Usability of SIPAHAJI: an Information and Communication System Innovation to Support Jakarta Smart City

Mochamad Priono [1]*, Unggul Utan Sufandi [2], Gunawan Wiradharma[3], Mario Aditya Prasetyo[4], Khaerul Anam[5]

Communication Study Program, FHISIP Universitas Terbuka, Indonesia[1],[3]
Information System Study Program, FST Universitas Terbuka, Indonesia[2]
Communication Study Program, FHISIP Universitas Terbuka, Indonesia [4]
Primary Teacher Study Program, FKIP Universitas Terbuka, Indonesia[5]

priono@ecampus.ut.ac.id[1], unggul@ecampus.ut.ac.id[2], gunawan.wirdharma@ecampus.ut.ac.id[3], mario.aditya@ui.ac.id[4], khaerul.anam@ecampus.ut.ac.id[5]

Abstract—**This research addresses the problem of insufficient information and communication systems for halal tourism in Jakarta, which affects both tourists and local stakeholders. The study aims to evaluate the Android-based SIPAHAJI application, designed to support the Smart City concept by providing tourists with efficient and effective information about halal tourism destinations in Jakarta. The app employs collaborative filtering and location-based filtering to offer personalized recommendations based on user preferences and location. The methodology includes black box testing to assess the app's functionality and User Acceptance Testing (UAT) to evaluate user satisfaction. Respondents, consisting of experts and public stakeholders with professional experience or education in the tourism industry, were selected through quota sampling. Questionnaires were used for data collection. The results indicate that the application functions effectively, demonstrating excellent usability and high user acceptance. Respondents reported satisfaction with the app's easy-to-use interface, which enhances the overall travel experience. Additionally, the app has the potential to optimize the Smart City concept, helping tourists navigate halal attractions and potentially increasing tourist visits, which could positively impact the local economy in alignment with the Sustainable Development Goals (SDGs).**

Keywords—Tourism Application, Halal Tourism, Smart City, City of Jakarta, User Acceptance Testing.

I. INTRODUCTION

The advancement of information and communication technology (ICT) affects almost every aspect of human life, and is inevitable as a very necessary resource in today's era. The advancement of ICT has the potential to simplify the process of completing tasks, including obtaining information. The smartphone, a product of mobile technology innovation that practically everyone uses, is one illustration of this technological advancement. Recognizing this potential, Jakarta's tourism marketing can use cellphones to communicate and spread information about tourism to the general public.

In the previous stage, research was conducted on the development of the SIPAHAJI application (Jakarta City Halal Tourism Application) which provides information and increases the potential for halal tourism in Jakarta City. This application has the potential to become a local application in the field of tourism, introducing the potential for halal tourism in Jakarta City in a sustainable manner. The content and features of the application can be utilized to provide benefits to visitors regarding tourist attractions in Jakarta. This application is designed to resemble a social media application, allowing tourists to identify suitable and enjoyable tourist destinations.

The results of the previous year's test demonstrated that the recommendation system was tested using the LBF (Location Bases Filtering) method compared to manual calculations and the CF (Certainty Factor) method compared to the output of the WEKA data mining tool. The WEKA data mining software tool, version 3.6.6, is a powerful modeling simulation tool for data mining computations [1]. The results of calculations made by hand (using formulas) were compared with the output of the JMG system in order to evaluate the LBF method. This is done to ensure that the system output can be viewed using basic theoretical calculations, regardless of how adequate it is. By comparing the outputs of the JMG system and WEKA tool using the Hierarchical Cluster approach, the recommendation system is evaluated using the CF technique. Both indicate that the application system may function properly and produce the same output outcomes [2].

Effective communication between users and products or services is surely essential. In addition, the system, product, or service that users will use must be easy to navigate and able to solve and fix problems [3] Therefore, the interface of a product or service that supports excellent usability and user experience will improve the user's experience and interest in the product or service. Usability testing is essential for applications like SIPAHAJI because it helps ensure that the app not only functions properly but also effectively address user problems and improves the overall user experience. By conducting usability testing, developers can identify potential issues that might hinder users from achieving their goals, such as navigation difficulties or unclear instructions. Usability testing measures key factors like efficiency, effectiveness, and satisfaction, which are critical for problem-solving in any system. Usability testing is crucial for ensuring that SIPAHAJI

is user-friendly and effective in solving users' problems, ultimately enhancing their experience and ensuring the app's long-term success in a competitive environment

Usability testing is the process of evaluating a product or service by involving end users to identify problems in use, as well as measure efficiency, effectiveness, and user satisfaction. This test is very important because it provides direct feedback from real users, helps developers understand user needs and expectations, and ensures that the product being developed is fit for purpose and easy to use. Good usability testing can reduce the risk of product failure in the market, increase user adoption, and provide a better user experience [4].

The Android operating system is used to develop mobile tourism applications that provide information to tourists in real time [5]. In developing an effective application, the most important component is its usability. Due to the variety of forms and operating systems of mobile devices, the usability of these devices allows for a variety of interactions with desktop-based environments [6]. In general, systems are rarely tested for usability during their development and implementation. Instead, they are deployed and used directly as the focus remains on meeting the functional and non-functional requirements of users making usability testing a lower priority [7], [8].

In an effort to improve the interface, the mobile application underwent usability testing, which involved user participation. This was done to obtain direct feedback on the functionality of the system and the challenges they faced. The application was tested using a questionnaire to measure user satisfaction and to ascertain user responses and opinions.

By finding bugs that could affect how the system interacts with the user, testing is also done to make sure the application runs correctly. Testing that finds mistakes in a program's implementation with a high likelihood of quality assurance is considered successful [9]–[11]. Users are not advised to reuse applications whose usability test results are inadequate [12]. Testing is done by utilizing the application as a user on various respondents. The next step involves respondents filling out a questionnaire to determine their level of satisfaction with the operation of the application. Identifying problems with design or services, analyzing user behavior and preferences, and testing directly by users are the most effective methods for evaluating usability measurement approaches [13], [14]. System design must consider all the advantages and disadvantages of users to ensure that the system is usable [15].

Dwi Putra Githa's [16] previous research is related to this investigation. This study developed a Batu tourist destination recommendation system. Based on the findings of this investigation, the recommendation system that has been developed is able to function as expectedEka Cahya Ningrum [17] developed a recommendation system for choosing Batu City tourist spots using the Item-Based Collaborative Filtering and Location Based Service approaches. According to the study's findings, the method can be used to choose Batu City's tourism attractions and help consumers find information. Furthermore, Rendra Sandi [18] investigated the creation of a recommendation system for culinary tourism in Malang City

utilizing two approaches: location-based filtering and collaborative filtering. Users can receive recommendations for the closest site via the site Based Filtering approach used in this study. The Collaborative Filtering method then carries out the process of filtering or assessing an item based on the opinions of other individuals by providing information to consumers based on similar characteristics. This study is unique because it uses Collaborative Filtering and Location-Based Filtering techniques to develop a halal tourism application in Jakarta.

Research on the evaluation of halal tourism applications using usability aspects is relevant in supporting the development of the tourism industry that can accommodate global needs. Through a deep understanding of user needs and ease of use of the application, a product or service can be developed so that it becomes a more effective and efficient solution design. In addition, it can also increase the competitiveness of halal tourism destinations and expand their accessibility to Muslim communities around the world.

In order to demonstrate the usefulness of information about halal travel in Jakarta, this study assesses the halal tourism application for the Android operating system from a usability perspective. Using the Collaborative Filtering and Location-Based Filtering techniques, this application is designed to run on the user's mobile device and recommend tourist destinations based on the user's location and preferences. It is anticipated that this approach will give researchers, the travel industry, and application developers important information to enhance the caliber and user experience of halal tourism location exploration. The results of this study are the usability values of the halal tourism application in Jakarta based on Android. It is anticipated that this application will enhance the Smart City concept currently being implemented by the Jakarta City Government, making it easier for visitors to learn about halal tourist attractions in Jakarta. This will help tourists when they travel to Jakarta and increase the number of visitors. In keeping with the goal of the Sustainable Development Goals, the growth in tourism may also help the local economy.

II. RESEARCH METHOD

The design of this study is descriptive and evaluative, with the aim of assessing and explaining the success of a particular product so as to reach a relevant, effective, and efficient conclusion [19]. The testing procedures for the previously created SIPAHAJI halal tourist destination location search application are being carried out again in this study [2]. Black Box Testing (BBT) and User Acceptance Testing (UAT) are used in this inquiry system testing stage to determine whether the system has fulfilled expectations. The BBT technique is intended to assess each software component's functionality, make sure input and output work as expected, and guarantee that the data captured is always current [20]. The system that was successfully established at the System Maintenance Stage is maintained by this procedure. Errors or the need to adjust to the external environment may force software that has been deployed to clients to be changed. For instance, Software that has been distributed to customers may be modified because of errors or the need to adapt to the external environment. For example, software that is further refined in response to customer requests or the use of new peripherals or operating
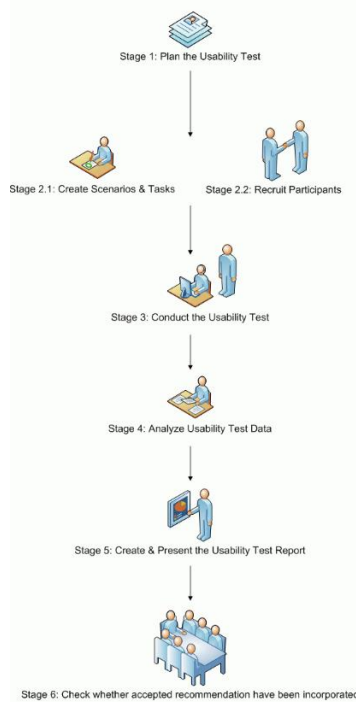
systems.

Fig. 1. UAT diagram

By using a questionnaire given to application users, this study evaluates the usability of the test. This study is classified as a survey study, namely collecting samples directly from the population of application users using a questionnaire as a research instrument [21], [22]. To ensure the achievement of validity correctly in survey research using a questionnaire, a sufficient number of respondents are needed to provide an explanation of the object being studied [23]. The results of the application evaluation were obtained by processing data collected from the questionnaire to ensure the relationship and mutual influence between usability components [24].

A number of statements that have been divided into different USE (Usefulness, Satisfaction, and Ease of Use) categories are included in the questionnaire. Ease of Use and Ease of Learning are the two subcategories of this category. A number of components make up the USE questionnaire, which is used to assess how usable computer systems are [7], [25], and [26]. The components pertaining to how easily new users can adjust to a product for the first time are included in the Ease of Learning (Learnability) factor. Satisfaction includes components related to the level of user satisfaction and positive attitudes towards the application. Usefulness includes components related to the product's ability to help users achieve their goals and the user's willingness to use the product [11], [27], [28].

Experts and the public were among the respondents selected for this investigation. Respondents were selected based on their professional or educational background in the tourism industry, which allows them to evaluate or assess the product. The sampling technique used quota sampling.

This investigation used a questionnaire as its data collection methodology. Furthermore, the questionnaire data was processed and analyzed to be used as a reference in the development of mobile learning media. The quantitative descriptive analysis method employed in this study was created to provide a predefined score weight and quantify the questionnaire data based on predefined indications. This analysis provided an explanation of each data set's features. Based on the findings of the data analysis, the application was revised to refine the development process. The assessment scale used in this investigation was the Likert scale ranging from 1 - 4.

The level of eligibility of the application developed was determined by categorizing the calculation results in the form of a percentage according to the criteria using a rating scale. The calculation of the Likert rating scale shows that the product developed is feasible to use if the interpretation is $\geq 60\%$ [29]. Table 1 illustrates the descriptive quality criteria with a rating scale.

TABLE I. DESCRIPTIVE QUALITY CRITERIA WITH RATING SCALE

Assessment Level	Description
0—20%	Very Less
21—40%	Less
41—60%	Enough
61—80%	Good
81—100%	Excellent

III. RESULTS AND DISCUSSION

The millennial generation who access various halal products to get their benefits requires a user-friendly mobile application platform that can accommodate all individuals, wherever they are, in today's digital era. This platform is based on a cost-effective and user-friendly mobile phone application. To use this application, users must first obtain it and then register via email. To activate the email site, verification is required when accessing it. Users will have the ability to access all markets that offer halal products after this stage is completed. This phase has become a widely used procedure in various applications that still exist.

An index page with a dashboard, SIPAHAJI maps, movies on Jakarta halal tourism, and a list of halal travel options in Jakarta makes up the main page of the Jakarta halal tourism application. A Jakarta halal tourist recommendation system that makes use of location-based filtering and collaborative filtering was created by the researchers after they analyzed and designed a system model. This system was developed using the Codeigniter Framework, PHP programming language, and MariaDB database. The Bootstrap and leaflet.js frameworks are used in the User Interface section to produce interactive maps. This section was also developed based on previous research that has been in accordance with expert input at the needs analysis stage [2]. Here are some of the SIPAHAJI application interfaces that have been developed.
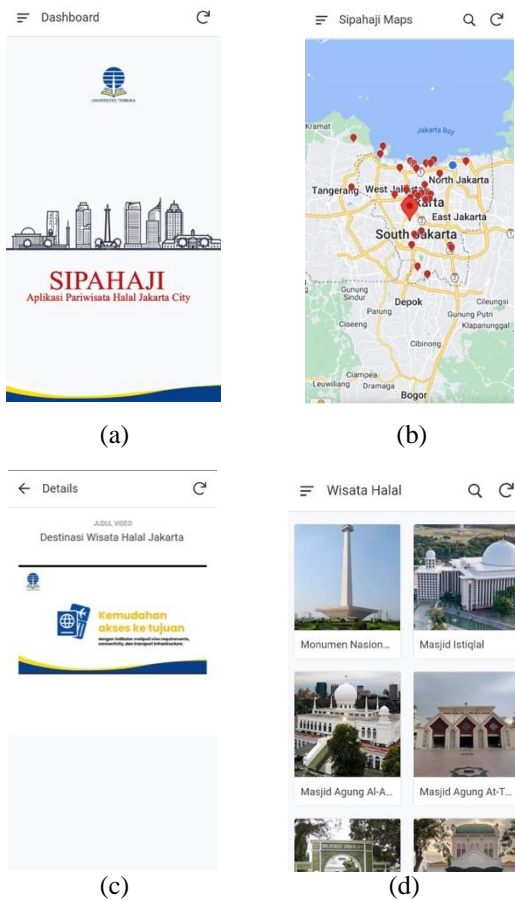
Fig. 2. a) Dashboard page, b) Sipahaji maps page, c) Video page about halal tourism in Jakarta, (d) Halal tourism list page

A. Black Box Testing (BBT)

The system testing procedure incorporates the BBT approach. This testing approach is intended to assess each software component's functioning, guarantee that input and output work as expected, and make sure that the data being recorded is always current (Krismadi et al., 2019). To do this, eight test variables were subjected to the equivalency partitioning technique, which produced the following results:

TABLE II.   BLACK BOX TESTING RESULTS

Test Case	Status
Login Page Function	Valid
Location Based Recommendation Function	Valid
Collaboration Based Recommendation Function	Valid
Map Page Function	Valid
Tourism Search Function	Valid
Tourism Description Function	Valid
Tourism Navigation Function	Valid
Tourism Rating Function	Valid

Testing of eight features in the system has established a valid status for all test cases, as indicated by the results of the BBT conducted previously, while there is no invalid status.

From the testing above, the achievement presentation is 100%. The login page function has shown that the system has successfully authenticated users correctly without error. Testing of the location-based recommendation function and collaboration confirms that the recommendation algorithm functions effectively in presenting suggestions based on user location and preferences collected from other user interactions (collaborative). Then the search and description functions of tourism show the validity that users can search and get accurate descriptions of tourism, which adds to the informative value and usability of the application. Finally, the navigation and tourism rating functions have been able to facilitate users in planning and assessing tourism experiences, which increases user interactivity and engagement with the application.

B. User Acceptance Test (UAT) Testing

The goal of the user's User Acceptance Test (UAT) is to generate a document that demonstrates the user's ability to accept the built system. The ISO 9126 standard requires users to perform UAT testing in order to generate a document that certifies the user's acceptance of the system. It is the end-user's responsibility to confirm that every system function is accurately checked throughout this test. The final stage of the system testing procedure is UAT [30]. The end-user is responsible for verifying that all system functionality is tested accurately during this test. UAT is the completion of the system testing procedure [30]. Several questions were asked to respondents through a validated questionnaire during this testing procedure.

To improve understanding of the acceptance and functionality of the SIPAHAJI application, a questionnaire was distributed to collect feedback from its users. This questionnaire aims to assess critical aspects of the application, such as ease of use, compatibility, and general user satisfaction. Through a series of structured questions, the questionnaire explores user opinions about the intuitiveness of the interface, the efficiency of the features provided, and the compatibility of the application with various devices and operating systems. In addition, the questionnaire also seeks to determine the level of user satisfaction with the content and functionality of the application, providing an opportunity for users to provide suggestions and comments that can help developers make necessary improvements and adjustments. The two main aspects analyzed are respondent characteristics and application evaluation. The following is a further discussion of these two subcategories.

1) Respondent Characteristics

The questionnaire conducted for the evaluation of the SIPAHAJI application reflects the diverse characteristics of the respondents involved. The questionnaire was completed by 80 respondents. The demographics of users show an even distribution between genders with 50% female and 50% male reflecting balanced acceptance between the two genders. The majority of respondents are aged 27-42 years (62.5%) indicating that the application is popular among the younger generation to young adults, while the other 37.5% are aged 43-58 years indicating that the application also reaches the older generation.

Respondents also come from various regions, indicating that the SIPAHAJI application has attracted users from various egions in Indonesia. This geographic diversity provides important insights into the potential for marketing the application to other regions and local adaptations that may be needed to increase user acceptance Seventy-five percent of the responders are either state contract employees or civil servants. In the meanwhile, 12.5% of those surveyed work for themselves or as private employees.

2) Application Evaluation

Regarding occupation, From the perspective of application evaluation, the results clearly show that users like the SIPAHAJI application. Generally speaking, up to 75% of respondents rated the application's usability highly and said it was simple to install. Seventy-five percent of responders are either state contract employees or civil servants. In the meanwhile, 12.5% of those surveyed work for themselves or as private employees.This indicates that the process of installing and operating the application is well designed and user-friendly.

Cross-platform compatibility also scored very well with 75% of users stating that the app works well across all platforms and 25% found it very good. This shows the app's effectiveness in operating across multiple devices, which is a critical aspect for the long-term success of an app in a competitive market.

In terms of responsiveness, the application was able to respond correctly by most users with 62.5% stating the application's response was good and 25% very good. The speed and accuracy of the application's response to user input is very important to ensure user satisfaction and the effectiveness of the application in real-world use situations.

One interesting area is the user's view on the possibility of replacing the application with a similar product. Although 50% of respondents felt that the application was not easily replaced, there was still a significant percentage (37.5%) who saw the possibility of replacement. This shows that applications must continue to innovate and offer unique features that differentiate them from competitors.

Fig. 3. The results of the questionnaire for the SIPAHAJI application

evaluation

The test results show that the SIPAHAJI application has good acceptance in various circles and shows solid performance in terms of technical and operational aspects. However, there are opportunities for continuous improvement, especially in developing innovative features and improving the user experience to ensure the sustainability and growth of the application in the future.

The integration of collaborative filtering and location-based filtering technology applied to the SIPAHAJI application is more recent compared to systems that only use one of these methods. In addition, the SIPAHAJI interface design is more intuitive and responsive based on user feedback. Different from previous applications that may focus more on functionality without in-depth evaluation of aesthetics and usability.

Compared to previous halal tourism applications that may focus on static data [31], [32], SIPAHAJI integrates dynamic data and personalization based on user preferences. Furthermore, SIPAHAJI concentrates on creating tourism applications that the general public currently requires in order to promote Jakarta's halal tourist attractions. In addition, SIPAHJI makes use of cutting-edge technologies for software development and testing, including contemporary frameworks and performance-enhancing algorithms.

In continuing the development of SIPAHAJI, it is important to consider feedback from UAT to improve and add features that are relevant to user needs. In addition, comparative analysis with similar applications can provide insights into unique features that can differentiate SIPAHAJI from other travel applications. This will help in increasing user adoption and ensuring the sustainability of the application in a competitive market.

IV. CONCLUSION

The study of the SIPAHAJI application, an Android-based platform for halal tourism in Jakarta, shows significant potential in increasing the accessibility of tourism information quickly and in real time. This application uses collaborative filtering and location-based filtering methodologies to optimize search and recommendations for tourist attractions according to user preferences and locations. The trial results show the success of the application in providing accurate recommendations supported by an intuitive user interface and ease of navigation.

Application testing includes black box testing (BBT) and User Acceptance Testing (UAT) which gave positive results. The black box test showed the validity of all tested functions with a 100% success rate in meeting the expected specifications. Users were surveyed as part of User Acceptance Testing (UAT) to verify that they were highly satisfied with the application's usability. This illustrates how crucial it is to incorporate direct user input into the application's design and development in order to guarantee the system's dependability and efficacy.

The findings of this survey demonstrate that people of all ages and professional backgrounds find this program to be user-friendly and satisfactory with its features. This assessment
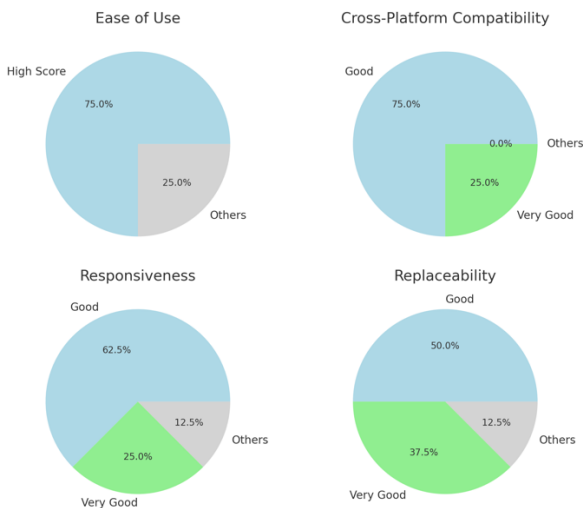
demonstrates SIPAHAJI's ability to satisfy consumers' expectations for locating and appreciating halal tourism attractions and enhancing their trip to Jakarta City.

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