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Decision Support System to Determine the Location of City Park Development Using the Analytical Hierarchy Process Method

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ABSTRACT

City parks are the main resource in improving the quality of the environment, therefore a good and quality city park is needed to improve the quality and quality of health. One of the efforts to get a quality and good park location is to choose the location of the opening of the park properly. The decision support system carried out at the Medan City Park Service is still conventional which is only based on certain elements so that the assessment is still subjective. Based on these problems, in this study a decision support system was developed using the Analytical Hierarchy Process (AHP) method for determining the location of urban park development. This system uses user-defined criteria and intensity, processed with AHP calculations, and produce a list of assessments for each city park location that will be selected. The results of testing this decision support system state that the system has been running correctly, so this system can be used to assist leaders in making more objective decisions on choosing thelocation of city parks.

1. Introduction

Park[1] is a very important component for human life.[2] The importance of parks in people's lives must be considered by the government[3]which is related. Especially with the rapid growth of development[4] which is part of the economy[5] and population growth. Parks can be green areas[6] which has many benefits, such as as a place for plant conservation[7] and trees[8] which can be green lungs in urban areas. Besides that, it can also be used as another alternative place for public entertainment[9] especially children in addition to modern shopping centers such as malls that are widely available in urban areas. The park can also be used as a recreation area,[10] community entertainment and children's playgrounds which are certainly healthy and cheap for all circles and social strata of society.[11] Therefore, it is very important to think about the right location for the construction of the park.[12]

Park Service[13] Medan City is a Medan city government agency that is responsible for sustainability[14] and the development of parks, especially in the city of Medan. The challenge faced by the Medan City Park Service is that it is increasingly difficult to find a location[15] which is suitable to be built as a garden. This is due to the rapid development and economic growth in the city of Medan. In addition, the main reason is because there are also some locations belonging to the Medan city government that have changed their status to private land. Conditions like this certainly complicate the work of the Medan City Park Service, which wants to green the city of Medan by building parks. Therefore, the Medan City Park Service needs to think of a solution to determine the choice of a park development location, one of which is to use a computer-based system that can work based on predetermined criteria. Applications in the form of a flexible Decision Support System in an organization can help human work tailored to the interests of each organization. Implementation of Decision Support Systems can be carried out in almost all business functions in the organization, from the production planning and financial functions, customer service functions, sales and human resource management. In the human resource management function, the Decision Support System can be used to help the human resource management (HR) process tobe easier and more effective. One of them is to use the AHP method or*Analytical Hierarchy Process*. AHP is a mathematically based

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procedure that is very good and suitable for evaluation conditions of qualitative attributes. The advantages of AHP compared to others are because of the hierarchical structure, as a consequence of the criteria chosen, down to the most detailed sub-criteria (Suparman, Center for Nuclear Energy Development – BATAN Journal).

Supriyono in his research which also raised a Decision Support System using the AHP (Analytical Hierarchy Process) method stated that to determine the value of a decision, a set of criteria is needed, each of which has a value (Jurnal SNTN ISSN 1978-0176). Marsani Asfi in the Journal of Informatics, Vol.6, No.2, December 2010: 131 – 144 states the concept of the AHP method is to change qualitative values into quantitative values. So that the decisions taken can be more objective. Based on this, this method can be used as a solution to the problems of the Medan City Park Service.

2. METHOD

2.1 Decision

According to (Prajudi Atmasudirjo, 2008: 45) Decisions are organizational behavior, the essence of individual behavior and in the description of this decision process is relative and it can be said that the understanding of organizational behavior is more important than individual interests.

(Kusrini,2007;25) stated the decisionis a reaction to several alternative solutions that is carried out consciously by analyzing the possibilities of these alternatives along with their consequences. Every decision will make a final choice, it can be an action or an opinion. It all starts when we need to do something but don't know what to do. For this reason, decisions can be perceived as rational or irrational and can be based on strong or weak assumptions. A decision is a decisiontaken by an authorized organ based on the authority it has.

2.2 Decision Support System

A Decision Support System or in English better known as a Decision Support System (DSS) is an interactive information system that provides information, modeling, and manipulating data. This system is used to assist decision making in semi-structured and unstructured situations, where no one knows for sure how decisions should be made (Kusrini, 2007: 16). *Decision Support System (DSS)* usually built to support a solution to aproblem or to evaluate an opportunity. Such a Decision Support System (DSS) is called a Decision Support System (DSS) application. The Decision Support System (DSS) application is used in decision making. Decision Support System (DSS) applications use flexible, interactive and adaptable CBIS (Computer Based Information Systems), which were developed to support solutions to unstructured specific management problems. Decision Support System (DSS) applications use data, provide an easy user interface, and can incorporate decision-making thinking.

In terms of context, basically a Stationery Inventory Decision Support System is Studying a system, you will be more familiar if you know in advance what a system is. Further understanding of the system can first be obtained from its definition. Thus this definition will have an important role in the approach to studying a system. The systems approach which is a collection of elements or components or subsystems is a broad definition. This definition is more widely accepted, due to the fact that a system can consist of several subsystems or other system parts (H. Arjuna Sembiring, 2013; 28).

2.3 Multi-Attribute Decision Making (MADM)

In general, the Multi-Attribute Decision Making (MADM) model can be defined as follows (Zimermann, 2005), Suppose A = {ai | i = 1,...,n} is the set of decision alternatives and C = {cj | j = 1,..., m} is the set of expected goals, then the alternative x0 will be determined which has the highest degree of hope for the relevant goals cj.

Janko (2005) provides limitations on the existence of several general features that will be used in MADM, namely:

1. *Alternative*, are different objects and have the same opportunity to be chosen by the decision maker.
2. *Attribute*, often also referred to as characteristics, components, or decision criteria. Although most of the criteria are onelevel, it is possible that there are sub-criteria related to the criteria that have been given.
3. *Conflict between criteria*, some criteria usually have conflicts with each other, for example the profit criteria will conflictwith the cost criteria.

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4. *Decision weight*, the decision weights indicate the relative importance of each criterion, W = (w1, w2, ..., wn). InMADM, the importance weight of each criterion will be sought.
5. *Decision matrix*, a decision matrix X of size mxn, containing the elements xij, which represents the rating of thealternative Ai (i=1,2,...,m) against the criteria Cj (j=1,2,...,n) .

2.4 AHP (Analytical Hierarchy Process) Method

The AHP (Analytical Hierarchy Process) method was developed by Thomas L. Saaty, a mathematician. This method is an essay to make effective decisions on complex problems by simplifying and speeding up the decision-making process by breaking the problem into its parts, arranging these parts or variables in a hierarchical order, assigning numerical values to subjective judgments about the importance of each variable and synthesize various considerations. This is to determine which variable has the highest priority and act to have a result in a given situation.

2.5 Park

Park is a fenced plot of land used for pleasure, joy and comfort. The city is a place where the process of life and life takes place or as a place for human activities to take place (Setiyaningrum, Diyah, 2005: 4). City Parks are parks located in urban environments on a broad scale and can anticipate the impacts caused by urban development and can be enjoyed by all city residents.

2.6 Research Methods

The experiences that emerged during the selection of park development sites at the Medan City Park Service carried out in the previous period provided useful lessons to improve the state of the implementation of the park development site selection at the Medan City Parks Service in the future even better. Criticisms and suggestions received by human resource management from the process of selecting a park construction site at the Medan City Park Service can be used as problem analysis material to be used as reference material for solving problems that occur. Problems that arise can be categorizedinto problems of supporting facilities and human error.

1. The lack of thoroughness of the selection team in the process of selecting a park construction site at the Medan City ParkService which resulted in the inaccurate location being chosen.
2. The workload faced by human resource management is due to the large number of HR (Human Resources) that mustbe selected and must concentrate on other jobs that become daily routines.

2.7 Analysis of The Methods Used

*Analytical Hierarchy Process*is a decision search method that will produce rational decision results. A rational decision is defined as the best decision of the various objectives to be achieved by the decision maker. The main key to a rational decision includes alternatives and criteria that lead to the desired goal and is oriented to existing sources.In making this decision the author performs several stages, namely:

1. *Intelligent.*
2. *modeling.*
3. *Choice*.

3. Results

3.1 Algorithm

Algorithm is a method used to obtain / explain a certain situation so that it can be better understood or show the steps for solving a problem. In general, the algorithm is more or less the same as the procedure that is often performed. Algorithms play an important role in the programming field, because of the importance of an algorithm, so it is necessary to understand the basic concepts of algorithms. Algorithms help a lot in understanding programming logic concepts. If for a programmer, of course an algorithm is carried out so that they can make algorithms so that the system that is built can run well.

Table 1.

Matrix of Comparison of Voter Perception Criteria

Criteria	K1	K2	K3	K4	K5

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K1	1.0000	1.50000	1.0000	1.0000	1.50000
K2	1.50000	1.0000	0.66666	0.66666	1.0000
K3	1.0000	1.50000	1.0000	1.0000	1.50000
K4	1.0000	1.50000	1.0000	1.0000	1.50000
K5	0.66666	1.0000	0.66666	0.66666	1.0000
TOTAL	5.16666	6.50000	4.33332	4.33332	6.00000

Where for the results of each column obtained from the results of the division as follows:
For row 1: (K1/K1), (K1/K2), (K1/K3), (K1/K4), (K1/K5)
For row 2: (K2/K1), (K2/K2), (K2/K3), (K2/K4), (K2/K5)
For row 3: (K3/K1), (K3/K2), (K3/K3), (K3/K4), (K3/K5)
For row 4: (K4/K1), (K4/K2), (K4/K3), (K4/K4), (K4/K5)
For row 5: (K5/K1), (K5/K2), (K5/K3), (K5/K4), (K5/K5)
Then to find the total, it can be obtained from the results of adding to each column as follows:1.0000 +0.66666 + 1.0000 + 1.0000 + 0.66666= 4.33332

a) Create a criterion value matrix

Table 2.
Overall Weight of Voter Perception Criteria

CRITERIA	K1	K2	K3	K4	K5	AMOUNT	PRIORITY WEIGHT
K1	0.23076	0.23076	0.23076	0.23076	0.23076	1.15384	0.22059
K2	0.15384	0.15384	0.15384	0.15384	0.15384	0.7692	0.29412
K3	0.23076	0.23076	0.23076	0.23076	0.23076	1.15384	0.22059
K4	0.23076	0.23076	0.23076	0.23076	0.23076	1.15384	0.22059
K5	0.15384	0.15384	0.15384	0.15384	0.15384	0.7692	0.29412

This criterion value matrix is obtained by dividing each column element according to the total as follows:

For K1
1.0000 / 4.33332= 0.23076
0.66666 / 4.33332= 0.15384
1.0000 / 4.33332 = 0.23076
1.0000 / 4.33332 = 0.15384
0.66666 / 4.33332 = 0.15384

To find the value of the column sum is done by adding each element in the column in each row as follows:
0.23076+ 0.23076+ 0.23076+ 0.23076+ 0.23076= 1.15384
And to get the value of the priority weight by dividing the value from the number column by the number of elements as follows:
1.15384/ 4 = 0.28845
max = (4.33332*0.28845) + (4.25000*0.7692) + (4.33332*0.28845) + (4.33332*0.28845) + (4.25000*0.7692) =10.28803
CI = 10.28803-4 / 4-1 = 2.09601
Making consistency ratio (CR) CR= CI / RI RI is taken from a random value generator.

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Table 3.
Random Index Value

Matrix size	1.2	3	4	5	6	7	8	9	10
Random index	0.0	0.58	0.9	1.12	1.24	1.32	1.42	1.45	1.49

Because the matrix is of order 5, the value of RI = 1.12Then CR=2.09601 / 1.12 = 1.87143

b. Create a comparison matrix for the selection of social assistance recipients.

To create a social assistance recipient selection matrix, it is carried out by calculating the weights of the overall criteriafor selecting social assistance recipients.

1. THAMRIN

a) Create a comparison matrix of criteria that are converted into 5 decimal numbers.

K1: Location = 3000000
K2: Location Condition = 2.000000K3: Location Density = 3000000
K4: Population = 2.000000K5: Weather Conditions = 1.0000\

Table 4.
Matrix Comparison of Criteria A

CRITERIA	K1	K2	K3	K4	K5
K1	1.0000	1.50000	1.0000	1.50000	3000000
K2	0.66666	1.0000	1.0000	1.0000	2000000
K3	1.0000	0.66666	1.0000	1.50000	3000000
K4	0.66666	1.0000	0.66666	1.0000	2000000
K5	0.33333	0.50000	0.33333	0.33333	1.0000
TOTAL	3.99999	4.66666	3.99999	5.33333	9,00000

Where for the results of each column obtained from the results of the division as follows:
For row 1: (K1/K1), (K1/K2), (K1/K3), (K1/K4), (K1/K5)
For row 2: (K2/K1), (K2/K2), (K2/K3), (K2/K4), (K2/K5)
For row 3: (K3/K1), (K3/K2), (K3/K3), (K3/K4), (K3/K5)
For row 4: (K4/K1), (K4/K2), (K4/K3), (K4/K4), (K4/K5)
For row 5: (K5/K1), (K5/K2), (K5/K3), (K5/K4), (K5/K5)
Then to find the total, it can be obtained from the results of adding to each column as follows: 1.0000+ 1.50000 + 1.0000 + 1.50000 + 3.0000 = 8.000000
0000 = 4000000

Create a criterion value matrix

Table 5.
Overall Weight of Criteria C

CRITERIA	K1	K2	K3	K4	K5	AMOUNT	PRIORITY WEIGHT
K1	0.25	0.25	0.25	0.25	0.25	0.625	0.23438
K2	0.125	0.125	0.125	0.125	0.125	1.25	0.23438
K3	0.25	0.25	0.25	0.25	0.25	0.625	0.31250

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K4	0.25	0.25	0.25	0.25	0.25	0.625	0.23438
K5	0.125	0.125	0.125	0.125	0.125	1.25	0.23438

This criterion value matrix is obtained by dividing each column element according to the total as follows:Example for K1

1.0000 /4.00000 = 0.25
0.50000/4000000= 0.125
1.0000 / 4000000= 0.25
1.0000 / 4000000= 0.25
0.50000/4000000= 0.125

To find the value of the sum is done by adding each element in the column in each row as follows:
0.25 + 0.25+ 0.25 + 0.25 + 0.25 = 0.625

And to get the value of the priority weight by dividing the value from the number column by the number of elements asfollows:

0.625/ 4 = 0.15625

For the value of four is taken from the number of elements.

b) Creating consistency index (CI) max –n / n-1max = Number of elements in matrix Y
N

max = (4,000000*0.23438) + (4,00000*0.23438) + (4,000000*0.31250) + (4,00000*0.23438) + (4,00000*0.23438) = 5,00008

CI = 5.00008-4 / 4-1 = 0.33336

c) Making consistency ratio (CR) CR= CI / RIThen CR= -0.75000 / 1.12 = -0.54408

Main Menu

Main Menu Display is the display that appears after running the program for the location selection decision supportsystem. The main menu display can be seen in Figure 3.1

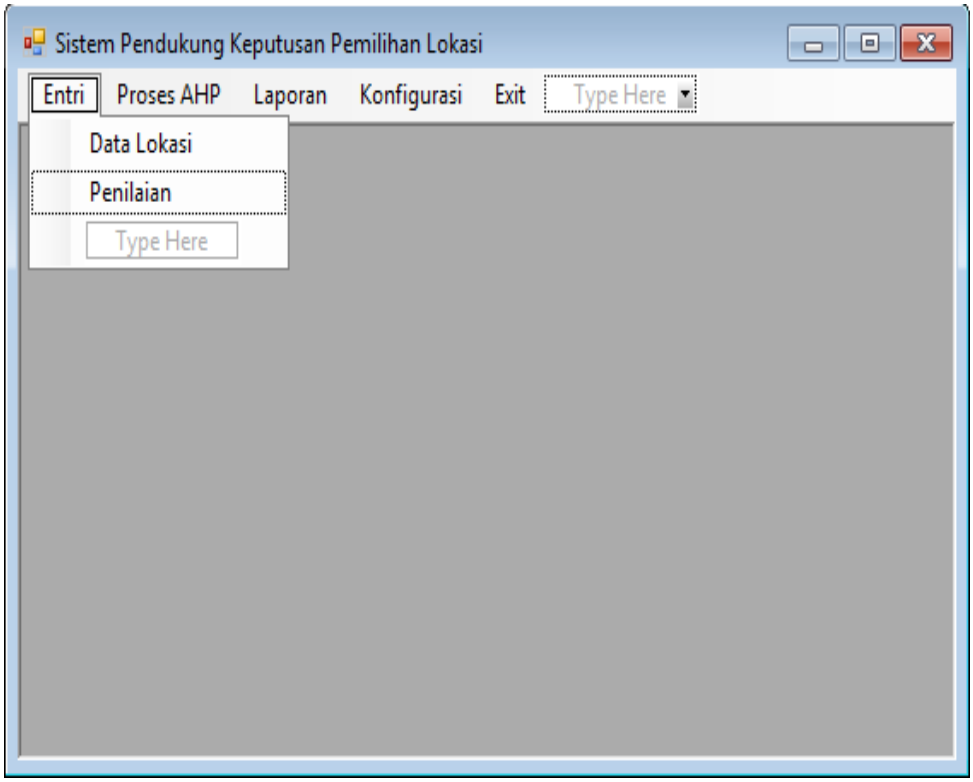

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Fig 1. Main Menu Form

The main menu contains the following menus:
1. Data, which serves to select the desired menu.
2. Process, which serves to carry out the selection process
3. Reports, which is used to view reports
4. System, which functions to exit the application

3.3 Location Data Menu

Initial Display Location Data menu is a menu to perform the process of inputting Location data. This menu is auseful display to perform the input process. Initial ViewThe menu can be seen in Figure 3.2.

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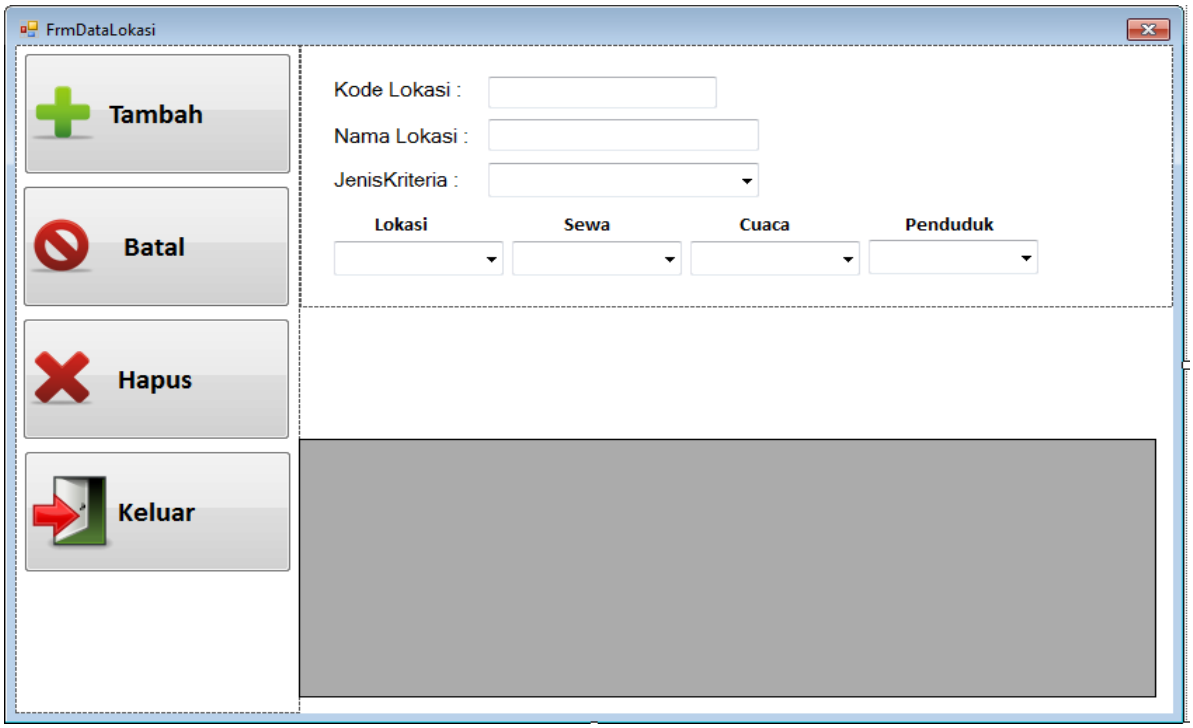

Fig 2. Location Data Menu Form

The main menu contains the following menus:
1. Add, which serves to input the data confectionery.
2. Create New is a function to add handling data
3. Delete is a function to delete the data you want to delete

3.3 Criteria Input Menu

The next menu display is the process menu display, this menu is a useful display for performing the criteria inputprocess. View menu can be seen in Figure 3.

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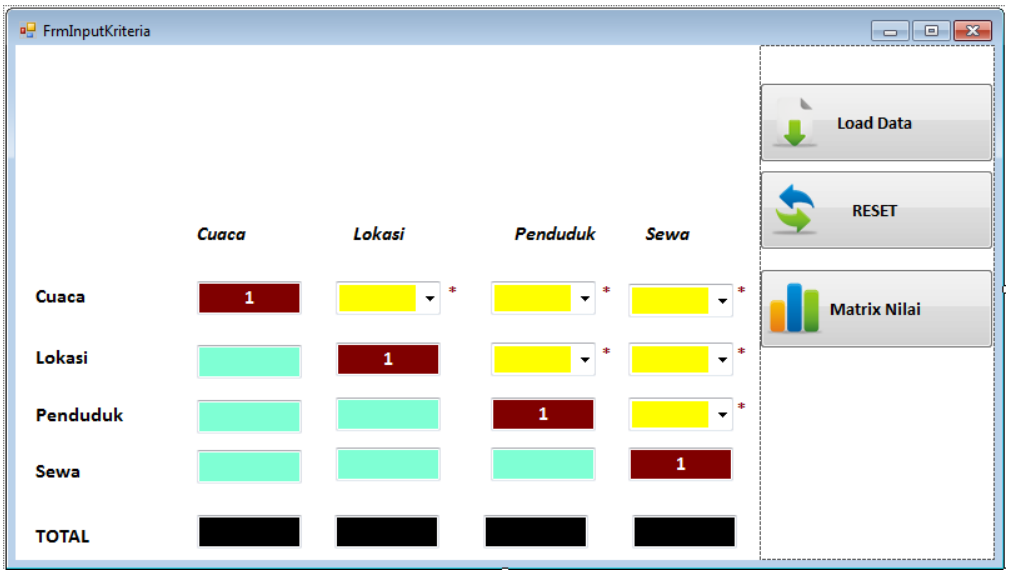

Fig 3. Process Menu

The main menu contains the following menus:
1. Load Data, which serves to input new data.
2. Create New function to enter new data

3.4 Rating Menu

The next menu display is the assessment menu display, this menu is a useful display for conducting the assessmentprocess. The menu display can be seen on figure.

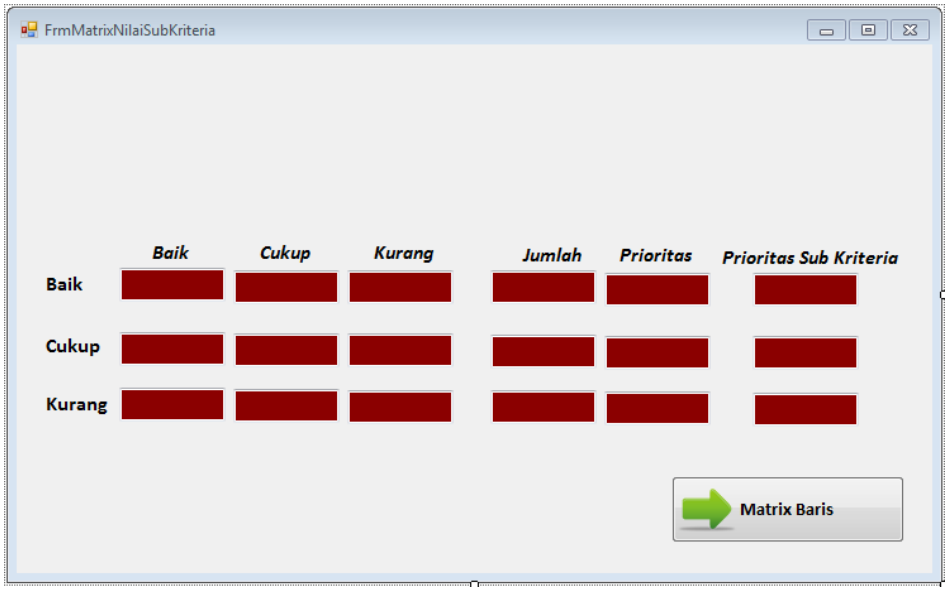

Fig 4. Rating Menu

The main menu contains the following menus:
1. Load Data, which serves to input new data.
2. Create New function to enter city park location data
3. The matrix is used to assess the matrix

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4. CONCLUSION

The results of the decision support system will produce values that can provide an overview of the selection of park development sites. So if we do an assessment it will get the right results for the selection of locations. The process must be carried out with complete data so that the assessment will be carried out objectively.

REFERENCES

[1] A. Pratomo, S. Soedwiwahjono, and N. Miladan, "QUALITY OF CITY PARKS AS PUBLIC SPACES IN THE CITY OF SURAKARTA BASED ON USER PERCEPTIONS AND PREFERENCES," *Village-City*, vol. 1, no. 1, 2019, doi:10.20961/desa-kota.v1i1.12494.84-95.

[2] S. Sumar, "Andragogy and the Purpose of Islamic Education: Concept Analysis in Perfecting Human Life," *Mawa'Izh J. Da'wah andPreaching. Sauce. Kemanus.*, vol. 9, no. 1, 2018.

[3] BAPPENAS, "2019 Government Work Plan," *Developer Equity. for Quality Growth*, 2019.

[4] HFD Siwu, "REGIONAL ECONOMIC GROWTH AND DEVELOPMENT STRATEGY," *J. Developer. icon. AND Finance. Dr.*,vol. 19, no. 3, 2019, doi:10.35794/jpekd.16464.19.3.2017.

[5] F. University of Indonesia, "The Impact of the Tourism Sector on the Indonesian Economy," *Sect Impact. Tourism AgainstEconomists. Indonesia.*, vol. 53, no. 9, 2018.

[6] A. Sahalessy, I. Krisantia, and RB Budiyanti, "Evaluation of the Availability of Public Green Open Spaces According to the Regulation of the Minister of Public Works Number 5 of 2008 in Gambir District, Central Jakarta," *Semin. Nas. developer. Will. andSustainable Cities*, vol. 1, no. 1, 2019, doi:10.25105/pwkb.v1i1.5291.

[7] G. Ekowati, S. Indriyani, and R. Azrianingsih, "Architectural Model of Branching of Several Trees in Alas Purwo National Park," *Biotropics*, vol. 5, no. 1, 2017, doi:10.21776/ub.biotropica.2017.005.01.5.

[8] AS Sjamsu, I. Krisna, and A. Dahrma, "TERRITORY TYPOLOGY IN THE UTILIZATION OF GREEN OPEN SPACES IN KENDARI CITY PARK (Case Study: Kendari Mayor Park)," *J. Malige Architect.*, vol. 1, no. 1, 2019.

[9] YA Wiratama, E. Ramedhan, and I. Irwansyah, "The Meaning of City Park Architecture," *InterCommunication*, vol. 2, no. 1, 2017,doi:10.33376/ik.v2i1.13.

[10] DM Midyanti, "RECOMMENDATIONS FOR THE DEVELOPMENT OF GREEN OPEN SPACES IN PONTIANAK CITY USING AHP-COPRAS METHOD," *Comput. eng. science. syst. J.*, vol. 3, no. 2, 2018, doi:10.24114/cess.v3i2.9987.

[11] M. Tobar, MT Kasnawi, and MRAT, "RELATIONS BETWEEN SOCIAL STRATEGIES IN MODERN COMMUNITY (The Rampanan Kapa' Case in the Tana Toraja Society)," *Hasanuddin J. Sociol.*, 2020, doi:10.31947/hjs.v2i1.10557.

[12] "APPLICATION OF VALUE ENGINEERING (VE) IN THE TAMAN SARI APARTMENT DEVELOPMENT PROJECT," *J. Spectra*, vol. 6, no. 2, 2018.

[13] D. Governor, "Regulation of the Governor of the Special Capital Region of Jakarta Number 157 of 2019 concerning theOrganization and Work Procedures of the City Parks and Forest Service," *Jakarta Government Website*, 2019.

[14] KLHK, *Status of Indonesia's Forests and Forestry*. 2018.

[15] A. Prianto, "DIVERSITY AND ZONATION OF AVIFAUNA IN SOME GREEN OPEN AREAS IN THE FORM OF CITY PARK, CITY FOREST AND GREEN LINE REGIONS IN KAB. BRASS,"*Quagga J. Educator. and Biol.*, vol. 10, no. 01, 2018, doi:10.25134/quagga.v10i01.871.

[16] "COMMUNITY PARTICIPATION IN MANAGEMENT AND CONSERVATION OF THE ENVIRONMENT," *LEX Soc.*, vol. 7, no. 5, 2019.