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Daycare Recommendation System Using Fuzzy Logic Method and Haversine Formula (Case Study : Medan)

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ABSTRACT

The problem currently faced is the lack of trust from some parents towards daycare due to the lack of detailed information about daycare and the lack of attractive promotional media for working parents to entrust their children. Therefore, a decision support system is needed that uses the fuzzy logic method and haversine formula to assist in decision making when choosing the best alternative in daycare selection. The criteria used in this study were price, distance, quantity of caregivers, quality of caregivers, and facilities and infrastructure. The results of this study indicate that the system calculations are in accordance with manual calculations and the results of system testing prove that this system percieved of usefulness it has an actual score of 93.69% (0.9369), in terms of percieved ease of use it has an actual score of 93.21% (0, 9321), in terms of attitude toward using it has an actual score of 92.68% (0.9368) and in terms of behavior in use it has an actual score of 91.19% (0.9119). This was obtained by distributing questionnaires to 28 users (parents) during system testing.

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1. Introduction

In this era of globalization, the needs of life are increasing which makes many young mothers also involved in earning a living with their husbands outside the home. In this condition, parents face new challenges, where their roles are both parents and workers, which makes it difficult for them to manage their time in caring for children, especially if the child is still in an early age which is often referred to as the golden age. Working parents have several options to consider, one of which is choosing to place their children in a daycare center (TPA). However, there are still many parents who feel doubtful about the existence of TPA due to the lack of detailed information about TPA and promotional efforts that can attract interest and convince parents to entrust their children to TPA. According to research conducted by [1], they found that when parents choose TPA there is a consideration of several factors. Based on

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the results of interviews conducted with young working mothers, identified four main parameters that parents consider. These parameters include price, age group of children enrolled, availability of CCTV protection, and TPA rating. Based on the previously mentioned research, researchers can conclude that there are five important criteria in this problem. The parameters include price, age group of children enrolled, availability of CCTV protection, and TPA rating. In addition, research conducted by [2] also shows that the completeness of TPA facilities and infrastructure has a significant influence on parents' decisions. has a significant influence on parents' decisions. On the other hand, research [3] highlights five indicators that become quality standards in TPA. These indicators include the ratio between children and caregivers, caregivers, action plan, environment and facilities, and cooperation with parents. By considering these findings, parents can make a better decision in choosing a suitable in choosing a TPA that suits their needs and expectations.

This system will provide relevant and useful information, so that parents can obtain more accurate and reliable guidance by parents. The researcher uses fuzzy logic to select the best alternative from the various options available so that the selected TPA recommendation is based on parameters that have been set in the system and in accordance with user input. This SPK can provide decisions regarding the selected TPA alternatives, which can later be used as advice or recommendations for TPAs that are suitable for user children.

represented by a *job shop scheduling problem* where machine orderings can be differentfor each job. Job shop scheduling problem is one of the hardest combinatorial optimizationproblems. It belongs to the class of NP-hard problems,consequently there are no known algorithms guaranteed to give an optimal solution and run in polynomial time. That means, classical optimization methods (branch and bound method, dynamic programming) can be used only for small scale tasks. Therefore, more complex tasks must be solved by heuristic methods [15], [1]. Successful heuristic methodsinclude approaches based on *simulated annealing* [7], [12], and *genetic algorithms* [8], [17]. A veryefficient method combines a variable depth search procedurewith a *shifting bottleneck* framework [1], [19].

The papers[13], [15] provide a survey and a comparison of various jobshop scheduling methods. Deterministic algorithms as well as approximation and heuristic approaches (including, simulated annealing, genetic algorithms, and ejection chains) to scheduling manufacturing processes are presented and discussed in [3]. In [11], a case with uncertain processing times is studied and an approach based on fuzzy set theory is proposed.

A decision maker will prefer that sequence which optimizes the chosen measure of effectiveness. Sequencing problems occur in flow-shop production systems and in job-shop production systems[2]. In the former, each production order goes across the same set of machine centers. The jobs may be fixed in number or they may arrive over time. In a job-shop production system, jobs flow across machine centers on many different routes. In this paper the flow-shop problems are presented for the case where the job set is fixed in number. Then the job-shop problem is presented for the dynamic case involving the continuous arrival of jobs over time.

2. Method

2.1 General System Diagram

Provides an overall description of the system, including the processes, flows, and interactions that occur in the system to be built. The general system diagram for this research can be found in Figure 1 and Figure 2.

User Login as Admin

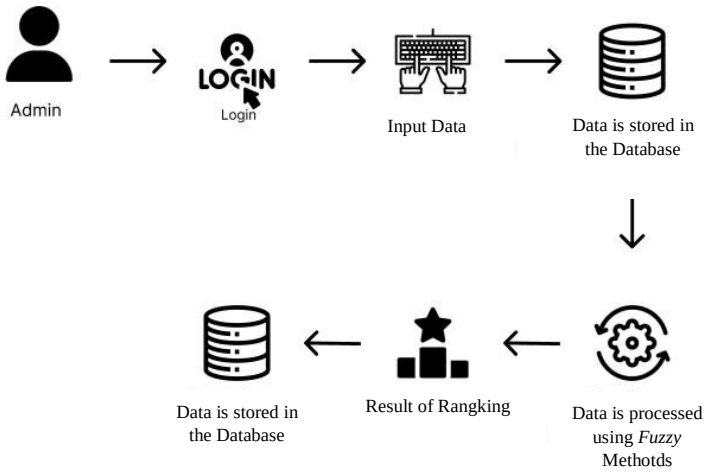


Figure 1 General User Diagram Login as Admin

User Login as User

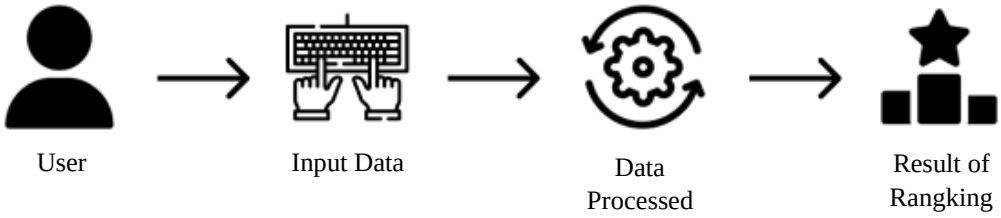


Figure 2 General User Diagram Login as User

The following are the steps of the system workflow:

A. User Logs in as Admin
   1. Admin logs into the system.
   2. Admin inputs alternative data, criteria and criteria values for each alternative.
   3. Input data is stored in the database.
   4. The system performs the calculation process using the fuzzy logic method and the haversine formula.
   5. The system displays the results of ranking alternatives.
   6. The ranking results are stored in the database.

B. User Logs in as User
   1. The user inputs the name and value of the selection criteria.
   2. The system performs an alternative search process.
   3. The system displays alternative ranking results.

System Modeling

System modeling is a step to describe the system model that will be built in this study. The system model serves as an overview of the system to be developed along with its components. This system

model is realized in various forms of diagrams, including general diagrams, use case diagrams, activity diagrams, and sequence diagrams.

2.2.1 **Use Case Diagram**

Use case diagram is a type of diagram that describes the system from the user's perspective. This diagram illustrates the functions or behaviors that exist in the system being developed. Use case diagrams explain how users interact with the system. The use case diagram for the system to be built in this study can be found in Figure 3.

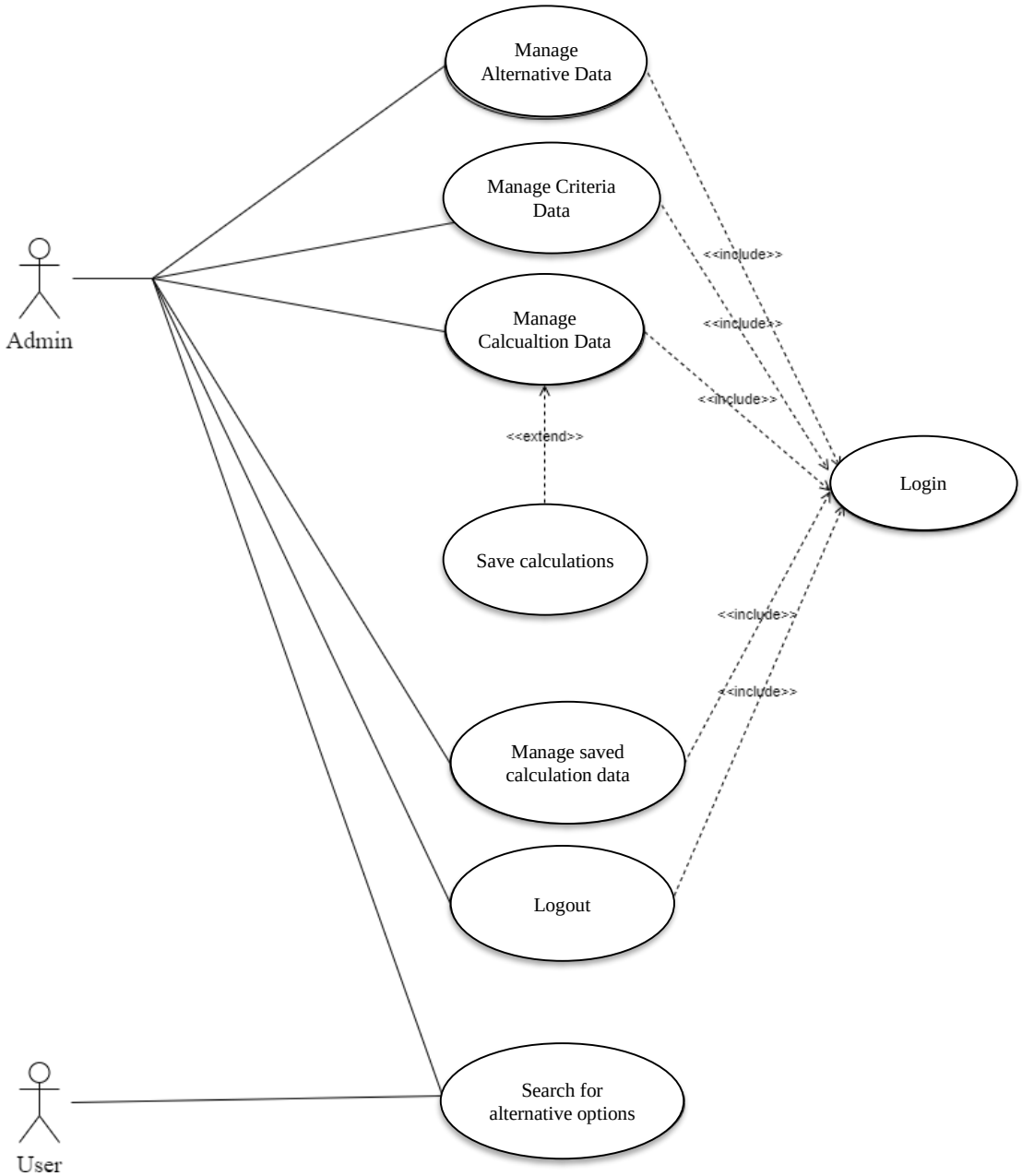


Figure 3 Use Case Daiagram

Result and Discussion

Main Page

The "Main" page is the first page displayed when the system is accessed for the first time. On this page, the system displays two options for users, namely to log in as an admin and to log in as a regular user. The display of the "Main" page can be seen in Figure 4.

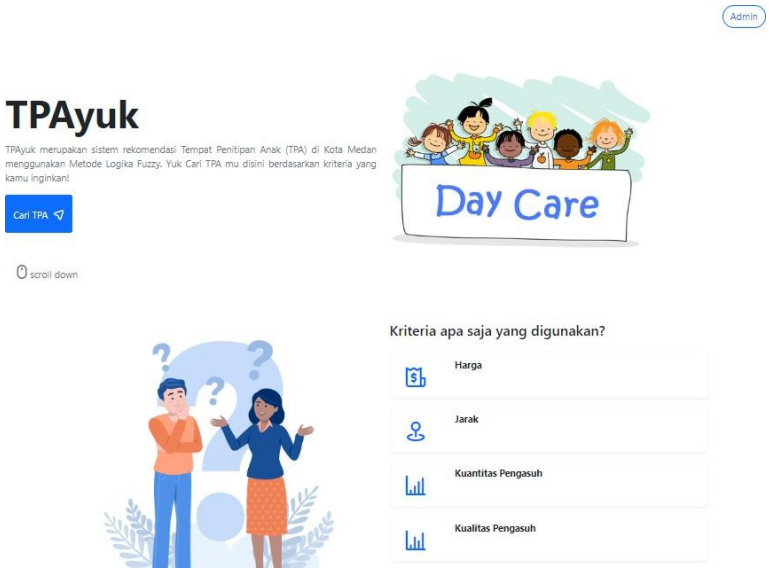


Figure 4 Main Page Display

3.2 User Login as Admin

3.2.1 Login Page

The "Login" page is the initial page displayed when the user logs in as an admin. On this page, users are asked to enter their username and password. The display of the "Login" page can be seen in Figure 5.

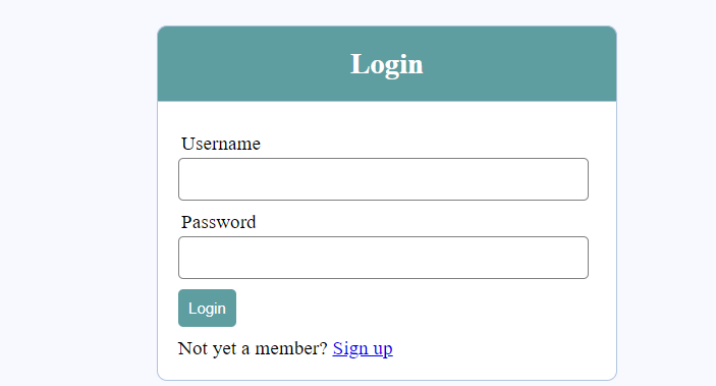


Figure 5 Login Page Display

3.2.2 Registration Page

The "Registration" page will appear after the user presses the "Sign Up" link. On this page, users are asked to fill in information such as username, email, password, and password confirmation. The display of the "Registration" page can be seen in Figure 6.

Figure 6 Registration Page Display

3.2.3 Home Page

The "Home" page is the initial page that appears after the admin has successfully logged in. On this page, there is information about the system. The display of the "Home" page can be seen in Figure 7.

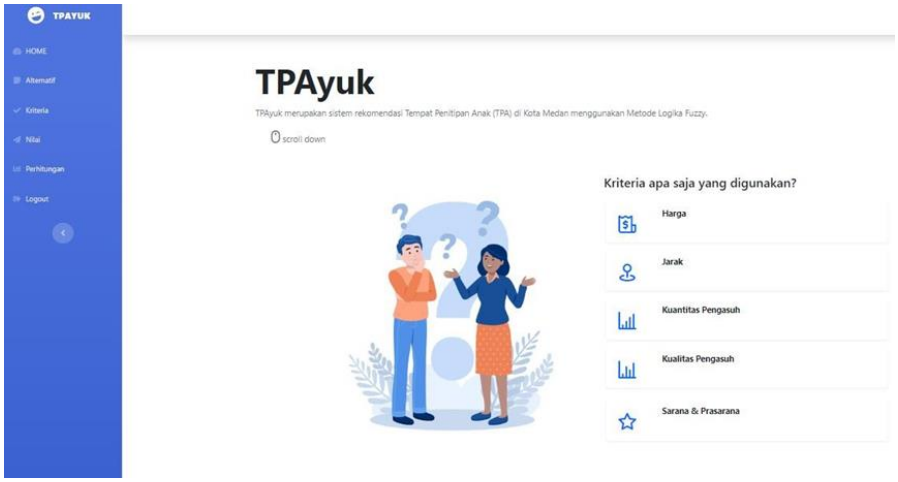


Figure 7 Home Page Display

3.2.4 Alternatives Page

The "Alternatives" page contains a table that displays a list of alternatives stored in the system. This table includes columns number, alternative ID, alternative name, rule, address, fuzzy value, and options. On this page, there are also buttons to add, change, and delete alternative data. Can be seen in figure 8.

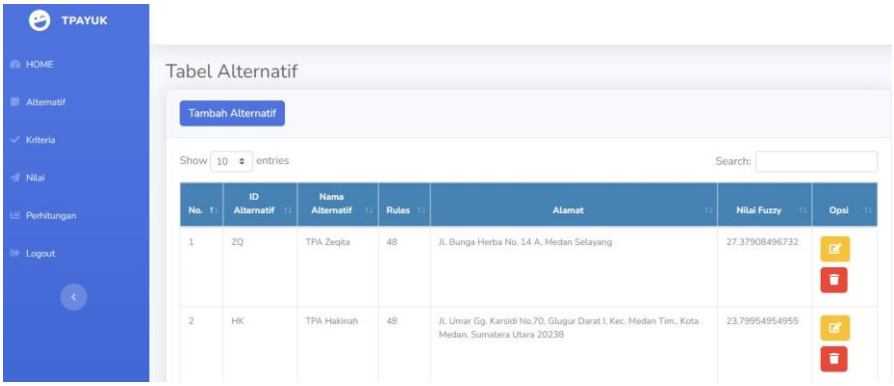


Figure 8 Alternative Page Display

3.2.5 Calculation Page

After the user completes the required data then the last one chooses the "Calculation" option on the menu, the "Calculation" page will be displayed. This page will display the calculation results to the admin. The calculation page display can be found in Figure 9.

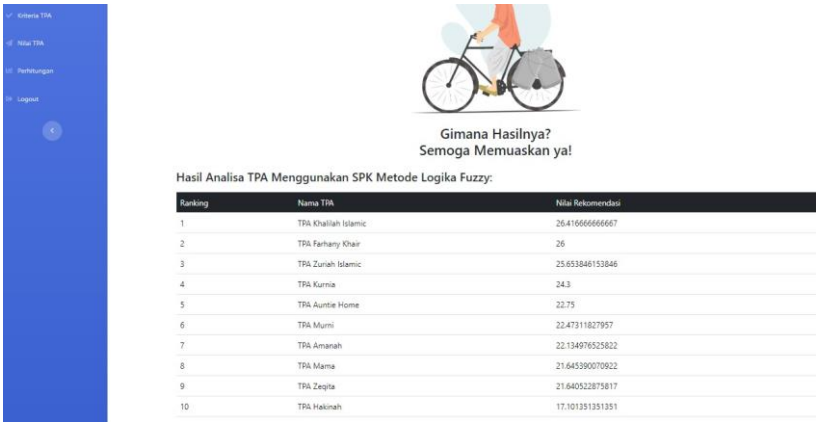


Figure 9 Calculation Page Display

3.3 User Login as User

3.3.1 User Page (Name Input)

After the user presses the "Search TPA" button, the "Search TPA" page will display a page for the user to input the name. The display of this page can be found in Figure 10.

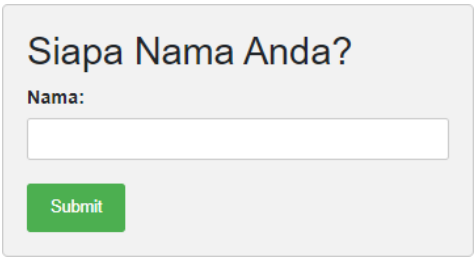


Figure 10 User Page Display

3.3.2 Search TPA Page

After the user presses the "Search TPA" button, the "Search TPA" page will be displayed. This page will display the criteria value input form according to the user's choice. The display of the calculation page can be found in Figure 11.

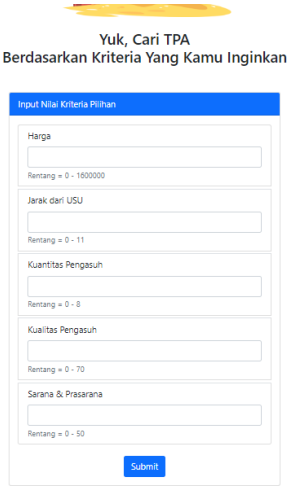
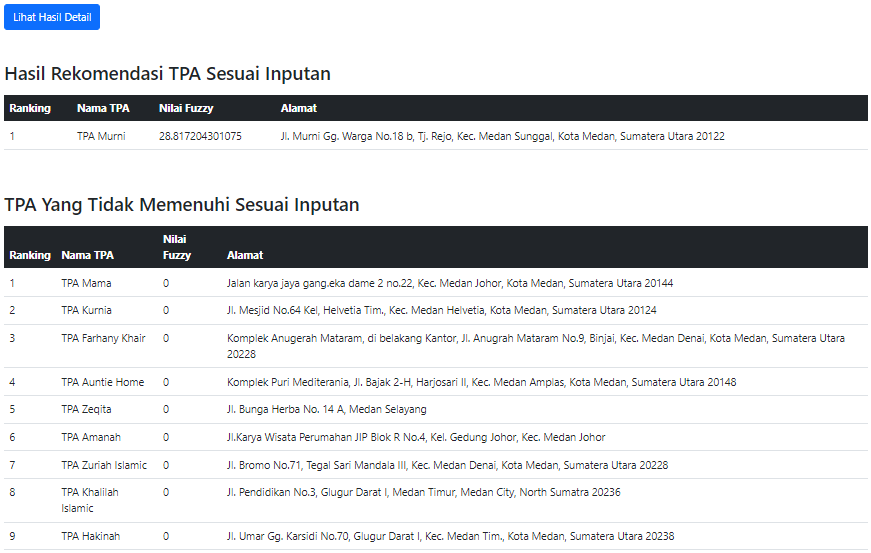


Figure 11 Search TPA Page Display

3.3.3 TPA Search Result Page

After the user presses the "Submit" button, the "TPA Search Results" page will be displayed. This page will display TPA recommendations based on user input values. The display of the "TPA Search Results" page can be found in Figure 12.


Lihat Hasil Detail

Hasil Rekomendasi TPA Sesuai Inputan

Ranking	Nama TPA	Nilai Fuzzy	Alamat
1	TPA Murni	28.817204301075	Jl. Murni Gg. Warga No.18 b, Tj. Rejo, Kec. Medan Sunggal, Kota Medan, Sumatera Utara 20122

TPA Yang Tidak Memenuhi Sesuai Inputan

Ranking	Nama TPA	Nilai Fuzzy	Alamat
1	TPA Mama	0	Jalan karya jaya gang.eka dame 2 no.22, Kec. Medan Johor, Kota Medan, Sumatera Utara 20144
2	TPA Kurnia	0	Jl. Mesjid No.64 Kel, Helvetia Tim., Kec. Medan Helvetia, Kota Medan, Sumatera Utara 20124
3	TPA Farhany Khair	0	Komplek Anugerah Mataram, di belakang Kantor, Jl. Anugrah Mataram No.9, Binjai, Kec. Medan Denai, Kota Medan, Sumatera Utara 20228
4	TPA Auntie Home	0	Komplek Puri Mediterania, Jl. Bajak 2-H, Harjosari II, Kec. Medan Amplas, Kota Medan, Sumatera Utara 20148
5	TPA Zeqita	0	Jl. Bunga Herba No. 14 A, Medan Selayang
6	TPA Amanah	0	Jl.Karya Wisata Perumahan JIP Blok R No.4, Kel. Gedung Johor, Kec. Medan Johor
7	TPA Zuriah Islamic	0	Jl. Bromo No.71, Tegal Sari Mandala III, Kec. Medan Denai, Kota Medan, Sumatera Utara 20228
8	TPA Khalilah Islamic	0	Jl. Pendidikan No.3, Glugur Darat I, Medan Timur, Medan City, North Sumatra 20236
9	TPA Hakinah	0	Jl. Umar Gg. Karsidi No.70, Glugur Darat I, Kec. Medan Tim., Kota Medan, Sumatera Utara 20238

Figure 12 TPA Search Result Page Display

3.4 Perceived of Usefulness Variable Calculation

Table 1 The TPA recommendation system helps parents to choose a daycare center.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	14	70	90%
Agree	4	14	56	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	126	

Table 2 The TPA recommendation system can facilitate the process of selecting daycare centers**.3**

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	21	105	95%
Agree	4	7	28	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	133	

Table 3 The TPA search menu helps input scores and select alternative data according to what parents want.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	19	95	93,571%
Agree	4	9	36	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	131	

Table 4 The TPA recommendation system displays the results of the input form.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	21	105	95%
Agree	4	7	28	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	133	

Table 5 The TPA recommendation system displays a list of recommendations according to the inputted data**.**

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	20	100	94,286%
Agree	4	8	32	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	132	

Table 6 The TPA recommendation system displays the final results in the form of rankings

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	20	100	94,286%
Agree	4	8	32	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	132	

Average percentage actual score is classified as very strong, with a value of 0.9369 which falls into the correlation range of 0.80-1.00 (very strong). Thus, it can be concluded that users have a positive tendency towards the TPA recommendation system.

Table 7 The TPA recommendation system is easy to learn

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	20	100	94,286%
Agree	4	8	32	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	132	

Table 8 The TPA recommendation system is easy to use.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	16	80	91,429%
Agree	4	12	48	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	128	

Table 9 The TPA recommendation system is clear and easy to understand.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	20	100	94,286%
Agree	4	8	32	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	132	

Table 10 The interface of the TPA recommendation system is flexible and user friendly.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	18	90	92,857%
Agree	4	10	40	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	130	

The average percentage of the actual score classified as very strong, with a value of 0.9321 which falls into the correlation range of 0.80-1.00 (very strong). Thus, it can be concluded that users have a positive tendency towards the landfill recommendation system.

3.6 Attitude Toward Using

Table 11 The TPA recommendation system is convenient to use.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	17	85	92,143%
Agree	4	11	44	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	129	

Table 12 The TPA recommendation system provides appropriate information.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	18	90	92,857%
Agree	4	10	40	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	130	

Table 13 Using a TPA recommendation system is a good idea

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	19	95	93,571%
Agree	4	9	36	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	131	

Table 14 Using the TPA recommendation system will be fun.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	17	85	92,143%
Agree	4	11	44	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	129	

The average percentage of the actual score classified as very strong, with a value of 0.9368 which falls into the correlation range of 0.80-1.00 (very strong). Thus, it can be concluded that users have a positive tendency towards the landfill recommendation system.

3.7 Behavior in Use

Table 15 Overall I am satisfied using the landfill recommendation system

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	17	85	92,143%
Agree	4	11	44	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	129	

Table 16 Overall I am satisfied using the landfill recommendation system

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	14	70	89,286%
Agree	4	13	52	
Undecided	3	1	3	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	125	

Table 17 I am interested in using the TPA recommendation system.

Answer	Score	Respondents	Total score	Percentage
Strongly Agree	5	17	85	92,143%
Agree	4	11	44	
Undecided	3	0	0	
Disagree	2	0	0	
Strongly Disagree	1	0	0	
Total		28	129	

Average percentage of actual score classified as very strong, with a value of 0.9119 which falls into the correlation range of 0.80-1.00 (very strong). Thus, it can be concluded that users have a positive tendency towards the landfill recommendation system.

Conclusion

The daycare recommendation system with fuzzy logic can provide daycare recommendations ranging from the most recommended to the least recommended based on user input. The results of system testing prove that this system is very useful with an actual score of 93.69% (0.9369), in terms of ease of use has an actual score of 93.21% (0.9321), in terms of user satisfaction with use, and has an actual score of 92.68% (0.9368) and in terms of behavioral tendencies has an actual score of 91.19% (0.9119). This was obtained through distributing questionnaires to 28 users (parents) during system testing. The system serves as a decision-making tool that provides reference information. The final decision remains in the hands of the decision maker.

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[3] Rizkita, D. Pengaruh standar kualitas Taman Penitian Anak (TPA) terhadap motivasi dan kepuasaan orangtua (pengguna) untuk memilih pelayanan TPA yang tepat. *Early Childhood: Jurnal Pendidikan* 1.1 (2017): 28-4