



SMART method utilization for meetinghouse elections in Pekanbaru City

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Abstract

Choosing and looking for information about the meetinghouse in Kota Pekanbaru is a problem for people in need. A Distance of distant location and limited information obtained. This application is built based on Android using Simple Multi-Attribute Rating Technique (SMART) method, there are several criteria used are rental price, capacity, and facilities. The application is built using the JAVA programming language with Android Studio. This system design analysis uses the Unified Modeling Language (UML). The results that this application can help users to choose existing meetinghouses in Pekanbaru City using the SMART method. The search result is a list of meetinghouse names in which there are various information about the meetinghouse and the location to the meetinghouse. The test results of the built-in application can work well and can address the problems faced by the user in determining the multipurpose building elections.

1. Introduction

Nowadays the rental of meetinghouse is a habit of citizens who do not have enough place to hold some events such as seminars, weddings, meetings, and so forth. The rented meetinghouse usually has considerable capacity, such as hotels, halls, and multipurpose buildings in the rent for the event. It also has facilities to support events such as seats, sound system, and so forth. Moreover, along with the increased used of buildings, the utilization rate of technology especially smartphones and the Internet also rised.

Technology utilization especially internet in Indonesia has reached the number 175, 4 million users from total population of 272.1 million people [1]. From the data it appears that 64% of the population of Indonesia is currently experiencing the

Internet. The application system that can be accessed by the Internet has been done by many organizations and companies. The implementation of this application system has also been utilized by the building tenants to facilitate the booking of meetinghouse.

Pekanbaru is the capital city of Riau province which has many meetinghouse, but the reservation applications to feature the entire meetinghouse in Pekanbaru are not available yet. The meetinghouse in Pekanbaru did not gather at one point only, but scattered in several places in the city of Pekanbaru, such as in the district Tampan there are several meetinghouse. The meetinghouse included the YKR Conventional Hall, BAPELKES building, and some of the hotels in the sub-district. In addition to the large building, tenants need to

take into account the distance and building facilities that will be rent.

To facilitate in viewing the map of buildings, facilities and distances. This research sets up a decision support system (SPK) to facilitate tenants in considering which meetinghouse to be rented. This research uses SIMPLE MULTI ATTRIBUTE RATING TECHNIQUE (SMART) method. According to [2] Smart method is a multi-criteria decision making technique consisting of a number of criteria that have values and each criterion has weights that illustrate how important it is compared to other criteria. The application system built into the research has several features that are used as consideration in choosing a meetinghouse.

The purpose of this research is to facilitate the community, especially in Pekanbaru, in renting the necessary meetinghouse. Rented buildings are found based on recommendations from application systems such as distance and building facilities.

2. Research Methods

2.1. Metodologi Penelitian

The study used the waterfall model as a research plot. The Waterfall Model according to [3] is a sequential software development process, in which progress is seen as continuing to flow downward (such as a waterfall) through planning phases, modeling, implementation (construction), and testing. Figure 1 is a waterfall model [4].

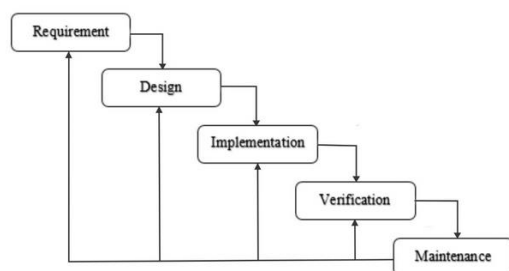


Figure 1. Waterfall Model

Waterfall models provide a sequential flow of software approach starting from analysis, design, coding, testing, and supporting phases [5].

a. Analysis

Data obtained in this study through interviews and observations of various meetinghouse in Kota Pekanbaru. Interviews and observations were conducted to view directly the facilities, location maps, and availability of systems used for meetinghouse rental processes.

b. Design

Once known the conditions of the meetinghouse in some places. The next step is to do the design using UML to make the program code easier.

c. Implementation

The program code gets from the design results using UML. To make it easier for people to get to the meetinghouse, this study uses the SMART method.

d. Verification

This research uses testing with Blackbox. Blackbox testing is used to test applications regardless of the output rendering process of the functions on the system created [6].

e. Maintenance

Even though the application system has been built, there is a possibility it may change when it is already used. Therefore, this research requires support and maintenance to run well.

2.2. Metode SMART

Smart method is one of the methods of the decision support system. A decision support system is a set of specific classes of computerized information systems that support business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision-makers[7]. Smart methods have several steps to simplify the calculation [8]:

1. Specifies how many criteria are used.
2. Specifies the weight of the criteria in each criterion by using an interval of 1-100 for

each criterion with the most important priority.

- Calculate the normalization of each criterion by comparing the weight value of criteria to the number of criteria weights. Using the formula:

$$\text{Normalization} = \frac{w_j}{\sum w_j}$$

Where

w_j is the weight value of a criterion.

$\sum w_j$ is the total weight amount of all criteria

- Provide the criteria parameter value on each criterion for each alternative.
- Specifies the utility values by converting the criteria value in each criterion to the value of the default data criteria. The utility value is obtained by using formula:

$$u_i(a_i) = \frac{C_{out} - C_{min}}{C_{max} - C_{min}}$$

Where

$u_i(a_i)$ is the value of 1st criterion for criteria to - I,

C_{max} is the maximum criteria value,

C_{min} Values are the minimum criteria and

$C_{out i}$ is the criterion value to-I.

So the value is obtained:

$$C_{out i} = u_i(a_i) = 0; 2 = 0,5 : 3 = 1$$

- Specifies the last value of each criterion by switching the obtained value from normalizing the value of the raw data criteria to the normalized value of the criteria weight. Then sum the values of the multiplication.

$$u(a_i) = \sum_{j=i}^m w_j u_i(a_i)$$

Where

$u(a_i)$ is the alternative total value,

w_j is the result of normalizing criteria weights and

$u_i(a_i)$ is the result of determining the value of utility.

Smart method calculations Defining Data

The Data used in this research are five selected meetinghouse, they can be seen in table 1.

Table 1. Selected meetinghouse

| Kode | Alternative | | Criterion | | |
|------|---------------------|--|-----------|------|-----|
| | Name | | C1 | C2 | C3 |
| A1 | YKR Convention Hall | | 605 | 2.74 | 380 |
| A2 | Gedung Auri | | 546 | 2.94 | 548 |
| A3 | Gedung Bapelkes | | 384 | 2.45 | 251 |
| A4 | Gedung PU | | 440 | 2.84 | 374 |
| A5 | Gedung PGRI | | 391 | 3.16 | 240 |

Determination of criterion weights

The value given at the weight of this criterion is based on a decision-maker rating (in which case the value is automatically generated by the system), as shown in table 2:

Tabel 2. Criterion Weights

| Code | Criterion | Criterion weights |
|------|-----------|-------------------|
| C1 | Price | 40 |
| C2 | Capacity | 30 |
| C3 | Facility | 30 |

Normalization of criterion weights

Normalization weight criteria are calculated based on dividing the value of each weight by the total number of weight values, the results as in table 3 below:

Table 3. Normalization of criterion weights

| Code | Criterion | Criterion weights | Normalization of criterion weights |
|------|-----------|-------------------|------------------------------------|
| C1 | Harga | 40 | 40/100 = 0.4 |
| C2 | Kapasitas | 30 | 30/100 = 0.3 |
| C3 | Fasilitas | 30 | 30/100 = 0.3 |

Determination of Parameter Values

In providing parameter values for each criterion, it is necessary for qualitative data, e.g. for quality criteria (very good = 5, good = 4, enough = 3, less = 2 and very less = 1). In this research, the value for each criterion is quantitatively so there is no need to be given a parameter value anymore.

Calculating the value Utility

Specifying the value of this utility depends on the nature of each criterion. The nature or type of each criterion in the study is shown in table 4.

Tabel 4. Tipe Kriteria

| Code | Criterion | Type of criterion |
|------|-----------|-------------------------------------|
| C1 | Price | Bigger is better (benefit criteria) |
| C2 | Capacity | Bigger is better (benefit criteria) |
| C3 | Facility | Bigger is better (benefit criteria) |

Determination of value utility price, capacity, facilities for each business is calculated using the following equation:

Calculating Utility values for price criterion

In calculating the utility value of the price criterion, first look for the $C_{max}(\text{Price})$ value and $C_{min}(\text{Price})$ value as follows:

$$C_{max}(\text{Price}) = \{605; 546; 384; 440; 391\} = 605$$

$$C_{min}(\text{Price}) = \{605; 546; 384; 440; 391\} = 384$$

Because price criterion is a benefit criterion, so that each utility value from each alternative can be calculated as follows:

$$(605 - 384) / (605 - 384) = 1.000$$

$$(546 - 384) / (605 - 384) = 0.733$$

$$(384 - 384) / (605 - 384) = 0$$

$$(440 - 384) / (605 - 384) = 0.253$$

$$(391 - 384) / (605 - 384) = 0.031$$

The calculation result of the utility values are summarized in table 5 as follows:

Tabel 5. Utility value

| Code | Alternative Name | Criterion | | |
|------|---------------------|-----------|-------|-------|
| | | C1 | C2 | C3 |
| A1 | YKR Convention Hall | 1.000 | 0.408 | 0.454 |
| A2 | Gedung Auri | 0.733 | 0.690 | 1.000 |
| A3 | Gedung Bapelkes | 0 | 0 | 0.035 |
| A4 | Gedung PU | 0.253 | 0.549 | 0.435 |
| A5 | Gedung PGRI | 0.031 | 1.000 | 0 |

Calculating the final value

Calculation of the final value / preference obtained the following results:

Calculation of the final value for alternatives A1 (YKR Convention Hall):

$$= (1.000 * 0.241) + (0.408 * 0.192) + (0.454 * 0.151)$$

$$= 0.241 + 0.078 + 0.068$$

$$= 0.387$$

Acquired final value $u(A_1)$ of = 0.387

Calculation of the final value for alternatives A2 (Gedung Auri):

$$= (0.733 * 0.241) + (0.690 * 0.192) + (1.000 * 0.151)$$

$$= 0.177 + 0.132 + 0.151$$

$$= 0.460$$

Acquired final value $u(A_2)$ of = 0.460

Calculation of the final value for alternatives A3 (Gedung Bapelkes):

$$= (0 * 0.241) + (0 * 0.192) + (0.035 * 0.151)$$

$$= 0 + 0 + 0.005$$

$$= 0.005$$

Acquired final value $u(A_3)$ of = 0.005

Calculation of the final value for alternatives A4 (Gedung Bapelkes):

$$= (0.253 * 0.241) + (0.549 * 0.192) + (0.435 * 0.151)$$

$$= 0.061 + 0.105 + 0.065$$

$$= 0.231$$

Acquired final value $u(A_4)$ of = 0.231

Calculation of the final value for alternatives A5 (Gedung PGRI):

$$= (0.031 * 0.241) + (1.000 * 0.192) + (0 * 0.151)$$

$$= 0.007 + 0.192 + 0$$

$$= 0.199$$

Acquired final value $u(A_5)$ of = 0.199

The results of the calculation of the final value can be presented in the table form as in table 6

Tabel 6. Final value

| Code | Alternative Name | Criterion | | | Final value u |
|------|---------------------|-----------|-------|-------|---------------|
| | | C1 | C2 | C3 | |
| A1 | YKR Convention Hall | 0.241 | 0.078 | 0.068 | 0.387 |
| A2 | Gedung Auri | 0.177 | 0.132 | 0.151 | 0.460 |
| A3 | Gedung Bapelkes | 0 | 0 | 0.005 | 0.005 |
| A4 | Gedung PU | 0.061 | 0.105 | 0.065 | 0.231 |
| A5 | Gedung PGRI | 0.007 | 0.192 | 0 | 0.199 |

Ranking

From the calculation result of the previous final value, by sorting the value of data from the largest to the smallest obtained the following results:

Tabel 7. Ranking

| Ranking | Alternative | | Final Value |
|---------|-------------|---------------------|-------------|
| | Code | Name | |
| 1 | A1 | Gedung Auri | 0.460 |
| 2 | A2 | YKR Convention Hall | 0.387 |
| 3 | A4 | Gedung PU | 0.231 |
| 4 | A5 | Gedung PGRI | 0.199 |
| 5 | A3 | Gedung Bapelkes | 0.005 |

From the data in the table 3.7 It can be decided that Gedung Serba Guna Auri is the most feasible with the final value of 0460.

UML

System design on this study using UML (Unified Modeling Language), one of the UML tools used is usecase diagram, UseCase diagram used to view interactions between actors with the system visually [9]. Figure 2 is the design of usecase.

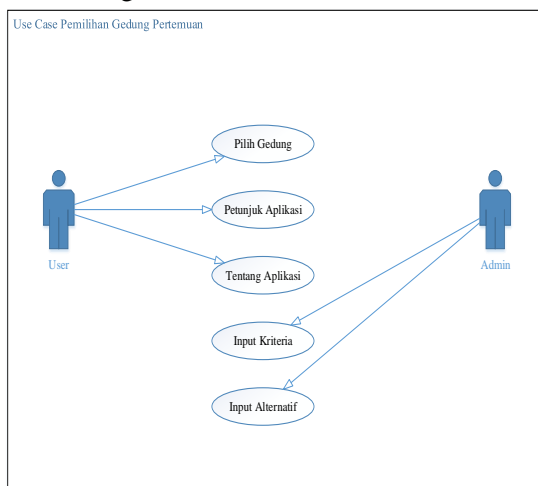


Figure 2. Usecase Diagram

App Interface Design

a. Output design

The purpose of the Output design is to transform data into quality and usable

information. The final goal is to process decision making. Figure 3 is the output design of the system to be created.



Fig. 3. Output interface

b. Input Design

Input design is the beginning of the information process. Here is the application input design that was built.

Dashboard

The application has five menus consisting of criterion menu, weight menu, alternative menu, data input menu, and result menu. Here is the built design.

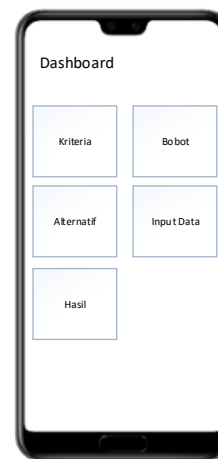


Fig. 4. Dashboard Application

Alternative Data Input

Alternative data is the data of the meetinghouse which later becomes the choice of the user in choosing buildings. The data input is the name of the building, location, and description.



Fig. 5. Alternate Input Data

Data input

Data input is the data value of criterion data entered, including rental rates, capacity, and facilities. The data entered is in the form of numbers from 1 - 100. Figure 6 is the design that was built.



Fig. 6. Input Data

3. Results and Discussion

The system of meetinghouse rental applications is the goal of this study. Then after the system built the application must be tested using black box. Black Box Testing focuses on the functional specifications of the software. Testers can define a set of input conditions and test the functional specifications of the program [10].

Testing of the application system is running well. The application can be used by the people of Pekanbaru to find a meetinghouse to conduct activities such as weddings, meetings, graduations, and so forth. Application system that has been implemented only use 5 meetinghouses. The development of the application system is expected to add the criteria displayed on the

application system in order to make the community is easy in determining the meetinghouse to be paid. Then the entire meetinghouse in Pekanbaru can be seen in this application system.

3.1. Implementasi System

The implementation of the application system consists of several stages.

Dashboard Android Apps

Here is the dashboard of the application, which has five menus i.e. criteria, weights, alternatives, data input, and results.

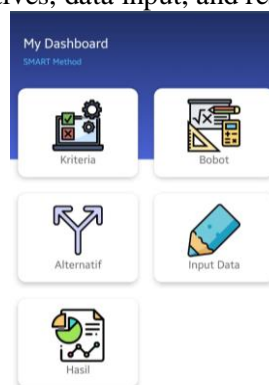


Fig. 7. Dashboard Android Apps

Weighted Data

In Figure 8 is the weighted data of each criterion used to determine the best meetinghouse.

| KRITERIA | BOBOT | NORMALISASI | TIPE |
|------------|-------|----------------|---------|
| Harga Sewa | 40 | 40 / 100 = 0.4 | cost |
| Kapasitas | 30 | 30 / 100 = 0.3 | benefit |
| Fasilitas | 30 | 30 / 100 = 0.3 | benefit |
| TOTAL | 100 | | |

Gambar 8. Weight Data

Criteria Data

Determining the meetinghouse that fits the needs, therefore there are several criteria that become reference calculation, as follows.

| ID KRITERIA | KRITERIA |
|-------------|------------|
| K1 | Harga Sewa |
| K2 | Kapasitas |
| K3 | Fasilitas |

Figure 9. Criteria Data

a. Alternate Input Data

Here is the input data done by the user in determining the best meetinghouse.

Figure 10. Alternate Input Data

b. Alternative Input Building

Figure 11 is the input data for alternative meetinghouse options.

Figure 11. Alternative Input Building

3.2. Testing

System testing is a complete and integrated software program testing. Software is just a unit element of a larger computer-based

system. Typically, the software is associated with other software and hardware.

Black Box testing or commonly known as functional testing is a software testing method used to test software without knowing the internal structure of the code or program. In this test, the tester is realized what the program must do but has no knowledge of how to do it.

Here are the results of testing conducted by the black box testing method.

Table 8. Blackbox Testing

| No | Testing Scenario | Expected Results | Conclusion |
|----|--|--|------------|
| 1 | Add criterion data (Data input is incomplete) then click Save | The system will not save when all fields are not filled, it will display the message "Data not complete" | Valid |
| 2 | Add criterion data, save correctly (no empty space) then click Save | The system successfully updated the data and displayed the message "Data successfully updated" | Valid |
| 3 | The system can update the criterion data by pressing while holding on the criterion data, the system will display a form to update the data and click Save | The system successfully updates the data and displays the message "Data Berhasil di Update" | Valid |
| 4 | The system can delete criterion data by pressing while holding on the criterion | The system successfully updated the data and displayed the message "Data | Valid |

| | | | |
|---|--|---|-------|
| | data, the system will display a form to delete data and click Save | successfully deleted" | |
| 5 | The system can display the results of calculations by displaying the best multipurpose building data in sequence | The system successfully displays data from the smart method calculation | Valid |

4. Conclusion

Based on the analysis of system design, implementation, and system testing, it can be concluded that this research has been successfully implemented. This system can provide convenience to the user in selecting the meetinghouse. In system-wide testing, the results of all trials are all valid.

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