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The smart method to support a decision based on multi attributes identification

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Abstract. Simple Multi Attribute Rating Technique (SMART) is method used to data processing in computing. This research uses SMART method with case study of election house-livable in the village. There are 6 stages how SMART method working. Firstly, determine the number of attributes used, specify the attribute weights for each attribute using the interval of 1-100 at each attribute with the most important priority, calculate the normalization of each attribute, assign the attribute parameter value to each attribute for each alternative, specify the value of the utility by changing the attribute value in each attribute becomes the value of the raw data attribute and determine the final value of each attribute by diverting the values obtained from the normalization of the raw data attribute value with the normalization value of the attribute weights. The implications that can be drawn from the implementation of this SMART method is to provide recommendations of data presented based on the calculation and rating, in this case there are ratings a homeowner who helped surgical house-livable so they could be used the village head as decision maker.

1. Introduction

Simple Multi Attribute Rating Technique (SMART) is a method used to solve problems computationally in decision support systems. This method was one of multi-attributes decision support system since 1977 [1]. The implementation of this method has been widely applied in several issues related to decision making.

The Case study of this research is about the problems selection of the poor in rural areas which is appropriate to get home surgery to be livable house. There are several attributes used for the selection of the house. SMART method is one method that can perform multi-attribute computation [2].

In previous study, there are 6 steps how SMART method is working. 1. determine the number of attributes used, 2. specify the attribute weights for each attribute using the interval of one to one hundred at each attribute with the most important priority, 3. calculate the normalization of each attribute, 4. assign the attribute parameter value to each attribute for each alternative, 5. specify the value of the utility by changing the attribute value in each attribute becomes the value of the raw data attribute, 6. Determine the final value of each attribute by diverting the values obtained from the normalization of the raw data attribute value with the normalization value of the attribute weights [3].

However this study did not reach application. Other research discussed about calculation model of SMART method on each steps which can be contributed to the pseudo code design process in this study [4]. This study improve that there are 12 attributes chosen to determine the poor should get home surgery



program in a village. This research also includes making pseudo code of the SMART method and its application. The impact of implementing this SMART method will result in output accurate data of rank from poor homeowners selected for home surgery livable [5].

2. Research method

In the development of system, researchers referring to model of **waterfall**. There are four development steps in the **waterfall** approach. In short, model of development was described as figure 1.

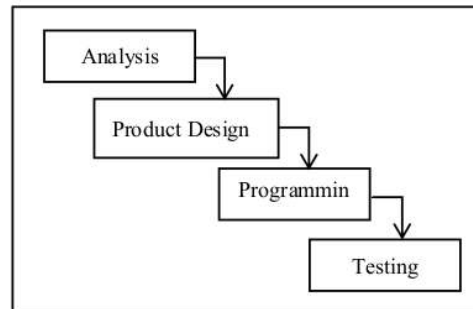


Figure 1. Software development model of Waterfall.

There are 4 steps of development the application. Firstly, conduct analysis through interviews and observation to get an attribute information used in the research. Secondly, making design. It means designing the system in the form of diagrams using UML. Third, create application program using PHP programming language and MySQL database. Forth, software testing by create the master data needed to do calculation with SMART method which has been built in the application to get the final result of rating data. The ratings indicate the priority of the people who are eligible for home surgery program [6][7].

3. Results and discussion

3.1. Data analysis

In this process preparing the attributes to determine which house appropriate to get home surgery program. There are 12 attributes on the resulting data to be used as in table 1.

Table 1. Identification 12 attributes selected.

No.	Attribute
1	Status of residential land (own, contract / rent, free of rent, official)
2	Floor area (...m ²)
3	Type of widest floor (marble, ceramic, rug, high quality wood, cement / red brick, bamboo, low quality wood, soil)
4	The widest type of wall (walls, plastering of woven bamboo, wood, woven bamboo, wooden sticks)
5	Type of roof (concrete tile, ceramic tile, metal roof tile, clay tile, asbestos, roofing, shingle, bamboo)
6	Bedrooms amount (...rooms)
7	Source of drinking water (branded bottled water, refill water, plumbing meter, retail ledge, pumping well, protected well, unprotected well, protected spring, unprotected springs, river / reservoirs, rainwater)
8	How to get drinking water (retail, be a customer, not buying)
9	Main source of lighting (PLN, Non PLN, not electricity)
10	Fuel energy to cook (electricity, gas > 3 Kg, gas 3 Kg, biogas, kerosene, briquettes, charcoal, firewood)
11	Toilet facilities (independent, shared, public, none)
12	Waste disposal feces (tank, SPAL, ground hole, garden / rice field / river / sea).

3.2. Stages of SMART Method

There are 6 steps calculation of SMART method, they are [1]:

- determine the number of attributes used,
- specify the attribute weights for each attribute using the interval of one to one hundred at each attribute with the most important priority,
- calculate the normalization of each attribute,

Formula used:

$$\text{Normalization} = \frac{w_j}{\sum w_j} \quad (1)$$

Notes:

w_j = A weight criteria
 $\sum w_j$ = Total amount of weigh

- assign the attribute parameter value to each attribute for each alternative,
- specify the value of the utility by changing the attribute value in each attribute becomes the value of the raw data attribute. The utility value is obtained by using the formula:

$$u_i(a_i) = 100 \frac{(C_{\max} - C_{\text{out } i})}{(C_{\max} - C_{\min})} \% \quad (2)$$

Notes:

$u_i(a_i)$: utility value of the 1st criteria for the i-th criteria
 C_{\max} : maximum criteria value
 C_{\min} : minimum criteria value
 $C_{\text{out } i}$: criteria value i-th

- Determine the final value of each attribute by diverting the values obtained from the normalization of the raw data attribute value with the normalization value of the attribute weights.

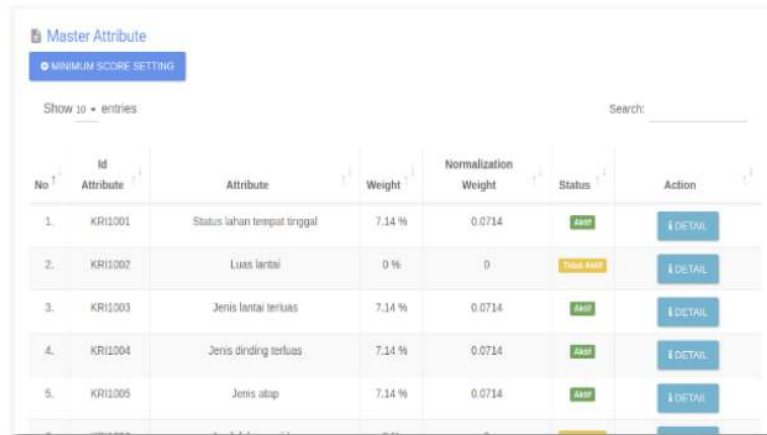
3.3. Pseudo code design of smart method implementation

Implementation of SMART pseudo code method used.

```
input : list attribute
input : list value of the candidate's attributes
normal weight
for each list attribute
normal weight = list attribute / 10;
end for each
return normal weight result
for each normal weight
result = normal weight* list value of
the candidate's attributes
end for each
return result
sum result
sort desc result
output : result
```

3.4. Programming

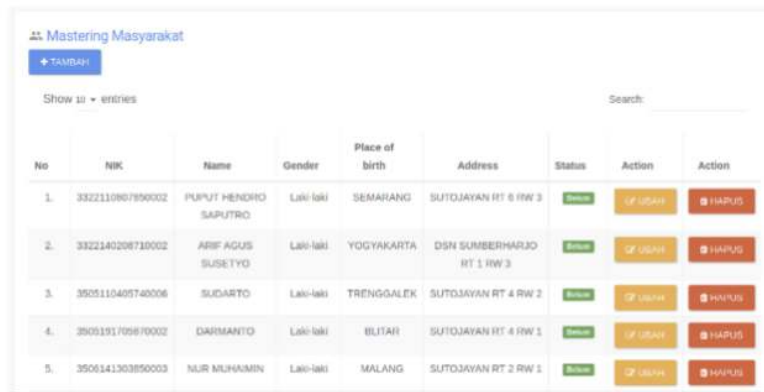
On the programming process conduct generating program code according to the result of design product stages. Stages of the program implements the results into lines of code. The appearance of the system is according its function. This is the view of the program [8].



No	Attribute	Weight	Normalization Weight	Status	Action
1.	KRI1001 Status lahan tempat tinggal	7.14 %	0.0714	aktif	DETAIL
2.	KRI1002 Luas lantai	0 %	0	Tidak aktif	DETAIL
3.	KRI1003 Jenis lantai terluas	7.14 %	0.0714	aktif	DETAIL
4.	KRI1004 Jenis dinding terluas	7.14 %	0.0714	aktif	DETAIL
5.	KRI1005 Jenis atap	7.14 %	0.0714	aktif	DETAIL

Figure 2. Form master attribute.

In Figure 2 is a multi-attribute master data page that will be used to calculate by SMART method.



No	NIK	Name	Gender	Place of birth	Address	Status	Action	Action
1.	3322110807890002	PURPUT HENDRO SAPUTRO	Laki-laki	SEMARANG	SUTOJAYAN RT 8 RW 3	aktif	EDIT	HAPUS
2.	3322140208710002	ARIF AGUS SUSETYO	Laki-laki	YOGYAKARTA	DSN SUMBERHARJO RT 1 RW 3	aktif	EDIT	HAPUS
3.	3505110409740006	SUDARTO	Laki-laki	TRENGGALEK	SUTOJAYAN RT 4 RW 2	aktif	EDIT	HAPUS
4.	3505191709870002	DARMANTO	Laki-laki	BLITAR	SUTOJAYAN RT 4 RW 1	aktif	EDIT	HAPUS
5.	3506141303850003	MUR MUHAMIN	Laki-laki	MALANG	SUTOJAYAN RT 2 RW 1	aktif	EDIT	HAPUS

Figure 3. Master people form.

In figure 3 is a resident master data page which will be used as alternative data. Alternative data is data of all residents to be selected as candidates who will receive assistance.

No	NIK	Name	Gender	Place of birth	Address	Status	Action
1.	332210807850002	PUPUT HENDRO SAPUTRO	Laki-laki	SEMARANG	SUTOJAYAN RT 6 RW 3	Kandidat	PROSES
2.	3322140208710002	ARIF AGUS SUSETYO	Laki-laki	YOGYAKARTA	DSN SUMBERHALJO RT 1 RW 3	Kandidat	PROSES
3.	3505110405740008	SUDARTO	Laki-laki	TRENGGALEK	SUTOJAYAN RT 4 RW 2	Kandidat	PROSES

Figure 4. People Candidate selection form.

In figure 4 is the candidate data page. The data is obtained after filling the attribute values in each selected people profile.

No	NIK	House Photos	Score	Action
		Front	Inside	
1.	1871010502704		98.53	PILIH
2.	2171112608859004		97.10	PILIH

Figure 5. Selection of people priorities.

In Figure 5 is a people priority data page after calculation using smart methods.

No	NIK	Name	Address	Date	Score	Status	Detail
1.	1871010502700001	SUPRIYANTO	JL. BENGAWAN SOLO RT 1 RW 19	2018-05-04	98.53	Pindah	DETAIL
2.	2171112608859004	MOCHAMMAD SAIHU RIZKI HARRIS	SUTOJAYAN NO 10 RT 1 RW 3	2018-05-04	97.10	Pindah	DETAIL
3.	3507140811800008	SINAWAR	SUTOJAYAN RT 7 RW 1	2017-01-01	100.00	Pindah	DETAIL
4.	3507190102750008	SUPRAPTO	SUTOJAYAN RT 7 RW 2	2017-01-01	100.00	Pindah	DETAIL
5.	3507190306400001	NGATEND	SUTOJAYAN RT 8 RW 7	2017-01-01	100.00	Pindah	DETAIL

Figure 6. Page calculated by using smart method.

In figure 6, it shows the final results of the simulation of SMART method. The result was a people rating who can receive home surgery program by the village government.

4. Conclusion

After conducting the waterfall stage, this research succeeded in making a decision support system beneficiaries livable home improvement with SMART method in the village. After testing the system, it can be deduced that the system can generate a list of beneficiary ratings based on predetermined attributes. Besides ranking produced more precisely and objectively. Thus, the ratings can help the village head in making the appropriate decisions.

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