Decision Support System for Home Selection in South Tangerang City Using TOPSIS Method

Haris Widjaya[1], Ririn Ikana Desanti[2]

[1,2] Information System, Faculty of Informatics Engineering, Universitas Multimedia Nusantara Tangerang, Indonesia

[1] haris.widjaya@student.umn.ac.id
[2] ririn.desanti@.umn.ac.id

Abstract—**The desire to have a dream house makes people consider of the criteria of the house they will be lived. Many developers offer a variety of house alternatives ranging from price, location, design, building area and land area. Customers are pleased to choose their dream house as their desired. Based on that situation, this research is conduct to create a web-bases application for home selection that consider the useful criteria to help consumers choose a decent home by using the Technique for Order of Preference by Similarity To Ideal Solution (TOPSIS) method. The TOPSIS method has the concept that the best alternative has the shortest distance from a positive ideal solution and also has the farthest distance from a negative ideal solution. This TOPSIS method is applied to provide recommendations on the choice of home decisions in the South Tangerang area based on predetermined criteria. The results obtained in the TOPSIS calculation are the housing recommendations that are closest to the value of the calculation result.**

Index Terms—**Decision Support System, housing, home selection, TOPSIS method, web-based application**

I. INTRODUCTION

Houses are one of the basic needs of humans. House is a place to live and is used to protect human against climate disturbances and other living things. Houses are one of the residential buildings that must meet the comfort, safety and health criteria so it may support residents to work productively and be able to use them as healthy and safe dwellings for their residents [4].

Currently the development of housing, especially in the South Tangerang area is growing rapidly. South Tangerang itself is a relatively young city in the Banten area that has a very good city development. Realizing it all, currently many developers offer a variety of home alternatives ranging from prices, locations, designs, and ways of payment [1]. In general, promotions from housing developers are done by placing advertisements on paper or electronic media, as well as on websites. Home has already led to changes in business behavior, especially in the Property business [5]. Developments in the field show that consumers in choosing homes in housing have at least several aspects that are taken into consideration [1].

Reviewing the research that has been done before about the decision support system in the selection of houses, then the main criteria have been chosen based on analysis in several studies to find out a criteria that is a factor when someone wants to find a house that consists of price, location, building area, land area, facilities general, bedroom and bathroom [1][2][3][8]. Criteria used in decision support systems (DSS) have a role in system design as a decision-making process, processing data and information carried out aims to produce a variety of alternative decisions that can be taken [3].

The method used in this decision support system is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. TOPSIS was chosen because this method is often used in making decision support systems and TOPSIS also uses the principle that the chosen alternative must have the closest distance from the positive ideal solution and the farthest distance from the negative ideal solution [11].

Therefore, it is necessary to design a web-based application of home selection by considering the criteria to support a property agent in the process of selling a house and also to help prospective buyers to determine the choice of housing in the South Tangerang area [2].

II. THEORETICAL BASIS

A. House or Home

Home is everyone's primary need. Usually, to be able to meet the needs of a house or residence, someone will buy it to the developer or housing developer. Many housing developers provide alternatives regarding housing. The house is also a

building that functions as a place to live that is used for house room, family facilities, and assets for the owner. The house is also a place to rest after doing various activities and the house must be able to accommodate the activities of its residents [8].

B. Decision Support System

Decision Support System is an interactive computer-based information system, by processing data with various models to solve unstructured problems so that it can provide information that can be used by decision makers in making a decision [4]. The concept of a decision support system is characterized by an interactive computer system that helps make decisions using data and models to solve unstructured problems [9].

Decision Support System is a specific information system aimed at assisting management in making decisions relating to issues that are:

1. Structures, which are related to problems that have been known before with the completion of predetermined rule standards.

2. Semi structured, which is related to problems that have not been known before with existing parameters.

3. Unstructured, which is related to new problems that are quite complicated because of the large amount of data that is not yet known.

C. Decision Support System Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

According to Hwang and Zeleny in TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) based on the concept that the best chosen alternative not only has the shortest distance from a positive ideal solution, but also has the longest distance from the ideal solution negative [3].

In general, the TOPSIS procedure follows the steps as follows [3]:

1. Calculate normalized decision matrices.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \quad \text{with } i = 1, 2, \ldots, m \text{ and } j = 1, 2, \ldots \tag{1}$$

2. Calculating the weighted normalized decision matrix.

$$y_{ij} = w_j r_{ij}, \text{with } i = 1, 2, \ldots, m; \text{ and } j = 1, 2, \ldots, n$$
$$A^+ = (y_1^+, y_2^+, \ldots, y_n^+);$$
$$A^- = (y_1^-, y_2^-, \ldots, y_n^-);$$
with
$$y_j^+ \begin{cases} max_{i\,y_{ij}} ; if\ j\ is\ benefit\ attribute \\ min_{i\,y_{ij}} ; if\ j\ is\ cost\ attribute \end{cases} \tag{2}$$

$$y_j^- \begin{cases} min_{i\,y_{ij}} ; if\ j\ is\ benefit\ attribute \\ max_{i\,y_{ij}} ; if\ j\ is\ cost\ attribute \end{cases}$$

j = 1,2,…,m.

3. Calculating the matrix of positive ideal solutions and matrix ideal negative solutions.

4. Calculating the distance between the values of each alternative with a matrix of positive ideal solutions and a matrix of negative ideal solutions.

$$D_i^+ = \sqrt{\sum_{j=i}^{n} (y_i^+ - y_{ij})^2}$$

i = 1,2,…,m

$$D_i^- = \sqrt{\sum_{j=i}^{n} (y_{ij} - y_i^-)^2}$$

i = 1,2,…,m　　　　　　　　　　(3)

5. Calculate preference values for each alternative.

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$

i = 1,2,…,m　　　　　　　　　　(4)

D. Previous Studies

Some journals from previous study are as follows:

TABLE I.　　JOURNALS FROM PREVIOUS STUDY

Title	Author, Journal
Analisis dan Perancangan Sistem Pendukung Keputusan Rekomendasi Pemilihan Rumah dengan Metode TOPSIS [4]	Fatima, Anggraini, Jasmir.,Jurnal Manajemen Sistem Informasi Vol. 1, No. 5, Desember 2016
Aplikasi pemilihan rumah di kota pontianak menggunakan metode TOPSIS berbasis *website* [6]	Alpaniam, Dwi Marisa Midyanti. Jurnal Coding, Sistem Komputer Untan, Vol 6, No. 3 (2018)

III.　RESEARCH METHODOLOGY

A. Data Collection Techniques

The method used in this data collection is library research, observation and distribution of questionnaires. Literature study is used to get basic references that are strong enough to be used as research while the observation method is done by surfing the internet to get information about a house and the last questionnaire is used to get the main criteria from the user.
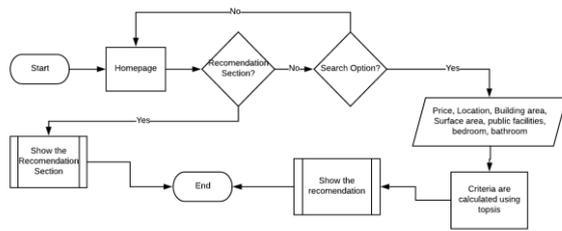
B. System Development

B.1 Flowchart

Fig. 1. Flowchart user

Flowchart which is used as a reference for how each stage and process will be carried out by the system. Flowchart can be interpreted as a tool or suggestion that shows the steps that must be taken in solving a problem for comparison by discussing it into tracking special graphic symbols [10]. Figure 1 shows the flow of the front-end user part of the system. when first accessing the website, the user will display a home page in which there is a recommendation page that is immediately presenting the house and also the user can use the function of the website to do a home search by filling in several types of criteria.

B.2 Data Flow Diagram (DFD)

Data Flow Diagrams are diagrams used to describe the processes that occur in the system to be developed, with this model, the data involved in each process can be identified [7]. The next stage is a context diagram that is used to describe the flow of data and the processes carried out by the system that will be created. In Figure 2 it can be seen that there are 2 entities that are connected with the decision support system, admin and user.
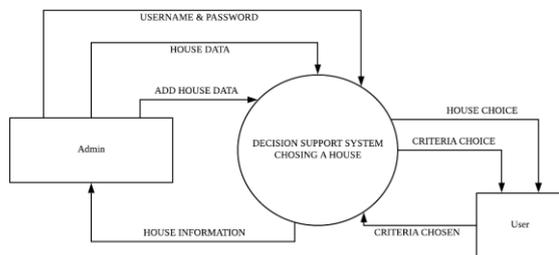

Fig. 2. Context diagram of web-based application

In Figure 3, it can be seen that the system will be divided into 4 main processes, login, manage data, TOPSIS calculations, and check alternatives.
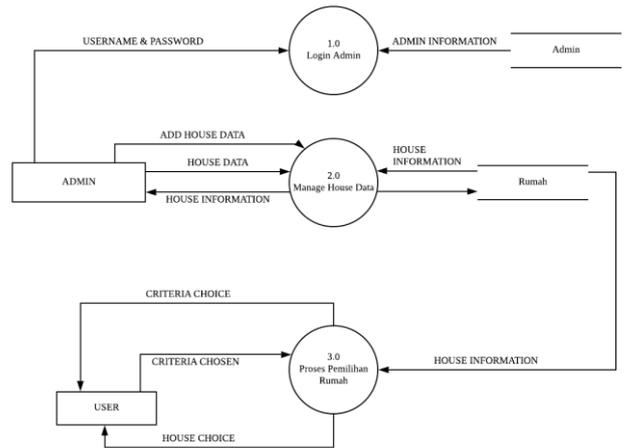

Fig. 3. DFD level 0 of web-based application
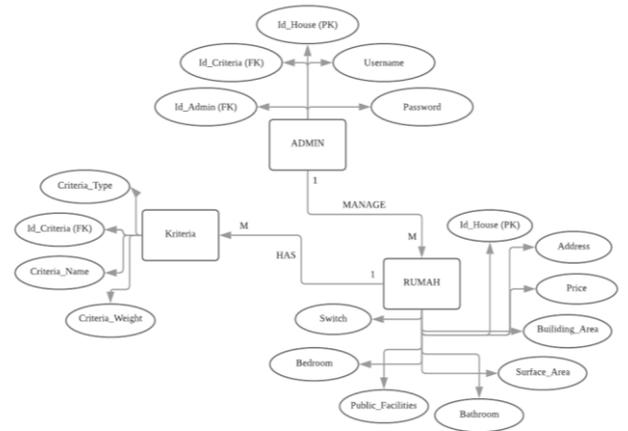
B.3 Entity Relationship Diagram (ERD)

Fig. 4. ERD of web-based application

In Figure 4, the relationship of entity in the database of web-based application of home selection is shown.

C. Coding

To build a system that has been designed, a place is needed to display the system. The system is based on a website and also uses the PHP and MySQL programming languages as its database. The website has a responsive form and can follow how the shapes and sizes are provided [6].

IV. ANALYSIS AND DISCUSSION

A. Analysis of The System

In building the system, the required identification needs to be a system built to run well. Data needed by the system from solving problems that have been formulated previously.

1. Data needed in research:

   - Criteria and weight for decision making. the weight specified is as follows: W = [1 0.5 0.5 0.75 0.75 0.5 0.5].

   - Input data from users in the form of prices, building area, land area, public facilities, location, bedrooms and bathrooms.

   - Changing data from the user is processed into fuzzy values based on the process written in chapter 3.

2. Simulation is done by taking 5 alternative choices of houses randomly to be given an assessment from each house that has its own criteria.

TABLE II.   DATA SAMPLE OF HOUSE

	House 1	House 2	House 3	House 4	House 5
Price	1	0.9	0.6	0.45	0.3
Building area	0.4	0.6	0.6	0.8	1
Surface area	0.3	0.45	0.75	0.75	0.9
Public facilities	0.4	0.6	0.6	0.8	1
Location	0.9	0.3	0.9	0.75	0.45
Bedroom	0.4	0.6	0.6	0.6	0.8
Bathroom	0.2	0.4	0.4	0.6	0.6

The values in table 1 have been changed into a previously determined form so that data can be processed through the system. After that, the calculation are made to find the matrix value normalized as seen on Table 3.

TABLE III.   NORMALIZED MATRIX

House 1	House 2	House 3	House 4	House 5
0.6372	0.5735	0.3823	0.2867	0.1911
0.2519	0.3779	0.3779	0.5039	0.6299
0.2010	0.3015	0.5025	0.5025	0.6030
0.2519	0.3779	0.3779	0.5039	0.6299
0.572	0.191	0.572	0.477	0.286
0.292	0.438	0.438	0.438	0.582
0.192	0.385	0.385	0.577	0.577

After getting the matrix value then the value is given a predetermined weight. After that the determination of the positive ideal and also the negative ideal is determined by looking for the maximum and also minimum values of the data. The next step is to calculate the distance of the positive ideal solution and also the distance of the negative ideal solution as seen on Table 4 below.

TABLE IV.   IDEAL SOLUTION DISTANCE

SI +	SI -
0.4635	0.5299
0.4181	0.4198
0.3656	0.4106
0.3856	1.0653
0.495	0.4689

The last stage is to determine the preference value for each alternative that has been calculated using the formula. The final result consists of various numbers and to equalize the user then the value of the user will be calculated and the value will be compared with the closest distance to the result.

$$P1 = \frac{0{,}53}{0{,}53 + 0{,}463} = 0.533$$

$$P2 = \frac{0{,}42}{0{,}42 + 0{,}418} = 0.37$$

$$P3 = \frac{0{,}411}{0{,}411 + 0{,}366} = 0.63$$

$$P4 = \frac{1{,}065}{0{,}386 + 1{,}065} = 0.494$$

$$P5 = \frac{0{,}469}{0{,}469 + 0{,}495} = 0.476$$

Fig. 5.   Calculation of P
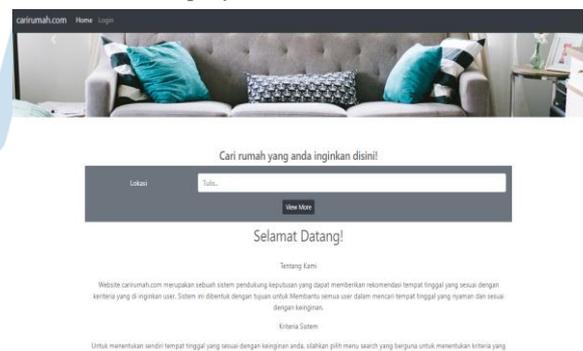
B. *Website Display*

Fig. 6.   Homepage

Figure 6 shows the homepage that will be displayed when the user or admin first accesses the website. On the homepage, a button is displayed to log in to the admin and the user can search the house based on the criteria.
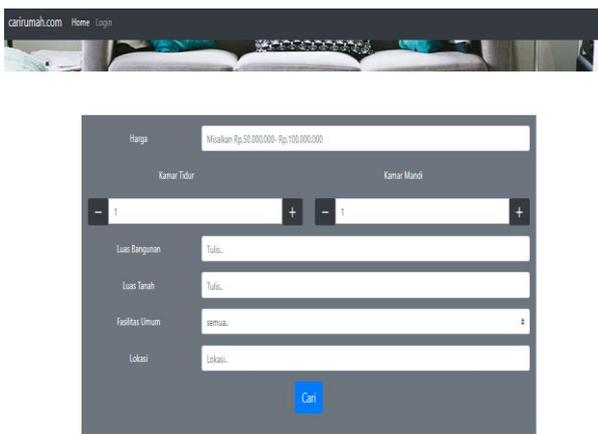
Selamat Datang!

Fig. 7. Search

In Figure 7, the search option consists of choices that have been designed based on priority interests and the criteria consist of price, building area, land area, public facilities, location, bedroom, bathroom. When the user will fill in the selection criteria, there are several choices that the user can choose so that the user is not confused when filling in the criteria.
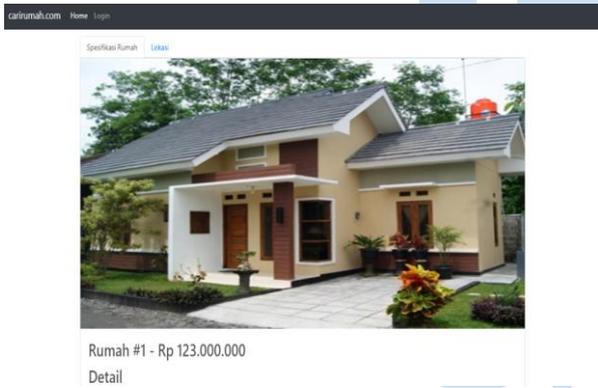

Rumah #1 - Rp 123.000.000
Detail

Fig. 8. Recommendation

In figure 8, the recommendations given by TOPSIS to the user are in the form of a photo of a house, the price of a house, the location of the house, the size of the building, the number of bathrooms, the number of bedrooms, and a description of the house and the location that can be used by the user to see where the house is located.
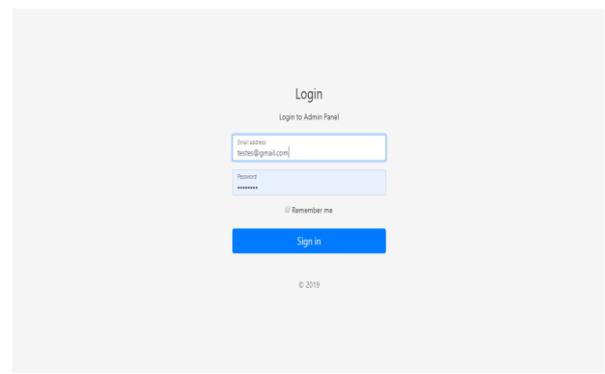

Fig. 9. Login

Figure 9 displays the Admin Login page. Admin can access the Admin (back-end) view by logging in first, this page has a form for admin to enter username and password. Next, if the admin has entered into the admin home screen, then the admin can see the navigation that points to home data and logout. Figure 9 shows how after the admin logged into the back-end and there is home data and logout.
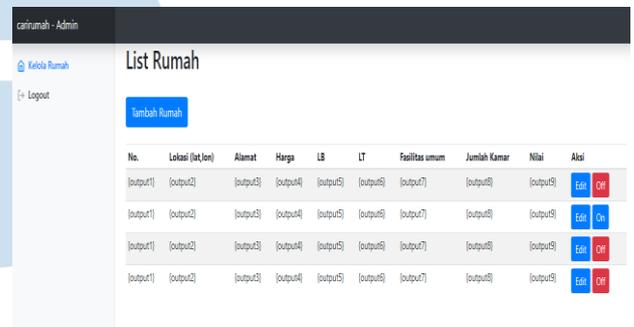

Fig. 10. Back-end

It can be seen in Figure 10 that there is a table of home data lists containing the house code, address, location, facilities, building area, land area, price, bedroom, bathroom. In addition there are buttons to change data or add data and an "on / off" button. When the "edit" button is pressed, the admin can access the edit home page which is useful for changing information about the house. Add home page that contains the form for the new data is loaded into the system so that it can be used.

V. CONCLUSION

The result of this research is a web-based application to supports decisions making about choosing a home by assessing the results of the score that has been given by the user. The research use TOPSIS calculation method that provides results with an ideal solution according to the criteria selected. This web-based application can be used by a property agent to help them in selling houses and by users in

terms of providing home recommendations that match the criteria.

REFERENCES

[1] D. E. Kurniawan and K. S. T. A. , "Pemilihan Rumah Menggunakan Metode Weight Product Dengan Visualisasi Lokasi Objek," *Kumpulan jurnal. Ilmu Komputer,* 2017.

[2] A. A. Chamid, "Penerapan Metode Topsis Untuk Menentukan Prioritas Kondisi Rumah," *Jurnal SIMETRIS,* 2016.

[3] S. Kusumadewi, "Aplikasi Logika Fuzzy untuk Pendukung Keputusan,," Yogyakarta, Graha Ilmu, 2010, pp. 4-5.

[4] F. Anggraini and J. , "Analisis dan Perancangan Sistem Pendukung Keputusan Rekomendasi Pemilihan Perumahan Dengan Metode Topsis," *Jurnal Manajemen Sistem Informasi,* 2016.

[5] T. R. Adianto, Z. Arifin and D. M. Khairina, "Sistem Pendukung Keputusan Pemilihan Rumah Tinggal di Perumahan Menggunakan Metode Simple Additive Weighting (SAW) (Studi kasus : Kota Samarinda)," *Prosiding Seminar Ilmu Komputer dan Teknologi Informasi,* 2017.

[6] A. and D. M. Midyanti, "Aplikasi Pemilihan Rumah Di Kota Pontianak Menggunakan Metode Topsis Berbasis Web," *Jurnal Coding, Sistem Komputer Untan Vol 06, No. 03,* pp. 161 - 172, 2018.

[7] F. Riandari, P. M. Hasugian and I. Taufik, "Sistem Pendukung Keputusan Menggunakan Metode Topsis Dalam Memilih Kepala Departemen Pada Kantor Balai Wilayah Sungai Sumatera II Medan," *Journal Of Informatic Pelita Nusantara,* 2017.

[8] M. A. Dewi, "Penggunaan Simple Additive Weighting Dalam Pengembangan Sistem Penunjang Keputusan Penentuan Bonus Karyawan," *ULTIMA Infosys, Vol. IX, No. 1,* p. 45, 2018.

[9] M. Elistri, J. Wahyudi and R. Supardi, "Penerapan Metode Saw Dalam Sistem Pendukung Keputusan Pemilihan Jurusan Pada Sekolah Menengah Atas Neger 8 Seluma," *Jurnal Media Infotama,* 2014.

[10] R. Nuraini, "Desain Algorithma Operasi Perkalian Matriks Menggunakan Metode Flowchart," *Jurnal Teknik Komputer Amik BSI,* 2015.

[11] R. T. Djaelangkara, R. Sengkey and O. A. Lantang, "Perancangan Sistem Informasi Akademik Sekolah Berbasis Web Studi Kasus Sekolah Menengah Atas Kristen 1 Tomohon," *e-jurnal Teknik Elektro dan Komputer,* 2015.

[12] G.W. Sasmito. "Penerapan Metode *Waterfall* Pada Desain Sistem Informasi Geografis Industri Kabupaten Tegal". *Jurnal Pengembangan IT (JPIT), Vol. 2, No.1,* 8, 2017.

[13] I. Muzakkir. "Penerapan Metode TOPSIS untuk Sistem Pendukung Keputusan Penentuan Keluarga Miskin Pada Desa Panca Karsa II". *ILKOM Jurnal Ilmiah,* 2017.

[14] Ma'ruf. "Pengembangan Sistem Pendukung Keputusan Pemilihan Supplier Menggunakan Metode TOPSIS pada Perusahaan Furniture". *Prosiding Seminar Nasional Ekonomi dan Bisnis & Call For Paper*, 2016.

[15] J. Hutahaean, E.A. Purba. Rancangan Bangun E-Ticket Bioskop Dengan Metode *Waterfall* Berbasis *Website*. *Riau Journal Of Computer Science Vol.2 No.2*, 52, 2016.