MALANG TOURISM RECOMMENDATION USING MOBILE BASED GROUP DECISION SUPPORT SYSTEM

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ABSTRACT

Malang has many tourist attraction so the decision support system can help user to choose the best place to be visited. The Decision Support System used for tourist attractions in Malang was built with TOPSIS method. TOPSIS was chosen as the primary algorithm due to its relatively low complexity of the algorithm so that it is precisely used on mobile devices. However, DSS using TOPSIS method can accommodate recommendation for single user only, it cannot be used for a group of users, whilst people usually go to a tourist attraction in a group. Therefore, this research contributes to make a group decision support system based recommendation of Malang tourism. In this research, usability test is conducted to understand user's perception about the application. The comparison between personal decision support system and group decision support system is conducted to understand the impact of group decision support system in user perception. The comparison between decision support system and group decision support system shows that SUS score of group decision support system (79.5) is better than personal decision support system (72.5).

Key words: Malang tourism, Group Decision Support System, SUS score.

1. INTRODUCTION

These days, traveling is a need for some people. Malang, as one of the travel destinations in Indonesia, is showing a rapid progress on its developments. Malang has appeal as the most visited spot for the tourists in East Java. It is proved by the amount of the tourists coming to Malang. Not only going to the tourist attractions, but souvenirs shopping is also one of the interesting things to do in Malang. This huge excitement is not balanced with the information about the tourist attractions in Malang for the tourists, while the use of mobile devices is widely increasing (Tolle *et al.*, 2017). Therefore, it is necessary to develop Malang tourism recommendation application based on mobile devices.

Research about mobile recommendation system has been conducted in (Ricci *et al.*, 2010) it states that mobile devices are primary tools for information access and when combined with recommender system technologies, they can used for leisure and business applications. Tourism or travel recommendation system suggest product or tourist destination and provide the user with information to support their process of decision making (Ricci *et al.*, 2002). Research about recommendation system in tourism are (Kabassi *et al.*, 2010) that contributes in personalizing recommendations for tourist and (Meehan *et al.*, 2013) about context aware recommendation system for tourism.

Malang tourism recommendation by using mobile application has been done in the research (Dewi *et al.*, 2019). The research (Dewi *et al.*, 2019) used TOPSIS as the decision support system algorithm of the Malang tourism recommendation. TOPSIS was chosen as the algorithm used in the research due to its relatively low complexity of the algorithm, so that it is precisely used on mobile devices. However, DSS using TOPSIS method cannot be used for a group of users, whilst people usually go to a tourist attraction in a group (Dewi *et al.*, 2018). Therefore, this research contributes to make a group decision support system based recommendation of Malang tourism. Previous research concentrates in the algorithm & the proof of its effectiveness, but there is no usability testing of the application from the user perspective. In this research, usability test is conducted to understand user's perception about the application. The comparison between personal decision support system and group decision support system is conducted to understand the impact of group decision support system in user perception.

2. LITERATURE REVIEW

The literature review of this research are including group decision support system, group decision support system algorithm and usability testing.

2.1 Group Decision Support System (GDSS)

GDSS is used to accommodate preferences of the decision makers, so it creates group decision. In the recommendation system scenario, users tend to make decisions in a group rather than personal. Group preferences are more complex and relatively different than personal preferences. Group decision support system method calculates the preferences of all members of the group and gives a set of recommendation based on it (Dewi *et al.*, 2018). Decision support system (DSS) has 3 interconnected core component. DSS components consist of data management, model management and communication management (Turban, 2005) as explained in Figure 1.

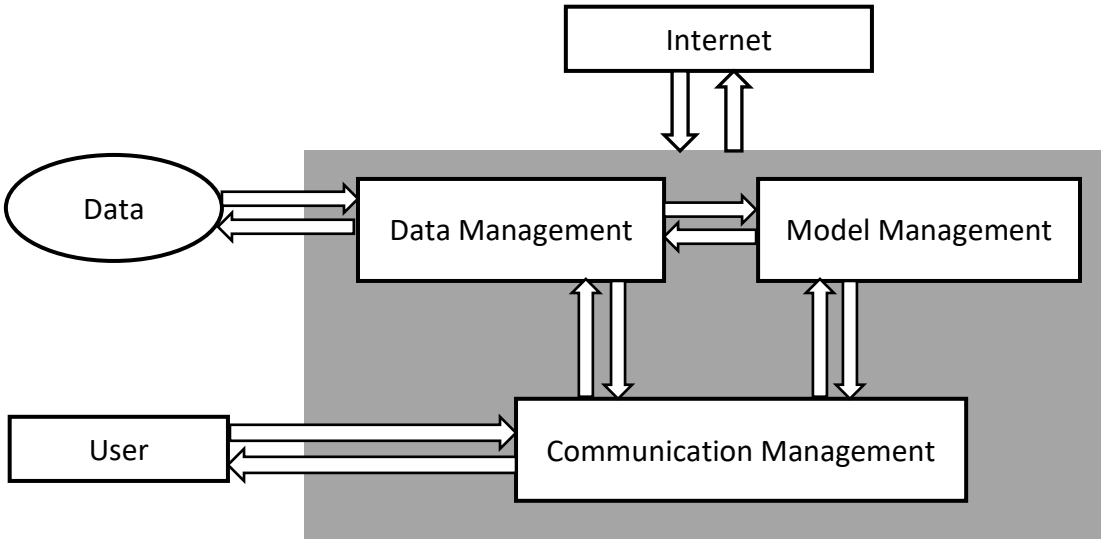

Fig. 1. Decision Support System Architecture

2.2 Group Decision Support System (GDSS) Algorithm

In this research, group decision support system developed with TOPSIS algorithm that combined with voting rule algorithm. Figure 2 explains the flow of the group recommendation.

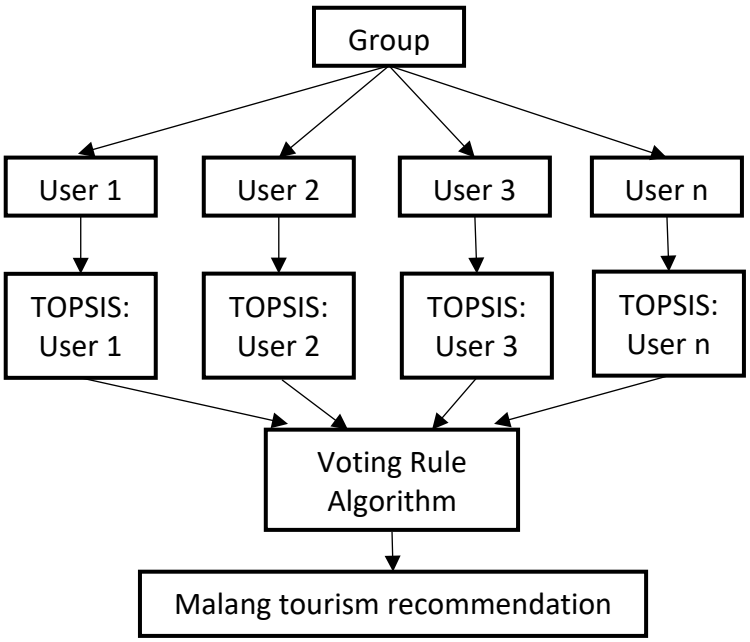

Fig. 2. Flow Diagram of GDDS Algorithm

TOPSIS is used to give personal recommendation of Malang tourism (Dewi *et al.*, 2019). Recommendation method using TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) is done the same way as (Hwang, 2012). While voting rule algorithm is used to rank group voting. The first alternative in the ranking is given a value greater than the other alternative with the rank position below it as in a pairwise comparison. Based on final calculation of the alternatives, alternative with the highest value is the most recommended or preferred by the decision makers.

2.3 Usability Testing with System Usability Scale

The System Usability Scale (SUS) was found by John Brooke in 1986. It is a usability test to evaluate variety of system types in practical. SUS is cheaper than any usability test, because it only requires some prospective users, and also quicker, because the template of statements is ready to be used and adjusted to the needs. Usability test is conducted to understand user's perception about the application (Gutiérrez-Carreón *et al.*, 2015). SUS (System Usability Scale) is done the same way as (Brooke, 2013) with 10 usability questions:

a) I think that I would like to use this system frequently
b) I found the system unnecessarily complex
c) I thought the system was easy to use
d) I think that I would need the support of a technical person to be able to use this system
e) I found the various functions in this system were well integrated
f) I thought there was too much inconsistency in this system
g) I would imagine that most people would learn to use this system very quickly
h) I found the system very cumbersome to use
i) I felt very confident using the system
j) I needed to learn a lot of things before I could get going with this system

3. RESEARCH METHOD

Group decision support system in this research is developed under the same architecture of general decision support system architecture in Figure 1. Decision support system (DSS) has 3 interconnected core component. DSS components consist of data management, model management and communication management as in Figure 3.

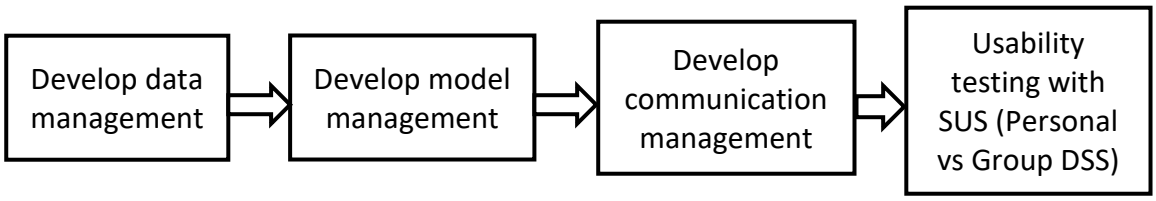

Fig. 3. Block Diagram of Research Methodology

Data management is related with the data used in group decision support system. In decision support system, there are 2 important terms, criteria and alternative. The Malang tourism data used as the recommendation option is referred as the alternative, while the variable that affects the decision maker to make a decision of some alternatives is referred as the criteria.

Model management used in this research is TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) combined with voting rule algorithm. The detail steps of Malang tourism recommendation using group decision support system are explained in section 2.2.

Communication management is the user interface, it accommodates the user to interact with the group decision support system that has been built. Communication management in this research is developed in Android platform.

4. RESULT AND DISCUSSION

The final result of this research consists of the core components of the group decision support system. Those components are data management and communication management. Overall, data management in this research is explained in Table 1.

Table 1. Data Management.

No.	Type of Malang Tourism Recommendation	Criteria	Alternative
1	Tourists destination in Malang & Batu	Price, distance, rating, number of reviewers	List of recommendations for Tourists destination in Malang & Batu
2	Beach around Malang	Price, distance, rating, transportation access, facility	List of recommendations for Beach around Malang
3	Shopping destination in Malang	Rating, facility, operational hours, distance	List of recommendations for Shopping destination in Malang
4	Place to buy souvenirs in Malang	Distance, price, store's existence	List of recommendations for Place to buy souvenirs in Malang
5	Place to buy Korean cuisine	Price, rating, operational hour, distance, facility	List of recommendations for Place to buy Korean cuisine
6	Café in Malang	Price, situation, distance, facility, rating	List of recommendations for Café in Malang
7	Martial arts in Malang	Distance, price, training duration	List of recommendations for martial arts training center

Model management used in this research is TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) combined with voting rule algorithm as in Section 2.2. Communication management (user interface) in this research is developed under Android platform. The user interface of the application is shown in Figure 4-6. It is the group decision support system recommendation application for one of the Malang tourism applications, places to buy souvenirs in Malang.

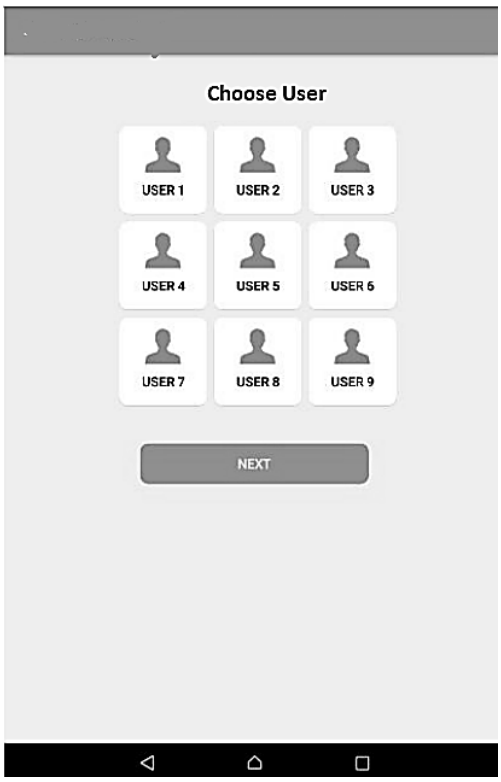

Fig. 4. User interface to choose the number of user

In Figure 5, user can choose the number of the user that will be included in GDSS. Figure 6 shows the user interface where user can choose DSS button (for personal recommendation system) or Group DSS button (for group recommendation system).

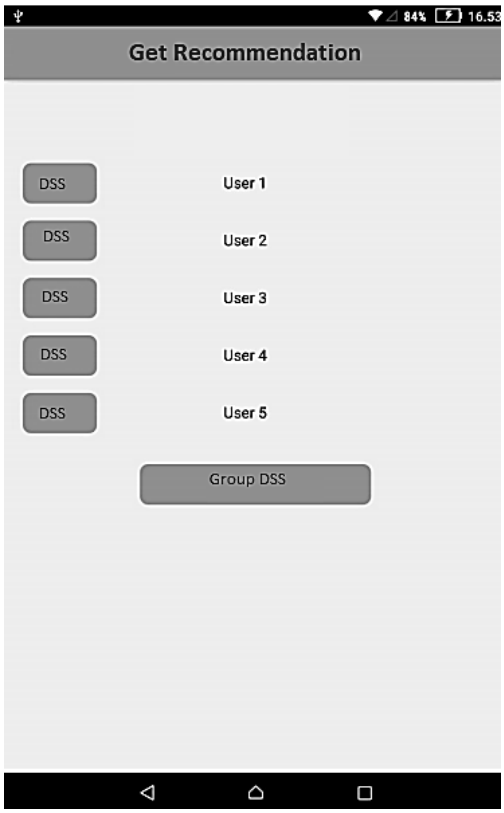

Fig. 5. User interface to get the recommendation

Figure 7 is the list of recommendation. These communication management are adapted from our previous study (Dharma *et al.*, 2020).

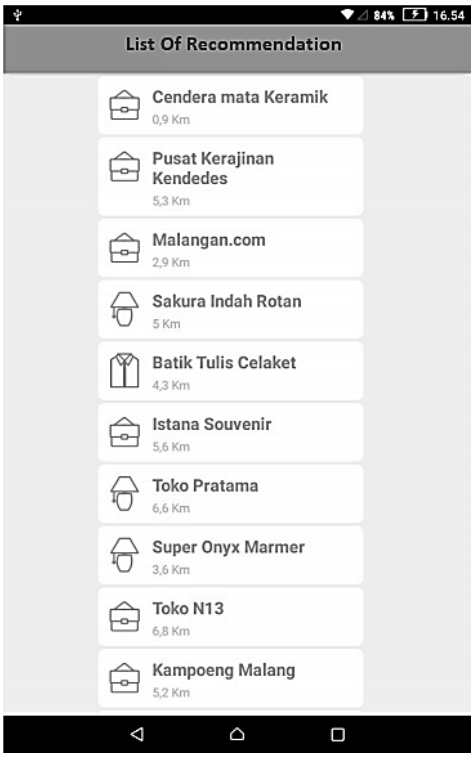

Fig. 6. User interface to get the list of recommendation

In this research, usability test is conducted to understand user's perception about the application. The comparison between personal decision support system and group decision support system is conducted to understand the impact of group decision support system in user perception as in Table 2.

There are 5 users that familiar with mobile application and ever have a holiday vacation in Malang that will be respondents for usability testing with system usability scale (SUS). SUS statement was given to them and each statement has a scale of 1 to 5, which means 1 for strongly disagree and 5 very agree to the statement in the SUS instrument. The final step is to analyze the test results that are calculated according to SUS calculations. The comparison between decision support system and group decision support system shows that SUS score of group decision support system (79.5) is better than personal decision support system (72.5).

Table 2. Usability testing.

	Personal DSS	**Group DSS**
User 1	28 *2.5 = 70	31 *2.5 = 77.5
User 2	30 *2.5 = 75	35 *2.5 = 87.5
User 3	28 *2.5 = 70	25 *2.5 = 62.5
User 4	30 *2.5 = 75	35 *2.5 = 87.5
User 5	29 *2.5 = 72.5	32 *2.5 = 80
SUS Score	**72.5**	**79.5**

5. CONCLUSION AND FUTURE WORK

The implementation of group decision support system is successfully implemented in Android platform. In this research, usability test is conducted to understand user's perception about the application. The comparison between decision support system and group decision support system shows that SUS score of group decision support system (79.5) is better than personal decision support system (72.5). It is also stated that the application can be accepted by the users. For further research, it is recommended to choose specific voting rule algorithm, for example BORDA algorithm and test the results with rank consistency testing. Rank consistency testing is recommended to test the GDSS algorithm.

ACKNOWLEDGEMENT

Authors (Ratih Kartika Dewi, M. Aminul Akbar, I Made Wira Satya Dharma, Felinda Gracia Lubis, Ade Armawi Paypas, Mustika Mentari) want to thanks lecturers and under graduate students from the Laboratory of media technology, games, and mobile devices, Faculty of Computer Science, Brawijaya University. Authors also want to thank colleagues from State Polytechnic of Malang for the participation in this research.

REFERENCES

Brooke, J. (1996). SUS-A quick and dirty usability scale. *Usability evaluation in industry*, 189(194), 4-7.

Dewi, R.K. (2019). Group Decision Support System based on AHP-TOPSIS for Culinary Recommendation System. *Jurnal Ilmu Komputer dan Informasi*, 12(2), 85-90.

Dewi, R.K., Ananta, M.T., Fanani, L., Brata, K.C., and Priandani, N.D. (2018). The Development of Mobile Culinary Recommendation System Based on Group Decision Support System. *International Journal of Interactive Mobile Technologies (iJIM)*, 12(3), 209-216.

Dewi, R.K, Mentari, M., Saputro, W., Nugroho, U.A., and Hibatullah M.H. (2019). Usability Analysis of TOPSIS based Mobile Recommender System of Malang Tourism, In: *The 4th International Conference on Sustainable Information Engineering and Technology*, 285-288. IEEE: New York NY.

Dharma, I.M.W.S, Dewi, R.K., and Akbar, M.A. (2020). *Pengembangan Aplikasi Android Sistem Rekomendasi Kelompok Tempat Pembelian Kerajinan Tangan Khas Malang dengan Metode TOPSIS-BORDA*. Undergraduate thesis of Brawijaya University, 2020.

Gutiérrez-Carreón, G., Daradoumis, T., and Jorba, J. (2015). Integrating learning services in the cloud: An approach that benefits both systems and learning. *Journal of Educational Technology & Society*, 18(1), 145-157.

Hwang, C.-L., and Yoon, K. (1981). Methods for multiple attribute decision making, In: *Multiple attribute decision making*, 58-191. Lecture Notes in Economics and Mathematical Systems, 186. Springer: Berlin, Heidelberg.

Kabassi, K. (2010). Personalizing recommendations for tourists. *Telematics and Informatics*, 27(1), 51-66.

Meehan, K., Lunney, T., Curran, K., and McCaughey, A. (2013). Context-aware intelligent recommendation system for tourism, In: *2013 IEEE Annual Conference on Pervasive Computing and Communications Workshops (PerCom)*, 328-331. IEEE: New York NY.

Ricci, F. (2010). Mobile recommender systems. *Information Technology & Tourism*, 12(3), 205-231.

Ricci, F. (2002). Travel recommender systems. *IEEE Intelligent Systems*, 17(6), 55-57.

Saputra, I.M.A.B., and Wardoyo, R. (2017). Sistem Pendukung Keputusan Kelompok Penentuan Karyawan Terbaik Menggunakan Metode Topsis dan Borda. IJCCS (Indonesian Journal of Computing and Cybernetics Systems), 11(2), 165-176.

Tolle, H., Pinandito, A., Kharisma, A.P., and Dewi, R.K. (2017). Pengembangan Aplikasi Perangkat Bergerak. Universitas Brawijaya Press.

Turban, E., Liang, T.P., and Aronson, J.E. (2005). *Decision Support Systems and Intelligent Systems* (International Edition). Pearson Prentice Hall: Upper Saddle River NJ.