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Location-Based Service with Interactive Mapping in Food Feed Mobile App (FeatiGo)

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ABSTRACT

Food serves as a cornerstone of human life, connecting sustenance with exploring diverse culinary experiences. With the increasing number of individuals embarking on gastronomic adventures, the demand for accessible and customized food information becomes paramount. Existing mobile applications offer a range of functionalities, primarily focused on posting food information, searching for eateries, filtering options and providing eatery details, frequently facilitated by location-based services. However, there remains a gap in the market for a comprehensive platform that consolidates these features with an interactive map in one mobile app, requiring users to navigate between multiple applications. The study tackles the issue of sifting through vast online food data by developing the FeatiGo mobile app, which uses location-based services and interactive mapping to provide a unified platform for effortless dining discovery. User testing encompassed functionality and instrumental testing alongside usability evaluation, yielding positive results and feedback on usability with a mean satisfaction score of 90.72%. Our app has proven to provide tailored food information, enriching culinary experiences by leveraging location in the digital mobile era.

1. Introduction

1.1 Background

Food plays a central role in people's lives, serving as both a necessity and a means to explore local culinary offerings. In the post-pandemic era, a culinary revolution is underway as more people venture out to dine or explore gastronomic wonders beyond their homes. For avid food lovers, the allure lies in the adventure of discovering local flavours, whether through food tourism or local culinary expeditions. Liu *et al.,* [1] discovered that 89.9% of respondents engage in online searches for food pictures on Flickr, primarily motivated by the desire for enjoyment (83.1%), exploration of

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new foods (62.7%) and discovery of different restaurants (32.4%). This interest in culinary exploration resonates with the concept of food tourism, defined by the World Food Travel Association [2] as "the act of traveling for a taste of place in order to get a sense of place," a journey to immerse oneself in the heart and soul of a destination through its cuisine.

However, amidst the excitement, challenges arise during local culinary expeditions as choices overwhelm and the quest for the perfect meal morphs into a tantalizing puzzle to solve. Consumers depend on a multitude of information sources to alleviate uncertainty when making decisions about trying new foods, dining experiences or selecting restaurants. However, despite the wealth of information available on the internet about local cuisine, it often provides only generic results [3], leaving users unable to find tailored details for individual queries, such as specific dishes offered, budget-friendly options or specialty dishes in a particular location. Conventional methods of providing food information need to be more effective for consumers due to their associated high search costs, often hindering their capacity to accurately identify the information necessary for making informed food-related choices [4,5]. Anderson *et al.,* [6] also uncovered that social networks significantly shape restaurant choices by providing influential information.

With the gradual increase in the number of mobile phone and tablet users, there has been a proportional rise in the number of mobile app downloads. The growth trend observed between 2016 and 2022 worldwide reached approximately 257 billion in 2023 [7]. Mobile apps serve as an effective tool to encourage and support users in gaining knowledge and learning [8]. Research indicates that mobile applications are pivotal in the food industry. Notably, food and drink apps ranked sixth among the most popular Apple app categories as of the 3rd quarter of 2022 [9]. Most of these apps enable catering to users' requirements through location-based services and tailored features. The increasing prevalence of smartphones has led to the growing importance of mobile and location-based search, prompting information retrieval systems to meet the distinctive requirements of mobile users and to adjust in order to offer location-specific results by taking into account factors like proximity, local recommendations and geolocation data for personalized search outcomes [10].

Localization attribute was recognized as one of the significant factors in the selection of food services [11,12]. As location determines customer access to specific products or services, it remains integral to customers' decision-making processes and is vital for the success of restaurant operations [13]. The study by Oostenbach *et al.,* [14] offers supportive evidence that individuals living in 20-minute neighbourhoods tended to utilize a broader array of food outlets weekly and noted that their regular dining locations were closer to home, potentially suggesting a preference for localized food practices and a higher frequency of dining out at various out-of-home food providers. Fraikue [15] underscores the significance of convenient restaurant locations, particularly in relation to customers' workplaces, as they significantly shape customer choices.

The proliferation of location-aware technology has facilitated the integration of location-based services into online social networks, allowing users to share present locations, rate or review restaurants and upload geotagged content like photos or videos [16,17]. However, many of these platforms primarily focus on providing information based solely on eatery location or offering directions. For enhanced usability, location-based services for eatery locations should be contextually responsive and interactive, adapting information and services based on the user's context, including their location and the surrounding geo-social environment [18]. Moreover, catering to consumers dining out with specific dietary restrictions is crucial, as they are often constrained in their options due to personal limitations, such as insufficient knowledge and a lack of provided information [19,20]. Dietary restrictions present challenges for individuals with diverse dietary needs, including those adhering to halal guidelines, managing food allergies or embracing vegetarian or vegan lifestyles.

1.2 Related Work

Several similar mobile applications related to providing food information or utilizing location services to locate eateries were selected and their features were compared with those of our proposed app, as depicted in comparison Table 1. The table primarily evaluates and compares the features of similar popular mobile applications with the new proposed features of the FeatiGo system, focusing on aspects such as the use of location services or the provision of food information.

The NYAM Android app, developed by Isabela *et al.,* [21], helps users find suitable dining places using GPS, types and categories while allowing them to view restaurant services, ratings, hygiene and comments. Most respondents found the app easy to use and understand and plan to continue using it to find quality restaurants at decent prices. Luhur *et al.,* [22] developed the Foodeal Android app for searching restaurant information, food reviews and promotions, featuring location-based and social networking capabilities. Heuristic evaluation and usability testing suggest the app is generally usable, though some cosmetic issues and the need for additional features were identified. Appleton *et al.,* [23] developed and assessed the FoodSMART mobile app that provides personalized food information based on individual characteristics such as allergies, diet type and preferences. The app was evaluated at events using the System Usability Scale and qualitative feedback, which revealed positive responses and broad interest.

Table 1
Comparison of similar apps with the proposed app

Features	Foodeal	FoodSMART	Nyam	Proposed App (FeatiGo)
Browse nearby eateries using GPS	Yes	Yes	Yes	Yes
Filter eateries using the map	Yes	No	No	Yes
View the eatery's menu	Yes	Yes	Yes	Yes
Manage Food Feeds	No	No	No	Yes
Customize food posts	No	No	No	Yes
Eatery rating system	No	No	Yes	Yes
Dietary restriction info	No	Yes	No	Yes

Drawing from the aforementioned comparative study and insights gleaned from interviews with two eatery owners, our proposed FeatiGo mobile app employs both contextualization, such as Interactive Maps that display nearby eateries and personalization, such as ranking restaurants, providing Menu Info, offering Feed Search Filters and presenting an ephemeral Food Deals Feed. Furthermore, the app aims to foster a community aspect where users can share their culinary experiences and recommendations, creating a supportive network for food enthusiasts.

Existing mobile applications in the food service industry offer a plethora of functionalities, including posting food information, searching for eateries, filtering options and providing eatery details, often integrating location-based services. Despite these offerings, there exists a notable gap in the market for a unified platform that consolidates these diverse features into a single mobile app experience. Currently, users are required to navigate between multiple applications to access different functionalities related to dining discovery. This fragmentation complicates user experience and hinders seamless interaction and information retrieval, thereby presenting a clear opportunity for innovation.

This paper addresses this market gap by proposing FeatiGo, a comprehensive mobile app solution to streamline the dining discovery process. FeatiGo integrates key features such as interactive mapping, customized eatery markers and robust location services into a cohesive platform. By centralizing functionalities that include posting food feeds and accessing detailed eatery information through an intuitive map interface, FeatiGo enhances user convenience and engagement.

Additionally, the app empowers eatery owners with tools to manage their business information on the platform's map while revolutionizing how users explore and engage with food establishments through a seamless, informative and integrated experience within a single mobile application.

The contribution of our research includes the development of a mobile app that transforms how users explore eateries, utilizing geospatial functionalities to enrich culinary discovery. Furthermore, it extends to the practical application of Geographic Information Systems [24], employing precise location mapping, marker placement and intuitive eatery filtering to enhance user experience and efficiency in finding dining options. Additionally, our research fosters a vibrant food feed community for food lovers, offering a platform to share culinary experiences, recipes and recommendations.

2. Methodology

The methodology employed in this project follows an Agile approach [25,26], emphasizing iterative development and continuous feedback to enhance mobile application features, which comprise the following stages:

i. Problem Analysis entails scrutinizing existing mobile applications for food eatery discovery to identify limitations and shortcomings. Need analysis is conducted by observing existing research subjects and interviewing prospective clients to gather data on the necessity of building the application, thereby determining its system requirements and functions.
ii. A technical feasibility study assesses the viability of implementing a project by evaluating its technical aspects, such as infrastructure, resources and technology requirements.
iii. Design and Development crafts both the user-facing mobile application and the administrative website while concurrently employing Test-Driven Development practices.
iv. The testing stage assesses the usability and effectiveness of the app through user testing and heuristic evaluation. Iterative Refinement involves gathering insights from users to refine the app's features.

2.1 System Design and Development

The use case diagram in Figure 1 showcases the interactions between the FeatiGo system and its three primary actors: admin, user and eatery owner. Admin functionalities encompass user management and post management, while eatery owners can manage eatery details displayed on the map marker. Users, meanwhile, can engage in actions such as searching for eateries, creating customized food posts, filtering posts, searching for nearby eateries and setting filters.

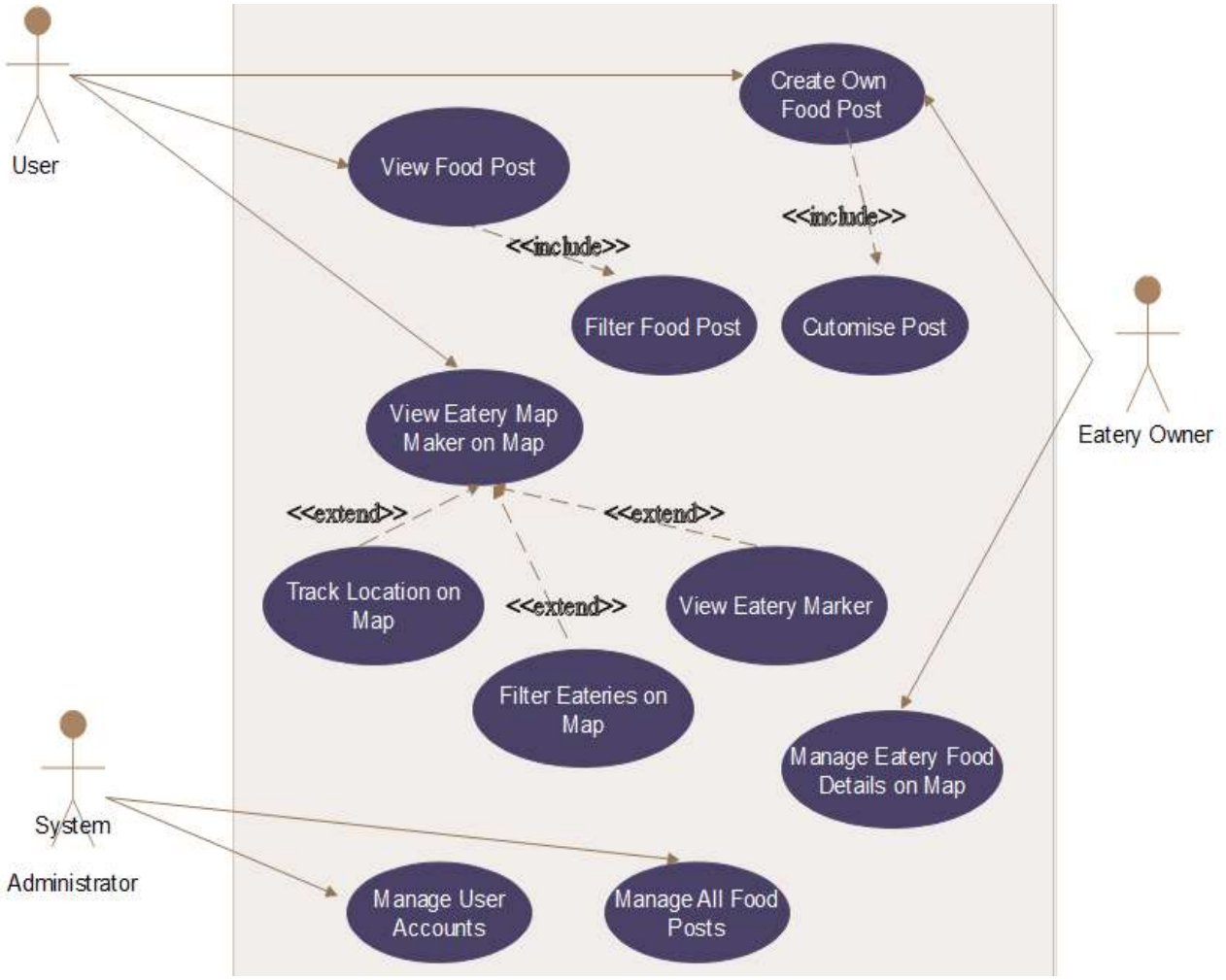

Fig. 1. Use case diagram for FeatiGo system

The FeatiGo System Architecture, depicted in Figure 2, encompasses a frontend mobile application developed with React Native for seamless mobile access. In contrast, a web application built with React.js serves administrative purposes, offering an intuitive browser-accessible interface. The backend infrastructure, powered by PHP Laravel, serves as the intermediary between the frontend and the database, facilitating data retrieval and manipulation. Communication between the frontend and backend is facilitated through APIs. Additionally, the system utilizes both file storage and a MySQL database to manage and store user and administrative data efficiently.

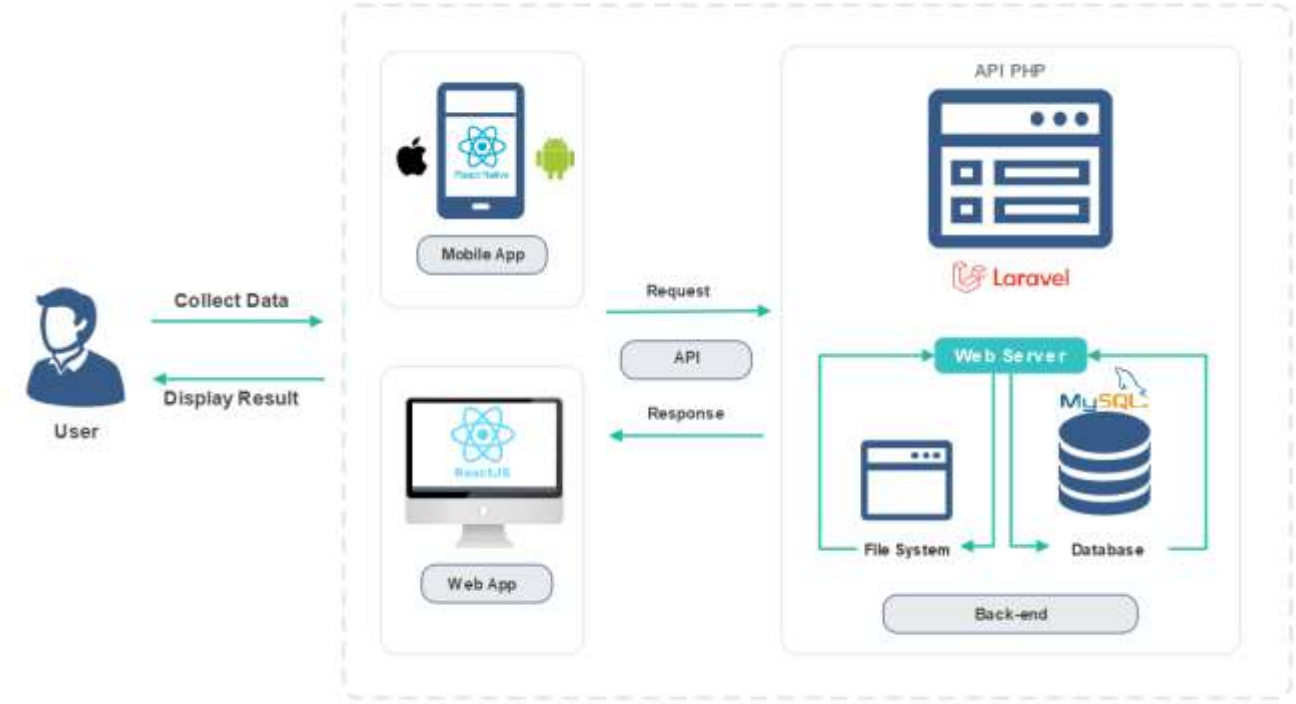

Fig. 2. FeatiGo system architecture

The enhancement of map functionality involves creating an interactive map that customizes eatery location markers, enabling users to access comprehensive details about each eatery, refine their search criteria and provide a tailored and engaging experience. As illustrated in Figure 3 on the mobile app for Eatery Marker, official details and menu items complete with photos, descriptions and prices; the app also includes a Search Filter on the Map feature to narrow down options by eatery type, food type, cuisine and set radius distance for map searches. The Map features two modes: a "view all" mode displaying all active food options and a "wishlist" mode showcasing only items added to the user's wishlist, including food deals such as discounts or free giveaways.

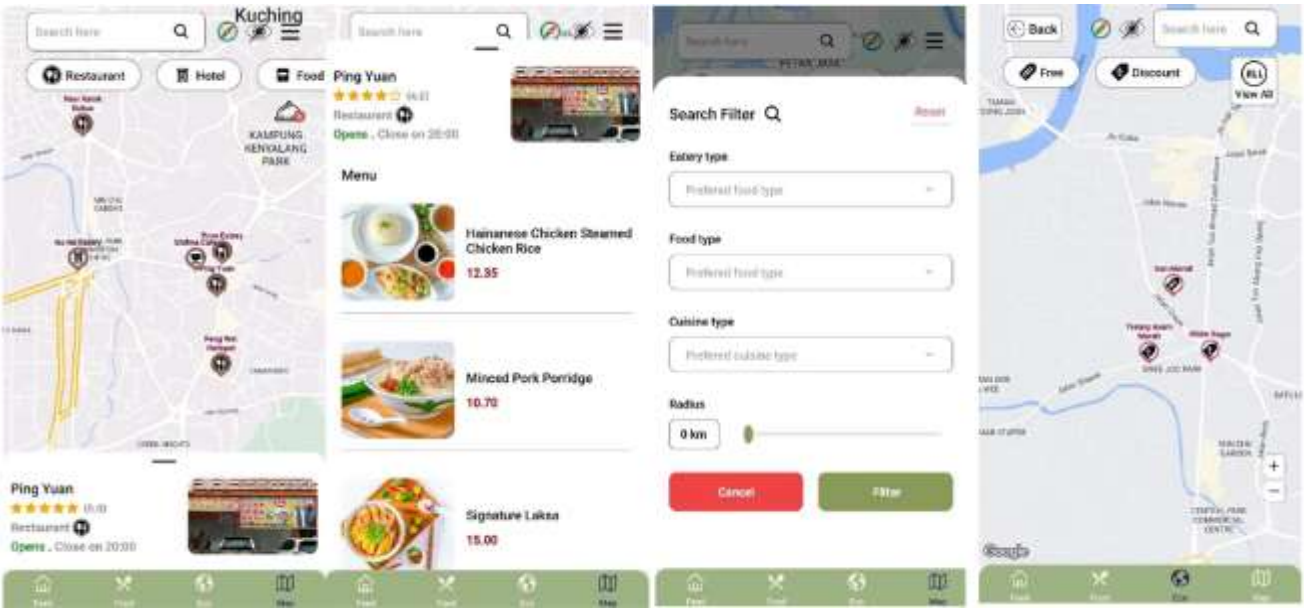

Fig. 3. Eatery marker, eatery details, search filter and food deal mode on map

The FeatiGo app showcases a user-friendly interface, as illustrated in Figure 4, with functions tailored to enrich users' culinary exploration. Food Feed offers a dynamic stream of food-related content, allowing users to explore diverse cuisines and discover new eateries. Through Food Post, users can share their culinary adventures by uploading images and descriptions of their favourite dishes. The Search Filter on Feed feature enables personalized exploration by allowing users to filter posts based on specific criteria such as cuisine type or location. Additionally, the Food Deals function notifies users of special offers and free food posts from eateries, available for a limited time.

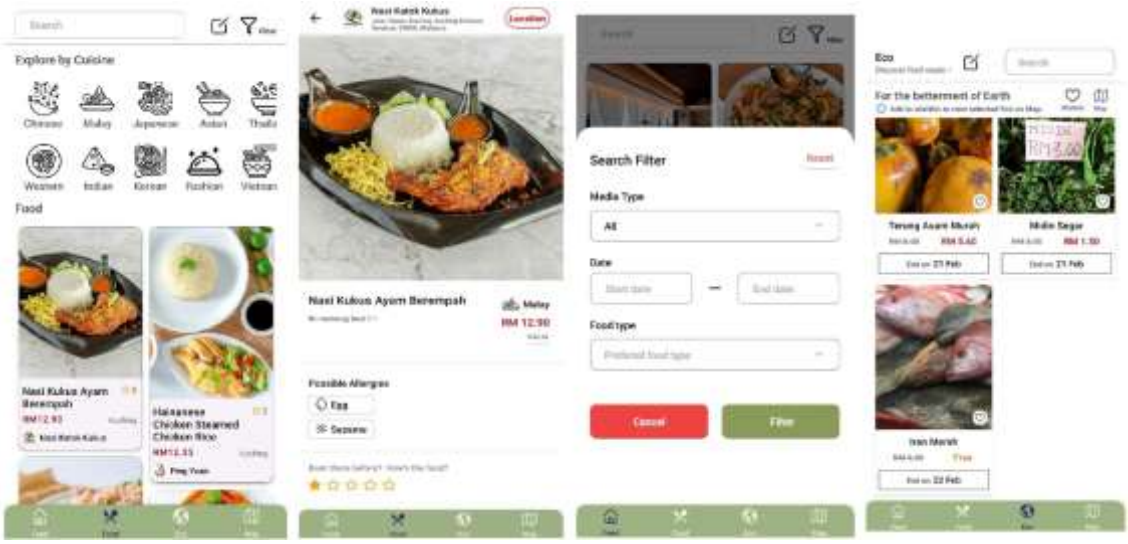

Fig. 4. Food feed, food post, search filter on feed and food deals feed

3. Testing and Results

User testing and evaluation in this study encompassed functionality and instrumental testing, which were conducted concurrently, as well as usability testing. Two technical testers conducted functionality and instrumented testing. Functionality testing was conducted using black box testing techniques according to the use case diagram and based on use case scenarios to identify any deviations or errors in system behaviour and validate the system's functionality. Instrumented testing was conducted in both physical and emulated environments under controlled conditions to evaluate the app's performance and compatibility across various device configurations. Three different physical device models were tested alongside two emulators. However, testing on iPhone devices has yet to be conducted. The results showed that 97% of all functionality tests passed without encountering any major defects. Only minor bugs were identified, including slight layout issues and inconsistent behaviour in certain edge cases on specific devices. Although no significant performance issues were found in the Android Monitor, minor responsiveness issues were detected on a specific physical device, which might be attributed to compatibility issues.

The usability guideline evaluation presented below has been meticulously crafted through a process of usability testing [27], as depicted in Table 2. This evaluation draws upon selectively chosen principles from [28-32]. These guidelines were curated by two seasoned lecturers proficient in Human-Computer Interaction and tailored with slight modifications to suit mobile app testing requirements to ensure that the development adheres to ISO 9241-11:2018 standards [33], which assess usability through effectiveness, efficiency and satisfaction.

Table 2
Usability testing evaluation

Usability	Evaluation Description
Effectiveness	
Consistency	Maintaining consistent design elements, navigation patterns and interaction behaviours ensures uniformity in the user interface and experience throughout the application, providing users with a cohesive and intuitive experience across all screens. Standardize location-related icons, terminology and interaction patterns.
Efficiency	
Reduce Short-term Memory Load	Users can easily navigate and interact with the app without the burden of memorizing complex commands or sequences.
Design for Varied Mobile Devices	Tailored layouts enable seamless adaptation to various screen sizes while incorporating progressive disclosure of information presents content gradually.
Error Prevention and Handling	Implement measures to prevent errors and ensure user-friendly error handling processes are in place.
Aesthetic and Minimalist Design	The app features a clean, visually appealing interface with minimal clutter, appropriate colour usage and intuitive navigation. Design location service interfaces to be clean and uncluttered.
Satisfaction	
Design for Dynamic Contexts	Create adaptable user interfaces and location service to accommodate diverse user preferences, including filter options and location context, allowing users to customize their experience and seamlessly transition between various contexts.
Design for Limited Attention	Incorporate concise and customizable post displays with filtering options to optimize user engagement amidst limited screen space.
Design for Speed and Recovery	Ensure swift start up times, enabling users to access the app promptly. Additionally, effective management of the app's lifecycle, including handling screen transitions such as start, pause, resume and stop, contributes to a seamless user experience.
User Control and Freedom	Provide options for users to customize settings, personalize their experience and filter content according to their preferences.
Visibility of System Status	Ensure that users promptly receive updates on the system's current status through visible tags, labels, status messages or icons. Provides timely updates to the user about the location status of nearby eateries and accurately filters them. The eatery's marker is clearly visible on the map, facilitating easy identification.
Help and Documentation	At present, the app lacks built-in contextual help or tutorials. However, it does offer an external user manual designed to provide guidance on using the app's features and functionalities.

Additionally, there was a general user experience evaluation conducted by eight evaluators, who are also prospective users, with the summary rating results shown in Figure 5. Overall, as depicted in Figure 5, the ratings suggest that the evaluated system is perceived positively across various usability dimensions, with users generally satisfied with its usability and functionality. The app received an overall average rating of 4.54 out of 5, indicating high satisfaction levels among evaluators, which corresponds to a mean satisfaction score of 90.72%. The overall average rating was derived from ratings based on seven criteria, as shown in Figure 5. Similarly, the admin web interface achieved an average rating of 4.59 out of 5, corresponding to a mean satisfaction score of 91.78%.

In general, the app received positive acceptance, with all agreeing that the app is user-friendly, easy to learn and innovative, expressing their intention to utilize it, especially for solving dine-out choice problems or during food tourism. However, evaluators provided several recommendations for enhancing the app's performance and user experience. These recommendations include implementing dynamic parameter settings for site configuration, adopting a structured grid layout over a staggered one to improve organization, integrating Google reviews directly into the existing

system instead of relying solely on in-app ratings and incorporating a chatting or messaging feature to facilitate real-time communication.

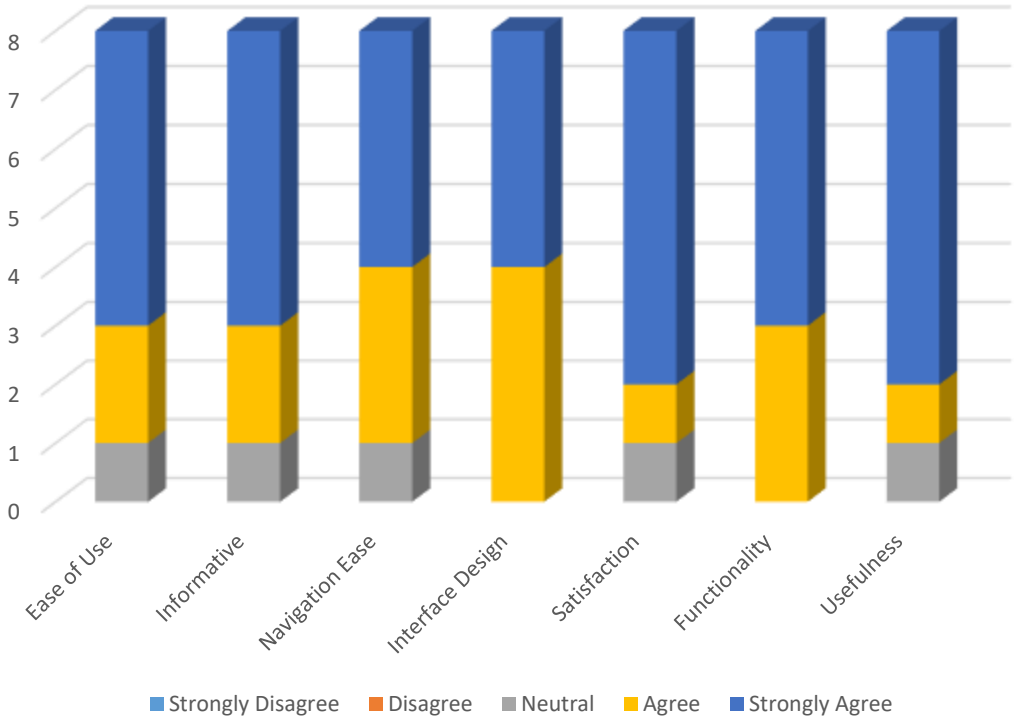

Fig. 5. User ratings for app evaluation

4. Conclusions

Our research presents the FeatiGo mobile app as a comprehensive solution to address the existing gap in the market for a unified platform for dining discovery, enabling users to engage in direct and indirect interactions with eateries and food lovers during their culinary exploration journey. By integrating location services and interactive mapping, FeatiGo offers enriched culinary discovery and fosters a vibrant food feed community, allowing users to discover and share culinary experiences. Despite positive evaluation and testing results, fruitful feedback on issues emerged and recommendations were provided, suggesting the implementation of additional features in the next development phase. Future enhancements include exploring the possibility of incorporating augmented reality features to provide users with immersive experiences when locating food establishments. Moreover, by extending testing to iPhone, alongside Android and utilizing React Native, the app's accessibility can be broadened to reach a broader user base.

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