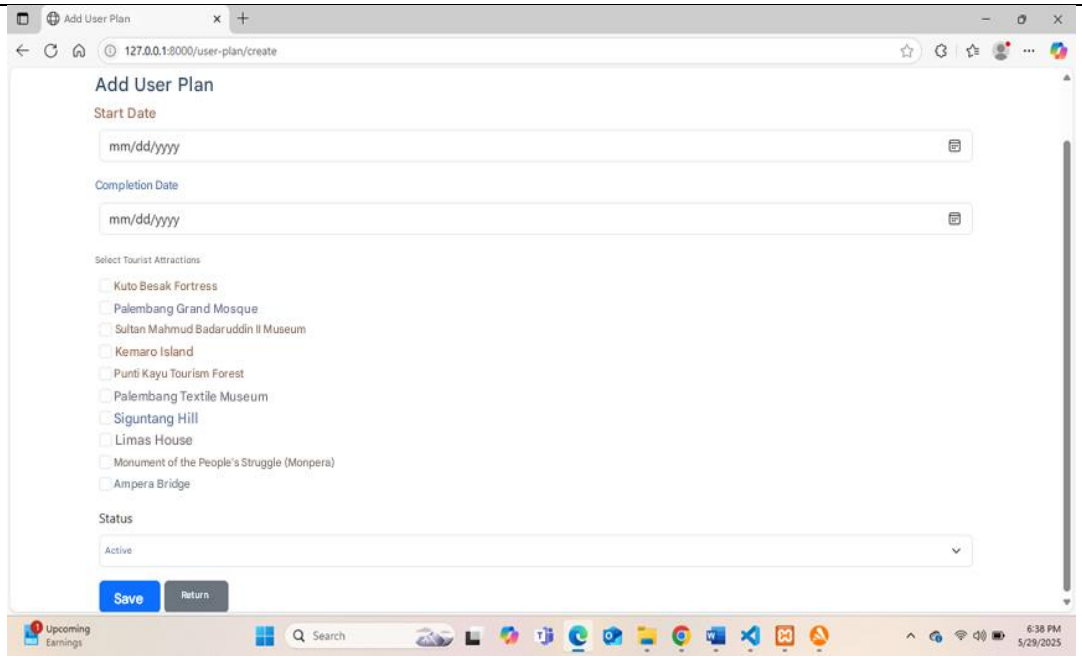
After successfully logging in, users are directed to the main dashboard that displays navigation to various important modules in the application. There are several panels such as User Plan, Detail User Plans, Detail Tourist Attractions, Categories, Schedule Plans, and Tourist Routes. Each panel has an action button such as "Manage" or "View Route" to enter the data management page.

4. **User Plan List**



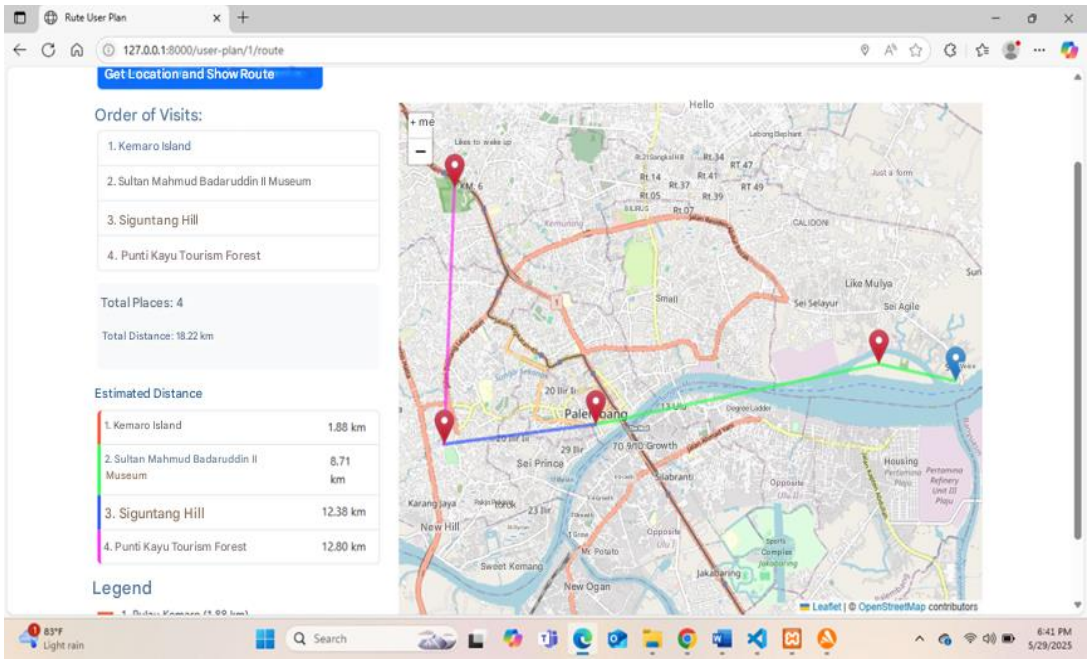
This page displays a list of travel plans created by the user. The data displayed includes the user's name, start and end date of the trip, and the plan status (active or canceled). The "Edit" and "Delete" features are provided to modify or delete plan data.

5. **Add User Plan Form**



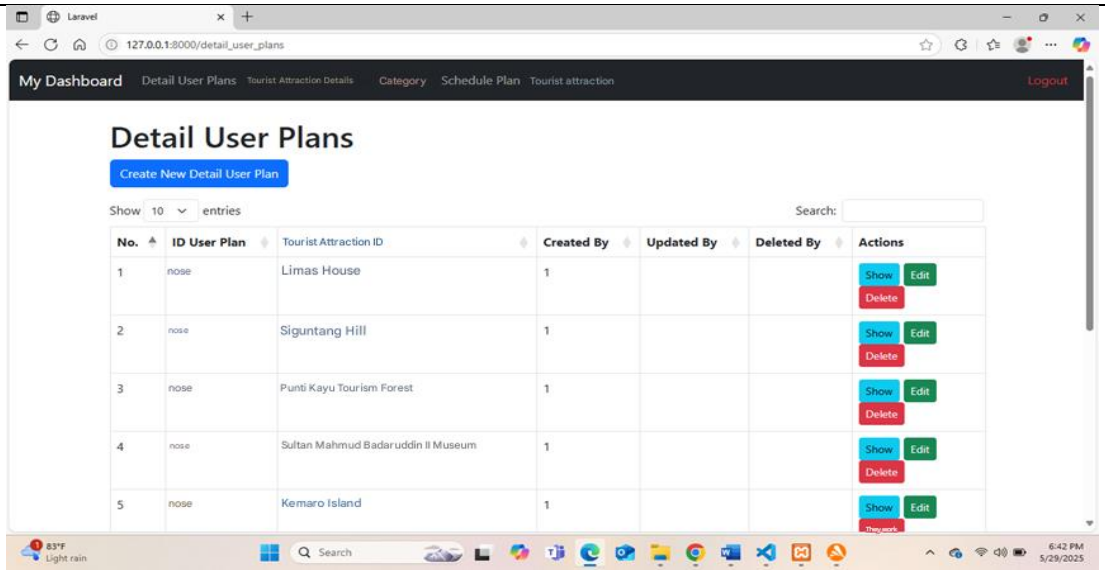
This form allows users to add a new itinerary by filling in the start and end dates, and selecting the attractions they want to visit from the list provided. Users can also specify the status of the plan, such as active or canceled. The data entered will be saved and displayed in the user plan table.

6. **Tour Route View**



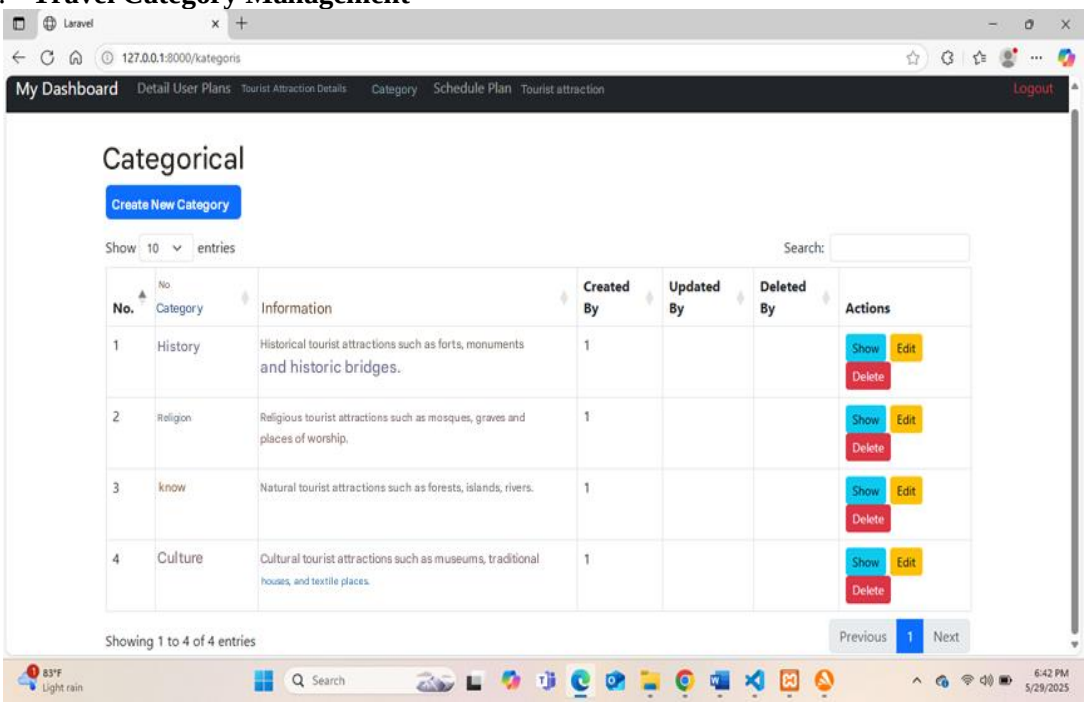
This page displays the travel route based on the order of visits to the selected tourist attractions. The system calculates the total distance traveled and displays an interactive map with colorful paths according to the route. The route displayed is the result of the A* algorithm calculation process, which considers efficient order based on distance.

7. **Visit Plan Details**



Displays the details of the destinations selected by the user in their itinerary. The table shows the user's name, the name of the tourist attraction, and information related to creating and editing the data. This page is useful for further managing the contents of the itinerary.

8. **Travel Category Management**



This page allows admins to manage tourist attraction categories, such as History, Religion, Nature, and Culture. Each category has a description and "Edit" and "Delete" actions to modify or delete irrelevant data. These categories will be used to group tourist destinations in the system.

Evaluation and Analysis

The evaluation was conducted by testing the application in several different travel scenarios, covering various starting points and destinations. The results showed that the A* algorithm is able to provide optimal and fast route results.

The effectiveness of the system is also assessed by:

- Route search response time
- Accuracy of displayed routes
- Ease of use interface

However, some limitations were found, such as incomplete road data or not taking into account real-time traffic conditions.

System Limitations

Some limitations of the developed system include:

- The app does not use real-time traffic data, so it cannot take into account current congestion or road conditions.
- Tourist location data is limited to manual input by admins, not yet automatically integrated with the government tourism system.
- Does not take into account factors such as tourist attraction operating hours, entrance fees, or user preferences.

Despite its limitations, this application still provides great benefits in helping tourists explore Palembang City efficiently.

CONCLUSION

Based on the results of the research and development that has been carried out, it can be concluded that the Palembang City tour guide application based on the A* algorithm has been successfully developed and is able to answer the needs of tourists in determining efficient travel routes. This application makes it easy for users to plan visits to various tourist attractions by providing the shortest and fastest routes interactively. The A* algorithm has proven effective in determining the optimal route based on the road network and distance estimation using heuristic functions. The technologies used, such as Android Studio, Google Maps API, and the Kotlin programming language, support the functionality and appearance of the application that is user-friendly. Overall, this application can improve the comfort and efficiency of tourists in exploring Palembang City and make a positive contribution to promoting regional tourism.

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