

# **Rasa Malang**

## **Software Design Document**

Global Software Engineering

Team M

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# 1. Introduction

The introductory section aims to outline this project's focus by highlighting the challenges faced by the people of Malang City concerning the tourism industry. To begin, specific issues within the tourism sector are identified. These issues will then be designated the objectives of this project that are to be resolved from an information technology perspective.

Malang City has the prospect of being a highly-desired city to visit by tourists. It has an abundance of historical and cultural sites that can be attractive to students, history enthusiasts, and common tourists alike. However, several issues are preventing the city from harnessing its true potential. These problems include:

- Lack of Exposure

As previously mentioned, Malang City has an abundance of historical, cultural, and educational tourism spots. The lack of tour guides and tourism information centers, however, has hindered both domestic and international tourists from fully exploring the city. Additionally, neighboring areas such as Malang Regency and Batu City pose competition, particularly with Batu City which boasts numerous well-known tourist attractions.

- Absence of Tourism Data Collection Infrastructure

Despite its tourism potential, Malang City currently lacks a data collection infrastructure for the tourism sector. The absence of such infrastructure in Malang City makes it challenging for the government to gather vital insights into visitor trends, preferences, and behaviors. A well-structured tourism data collection system is essential to assist the government in making data-driven decisions and strategic planning to enhance the overall tourist experience in Malang City.

- Local Restaurants' Limited Discoverability

Micro, Small, and Medium Enterprises in the culinary field play a crucial role in Malang City's economy. However, some of the lesser-known establishments suffer from limited discoverability. Despite their culinary richness and local

representation, tourists may struggle to find these underappreciated dining options. Furthermore, these establishments are often overshadowed by their more famous counterparts such as franchise enterprises and large restaurants. The challenge lies in making these culinary hidden gems more visible and accessible to both local residents and tourists.

- Insufficiency of Restaurant Information for Tourists

Tourists in Malang City are often faced with obstacles when it comes to finding local eateries that cater to their preferences and dietary restrictions. It is fairly difficult for tourists to find eateries that would fit their culinary criteria as the information is hard to find. Despite the presence of various online platforms, the provided details often lack crucial information, such as ingredients that may trigger allergies or are related to specific religious dietary requirements. The lack of such information may hinder tourists from fully enjoying their visit to Malang City.

Overall, the aforementioned issues together form a hurdle that prevents Malang City from achieving its true potential. The challenges faced by Malang City in the tourism sector are multifaceted, ranging from lack of exposure and the absence of tourism data collection infrastructure to the limited discoverability of local restaurants. To address these issues and unlock the full potential of Malang City as a tourist destination, an innovative information technology solution is imperative. To that end, the objective of this project is to develop a website that may serve as a data collection infrastructure for the city government, a restaurant recommender system for tourists, and an online platform that enables local restaurants to be promoted.

## 2. Requirements

This section aims to provide a detailed overview of the project requirements. Firstly, the perspectives of three distinct user groups, namely tourists, local restaurants, and government, are defined. Subsequently, the explanation of the technical requirements essential for the successful implementation of the project will be elaborated.

### 2.1 User Requirements

This section details the specific requirements for each user group. It begins by outlining the features intended for tourists, followed by the essential support needed for local restaurants. Finally, it lists out the access and functionalities that will be available to the government.

#### 2.1.1 Tourist-Focused Features

- User Profile

Users should be able to create profiles specifying their preferences, including desired cuisine types and dietary restrictions. This information is taken into account whenever the tourist utilizes the restaurant recommender system.

- Recommendation Algorithm

An Artificial Intelligence-driven recommendation algorithm should curate restaurant selections for each stop on the itinerary based on user preferences, such as distance from desired tourist attractions, price ranges, payment options, dietary restrictions, and previous choices. With enough data, recommendations liked by other users with similar preferences can be given as well.

- Trip Overview

The application should generate a descriptive map and textual elements

summarizing the entire trip itinerary, combining tourist attractions and dining options.

### **2.1.2 Support for Local Restaurants**

- Restaurant Registration

Local restaurant owners should be able to create accounts and submit information about their establishments.

- Culinary Criteria and Dietary Restrictions

Restaurant owners can upload menus, set culinary restrictions, and specify criteria their establishments satisfy.

- Image Upload

Restaurant owners should upload pictures of their restaurants to showcase the interior and exterior of their establishments as well as the food and beverages they serve.

- Consideration by Algorithm

Restaurants meeting input criteria should be considered by the system to potentially be recommended to tourists.

- Insights for Restaurant Owners

Restaurant owners should have access to itinerary insights, providing information on how often their establishments were recommended to tourists. Owners may also receive information about what their customers think of their food and service in the form of frequent keywords mentioned in their ratings as well as the sentiments contained in them. This consequently supports local restaurants' awareness of which aspects require improvement.

### **2.1.3 Government Access**

The city government should have access to datasets collected by the application to build a city-wide tourist data collection infrastructure. They have the permission to access data regarding:

- Itinerary Insights

Insights into popular tourist attractions and frequently visited restaurants, derived from the application's collected data.

- Restaurant Information

Access to information about registered restaurants, including their details and recommendations.

- User Demographics

Information about registered users, including their country of origin, age, purpose of visit, dietary restrictions, and visited sightseeing locations and restaurants.

## 2.2 Technical Requirements

In order to appropriately serve as a data collection infrastructure and online restaurant recommender system, several technical criteria have to be adhered to. The technical requirements that the system has to comply with are listed as follows:

- Accessible Platform

The application should be accessible through the most convenient means for the users. An example is by having it operable as a website as it offers the most versatility regardless of devices.

- User Permission

User permission is arguably the most important aspect of the system. The system completely depends on the volition of both tourists and restaurants to provide necessary information for the government to collect.

- Authentication and Authorization

The system must be able to ascertain the existence of the users and correctly identify them based on their group. Each user group may only have their respective permissions as explained in the user requirements section. The

system must also ensure that the stored data are authentic to guarantee high-quality dataset maintenance.

- Data Protection

Data collected from the application has to be stored securely and must not be misused. User credentials and personal information should be protected through several layers of security which may include encryption and other means to secure data.

- Satisfactory Recommendation

The performance of the recommendation system has to satisfy both tourists and eateries. Tourists should only be recommended restaurants that cater to their dietary restrictions and preferences, whereas restaurant owners should receive exposure and discoverability. The application should initially be a knowledge-based recommender system and filter restaurants based on the distance to tourism spots and user preferences. However, if the amount of data suffices, it should support collaborative filtering which utilizes Machine Learning to recommend restaurants based on user and restaurant similarity.

- Review Analysis

The reviews that tourists leave for each restaurant should be analyzed so that important keywords and sentiments can be extracted. This allows tourists to recognize the best items of the restaurant and lets restaurants determine which aspects need improvements and which require rigorous maintenance. In this case, Machine Learning algorithms should be adopted.

- Language Availability

The application should be able to support different languages as it is intended to be used by domestic and international tourists alike.

- Scalability

The application should be built on the idea of scalability. Although the system should primarily focus on dining establishments, it should also be

scalable to accommodate other sectors such as hotels, tourism spots, and other kinds of businesses.

- Periodic Updates

Information stored in the database must be updated regularly to enhance user experience. Tourists, in particular, should only be provided with the most recent data.

- Swift Performance

The system should not take too long to load and minimize user wait times. Longer wait time is usually associated with customer dissatisfaction.

### 3. Rasa Malang

As highlighted in the earlier sections, Malang City lacks a centralized platform for the government to collect data, for tourists to conveniently discover their preferred dining establishments, and for restaurants to enhance their discoverability and gather feedback. This is precisely the gap that this project aims to bridge. Thus, to attract users, the project is named Rasa Malang. The word *rasa* means taste in the native Indonesian language, hence the decision to include the word in the application name. Rasa Malang therefore means the taste of Malang, a platform that allows tourists to discover restaurants that cater to their culinary preferences and dietary restrictions and supports local restaurants by providing them with more exposure and customer feedback. As it will be maintained by the government of Malang City, this application will also act as a centralized data collection infrastructure. Figure 1 depicts the logo of the application. The outer shape resembles location pins often used in navigation applications. Coupled with the spoon and fork symbols, this logo overall shows that the website aims to help users create their culinary itineraries. The red color aligns with Indonesia's national flag color, and the tagline "Uncover Culinary Gems" further emphasizes one of the objectives of the application, which is to promote underappreciated local restaurants to tourists.



Figure 1: Logo and tagline of the website.

Rasa Malang enables tourists to complement their sightseeing itinerary with personalized recommendations of restaurants around the tourist spots. Unlocking

the ultimate tourism experience is just a few clicks away with Rasa Malang. Users merely need to let the system know their desired tourist attractions in chronological order and specify their preferred cuisine types, price ranges, and establishment types. Afterward, a recommendation algorithm curates a selection of restaurants for each stop on the itinerary, taking into account the user's dietary restrictions saved in their profile and the previously selected preferences. Once the user has chosen their favored restaurants for each sightseeing location, the application presents an overview of the trip in the form of a descriptive map and informative textual elements. Users can then effortlessly access their entire trip itinerary which also includes sightseeing locations and dining options.

The application's other objective is to help lesser-known local restaurants to be discovered by tourists. Restaurant owners can create their own accounts which will be considered by the recommendation algorithm. The restaurant owners are prompted to upload images of their establishment, menu, and dishes. They are also required to set culinary restrictions and criteria their restaurant satisfies. After meeting the requirements, their restaurant can then be considered by the recommendation algorithm. Additionally, the owners can gain itinerary insights and see how often they were recommended to the tourists. Tourists may also leave reviews and ratings, which are then analyzed to help identify aspects that need improvement.

As the super administrator, the government of Malang City has the capability to view datasets collected by the application in order to build a city-wide tourist data collection infrastructure. The government may also view itineraries where they can determine which tourist attractions and restaurants are most frequently visited. The government can also see which restaurants are registered in the application and view their information. Lastly, they may also view information about users such as the number of registered users, their country of origin, gender, age, and visited sightseeing locations and restaurants.

The component diagram in Figure 2 illustrates the relations between the components in Rasa Malang. The itinerary is the core of Rasa Malang's system. Itineraries can be made after taking tourists' input such as culinary preferences and

dietary restrictions, and the information on tourism spots and restaurants. After completing the itinerary, tourists can get their culinary itinerary and restaurant admins can gain business insights. Tourists can also leave reviews that will be sent to the restaurant and also the recommender system. The reviews can then be processed by the machine learning model in the review analyzer to extract relevant keywords and sentiments that lie within the reviews. These insights are then sent to the restaurant and included as a type of information that is considered in the itinerary creation. At the earlier stages, when the number of reviews is insufficient, the itinerary should not have to rely on the review analyzer yet. The government can then view everything in the database including the tourist information, itinerary insights, and all of the restaurant data.

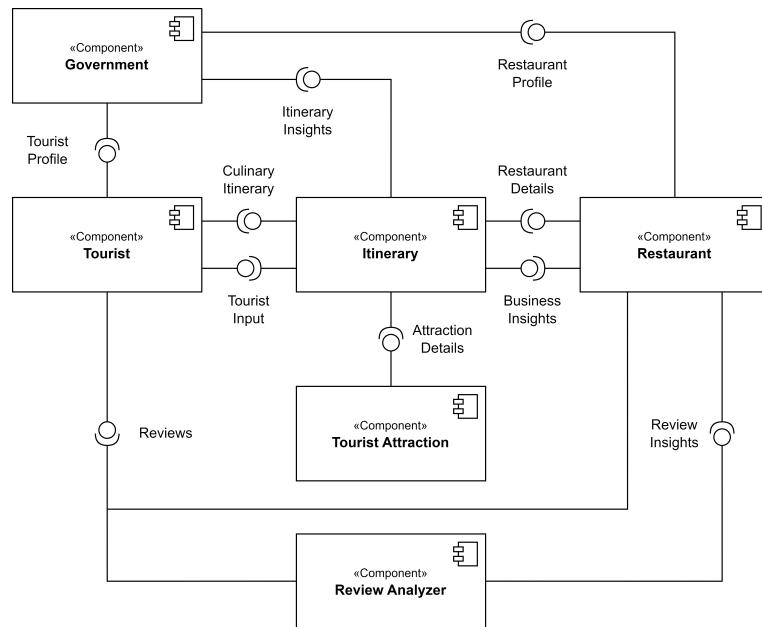


Figure 2: The component diagram which depicts the relations between Rasa Malang’s components.

## 4. Use Cases

As depicted in Figure 3, Rasa Malang is intended to be used by three actors, namely tourists, restaurant owners, and the government. Each of them is provided with different features and capabilities. This section details each of the use cases down to the description, assumption, and prototype constraints for each user group. Although some use cases are very self-explanatory and simple, some of them must be broken down so that their specifications can be clearly explained.

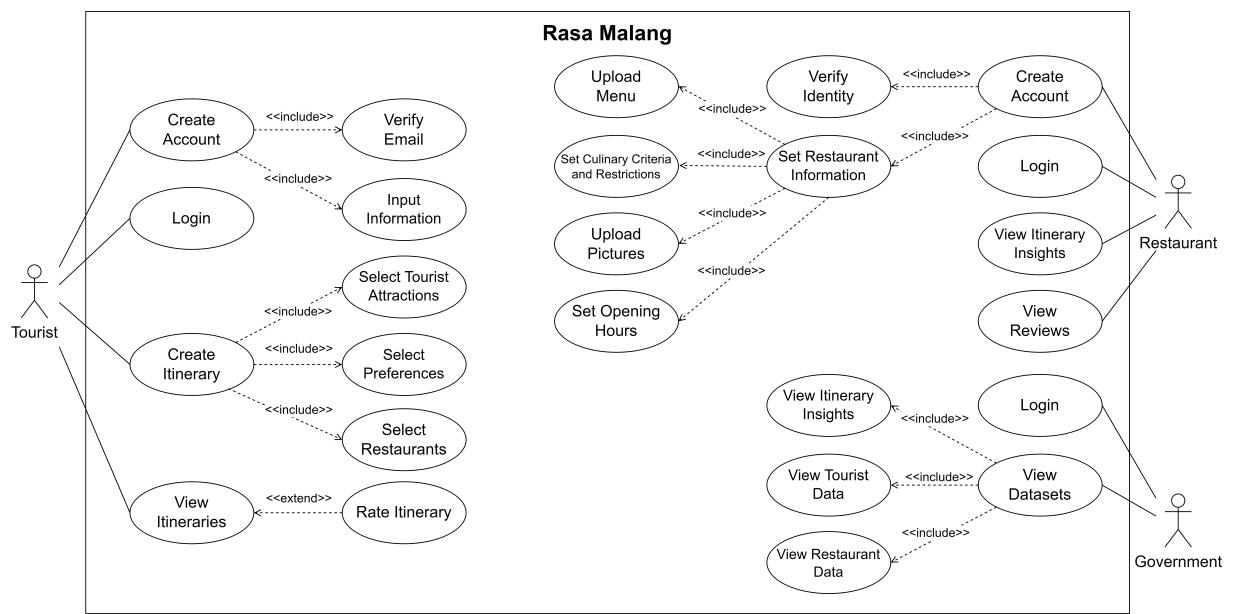


Figure 3: Use case diagram of Rasa Malang.

## 4.1 Tourist Use Cases

Table 1: Tourist Use Case (Create Account)

Use Case	Create Account
Description	<ul style="list-style-type: none"> <li>Tourists should be able to create a new account using their email address. A verification email is sent to the provided user email address, containing a 4-digit code which the tourist has to input in the application interface. Upon successful comparison, the system activates the account, granting the tourist access to the website.</li> <li>After verification, tourists must input their dietary restrictions, which may include preferences such as vegetarian, vegan, halal, pork-free, kosher, and allergies. These preferences are factored into the customized recommendation algorithm when generating the itinerary, ensuring that restaurant suggestions align with the tourist's dietary needs and restrictions.</li> <li>Tourists are required to input the demographic information that they wish to disclose to the application.</li> </ul>
Assumption	A tourist must have an existing account.
Prototype Constraints	Tourists will not be able to modify their dietary restrictions in their account settings. Additionally, third-party identity providers will not be supported.

Table 2: Tourist Use Case (Login)

<b>Use Case</b>	<b>Login</b>
Description	Tourists can gain access to the website by logging in with their registered email address and password.
Assumption	Tourists are assumed to have already created an account.
Prototype Constraints	-

Table 3: Tourist Create Itinerary Sub Use Case (Select Tourist Attraction)

<b>Sub Use Case</b>	<b>Select Tourist Attraction</b>
Description	Tourists are prompted to create a travel itinerary based on their desired tourist attractions available on the application. The tourist selects the date of the trip and the order in which they wish to visit the attractions.
Assumption	Before using the application, tourists are expected to have prior knowledge of the attractions they intend to visit. The application will only provide the name of the attraction and the geographic location. Any additional description of the tourist spot will not be included.
Prototype Constraints	Tourists will have to select from different tourist attractions. Furthermore, during the itinerary creation process, they will be restricted to choosing a maximum of three tourist attractions.

Table 4: Tourist Create Itinerary Sub Use Case (Select Food Preferences)

<b>Sub Use Case</b>	<b>Select Food Preferences</b>
Description	Tourists are prompted to input their food preferences for the day. These preferences include details of their preferred cuisine type, price range, and the type of establishment they are seeking.
Assumption	Tourists are assumed to possess prior knowledge of the available cuisine types in Malang. They may, however, view the information that the restaurant administrators provide in their profiles for additional details.
Prototype Constraints	Tourists have a limited range of selection for the preferences. Tourists cannot have multiple selections for the two aforementioned preferences.

Table 5: Tourist Create Itinerary Sub Use Case (Select Restaurants)

<b>Sub Use Case</b>	<b>Select Restaurants</b>
Description	Restaurant suggestions for each tourist attraction generated by the customized recommendation algorithm are presented to the tourists. Each recommendation includes a descriptive overview, featuring details such as the distance from the tourist attraction, menu options, and price range. Tourists have the option to choose a restaurant that best suits their preferences at each destination. Furthermore, tourists are not required to select a restaurant at every tourist attraction. For instance, a user might intend to dine three times during a day trip encompassing five tourist attractions. Tourists can review the finalized itinerary on a descriptive map that displays the geographic locations of the selected restaurants.
Assumption	Tourists finalize their preferred restaurants in one session.
Prototype Constraints	Tourists have a limited range of selection for the preferences. Tourists cannot have multiple selections for the two aforementioned preferences.

Table 6: Tourist Use Case (View Itineraries)

<b>Use Case</b>	<b>View Itineraries</b>
Description	Tourists can access and review their past, ongoing, and future itineraries.
Assumption	-
Prototype Constraints	-

Table 7: Tourist Use Case (Rate Itineraries)

<b>Use Case</b>	<b>Rate Itineraries</b>
Description	Tourists may rate past itineraries using a one to five-star rating system. Tourists may also choose to leave comments and rate the restaurants they visited.
Assumption	Tourists have successfully concluded their itinerary and visited the recommended restaurants in Malang.
Prototype Constraints	-

## 4.2 Local Restaurant Use Cases

Table 8: Restaurant Use Case (Create Account)

Use Case	Create Account
Description	<ul style="list-style-type: none"> <li>• Restaurant administrators should be able to create a new account using their email address. The government should provide a means of verification to ensure that the restaurant exists. Upon successful comparison, the system activates the account, granting the user access to the website.</li> <li>• After verification, the restaurant administrators must input their eatery information. Menu, culinary criteria and restrictions, photos of their establishment and food, and opening hours should be uploaded to their profile so that tourists can view this information on the restaurant profile. These categories are factored into the customized recommendation algorithm when generating the itinerary, ensuring that restaurant suggestions align with the tourist's dietary needs and restrictions.</li> </ul>
Assumption	The restaurant administrator has to have an existing account.
Prototype Constraints	Within the scope of this prototype, there will not be a method to verify the authenticity of the restaurant administrators. They will also not be able to modify their restaurant information in their account settings.

Table 9: Restaurant Use Case (Login)

<b>Use Case</b>	<b>Login</b>
Description	Restaurant administrators can gain access to the website by logging in with their registered email address and password.
Assumption	Restaurant administrators are assumed to have already created an account.
Prototype Constraints	-

Table 10: Restaurant Use Case (View Itinerary Insights)

<b>Use Case</b>	<b>View Itinerary Insights</b>
Description	Restaurant administrators have the capability to track the frequency with which their establishment is recommended in the itinerary database.
Assumption	Tourists have created itineraries.
Prototype Constraints	-

Table 11: Restaurant Use Case (View Reviews and Ratings)

<b>Use Case</b>	<b>View Reviews and Ratings</b>
Description	Restaurant administrators are capable of viewing the reviews and ratings that tourists leave after dining at their establishment.
Assumption	Tourists have already left reviews and ratings.
Prototype Constraints	-

### 4.3 Government Use Cases

Table 12: Government Use Case (Login)

Use Case	Login
Description	The government administrator can gain access to the website by logging in with their registered email address and password.
Assumption	The administrator from the government side should already have created an account.
Prototype Constraints	-

Table 13: Government Use Case (View Datasets)

Use Case	View Datasets
Description	<ul style="list-style-type: none"><li>• The government administrator has the capability to determine the most popular tourist attractions by analyzing their frequency of appearance in the itineraries. Similarly, the government can also track the number of times each restaurant is recommended in the itineraries.</li><li>• The government administrator is granted access to the database of tourist profiles that contain certain demographic information that the government can use to analyze tourism in Malang City.</li><li>• The government administrator may view the data that the restaurant administrators have provided in the restaurant profiles.</li></ul>
Assumption	The datasets exist in the database.
Prototype Constraints	Most of the data used are derived online. Real restaurant data are limited. Tourist data are made using a script.

## 5. Proposed Database Schema

Based on the system description in the aforementioned sections, a database schema capable of accommodating the information provided by the users needs to be adopted. The proposed database schema is illustrated in Figure 4, where the type of each element in the entity tables has been defined.

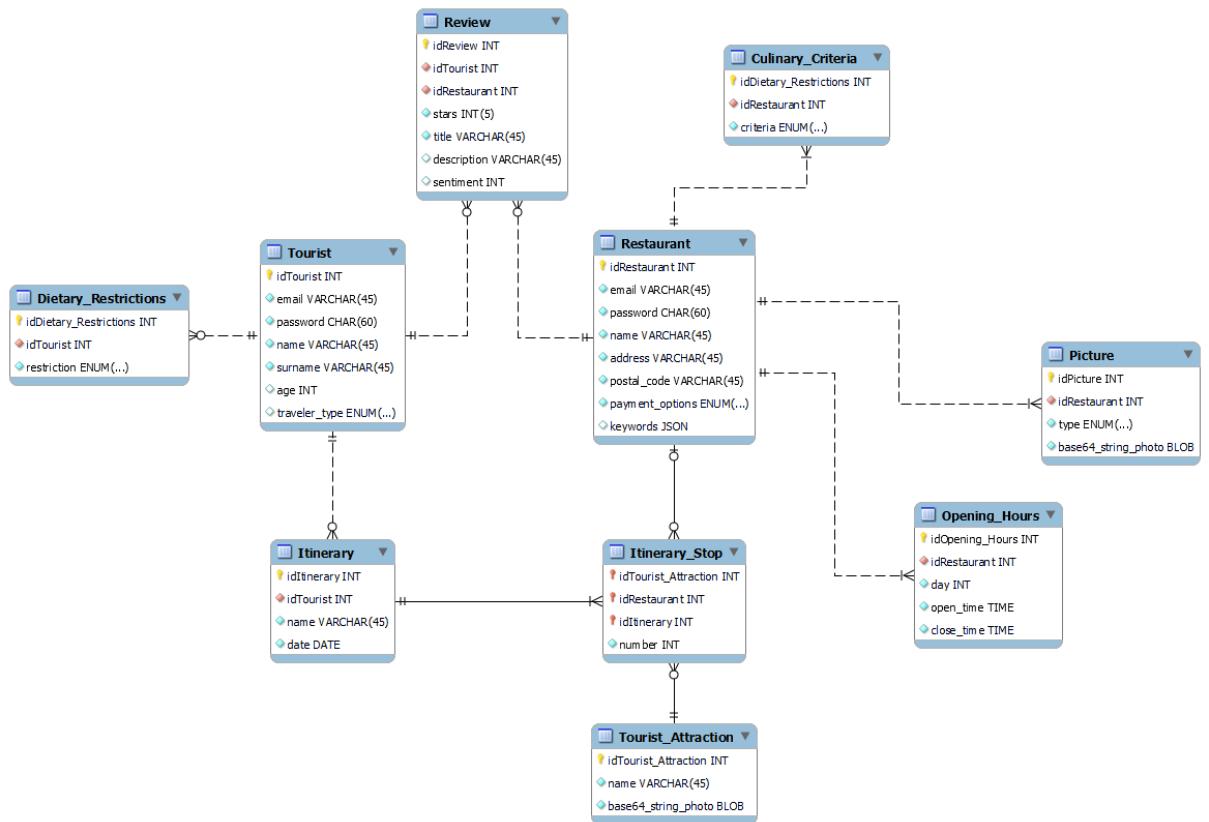


Figure 4: Database schema of the Rasa Malang system.

Restaurant entities should contain basic information, as depicted in Figure 4. Culinary criteria should include the dietary restrictions associated with a particular restaurant. Additionally, restaurants have pictures and opening hours connected to their profiles. As for the tourist entities, their demographic information and

dietary restrictions are stored, as shown in Figure 4. Furthermore, their itineraries are stored in the database. Each itinerary includes specific tourist attractions and desired restaurants. Tourists can also leave reviews containing ratings and descriptions, which will later be used in the review analyzer. These review entities are each associated with a particular tourist and a specific restaurant.

# 6. Prototype User Interface

For the prototype, the user interface has been designed in a simplistic manner to provide the most comfortable user experience. In Rasa Malang, there are three user groups: tourists, restaurants, and the Malang City government. The images in this section are taken from the Rasa Malang project prototype, and due to time constraints, only the most crucial steps are shown. The data used in the prototype was either gathered online, obtained by visiting the establishments, or artificially generated. Overall, the prototype successfully served as the proof of concept for Rasa Malang.

## 6.1 Tourists

For the tourist user group, the registration pages include specifying dietary restrictions and entering personal information, as depicted in Figure 5. Tourists should initially input their dietary restrictions from the provided list, which currently includes options like vegetarian, vegan, kosher, pork-free, poultry, gluten-free, and halal. In the future, additional restrictions such as allergies and culture-related limitations will be included. Following this, tourists are required to enter their first name and surname. Demographic information, including age range, nationality, and gender, should also be provided. Additionally, tourists are required to specify their traveler type or purpose of visitation, which can be business, family, or student.

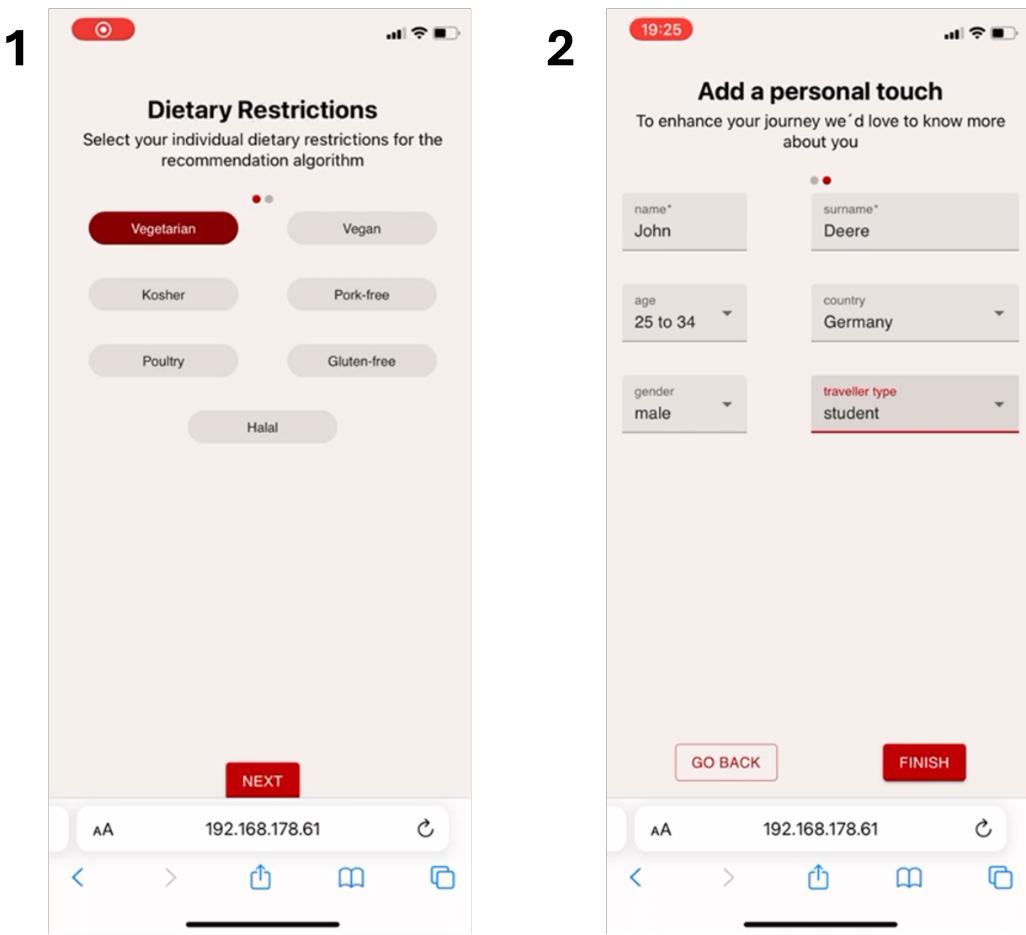


Figure 5: Tourist registration steps as designed in the prototype.

After successful registration, tourists can create their own culinary itinerary by following the steps outlined in Figure 6. Initially, they need to select their desired tourist attractions. Subsequently, they can name their itinerary, specify the date, choose the type of establishments they wish to visit, and select a particular cuisine they want to experience. The application will then generate a list of dining options, prioritizing those that align with the tourist's dietary restrictions while accommodating their preferences as much as possible, recognizing that preferences may not always be fully met.

The application displays restaurant profiles, allowing tourists to review photos,

ratings, reviews, essential keywords, the number of positive reviews, and opening hours. After ensuring that the recommended restaurant meets the tourist's criteria, it can be saved into the itinerary. Upon completing their itinerary, tourists can view a detailed overview, including a map of the tourist attraction and the selected restaurant, along with the estimated walking distance in minutes. The optimal way to display the itinerary has yet to be determined. Tourists should also be capable of accessing past itineraries and rate the restaurants they have visited through that feature. However, in the prototype, that feature is yet to be developed.

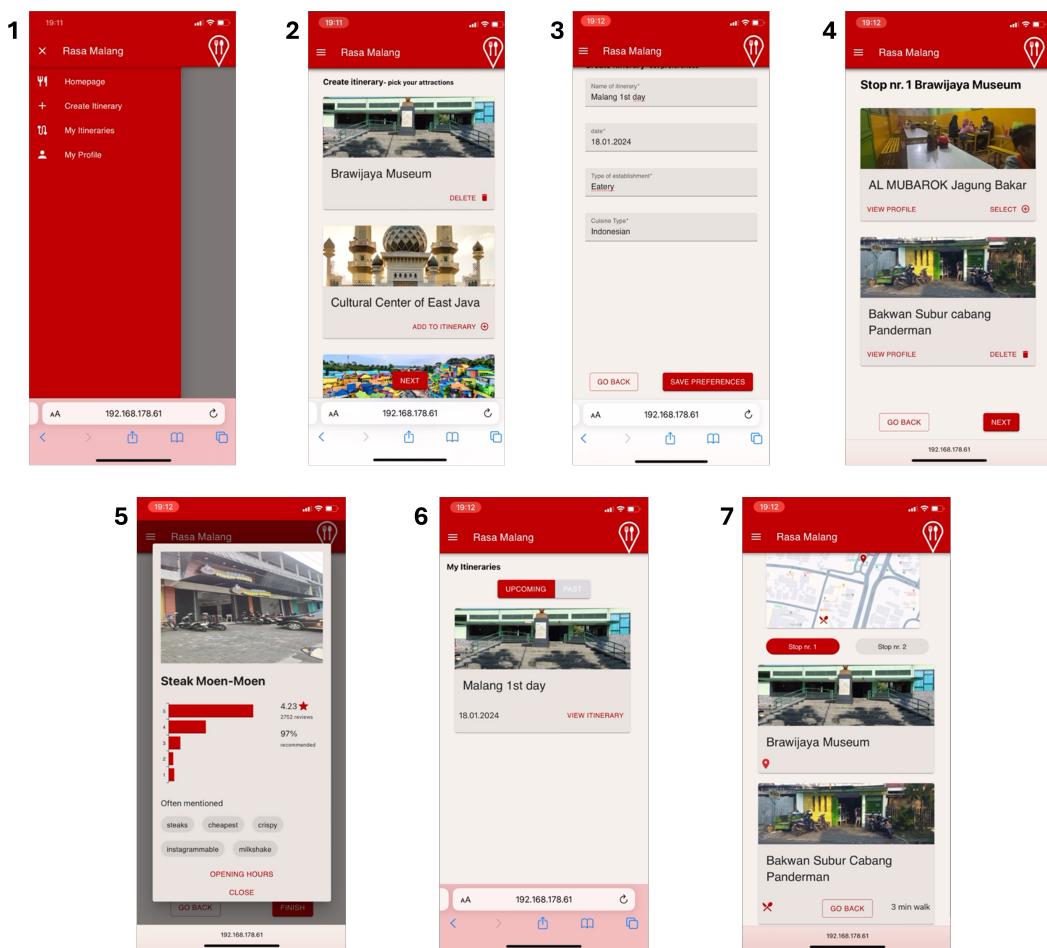


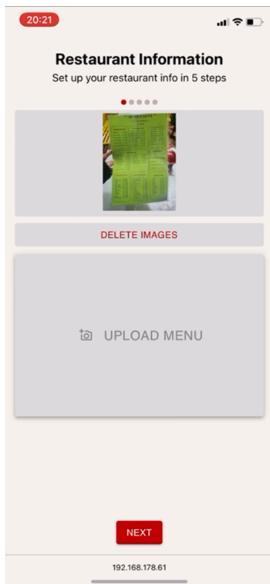
Figure 6: Tourist creating itinerary steps as designed in the prototype.

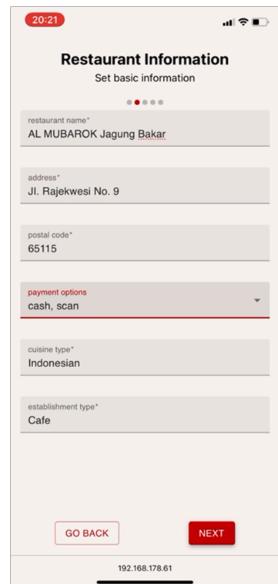
## 6.2 Restaurants

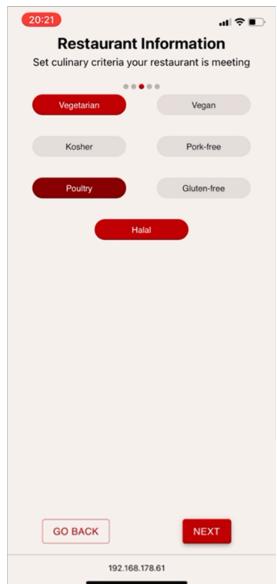
The registration process for restaurants differs from that of tourists. In this prototype, authentication is not required. However, in the event of a full application launch, the government must have a method to verify the existence of restaurants and ensure their authenticity.

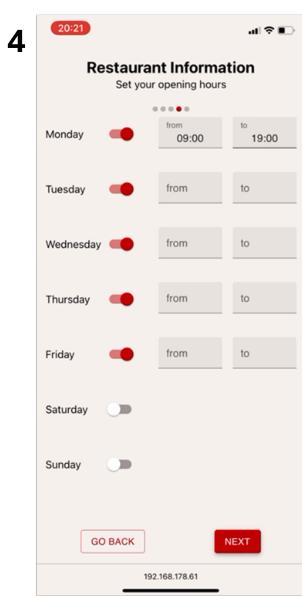
The restaurant administrator initiates the process by uploading the restaurant's menu. Additionally, they need to complete the blank spaces with the name and address of the establishment, list available payment options, determine the type of food they sell, categorize their establishment type, specify dietary restrictions, set opening hours, and upload photos of the establishment. The options for dietary restrictions are not yet complete and should be expanded over time.

After this setup, the admin can delve into the details of the reviews left by tourists, observing important keywords and sentiments associated with the reviews. Furthermore, they can gain insights, such as how many times their establishment is recommended and how frequently tourists choose their venue.

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Figure 7: Restaurant registration stages as designed in the prototype.

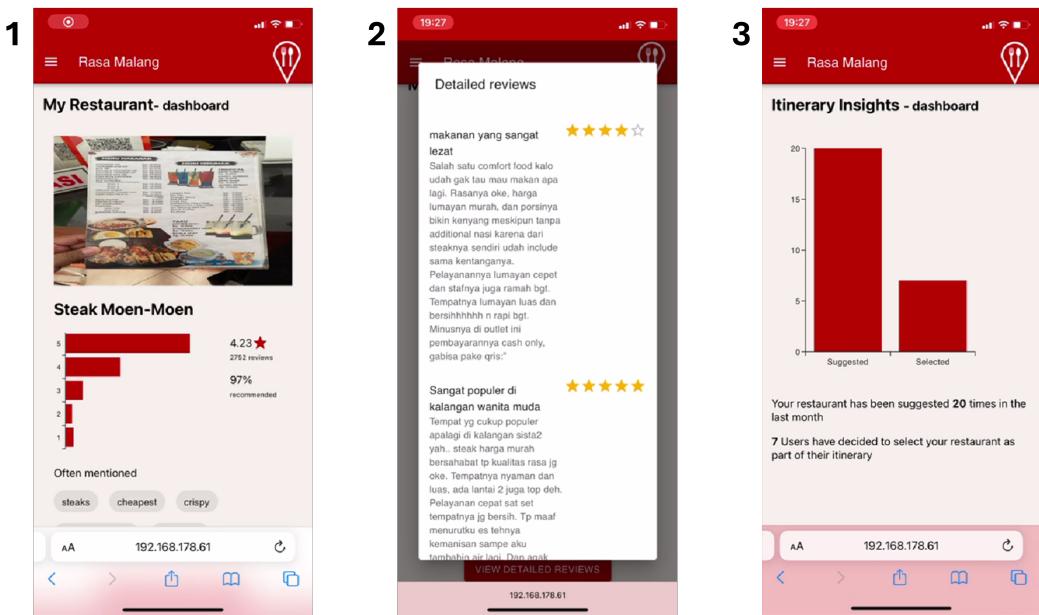


Figure 8: Restaurant administrators can view reviews intended to their establishment.

## 6.3 Government

The government of Malang City acts as the overseer and super administrator, granting them access to all information in Rasa Malang's database. They have the option to view the data and gain insights using third-party Business Intelligence tools. Figure 9 illustrates the options available to the government for viewing the demographic information of tourists. Similarly, Figure 10 includes several graphs, encompassing simple demographic restaurant information to a heat map of restaurant distribution across Malang City. Concerning tourist attractions, the spot administrator can observe the demographic information of the visitors, as depicted in some of the graphs in Figure 11. This data-driven approach aids in making informed decisions regarding business and improving the tourism sector of the city. Lastly, the government administrator may also derive valuable insights based on the itineraries of tourists, as shown in Figure 12.

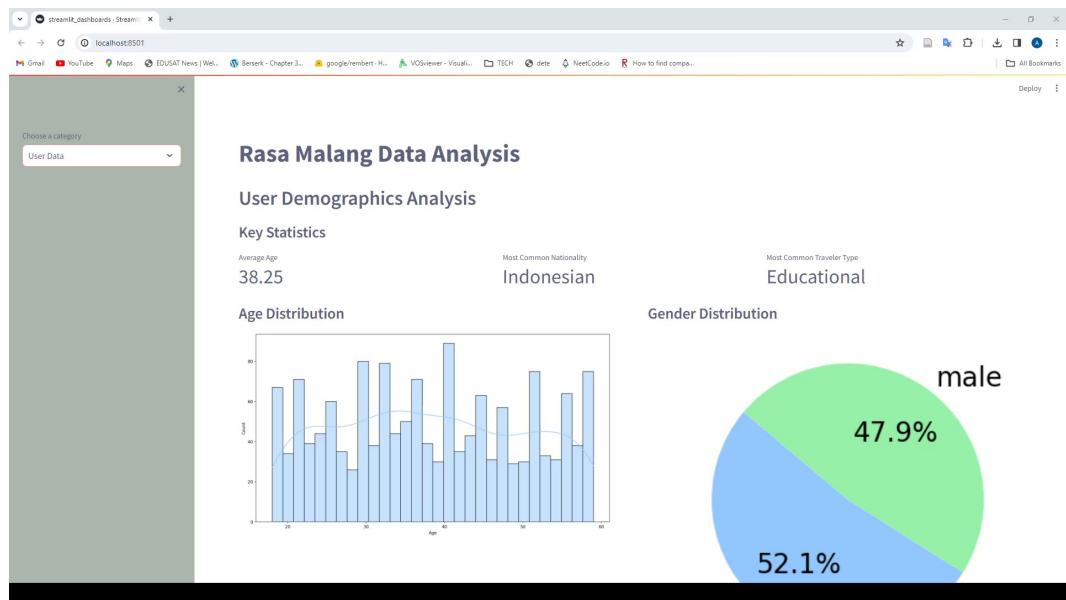


Figure 9: Government dashboard for tourist data.

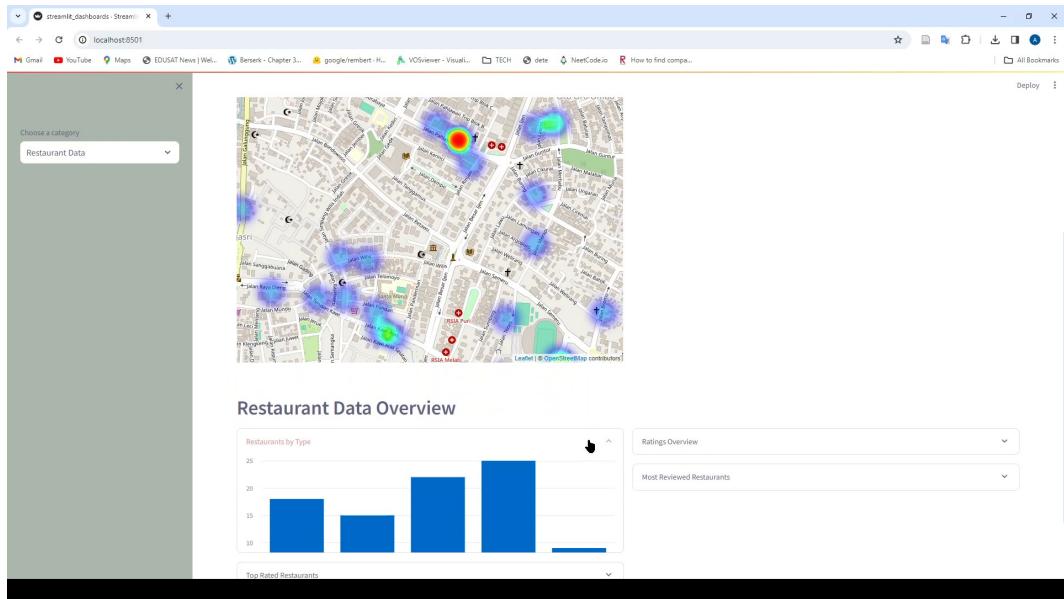


Figure 10: Government dashboard for restaurant data.

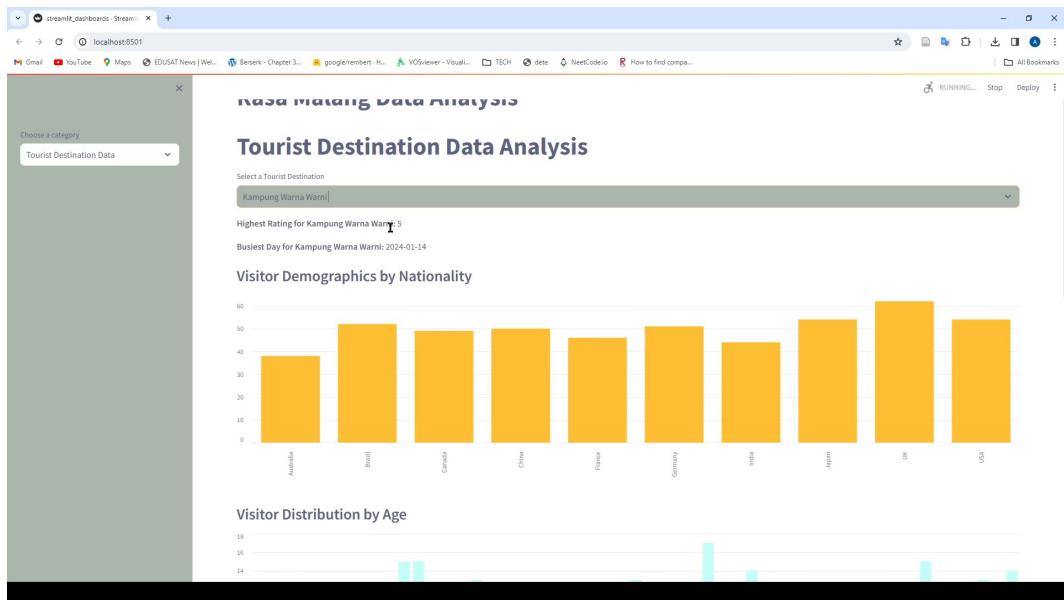


Figure 11: Government dashboard for tourism spot data.

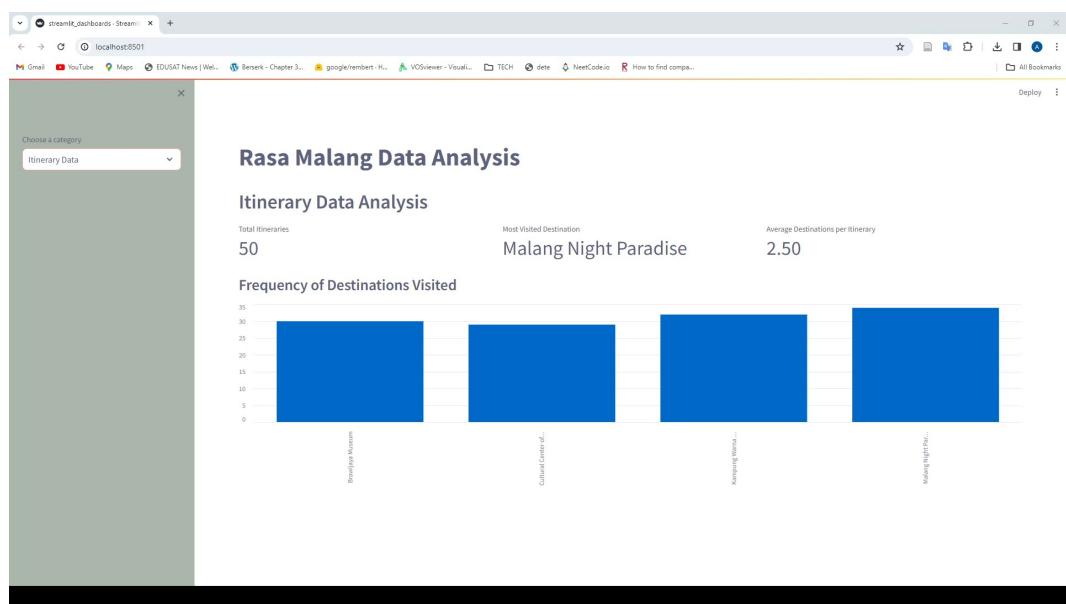


Figure 12: Government dashboard for tourist itinerary data.

## 7. Conclusions

In conclusion, the challenges faced by Malang City in the realm of tourism are multifaceted, ranging from insufficient exposure and the absence of tourism data collection infrastructure to the limited discoverability of local restaurants. To address these issues and unlock the full potential of Malang City as a tourist destination, an innovative information technology solution is imperative, hence the development of Rasa Malang.

Rasa Malang aims to create a comprehensive web application as a solution for tourists, providing detailed information about the city's hidden gems and enhancing their discoverability. The project also seeks to improve the visibility of local restaurants, especially those belonging to Micro, Small, and Medium Enterprises. The current prototype serves as a proof of concept, demonstrating that the Rasa Malang system is adoptable in real-world scenarios. However, for Rasa Malang to be a complete system, further development is required.

Through the integration of a restaurant recommendation feature, tourists will have the opportunity to explore and enjoy the diverse culinary offerings of Malang City. Additionally, implementing a robust tourism data collection infrastructure will enable the city government to make informed decisions for the growth of the tourism sector by providing insights into visitor trends and preferences.

While this project strives to contribute significantly to the prosperity of Malang City's tourism industry from an information technology perspective, it is essential to note that the prototype can only serve as a proof of concept, given the limited amount of real restaurant data available.