

Information system to determine study programs for prospective students based on Android

Murti Retnowo*, Ikrimach

Information Systems Study Program, Diploma Program, Universitas Teknologi Yogyakarta, Indonesia

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ABSTRACT

The development of information technology, especially the technology that exists on smartphones is very large, so many people have smartphones, with the existing smartphones at this time it can be used for various things, one of which is the determination of study programs for prospective new students. The selection of study programs that are permanent and in accordance with their abilities is one way for students to be able to complete their studies at universities. Many students are confused and careless in choosing a study program. There are also those who choose a study program only to go along with their friends so that during the lecture process there are many obstacles to achieve a bachelor's degree, even having to take education until the end of the study period. Multi Criteria Decision Making is one of the ways that can be used to help prospective students based on their own abilities, especially since the program is made specifically for Android-based Smartphones. Thus, prospective students can try to choose the best based on the values that match the criteria determined by the desired study program without being embarrassed to know whether to be accepted in the chosen study program or not. The use of the Android platform is because almost everyone now has an Android-based smartphone so that applications can be downloaded for free on the Play Store.



Corresponding Author:

Murti Retnowo,
Sistem Informasi Diploma Tiga,
Program Diploma Universitas Teknologi Yogyakarta,
Jl. Siliwangi (Ring road Utara) Jombor, Sleman Yogyakarta.
Email: murti.retnowo@uty.ac.id

1. INTRODUCTION

The pace of technological development currently is very fast, both in the field of telecommunications technology to computing technology. In the field of computers, many things are growing and developing. In the past, computers could only be used for data collection and processing which was intended to speed up data processing with a parallel system using Mapreduce model programming (Retnowo, 2018). But now, computers can also be used as a tool to help decide. Along with the development of technology and people's need for information, computer usage has begun to change by using smartphones to support human activities and data processing in making decisions.

Higher education is a continuation of secondary education which is prepared for students to become members of the community who have academic and professional abilities who can apply, develop and create science, technology and art as stated in Law 2 of 1989, article 16, paragraph (1) and develop and disseminate science, technology and art as well as optimize their use to improve people's living standards and enrich them.

Basically, high school or vocational high school students and the equivalent definitely want to continue to a higher level of education in a college and determine a good study program in the future. Prospective students will usually only choose majors based on their friends or parents' wishes, but prospective students usually never take into account their own abilities based on academic values obtained during high school or vocational school. Thus, while attending lecture activities from the beginning they have experienced problems. It is because they did not understand the material given during lectures, especially when entering majors or concentration courses. As a result, the possibility of achieving graduation as expected is not achieved and it is usually a factor in the decline of student enthusiasm for learning. The decision-making process by decision-makers in difficult situations, limited time, and uncertain conditions are needed (Jaya et al, 2020).

Based on the problems above, it is necessary to create a system. The availability of a major selection decision-making system using the Multi-Criteria Decision Making (MCDM) method is expected to be able to provide input to prospective system students who will take a study program in accordance with the National Standardized Final Examination Score (UASBN), Written Examination, Interview Examination, and Psychological Test. The system was developed using the Android-based Multi-Criteria Decision Making (MCDM) method.

		A_1	.	.	A_n
w_1	C_1	a_{11}	.	.	a_{m1}
.
.
w_m	C_m	a_{m1}	.	.	a_{mn}

Figure 1 Decision Table

The A_{ij} value shows the alternative performance score A_j on the C_i criteria which is the preference of the decision-maker. Each criterion has a weight of w_i which indicates the level of importance of the C_i criteria in the decision-making process (Agung et al, 2015). The Multi-Criteria Decision Making (MCDM) method uses multiplication to connect attribute ratings, where the rating of each attribute must be raised to the first power with the weight of the attribute in question. The steps in using this method are:

1. Determine the criteria that will be used as a reference in making decisions.
2. Determine the suitability rating of each alternative on each criterion.
3. Determine the preference weight of each criterion.
4. Multiply all attributes for an alternative with the weight as a positive power for the benefit attribute and the weight with a negative power for the cost attribute.
5. Add the multiplication results together to produce a V value for each alternative.
6. Find alternative values by performing the same steps as in step one, only using the highest value for each attribute, the highest value for each benefit attribute, and the lowest value for the cost attribute.
7. Divide the value of V for each alternative by the standard value ($V(A^*)$) which yields R .
8. Find the ideal alternative value [1].

After the method used has been determined, the next step is to determine the tools to be used, where this decision support system is designed as a desktop application with the tools used, namely Android and MySQL-based programming.

2. RESEARCH METHOD

Multi-Criteria Decision Making (MCDM) is concerned with structuring and solving decision and planning problems involving several criteria. Its purpose is to support decision-makers in dealing with these problems. Usually, there is no unique optimal solution to such a problem, and it is necessary to use the preferences of the decision-maker to distinguish between solutions.

The solution can be interpreted in different ways. It can correspond to selecting the best alternative from a set of available alternatives. Other interpretations of the solution could be selecting a small set of good alternatives or grouping the alternatives into different sets of preferences. The extreme interpretation may be to find all alternatives that are efficient or not dominated.

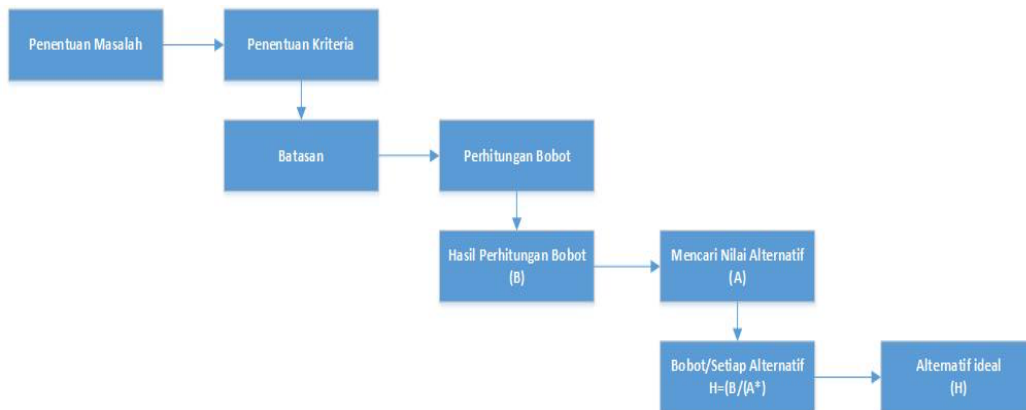


Figure 2. Process Flow

The problem difficulty stems from the existence of more than one criterion. No more unique optimal solutions to MCDM problems can be obtained without entering preference information. The concept of an optimal solution is often replaced by an undominated solution set. A solution is called nondominated if it is not possible to improve it on any criterion without sacrificing it on any other criterion. Therefore, it makes sense for the decision-maker to choose a solution from the non-dominated set. Otherwise, it could do better on some or all of the criteria, and not do worse on any of them. Generally, the set of nondominated solutions is too large to be presented to the decision-maker for the final choice. We, therefore, need tools that help decision-makers focus on preferred (or alternative) solutions. Usually, one must trade certain criteria for someone else.

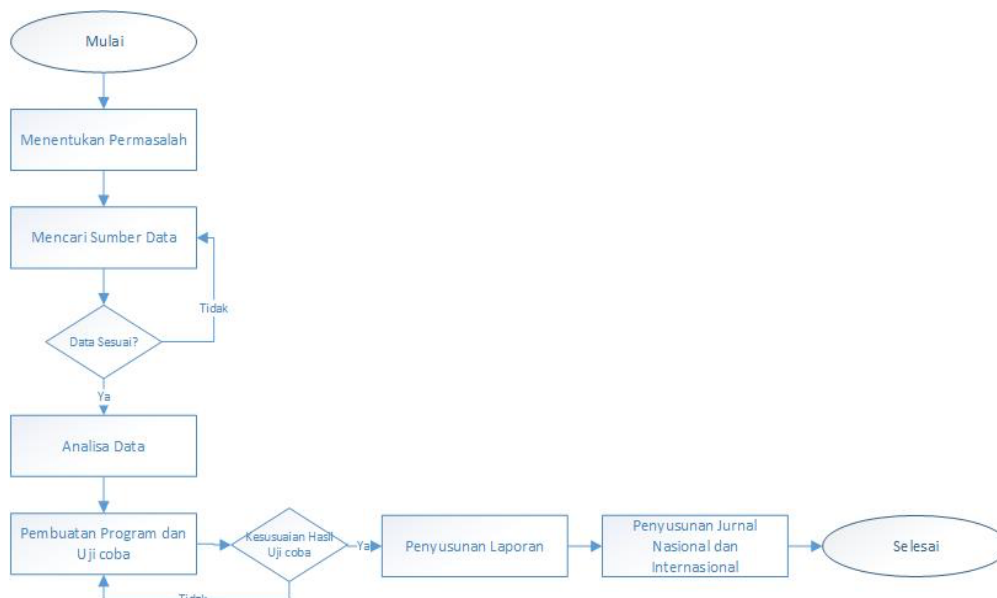


Figure 3. Research Flow

The system to be built is a system consisting of a computer server that functions as a data processing model and as a database server, an Android phone that functions as a client that will be used by users to input and process data using the MCDM method. The process will start from the android phone that is used by prospective students to determine the destination study program and enter a value. The value that has been entered will be stored in a database located on the server computer which will then be calculated. After the data has been successfully entered, the user presses the corresponding process button. If it is on a cellphone, the calculation process using the Multi-Criteria Decision Making (MCDM) method will be carried out on the user's cellphone-based on the parameters and value variables used, then prospective students will know the

results whether the desired study program matches the value entered or not. The process flow of the Multi-Criteria Decision Making (MCDM) program can be seen in Figure 4.

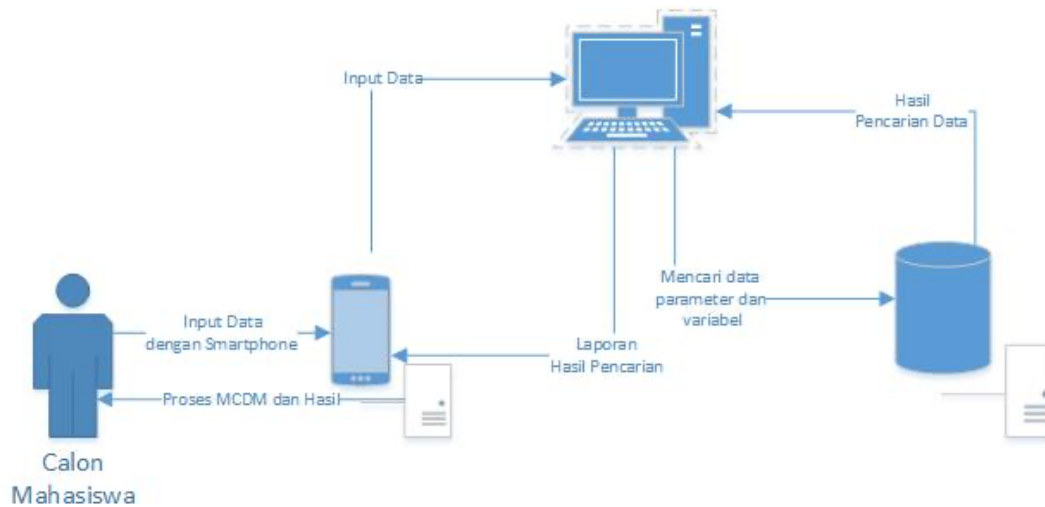


Figure 4. MCDM Process Flow

3. RESULTS AND ANALYSIS

The test results are used to determine whether prospective students can be accepted into the desired study program using Multi-Criteria Decision-Making Application (MCDM App) which is built based on Mobile (Android Application) or not. The applications are used to find out whether prospective students can be accepted into the desired study program with the parameters that exist in the study program of interest or not. Prospective students who will take an existing study program at Universitas Teknologi Yogyakarta (UTY) are asked to enter the value they have based on the criteria, parameters, and sub-parameters that have been determined by the study program. It will be later used to compare the final calculation results with the existing standard values on the study program. The criteria, parameters, and sub-parameters between one study program and another are made different according to standards that exist in the study program.

The Multi-Criteria Decision Making (MCDM) method is used to calculate criteria that have been entered previously or are commonly referred to as parameters. In this trial, the parameters used are Grade XII Report Cards, Interviews, Academic Achievements, and Psychological Tests, where parameters can be increased or decreased according to the needs of the study program. In addition, each parameter also has a sub-parameter that is used to perform calculations. MCDM is based on variables or standard values determined for each study program.

This study can provide an assessment of the practicum students' social competence. Besides the hard skills, students must also have soft skills that come from social competence. It is because they are indirectly used in everyday life, especially in future work. Determination of criteria and weighting of criteria are very important in the use of this method because they will affect the results to be obtained. The use of this method has shortcomings in the validation process in assigning weighting criteria. Furthermore, the measurement of the real results cannot be known in the short term about the accuracy of the results from the use of this method. Therefore, complementary methods are needed, which can support further research.

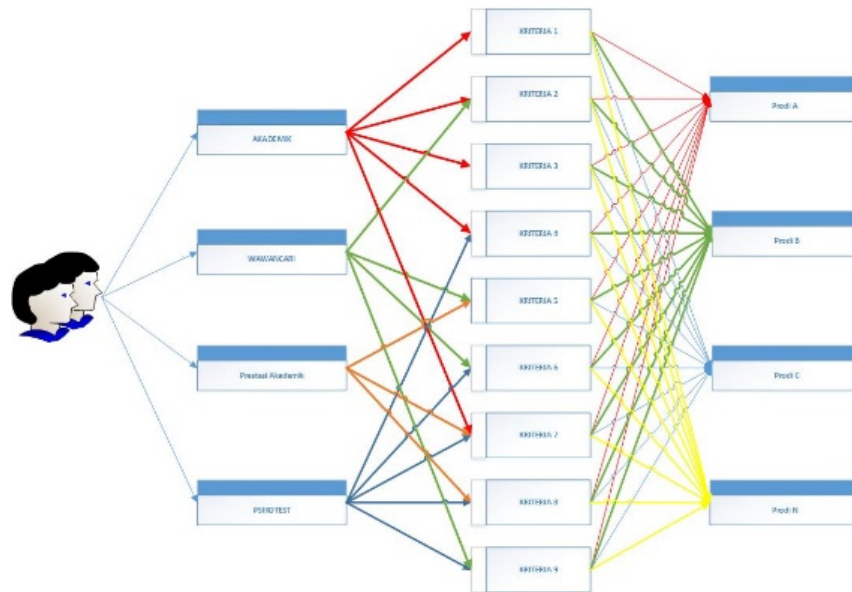


Figure 5. MCDM Process

a. Business process

The criteria used to perform the calculations are divided into several sections where each section has different criteria for each study program. To be accepted into the desired study program, the prospective students must reach the minimum value limit that must be met. Where the value limit is obtained from the previous supporting calculations. The following is an example of a value limit table that will be used as a standard value in the desired study program.

Determination of criteria is determined by calculating parameters based on the values entered by prospective students, where the criteria and value calculations have been set by the study program officer whose function is to determine the initial value. The following is the initial calculation formula.

$$N1 = P1 * N \tag{1}$$

Information:

N1 = Value calculation result with the first criteria

P1= The first parameter determined by the production officer

N = Value entered by prospective students

An example of the initial calculation results in determining the final value can be seen in table 3 where the result column is obtained from the value column multiplied by the percentage value column. After the initial calculation has been carried out, the next process is the parameter calculation based on the total value generated from the initial calculation. Table 4 shows the value criteria that will be multiplied by the results of the previous calculation. The calculation formula can be seen in formula 2 below.

$$N2 = \text{sum}(P2) * N1 \tag{2}$$

The next calculation is to add up the results of the calculation process based on the existing parameters multiplied by the percentage value that has been previously determined by the study program officer, for example, the results of the second calculation in determining the results of parameter calculations can be seen in table 5

The final stage is to compare the total value generated by the parameter calculation with a minimum value limit for the intended study program. The minimum value for each study program can be seen in table 1 in the Minimum Value column. The process of checking whether prospective students can be accepted into the desired study program can be done by using the If function in the program. The If formula can be seen in third formula

$$H = \text{if}(N2 \geq P3; H1; H2) \tag{3}$$

Information

H = Result

N2 = Value resulting from the calculation of Parameter

P3 = Minimum value of study program

H1 = Result if $N2 \geq P3$

H2 = Result if $N2 \leq P3$

Table 1. The minimum value of study program

Study Program Code	Name of Study Program	Accreditation	Minimum Score
P001	Sistem Informasi D3	A	70
P002	Sistem Informasi S1	B	65
P003	Informatika	A	80
P004	Sistem Komputer	B	65
P005	Elektro	B	65

Table 2. Parameter value

Parameter Code	Name of Parameter	Percentage
P0001	Akademik	35
P0002	Psikotest	20
P0003	Wawancara	25
P0004	Prestasi Akademik	20

Table 3. Examples of calculations per parameter

Name of Parameter	Percentage Value	Initial sum result	Multiplication Result
Akademik	35	74,3	26,005
Prestasi Akademik	20	60	12
Psikotest	20	75	15
Wawancara	25	78,75	19,6875
Total			72,6925

Table 4. Study program value criteria

Name of study program	Name of Parameter	Name of Criteria	Percentage Value
Elektro	Akademik	Bahasa Indonesia	0,05
Elektro	Akademik	Bahasa Inggris	0,05
Elektro	Akademik	Fisika	0,25
Elektro	Akademik	IPA	0,15
Elektro	Akademik	Kemampuan Analisa	0,1
Elektro	Akademik	Kimia	0,05
Elektro	Akademik	Kreativitas	0,1
Elektro	Akademik	Matematika	0,2
Elektro	Akademik	Kemampuan Sosial	0,05
Elektro	Psikotest	Kemampuan Sosial	0,65
Elektro	Psikotest	Kemampuan interaksi	0,35
Elektro	Wawancara	Pengambilan Keputusan	0,25
Elektro	Wawancara	Kemampuan interaksi	0,25
Elektro	Wawancara	Kemampuan Analisa	0,5
Elektro	Prestasi Akademik	Kreativitas	0,25
Elektro	Prestasi Akademik	Pengambilan Keputusan	0,2
Elektro	Prestasi Akademik	Kemampuan interaksi	0,3
Elektro	Prestasi Akademik	Kemampuan Sosial	0,25

Table 5. Initial calculation results

Name of Study Program	Name of Parameter	Name of Criteria	Percentage Value	Value	Results
Elektro	Akademik	Bahasa Indonesia	0,05	85	4,25
Elektro	Akademik	Bahasa Inggris	0,05	85	4,25
Elektro	Akademik	Fisika	0,25	75	18,75
Elektro	Akademik	IPA	0,15	70	10,5
Elektro	Akademik	Kemampuan Analisa	0,1	69	6,9
Elektro	Akademik	Kimia	0,05	56	2,8
Elektro	Akademik	Kreativitas	0,1	26	2,6
Elektro	Akademik	Matematika	0,2	100	20
Elektro	Akademik	Kemampuan Sosial	0,05	85	4,25
Elektro	Psikotest	Kemampuan Sosial	0,65	75	48,75
Elektro	Psikotest	Kemampuan interaksi	0,35	75	26,25
Elektro	Wawancara	Pengambilan Keputusan	0,25	85	21,25
Elektro	Wawancara	Kemampuan interaksi	0,25	80	20
Elektro	Wawancara	Kemampuan Analisa	0,5	75	37,5
Elektro	Prestasi Akademik	Kreativitas	0,25	75	18,75
Elektro	Prestasi Akademik	Kemampuan interaksi	0,3	75	22,5
Elektro	Prestasi Akademik	Kemampuan Sosial	0,25	75	18,75

b. Running Program

The program is used to help prospective students who will take courses at UTY that are in accordance with the abilities based on the scores obtained during school and the results of interviews and psychological tests. To be able to run the program, first the admin or the person authorized to enter the data needed to perform calculations using the Multicriteria Decision Making method. The data needed is study program data, parameters, sub parameters and criteria, from each study program will be able to configure the values needed to perform calculations.

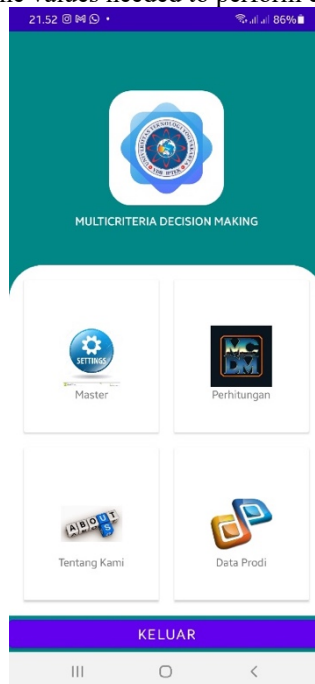


Figure 6. Main menu programs

Study program activity that is used to input data on study programs within UTY campus environment along with study program accreditation, parameter values that are used as final value limits or minimum standard values.

This activity is used for prospective students who will perform calculations based on their grades. For prospective students, the next step is to select parameters, sub-parameters, criteria and enter values according to their values. All parameters must be filled in so that the calculation results are more optimal or in accordance with the actual situation. Activity MCDM transactions are used for students to determine the desired major. After pressing the Input Value button, the prospective students can enter values according to the criteria determined by the study program admin. The stage for entering the value process of prospective students, they only choose the parameters that have been determined, name the parameter, and enter the value according to the value owned. After all the values have been entered, press the process button to find out the results of the program calculations to pass or not to the intended study program.

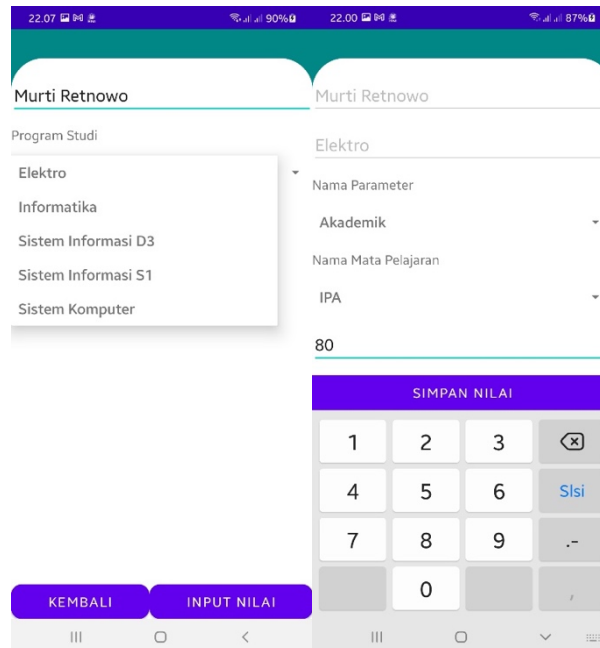


Figure 7. Selection of study programs and input values

After pressing the Next Process button, the prospective students will be notified of the calculation results from the previously entered value. To clarify for prospective students the value generated from the system can press the **DETAIL RESULTS** button so that prospective students can see the results of the calculation of values with this MCDM method.



Figure 8. Results and program assessment

4. CONCLUSION

Based on the application of the Multi-Criteria Decision Making method on android-based smartphones, they are:

1. Prospective students can do calculations on their own abilities based on the results of report cards, interviews, and psycho tests
2. Prospective students can be calm in determining the study program because they have received a recommendation from the program
3. Prospective students can try more than one study program and try to calculate the value in order to provide recommendations for other study programs
4. Study program officers can determine the criteria for prospective students according to the quality of prospective students

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