

## Recommendations for Selecting Houses in the Bintaro Area Using the AHP Method for Property Sales Companies

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### ABSTRACT

This research aims to overcome customer difficulties in choosing a house in the Bintaro area, especially in the context of Property Sales Companies. Customers often face challenges in navigating the process of selecting a home that fits their preferences and needs. The complexity of very complicated and unstructured situations is one of the main obstacles, so an approach is needed that can simplify the process. In order to overcome these problems, this research proposes the application of two main approaches, namely Process Hierarchy Analysis (AHP) and system prototype development. Using AHP, variables such as price, land area, building area, number of bedrooms, and distance from the city center were identified as key elements that were the focus of the research. A criteria priority matrix will be created based on these variables to become the basis for determining optimal housing choices. In addition, this research also tries to overcome barriers in housing selection by adopting a prototype approach to system development. Thus, it is hoped that the system developed can provide a more effective and efficient solution in simplifying the home selection process for customers. By considering the findings of the AHP calculation method. It is hoped that this research can make a significant contribution in improving the house selection process in the Bintaro area. With better solutions, it is hoped that Property Sales Companies can more effectively overcome challenges in meeting customer preferences, thereby increasing their satisfaction.

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## 1. INTRODUCTION

Situated in the eastern part of Banten Province, Tangsel City is a relatively recent municipality that gained independence from Tangerang Regency in 2008. Geographically, it is positioned between 6°39' to 6°47' South Latitude and 106°14' to 106°22' East Longitude, covering 1.63 percent of Banten's total area, equivalent to 147.19 km<sup>2</sup> [1]. With the escalating population, there arises an augmented demand for housing, with developments like Bumi Bintaro Permai and Graha Taman Bintaro Housing spearheaded by Property Sales Company based in Bintaro. However, the company encounters challenges in addressing consumer housing preferences, specifically the complexity customers face in selecting residences within the Bintaro vicinity. To date, the marketing division of Property Sales Company has deliberated strategies to streamline the selection process for customers seeking an ideal location in Bintaro [3].

When consumers decide on a home purchase, numerous criteria come into play, often causing difficulties when choices meet identical standards. This research endeavors to mitigate customer challenges in selecting homes within the Bintaro area, particularly within the framework of Property Sales Companies. The proposed system aims to provide a more efficient solution in simplifying the home selection process for customers—a

Decision Support System (DSS) optimized based on predetermined criteria. Criteria such as price, distance from the city center, land area, building area, and the number of bedrooms are integral considerations for the research. Employing the Analytic Hierarchy Process (AHP) as the chosen approach for the Decision Support System (DSS), it proves effective for multi-alternative and multi-criteria situations [4]. AHP supports group decision-making in both organized and unstructured scenarios, integrating groups within a hierarchy. Human subjectivity is then replaced with numerical values in relative comparisons [4]. Consequently, the research utilizes the AHP approach to ascertain the optimal housing choice in the Bintaro area of South Tangerang.

## 2. RESEARCH METHOD

### 2.1 Decision Support System

Michael S. Scott Morton [5] claims that this is the first time the idea of a decision support system (DSS) has been understood. According to Michael S. Scott Morton, DSS is a computer-based system that assists in making decisions about how to use different models and data to solve unstructured problems. An interactive, computer-based system that may assist in making decisions based on models and data to resolve an unstructured scenario is what defines the DSS concept. The steps of decision-making, such as identifying a problem, selecting pertinent information, and deciding on a course of action, are all supported by this decision support system [6]. It can be said that the house selection system is an activity that can be carried out to make it easier for companies. These results can be used to retrieve information for the company regarding the best home selection strategy to be carried out.

### 2.2 Use Case Diagram

Use Case Diagram is a model of system requirements at a high level. Used to visualize use cases, related sectors and their interactions. The diagram itself is not a use case but a visual of the actor and a group of related use cases. The visual model of the use case facilitates understanding of the business process and helps communicate with stakeholders [7].

### 2.3 PHP Programming

PHP is a general-purpose programming language that is mostly used for WEB development. PHP was created by Rasmus Lerdorf in 1994. The PHP language is server-side, which means that PHP is not processed by the client computer. In other word when you access a PHP page in your browser, the code is not processed on your computer but your browser sends a request to the web server, which then the server will run the code and then return the result of the code to your browser in the form of a web page [8].

### 2.4 User Acceptance Test

User Acceptance Test is used to refer to end-user software testing that is performed before a new information system is introduced to an organization. The main purpose of UAT is to ensure the new system does what it is supposed to do or is set to do and meets the existing requirements [9].

### 2.5 AHP

By giving each variable a relative subjective value and designating a high-priority variable that will have an impact on the situation's outcome, the Analytical Hierarchy Process (AHP) breaks down extremely complex and unstructured situations into components in a hierarchical arrangement [9]. When elucidating a decision-making process, this AHP offers numerous benefits. One of them is that it is easily comprehensible for the people engaged in decision-making when it is presented graphically [10].

The following are the steps in using AHP that must be done refer to Table 1.

1. Structure the hierarchy, starting with the primary goal.
2. Identify a problem and determine an expected solution.
3. Creation of a comparison matrix that describes the contribution of the relative effect of the elements on the criteria.

Table 1. Assessment of Pairwise Comparison

	Criteria - 1	Criteria - 2	Criteria - 3	Criteria - n
Criteria - 1	K11	K12	K13	K1n
Criteria - 2	K21	K22	K23	K2n
Criteria - 3	K31	K32	K33	K3n
Criteria - m	Km1	Km2	Km3	Kmn

4. Determine the ratio of the pairwise comparisons so that the sum is  $n \times [(n-1)/2]$ , where  $n$  is the number of elements to be compared refer to Table 2.

Table 2. Rating of Pairwise Comparison

Intensity of Interest	Information
1	The two elements are the same.
3	One element is slightly more important than the other.
5	One element is more important than the other elements.
7	One element is very important from the other aspects.
9	One element is absolutely very important to the other.
2,4,6,8	Values between two adjacent consideration values
Otherwise	If activity $i$ get one point compared to activity $j$ , then $j$ has the opposite value compared to $i$

5. Calculation of the eigenvalues and testing their consistency. If it is not consistent, then the data collection will be repeated.
6. Repeat steps 3, 4, and 5 for all hierarchy levels.
7. To assess the priority of a component at a low level of the hierarchy to accomplish a goal, compute the eigenvector of each pairwise comparison matrix, which is the element's weight. To calculate this, add a relevant value to create a standardized matrix. Then, add the values of each row to create a row, divide the value by the number of components to create a row, and divide the total number of factors to obtain the average. The weight vector will be created where  $A$  is a matrix of pairwise comparisons.

$$(A)(w^T) = (n)(w^T) \dots\dots\dots (1)$$

It can be approached by:

- a. Normalization of column  $j$  into matrix  $A$  so that it becomes:

$$\sum_i a(i,j) = 1 \dots\dots\dots (2)$$

As  $A$ .

- b. Counting from the average value in each row  $I$  in  $A$ :

$$w_i = \frac{1}{n} \sum_i a(i,j) \dots\dots\dots (3)$$

$W_i$  is the goal weight for me, namely the weight vector.

8. Check for consistency in the hierarchy.

**2.4 Definition Prototyping**

The Prototyping method is the beginning of the system stage that can be used to describe ideas, look for existing problems, and find solutions to these problems [11]. This prototyping method is used by an information system that will allow users to know the stages of the system to be made so that it can be appropriately operated [11].

**3. AHP Method**

The Analytical Hierarchy Process is a method for solving complex unstructured situations into a hierarchical arrangement by assigning subjective values to variables relatively and assigning variables that have a high priority to influence the outcome of the case.

**3.1 AHP Calculation Stages**

**1. Decomposition**

Make a definition by solving the problem as a whole and into elements refer to Figure 1.

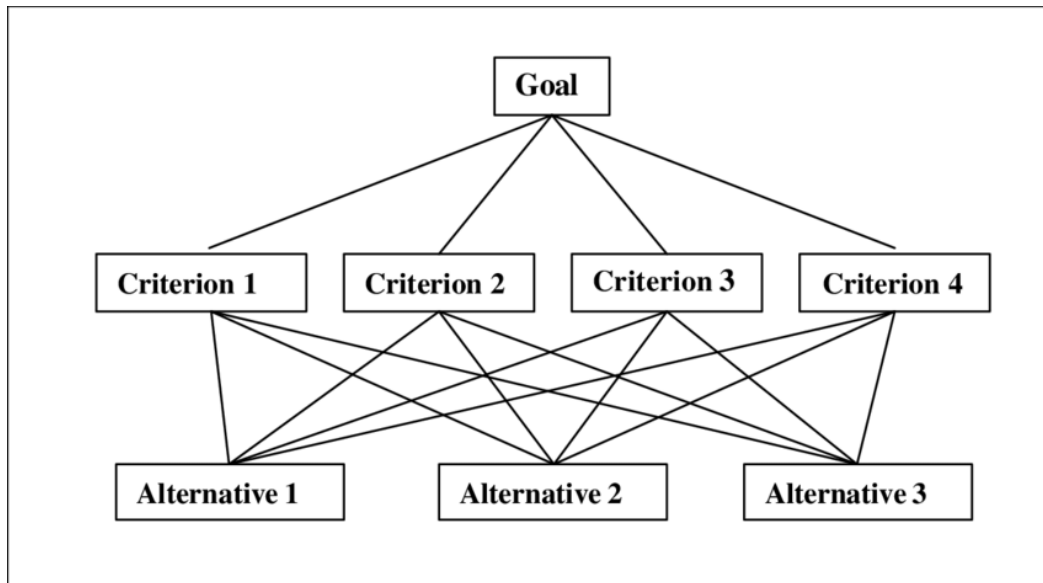


Figure 1. Structure AHP

## 2. Comparative Judgement

Create a comparison matrix in the first step, which compares the details in pairs based on the specified criteria, to identify the items. This comparison matrix, which is expressed as a pairwise comparison matrix, use numbers to evaluate the relative two components.

## 3. Synthesis of Priority

After generating eigenvectors from the pairwise comparison matrix, obtain local priority. The sum is obtained by synthesizing pairwise comparisons. What will be done in this instance is:

- The total of the values in every matrix column
- Take the sum of all the values in each column and divide it.
- To find the average, sum the values for each row and divide by the total number of items.

## 4. Consistency

Research does not want conclusions based on low consistency, thus understanding the degree of consistency in the data is crucial at this decision-making stage. As a result, the following actions need to be taken regularly:

- Divide each value in the first column by the second element's relative, and so forth.
- Totals all of the current rows.
- The row sum result is split by the element with the relative priority.
- The maximum result is obtained by multiplying the quotient by the total number of elements.
- Using the formula  $CI = (\lambda_{max} - n) / (n-1)$  to calculate the consistency index  
The number of items is denoted by n.
- Using the formula  $CR = CI/RI$  to get the consistency ratio (CR).  
CR = stands for Consistency Ratio.  
CI = Index of Consistency.  
RI = The Random Consistency Index.

The assessment has to be adjusted if the value exceeds 10%; otherwise, the computation is deemed accurate if the consistency ratio (CR/IR) is less than or equal to 0.1.

### 3.2 Prototyping Method

The Prototyping Method is used in this study's software development. One step in creating a system where users can communicate with one another while the system is being created is the prototyping approach[12].

### 3.2.1 Stages of the Prototyping Method

1. Communication  
At this stage, meet with the client to ask about the problems experienced and discuss the development of the system that will be made to get a solution that is being shared.
2. Quick Plan & Modeling Quick Design  
In this process, know the system's needs you want to make quickly. This begins with creating a *Unified Modeling Language* (UML) diagram.
3. Construction of Prototyping  
In this process, develop a system that is needed with the Prototyping method and the process of making a website display using programming languages such as PHP, HTML, bootstrap, and others.
4. Deployment Delivery & Feedback  
After designing and prototyping the application, this last stage is followed by an analysis of the system. The study is based on feedback from users about the applications that have been built.

### 3.3 Thinking Framework

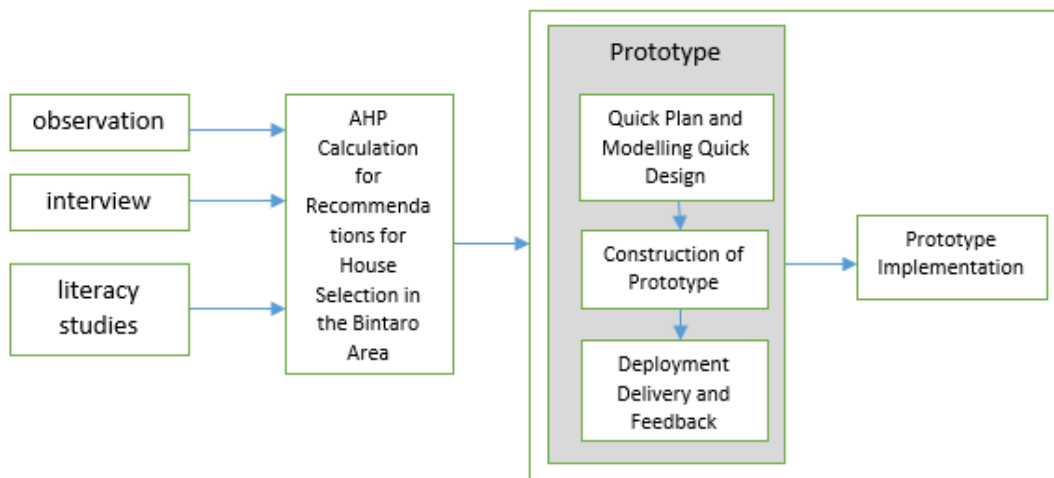


Figure 2. Thinking Framework

### 3.4 Communication

At this communication stage, an analysis of the problems experienced and an interview with the Property Sales Company will be conducted, asking about the issues that occurred and the solutions that will be given to solve these problems.

#### 3.4.1 Problem Analysis

At the problem analysis stage, interviews were conducted with the marketing department of the Property Sales Company to find out what needed to be implemented in a website-based selection system. This interview aims to facilitate system creation with communication from the company. After conducting the interview, there were problems faced by the Property Sales Company in selecting a house in the Bintaro area. This problem arises because all house selection in the Bintaro area is still done manually through distributing brochures and there is a lack of complete information regarding houses in the Bintaro area. Consumers experience difficulty in accessing comprehensive information, so the home selection process becomes less efficient and inadequate. Therefore, implementing a website-based selection system is deemed necessary to overcome this obstacle and provide a better experience for consumers in choosing housing that suits their needs and preferences.

#### 3.4.2 Solutions Offered

Several solutions are proposed to overcome the problems faced by Property Sales Companies. One of the proposed solutions is the implementation of an integrated, website-based system that can facilitate the process of selecting a house in the Bintaro area. This system will provide customers with easier and more comprehensive access to available property information, including design, facilities and other relevant information. With this integrated system, it is hoped that the home selection process will become more efficient and transparent for consumers. Apart from that, the application of this technology is also expected to improve the customer experience in determining home choices that suit their needs and preferences. The main objective

of this solution is to improve the quality of service to customers and optimize the property selection process in the Bintaro area.

**3.4.3 User Requirements**

Based on the results of an interview conducted on March 10, 2022, by Mr. Samuel. Table 3 is the result of the User Requirements needed for the house selection system in Bintaro after conducting interviews.

Table 3. User Requirements

No	Requirement	Actor	Use Case
1	Can verify the user for use on the system	Admin and Marketing	Proses Login
2	Can create user access rights on the system.	Admin	Create user access.
3	Able to enter the house you want to input into the system	Admin	Input house
4	The technology allows you to enter the desired location zone.	Admin	Input location zone
5	Able to calculate the priority matrix of criteria that includes the cost, land area, building area, land distance to the city center, and number of beds.	Admin	Define the criteria priority matrix
6	Provide input and produce output from modules that the admin has verified	Admin and Marketing	Making the Best Home Selection

**4. Result & Discussion**

**4.1 Quick Plan and Modeling**

**4.1.1 Use Case Diagram**

We are designing Unified Modeling Language (UML) diagrams, which develop the system to be created. The design begins with creating a Use Case Diagram, Activity Diagram, Class Diagram, and Data Directory refer to Figure 3.

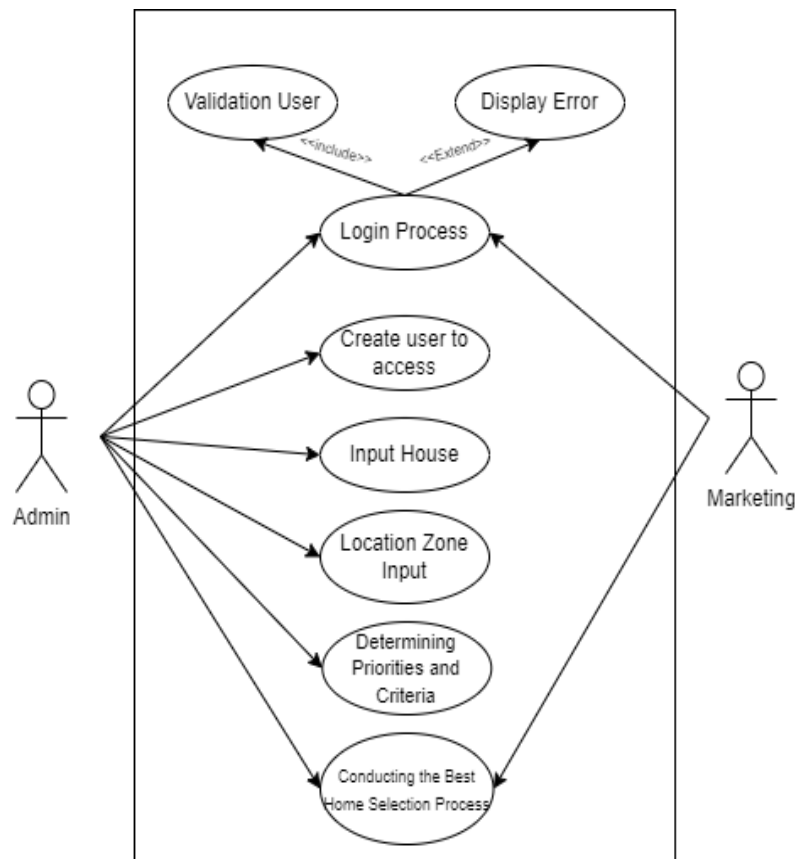


Figure 3. Use Case Diagram

Figure 3 is a Use Case Diagram of the house selection system; 2 actors have their respective roles. The first is the Administrator, who can add criteria data and assessment data and can add houses in the Bintaro area. The second is the user who uses the house selection system.

**4.1.2 Activity Diagram Process Login Page**

The admin modifies data from the determined Criteria Matrix in Figure 4, the Activity Diagram from the Criteria Matrix Page. This activity begins when the system displays on the login page, and the admin inputs their username and password. The approach is verified; the system is deemed faulty if the password and username do not match the database.

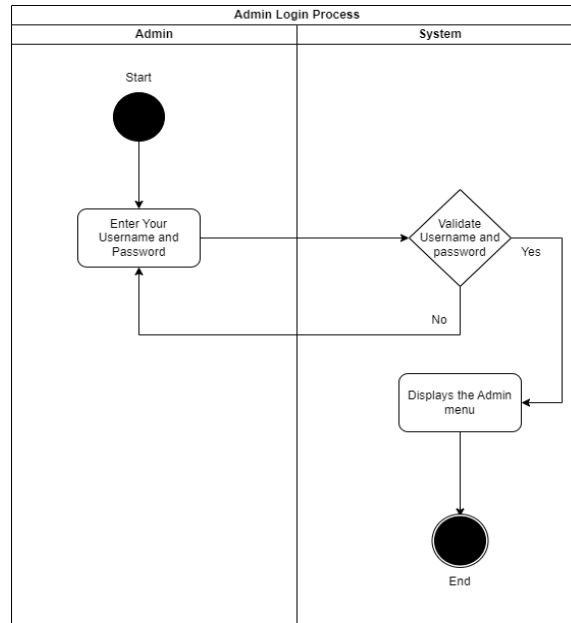


Figure 4. Activity Diagram Process Login Page

**4.1.3 Activity Diagram House**

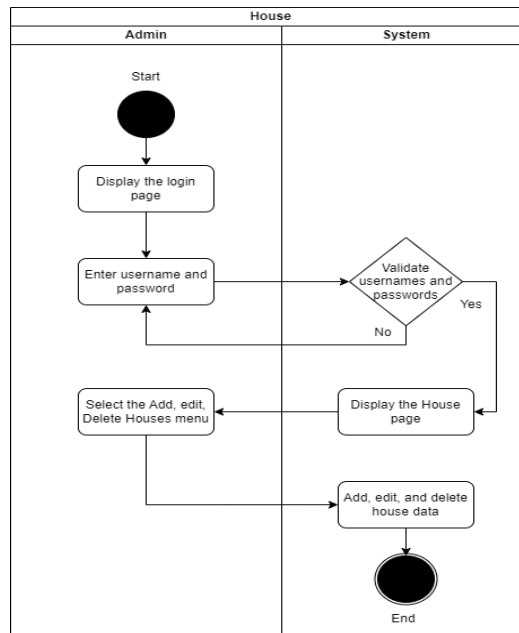


Figure 5. Activity Diagram House

Figure 5 shows an activity diagram of the residence with the activities. At home, the administrator can add data. This process begins when the admin sees the login screen and inputs their username and password. The method is then checked to make sure they match the database; if they don't, the system is deemed invalid.

Because of this, the administrator cannot access the home page. If the username and password are entered incorrectly, the administrator will be taken back to the login screen.

**4.1.4 Activity Diagram Matrix Criteria Priority**

The Activity Diagram of the Zone page, shown in Figure 6, is where the admin can input data from zones surrounding Bintaro. The system displays the login screen and the administrator enters the password and username. The method is then validated; if the password and username do not match the database, the system is deemed invalid. The Home Zone page is therefore unavailable to the admin.

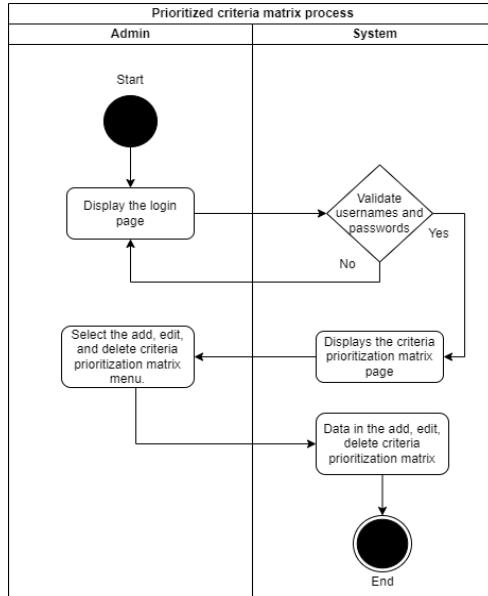


Figure 6. Activity Diagram Matrix Criteria Priority

**4.1.5 Class Diagram**



Figure 7. Class Diagram



Figure 7 is a relationship from the Election System Database House. The Class Diagram above is the result of the interview regarding the creation of a House selection system.

### 4.2 Construction of Prototyping

The process of creating an initial or representative model of the product or system to be developed. This prototype is used to test concepts, features, design, and functionality before the final product or system is built.

#### 4.2.1 Dashboard Page



Figure 8. Dashboard Page

Figure 8 is a prototype display on the Home Data page. On this page can see data on houses in Bintaro and its surroundings. You can add houses, delete houses, and place a house data page.

#### 4.2.2 House Page

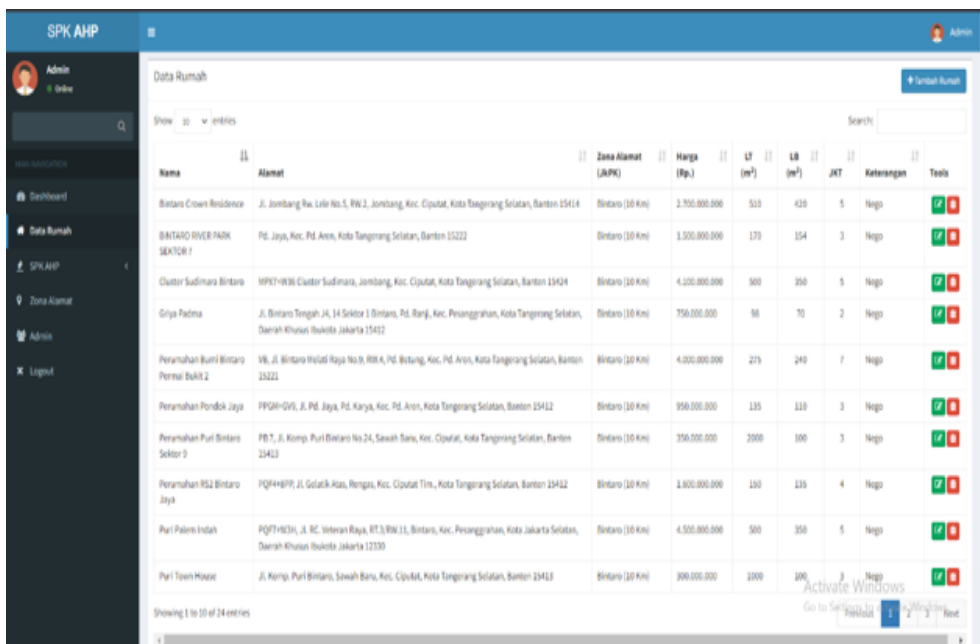


Figure 9. House Page

Figure 9 is a prototype display on the Home Data page. On this page can see data on houses in Bintaro and its surroundings. On this house data page, you can add places, delete houses, and edit houses.

**4.2.3 Criteria Priority Matrix Page**

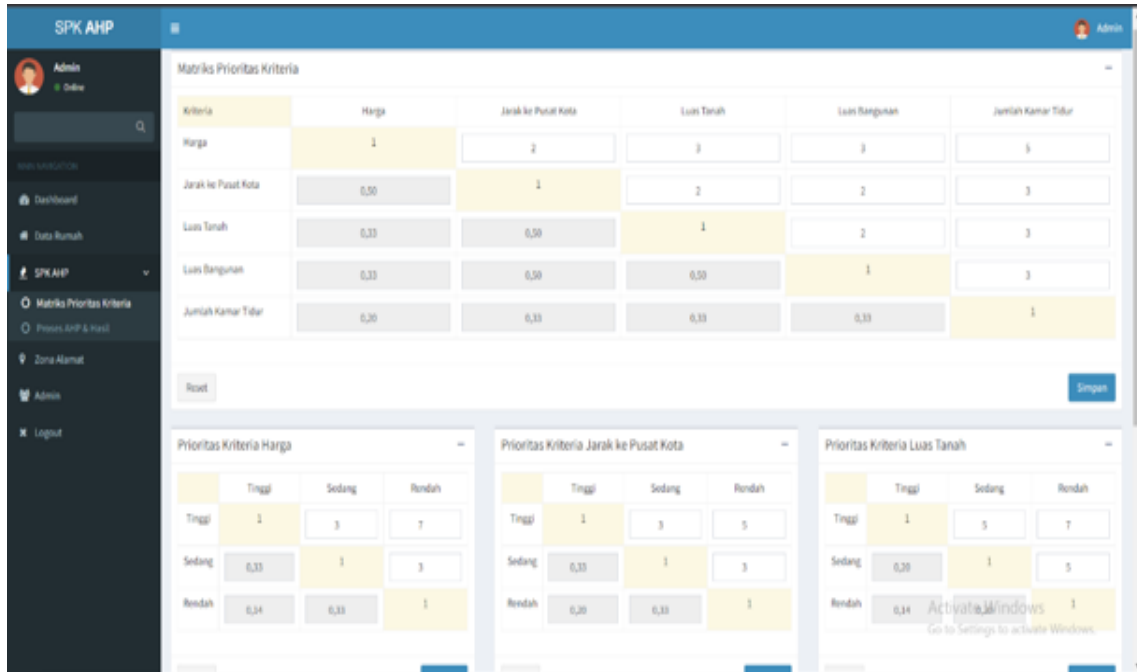


Figure 10. Criteria Priority Matrix Page

On the Criteria Priority Matrix page, a prototype display is shown in Figure 10. This page displays the Criteria Priority Matrix, which includes a number of priority criteria, including priority number of beds, priority land area, priority building area, and priority distance to the city center. Everybody can add, remove, and alter pre-made criteria priority matrix pages.

**4.2.4 AHP Process & Results Matrix Page**

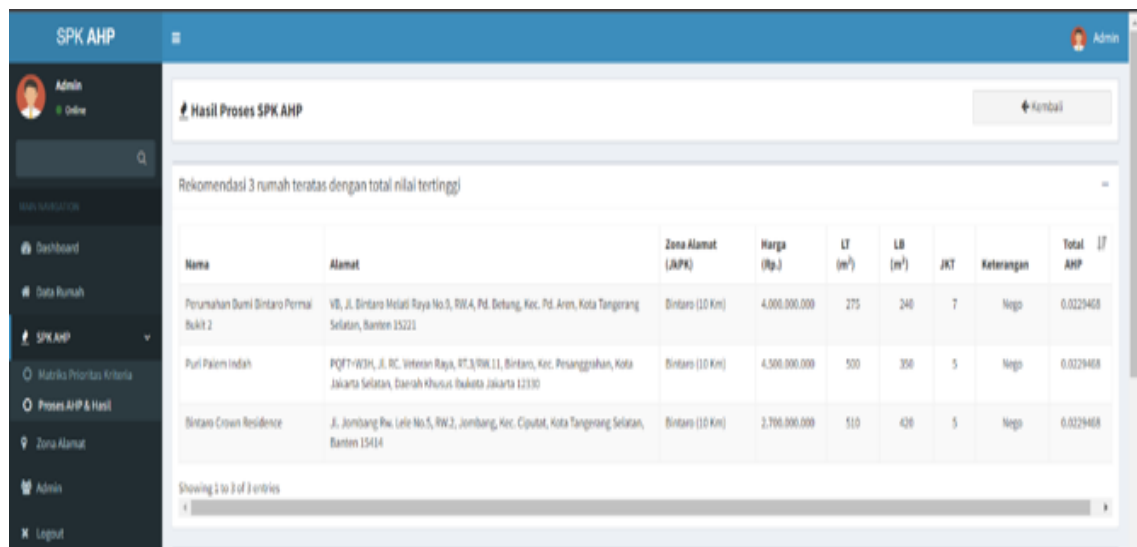


Figure 11. AHP Process & Results Matrix Page

Figure 11 is a prototype display on the AHP Process & Results page, which can see the results of the AHP calculation to choose the three best house recommendations.

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### 4.2.5 Result Matrix Table Page

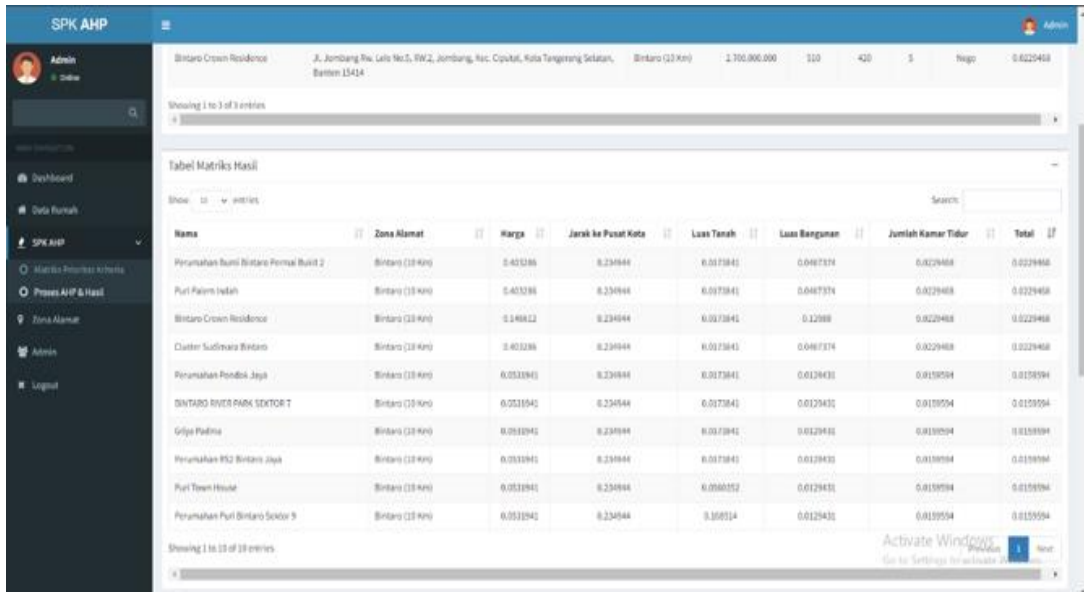


Figure 12. Result Matrix Table Page

Figure 12 is a prototype display on the AHP Process & Results page. This is where, on this page, you can see the results of the AHP calculations to describe the result matrix table for each house.

### 4.2.6 Page Priority Criteria and Normalization of Home Data

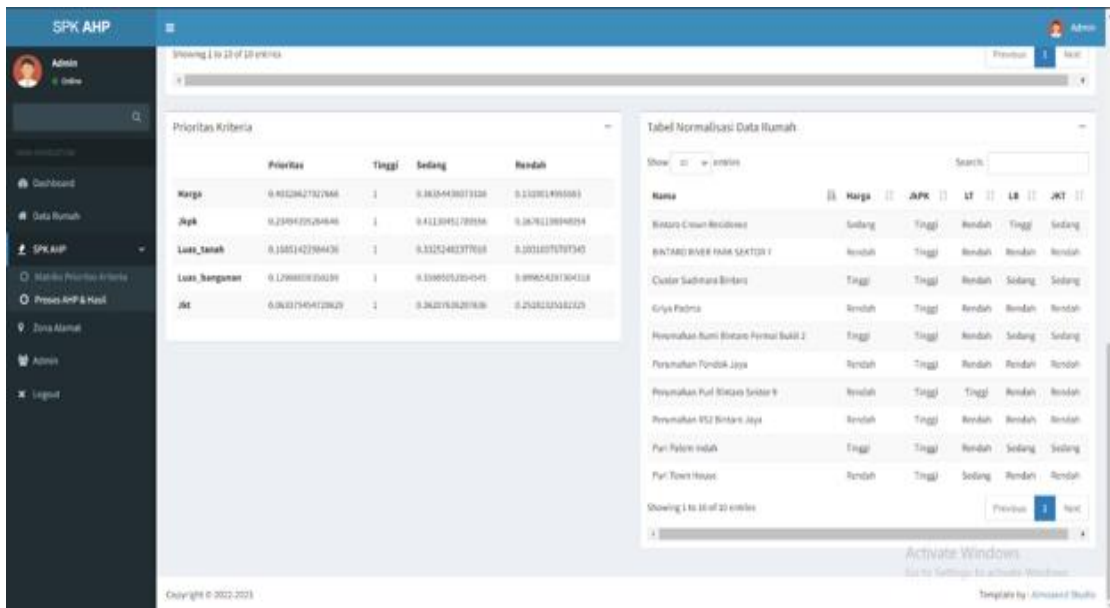


Figure 13. Page Priority Criteria and Normalization of Home Data

Figure 13 is a prototype display on the AHP Process & Results page. On this page can see the results of the priority criteria and normalization of the house.

### 4.3 User Acceptance Test

Potential users are requested to test some of the aspects of the developed system; this will help when the system is used in the future. Consequently, in order to comply with UAT standards, it is important to expand multiple testing systems using the black box method refer to Table 4.

Table 4. UAT Form

Admin				
Project		Recommendations for Selecting Houses in the Bintaro Area Using the AHP Method for Property Sales Companies		
Tester Name		Samuel Widiyanto		
Testing Date		25 Mei 2022		
No	Testing	Testing Process	Result	Status
1	Account Login	- Input personal data to log in - Click the login button	- If the login is successful, you will enter the dashboard page - If the login fails, an error warning will be displayed stating that your username or password is incorrect.	PASS
2	Dashboard Menu	- Click the menu on the sidebar that says dashboard	- If the menu on the sidebar is working, you can go to the dashboard page - If the menu on the sidebar doesn't work, you won't be able to go to the dashboard page	PASS
3	Admin Menu	- Click the menu on the sidebar that says Admin	- If the menu on the sidebar is working, you can go to the Admin page. - When you enter the admin page, you can carry out activities such as adding admin, editing admin, and deleting admin. - If the menu on the sidebar doesn't work, you can't go to the Admin page.	PASS
4	Address Zone Menu	- Click the menu in the sidebar that says Address Zone	- If the menu on the sidebar is working, you can go to the address zone page. - If you enter the address zone page, you can carry out activities - activities like adding address zone, editing address zone, and deleting address zone. - If the menu on the sidebar doesn't work, you can't go to the address zone page	PASS
5	Home Menu	- Click the menu on the sidebar that says Housing Data	- If the menu on the sidebar is working, you can go to the home data page. - When you enter the home data page, you can carry out activities - activities such as adding house data, editing house data, and deleting house data. - If the menu on the sidebar doesn't work, you can't go to the home data page.	PASS
6	Home Menu Priority Display Price Criteria	- Click the menu on the sidebar that says SPK AHP and click the criteria priority matrix button to go to the criteria priority matrix page.	- - If the menu in the sidebar is working, you can go to the criteria priority matrix page. - If successful, you can continue the process to edit and delete the priority price criteria. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
7	Tampilan Prioritas Kriteria Jarak ke Pusat Kota	- Click the menu on the sidebar that says SPK AHP and click the criteria priority matrix button to go to the criteria priority matrix page.	- Apabila menu pada <i>sidebar</i> berfungsi dapat ke halaman matriks prioritas kriteria. - If the menu in the sidebar is working, you can go to the criteria priority matrix page. - If successful, you can continue the process to edit and delete the Priority Criteria Distance to City Center. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
8	Land Area Criteria Priority Display	- Click the menu on the sidebar that says SPK AHP and click the criteria priority matrix button to go to the criteria priority matrix page.	- If the menu in the sidebar is working, you can go to the criteria priority matrix page. - If successful, you can continue the process to edit and delete Priority Land Area Criteria. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
9	Priority Display of	- Click the menu on the sidebar that says SPK AHP and click the criteria	- If the menu in the sidebar is working, you can go to the criteria priority matrix page.	

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Admin				
Project	Recommendations for Selecting Houses in the Bintaro Area Using the AHP Method for Property Sales Companies			
Tester Name	Samuel Widiyanto			
Testing Date	25 Mei 2022			
No	Testing	Testing Process	Result	Status
	Building Area Criteria	priority matrix button to go to the criteria priority matrix page.	- If successful, you can continue the process to edit and delete the Priority Criteria for Building Area. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
10	Priority Display Criteria Number of Bedrooms	- Click the menu on the sidebar that says SPK AHP and click the criteria priority matrix button to go to the criteria priority matrix page.	- If the menu in the sidebar is working, you can go to the criteria priority matrix page. - If successful, you can continue the process to edit and delete the Number of Bedrooms Priority Criteria. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
11	Criteria Priority Matrix View	- Click the menu on the sidebar that says SPK AHP and click the criteria priority matrix button to go to the criteria priority matrix page.	- If the menu in the sidebar is working, you can go to the criteria priority matrix page. - If successful, you can continue the process to edit and delete the Criteria Priority Matrix. - If the menu in the sidebar does not work, you cannot go to the criteria priority matrix page.	PASS
12	AHP calculation process results matrix.	- Click the menu on the sidebar that says SPK AHP calculation	- If the menu on the sidebar is working, you can go to the AHP Calculation page - If successful, you can continue the process to carry out the AHP process calculation, which contains the results of a matrix that has been normalized and determined to select the best housing. - If the menu on the sidebar doesn't work, you won't be able to go to the results matrix page. - If the menu on the sidebar doesn't work, you won't be able to go to the results matrix page.	PASS
13	Logout Account	- Log out account	- If the Layout menu is working, you can go to the login page. - If the menu on the sidebar doesn't work, you won't be able to log in or log out.	PASS

Utilizing a black box testing approach, testing is done on the system that was developed during the UAT process. This is an evaluation of the system based on how the features and design of the system work as intended.

## 5. CONCLUSION

The AHP approach is used as the initial step in the analysis process, and its application necessitates a number of qualities related to choosing the finest dwelling. Researchers examined interview data and carried out further study of the AHP methodology to derive AHP computations during the AHP stage of deployment. You can see the weights that are generated for each criterion in this AHP approach. These weights will be used as a guide to sort the most important alternative evaluations from the least important ones. Price, proximity to the city center, land area, building area, and number of bedrooms are among the parameters used in this study. This criterion will serve as the main point of reference for determining the optimal course of action, and it will eventually be used to create the criteria priority matrix. Based on "high," "medium," and "low," each bar that is used will be normalized. The results of the AHP calculation procedure that yield the three highest weights on these criteria, which are used in the multi-criteria technique to pick houses: Rumah Bumi Bintaro Permai Bukit (0.02294682), Puri Palembang Indah (0.0229468), Bintaro Crown Residence (0.0229468).

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