USABILITY STUDY FOR TOURIST MOBILE SYSTEMS RECOMMENDATION

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ABSTRACT

Tourist recommendation system is a system that provides information and recommendations for tourists. This system will help users to reduce the search process and help to make choices. Currently, the recommendation system uses the internet because it is cheap, requires a short time, can be accessed from anywhere and always update. The tourism recommendation system works by using the restrictions and preferences of tourists, then it will recommend tourism travel routes. Recommendation systems can be grouped into four types which are content-based, collaborative-filtering, knowledge-based, and hybrid systems that combine two or more methods.

Usability is a product condition that can be used specifically by users to achieve effectiveness, efficiency, and satisfaction in the context of use. Usability test is conducted to see the level of comfort and ease of use of a system recommendation. In general, there are two types of measurements, which are quantitative and qualitative measurements. Quantitatively is the level of completion, level of success, processing time, level of satisfaction and level of error. The SUS (System Usability Scale) will measure user satisfaction by software, hardware and mobile equipment and consisting of a scale that is easy and simple to respondents and makes it ideal for use with a small sample size. The metrics are completion rates, usability problems, task time, task level satisfaction, test level satisfaction, errors, expectations, page views/clicks, and conversions. This research will compare two existing tourist recommendation systems using SUS. The information recommendation that must be fulfilled are level of fulfillment (100%), usability (64%), and level of understanding (64%). Respondents said they need system recommendation that does not need special expertise to operate it (75%) and the function is well integrated (71%).

Keywords: tourist, tourism, usability study, routing, digital, recommendation system

Introduction

Background

Travelers, according to Hargrove (2014) are those who travel more than 50 miles or 80.47 kilometers. He divided tourists into two groups: tourists who first visit the destination and experienced tourists. Both types of tourists require information that is easily accessible and can be trusted. Tourists need general information while experienced tourists need more specific information. The type of service needed are finding information, planning, comparing prices, and ordering products, services or travel tickets. He also observed that family holidays create conditions that are more complicated than personal travel because there are so many needs to be accommodated. Since 1985, more and more tourists are taking short but frequent trips. These conditions are relevant with domestic tourists who take advantage of long weekends to travel outside the city. Nowadays tourists tend to travel personally, occurring at an increasingly young age, educated, and require Information and Communication Technology (ICT) to support their independent journey.

According to Lu, Wu, Mao, Wang, & Zhang (2015) there are eight developing recommendation systems, which are e-government, e-business, e-commerce, e-library, e-learning, e-tourism, e-resources services and e-group activities. The information system for tourists or e-tourism began with a flight ticket booking system in the 1950s by American Airlines. Since then the information system has been used in

tourism activities such as booking tickets and hotels via the internet. Customers can use it personally and harmonize with their needs. All of these activities aim to support their travel planning better. Then this system develops into a recommendation system that can recommend travel planning according to tourist choices. Some of these systems collect information from many sites and links, which are visualized in 2D, 3D and video clips. This type of recommendation system will accept input from tourists and provide recommendations in the form of trips that can be carried out by adjusting to tourist input. By using multimedia technology, the system can provide recommendations by selecting destinations, types of transportation and accommodation. This then developed into the Visual Travel Recommender System (VTRS) (Ponnada, 2008).

Gavalas, Kasapakis, Konstantopoulos, Mastakas, & Pantziou (2013) have reviewed various studies related to the topic of travel recommendation systems. The recommendation system is a system that not only provides enough information, but also provides recommendations for users. This system will help users to reduce or ignore the search process and choose activities. Many recommendation systems now use the internet because they are inexpensive, require a short amount of time, can be accessed from anywhere and always updated. The recommendation system works by using the constraints and preferences of tourists, and recommending some suggestions. Regarding tourism business, the recommendation system will help tourists to decide what destinations are recommended to visit, related to the characteristics and preferences of tourists. If tourists have to deal with many alternatives, this system will help them with less effort and time.

Based on Stabb, et al., (2002) the recommendation system can be grouped into four types. The first type is content-based, where the system will provide recommendations based on tourist profiles and product information. The second type is collaborative-filtering, using feedback or reviews that show compliance with user needs. This is in line with research by Shen, Deng, & Gao (2016) and Lu, Wu, Mao, Wang, & Zhang (2015). The third type is knowledge-based, by combining knowledge between users and products, so the system can predict user needs. Last is a hybrid system that combines two or more methods to satisfy users, such as artificial networks. A preliminary study of the recommendation system that can be applied to archipelago tourists was conducted by Hapsari & Surjandari (2017).

Gavalas, Kasapakis, Konstantopoulos, Pantziou, Vathis, & Zaroliagis (2014) make several groups that show how the algorithm is modified. The focus of this is the Tourist Trip Design Problem (TTDP) which can be divided into two groups, single tour and multi tour. Single tour is a trip that is built from a network where nodes will be connected with benefits and costs. The aim is to maximize profits by minimizing travel costs. For the first method developed is Traveling Salesman Problem with Profits (TSPP) which is then followed by Multi-objective Vending Problem. There are three methods on a single tour that have the aim of maximizing the benefits collected and minimizing the cost of the trip, which are:

1. The Profitable Tour Problem (PTP) (Amico, Maffioli, & Värbrand, 1995) to maximize revenue minus travel costs to obtain benefits.
2. The Prize Collecting TSP (PCTSP) (Balas, 1989) will minimize the cost of the trip with the total profit of the trip not less than the value given.
3. The Orienteering Problem will provide travel recommendations that will maximize the total benefits collected when keeping travel costs at a fixed value. OP is closer to the formulation of the single tour on TTDP than the two single-criterion variants of the TSPP.

Those are in line with various studies on tourism recommendation systems that have emerged in the last ten years. The recommendation system can be divided into four groups. The first group is a form of a recommendation system, whether in the form of a website (website) or a recommendation system in a mobile application according to the research of Wang, Li, Zhen, & Zhang (2016). They changed it from the desktop version to the recommendation system on the device because it was more practical and easier to use, but more difficult to make. The second group contains a recommendation system that provides

information about destinations and services around it, others can provide travel itineraries and information. The system will plan a trip by determining which destinations are visited first and the schedule, then it is followed by other destinations. The next group is the use of transportation. Related research uses public transportation to integrate various modes of transportation, or one type of transportation such as a bicycle or a car. The fourth group which is the last group separates research related to the sources used by the data in the recommendation system. There is a collaborative group of tourists (collaborative) whose information is obtained from sharing between tourists. There is also a form of content that has been prepared by the designer or manager of a recommendation system. Finally, a hybrid that combines collaboration and content.

Of all the research system recommendations for tourists that have been reviewed, there are several areas of research that can be continued by other researchers. Some studies have been completed by further research, for example the need to add weather conditions as explained in the research of Kenteris, Gavalas, & Economou (2009), Kenteris, Gavalas, Pantziou, & Konstantopoulos (2010), Gavalas & Kenteris (2011) and Vansteenwegen , Souffriau, Berghe, & Oudheusden (2011). But there are still opportunities for improvement based on the researchers' suggestions. For example like Cheverst, Davies, Mitchell, Friday, & Efstratiou (2000) who offer advice for their prototype, GUIDE. This design should require no electricity, micro-cellular, and use wireless technology such as Bluetooth. Stabb, et al., (2002) need a future system that is easy to install and use. Savage, Baranski, Chavez, & Höllerer (2012) suggest that mobile devices can extend the battery used, and want devices that do not need to be viewed too often and too long. This is related to driving safety while still being guided by the device.

The recommendation system performance can be separated into two groups, which are modifying the process which means changing the algorithm, or related to the database. The recommendation system must be fast, and more personal (Stabb, et al., 2002). The database must be more accurate, more complete, be able to include dynamic data, and be able to provide useful information (Garcia, Arbelaitz, Vansteenwegen, Souffriau, & Linaza, 2010) plan to add more cities to the recommendation system, consider public transportation and provide public transportation more information. Gavalas, Kasapakis, Konstantopoulos, Mastakas, & Pantziou (2013) need input data that are more accurate, uses metrics and formal evaluations effectively, and inform events that will be held.

Another alternative is to consider when to have a short lunch, through beautiful panoramas, and a more integrated mode of transportation. Recommendations such as accommodation, restaurants, entertainment, travel agents, gift shops and local public facilities are suggested by Gavalas & Kenteris (2011). Kenteris, Gavalas, & Economou (2009) continue their research focusing on the Location API which will prepare orientation, navigation, and other services. Gavalas, Kasapakis, Konstantopoulos, Pantziou, Vathis, & Zaroliagis (2015) want to improve eCOMPASS by considering the trip, benefits (score for each destination chosen), the route chosen considering the beauty of the panorama, and machine learning for things that are uncertain and affect the schedule. Tumas & Ricci (2009) also consider multi-mode transportation, but also consider single modes such as bicycles and taxis.

Research Objectives

Based on explanations, this research will explore the recommendation system for tourist and test the usability, as a consideration to develop a new recommendation system that can fulfilled respondents expectations.

Literature Review

To assess the destinations, Morrison (2013) formulates the principle of 10 A to achieve the success of a tourist destination, namely:

1. Awareness, or awareness from tourists about the destination. Means the manager or the government has sufficiently promoted and published the existing destination.
2. Attractiveness, or interest in tourist destinations. Although interest can be caused by internal factors of tourists themselves, for example due to certain interests, but managers can work on it by knowing the strengths and weaknesses of the existing destinations, so there will be more tourists are interested in going there.
3. Availability, or availability can also be interpreted as the reliability of tourist destinations to be visited by tourists. Closing of the tourist destinations because of many repairs should be avoided.
4. Access, or convenience to reach the destination. This is related to the destination location and environmental conditions such as vehicle flow and road conditions and width.
5. Appearance, because tourists will be interested in something interesting and well maintained, even if the destination is not the newest or different from the others. What's important is how the manager can package it to attract potential tourists.
6. Activities, are factors that tourists will come back again. If only relying on physical facilities, one visit might be enough, but by combining it with interesting activities, tourists will want to get involved and visit the destination again.
7. Assurance, or security guarantee. Because tourists are on vacation, they don't want anything to disturb or delay their excitement. Managers need to prepare so that tourists are guaranteed security during their stay.
8. Appreciation for destination that can achieve, such as the number of visitors or a good review will encourage others to experience the same experience.
9. Action, is an effort that must be carried out by the manager of an event related to its destination. For example, if there is a disaster around the tourist destination, the manager can do company social responsibility and publish it as an act of concern for the surrounding community. Or there is an accident in the destination environment, the manager can give compensation to neighborhood. Maintaining good relationships and images with customers must continue to be done with a positive image that will cause sympathy for the destination.
10. Accountability, or the ability to take responsibility. Many destinations in Indonesia do not carry out ticket payment procedures or report how much they earn. This makes it difficult to develop if the flow of money is difficult to track.

Related to the tourist profile, Šimková & Holzner (2014) states that tourists need cognitive, aesthetic, and self-identification aspects when fulfilling their tour. In accordance with Maslow's concept, there are physical, safety, social and multi needs aspects such as cognitive aspects of knowledge and understanding of local lifestyles and existing traditions. The second aspect of multi needs is aesthetics as an appreciation of beauty. McKercher, Wong & Lau (2006) stated that tourists will choose a destination according to the type of tourists, so the recommendation system must be able to give tourists flexibility to choose. Regarding the tourist duration when visiting a destination, as well as factors of the destination and the profile of tourists themselves, there are other factors that will influence. From the results of Martínez-Garcia & Raya's (2008) research, factors such as citizenship, age, education level, type of work, type of accommodation and current season are obtained. Presentation by Ratman (2016) as Deputy of Tourism Development Destinations and Investment at the National Coordinating Meeting of the Ministry of Tourism explained 9 portfolios of marine tourism products, ecotourism, adventure tourism, cultural and historical heritage tourism, shopping and culinary tourism, city tourism and villages, MICE tourism, sports tourism, and integrated tourist attractions. About 60% of tourist destinations in Indonesia are cultural tourism, 35% nature, and the remaining 5% are artificial.

According to ISO 9241-11 (Bevan, 2000) about Usability Guidelines, usability is an effort where the product can be specifically used by users to achieve effectiveness, efficiency, and satisfaction in the

context of use. What is intended to be effective is the accuracy and completeness of the user can achieve his specific objectives. Efficient in question is the resources spent related to accuracy and completeness that is in line with the user's goals. The satisfaction is about comfortability and acceptance of use.

In ISO 9126-1 about the Product Quality Software Model, the outline can be divided into 6 sections to assess the quality of use of the software, namely:

1. Functional (accuracy, suitability, operational and security).
2. Reliability (maturity, fault tolerance, ability to recover, availability)
3. Usage level (level of understanding, level of learning, operability, attractiveness)
4. Efficiency (time spent, resources, utilization)
5. Ability to care (analytical skills, ability to change, stability, ability to test)
6. Ability to move (adaptability, installation ability, availability, replaceability)

The ability of a software are come from how to be understood, studied, used and attractive to users when it is used in special conditions. The effectiveness metric has several measures to measure effectiveness, such as whether the assignment has been done correctly and effectively, whether the assignment has been completed, and the level of frequency of errors.

The measure of productivity metrics can be task time or time to complete a task, waiting time or time the user waits until the system responds, task efficiency or how efficient it is used, economic productivity or calculation of the user's effective cost, productive proportion or what proportion of time the user needs for productive activities, user productivity when compared to experts, and the frequency of asking for help. While the satisfaction metric measure is the scale of satisfaction by users, the satisfaction questionnaire contains how satisfied the user is with software facilities, and the choice of usage that shows how much the proportion of customers who choose to use the system.

Usability test is conducted to see the level of comfortability and easiness of use of a media, for example a recommendation system or a site. Several standards have been developed to be able to measure the media. In general there are two types of measurements, which are quantitative and qualitative measurements. Quantitatively is asked as the level of completion, level of success, processing time, level of satisfaction and level of error. The qualitatively questions are the steps of participants to complete the assignment and the problem. This can be done by answering the questionnaire or conducting interviews after the session. Satisfaction will be associated with comfortability and ability to use. There satisfaction level based on level of difficulties from the participants perspective. This can be achieved by SEQ (Single Ease Question) by giving a question to be responded by participants. Sauro (2012) recommends using SEQ because it is short and easy to respond, easy to set up and easy to assess.

Sauro (2012) also recommends the SUS (System Usability Scale) developed by John Brooke in 1986 to measure user satisfaction using software, hardware and mobile equipment. SUPR-Q (Standardized User Experience Percentile Rank Questionnaire) is more appropriate to measure website satisfaction. SUS also proved to give accurate results. SUS consists of a scale that is easy and simple to guide participants, and makes it ideal for use with a small sample size.

Metrics that can be used from Mifsud (2015) are:

1. Completion Rates:

Often called the fundamental usability metric, or gateway metric, completion rates are a simple measurement of usage. Usually recorded as a binary metric (1 = successful task, 0 = failed task). If the user cannot complete their goal, then the test cannot continue.

2. Usability Problems is the probability of the user finding a problem in each step. Knowing the percentage of each user will make it easier to predict sample sizes, the level of problem, and what problems founded by a user.

3. Task Time is the total duration of the assignment that calculates efficiency and productivity in the form of time required in seconds or minutes. The assignment time starts when the user finishes reading the

command and ends when the user completes all his activities including reviewing.
4. Task Level Satisfaction is done after the user completes an order. The user will answer a few questions or only one question about how difficult the task is. The task level satisfaction metric will describe a difficult task, especially when it is compared to other tasks.
5. Test Satisfaction Level is a conclusion about the reusability test, participants will answer a few questions about their impression about user friendly.
6. Errors will record all unintentional things, omissions, errors or things that are out of the habit of the user when completing a task. The following error description will be noted. Error ratings can be added or grouped errors into categories. Errors indicate good diagnostic information and can be a source of usability problems.
7. Expectation is the user's expectation about how difficult a task is based on the assignment order. It is done by asking users to estimate the difficulties they have been expected on a task and compare it with task ratings difficulties from the same or different users.
8. Page Views / Clicks on the website or recommendation system will be the only information obtained without being directed by research. 'Click' is closely related to the assignment time where improvements can provide better efficiency. The first click will indicate the assignment's success or failure.
9. Conversion will measure whether users can register or shop for products as a measure of effectiveness. The conversion rate is the level of special fulfillment and metrics that are important in e-commerce. The conversion rate also becomes a binary calculation (1 = can convert 0 = cannot convert) and can be summarized in all sales phases from landing page, registration, checkout and purchase. This is a combination of usability, error and time for shopping carts.
10. Single Usability Metric (SUM) is an easier measurement to describe the usability of the system by combining metrics into a single value, for example by comparing competing products. SUM (Sauro & Kindlund, 2005) is the average of the measures of effectiveness, efficiency, and satisfaction that is manifested in 3 metrics namely the level of fulfillment, level of satisfaction and time of assignment

Methodology

There are several recommendation systems that have been developed by previous researchers and can serve as a benchmark for the design of further recommendation systems. Evaluation of each of these recommendation systems will be discussed based on the usability test. It turns out nothing can be tried because there are only prototypes on the journal paper, not uploaded on the internet. The model is not in accordance with the recommendation system that will be developed. Search is prioritized on the desktop platform according to the application that will be developed. However, due to the absence of a recommendation system that can be tested, finally some applications are performed on the Play Store owned by the Android operating system. By entering the travel planner keyword, there are several recommendation systems that appear as in Figure 1.

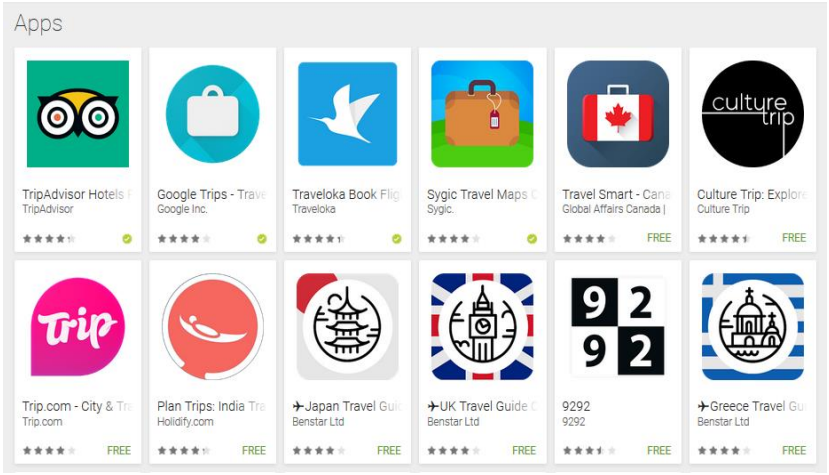

Figure 1 Travel recommendation system on the Google Play Store

Voyager

This recommendation system builds the optimal route by visiting all existing points. There are a maximum of 20 routes formed, each with a maximum of 25 points. By using online data from Google, there are obstacles that Google's direction service free API or Google's location coordinate database only allows 8 points per request. A preliminary map and a final map of the calculation results are shown, toll roads are ignored, there are options for walking, using motorized vehicles, or cycling. This program can calculate the distance traveled and send it via email.

This recommendation system ensures that the route given is the fastest route that can be taken to reach the destination using the Traveling Salesman Problem (TSP) method. This recommendation system will use two methods to calculate the optimal route. The recommendation system uses a route approach for a few destinations, and then uses a TSP algorithm when there are many destinations.

Sygic

In Sygic Travel application has a photo and description of certain tourist destinations. If you want something more detailed and practical, you can use premium Sygic Travel. The database comes from Fodor's Travel, there are maps that can be accessed offline and walking guides.The map is derived from openstreetmap.org There are third parties who offer tour and activity, hotels, rent a car, weather forecasts, travel forecasts and databases about geography. Estimated travel time comes from OSRM (Open Source Routing Machine) that uses C ++ to reach the shortest route.

Google Trips

Destinations on Google Trips cannot be chosen because they have to follow the available choices, making it difficult to manage and difficult to add or change destinations. Destinations can be chosen per category, there are photos, information about opening hours, and scores. The 'things to do' menu is not related to day plans. On the day plan menu, the user can choose the morning, afternoon, or full day. The route will be arranged based on visit time, travel time, flow between attractions and opening hours. Google Trips is possible to see around any destination and the results of the route can be saved. There is a choice of days to travel. If the selected destination is not saved then it is recommended that the destination is nearby.

To conduct a reusability test, the first step taken is to select the application to be tested. Determining the demographics of respondents for application testing. It will focus on young age, because the main market for this application is internet users and they are accustomed to using devices. The young age is considered to represent the population to be addressed. A case study is prepared as an assignment

that must be carried out by the respondent. Then there are questions that are designed to find out the response and performance criterion can be measured from the score, total time needed (travel), execution time, and memory storage. There are Voyager and Sygic that will be tested. The Google Trip application cannot be used because this application will automatically arrange routes, regardless of the order in which they are selected.

For this usability test, the selected city is Jakarta because in both applications Jakarta is the only city in Indonesia to offer. Departure date is set from 21 September to 22 September 2019 or 2 days. The time is set limited to see which destinations do not enter the route and which destinations join the route. The trip starts from Soekarno-Hatta airport and the hotel chosen is Amaris Hotel Senen. The destination are:

1: National Monument
2. National Museum
3. Jakarta Cathedral
4. Taman Ismail Marzuki
5. Textile Museum

After all the routes are selected and the route appears, the next is to change the order as follows:

1. Jakarta Cathedral
2. Textile Museum
3. National Museum
4. Taman Ismail Marzuki
5. National Monument

Before conducting a usability test, the application need to be tried first to see whether or not a test order is possible. The Voyager application starts with a starting and ending location, and the results can be sent via email. If the order will be changed it is necessary to remove the destination in previous order, to repeat the input the destination in the new order. There is a map that will show the route and distance traveled. In the Sygic application there is a start date and end date. The user can arrange the place of arrival and the destination hotel. The Sygic application has a location database but for Jakarta is incomplete. The user can enter destinations per date, in the order as the user wants. The application will calculate the length of walking time and the total time of day. There is an estimated time of visit. At the end of the day will return to the selected accommodation. Destination options can be edited. Both of these applications can be used to test usability.

Respondents will fill in the questionnaire with the following questions:

Design questions to measure usability:

1. Fulfillment level: (1 = Success and 0 = Fail).
2. Usability issues:
3. Time of assignment:
4. Assignment satisfaction level: (1 = Easy and 0 = Difficult)
5. Test satisfaction level:

Respondents will rank each question from 1 to 5 based on how much they agree with the statement read. 5 means they strongly agree, 1 means they strongly disagree. There are 10 draft questions that can be adjusted to use the application.

1. I will use this application more often
2. This application is not complicated
3. This application is easy to use
4. No need special ability to use this application
5. The functions in this application are well-integrated

6. This application is consistent
7. Most people will be able to learn this application quickly
8. This application is practical to use
9. I am very confident with this application
10. No need to learn further to run this application

Results and Discussion

Respondents' answers related to usability test can be seen in table 1 as the average answers between the applications and among the respondents..

Table 1. Answers for Usability Test Respondents

Information	Proposed System Recommendations
1. Level of fulfillment	100%
2. Usability (minimum)	64%
3. Assignment time (minimum, in minutes)	8,80
4. Level of understanding (minimum)	64%
5. Level of satisfaction (minimum)	45%
Question	
1. I will use this recommendation system more often	62%
2. This recommendation system is not complicated	61%
3. This recommendation system is easy to use	59%
4. No need special expertise to use this recommendation system	75%
5. The function in this recommendation system is well integrated	71%
6. This recommendation system is consistent	68%
7. Most people will be able to learn this recommendation system quickly	53%
8. This recommendation system is practical to use	59%
9. I am very confident in this recommendation system	61%
10. No need to learn further to run this recommendation system	59%

Although all respondents successfully completed the given task, the level of usability was not perfect, especially for Sygic applications. If seen from the 10 criteria asked, the respondent's answer to the use of the Sygic application is the same or lower than the Voyager application, except for criteria number 2 (application complexity), number 4 (no special skills required), number 7 (can be learned quickly) and number 8 (practical). The assignment time, level of understanding of the procedure, and level of satisfaction using the Sygic application are also lower than Voyager. Based on this respondent's answer, the application to be designed is expected to exceed the usability results of existing applications.

Conclusion

From the usability test on the interface of the mobile tourism recommendation, there are two things to consider, which are the information obtained and the opinions from the users. In the information section, the level of fulfillment of assignments can be done entirely (100%). The level of use and understanding is also quite good (64%) while satisfaction is rather good (45%). This might be caused by

the long assignment time for an application (8.8 minutes). For the opinions given, the majority of users consider both applications easy to use even for the first time user (75%), all features or menus are related to each other (71%), and the system is consistent (68%). Medium opinions are given for usability frequency (62%), complicated (61%), and not so convincing (61%). The lowest rating is given for ease of use aspects (59%), less practical (59%), need to be studied further (59%) and need time to learn (53%). So that the proposed recommendation system is expected to provide information that is easily obtained in a shorter time, as well as easier to use so that the mobile recommendation system can be used more frequently for wider users.

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