Decision Support Systems Major Selection Vocational High School in Using Fuzzy Logic Android-Based

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Abstract— One of the roles of Decision Support Systems in the field of education is decision-making process for the selection of students majoring in Vocational High School, which can help decision makers providing alternatives majors that can be used to help teachers in making decisions. The process of determining department can be done by 3 factors.. These factors include: the score of IPA, B.ING, and TIK. Fuzzy logic functions perform processing for certainty and uncertainty factors. In general, fuzzy logic can be a good deal of uncertainty factors that can be implemented in the decision-making process. Fuzzy logic models work by using the degree of membership of a value, then used to determine the desired results, based on the rules that have been determined. Decision support systems placement of students in secondary Vocational School is developed using development methods System Development Life Cycle (SDLC) Waterfall. Application development process starting from the planning system, the system requirements analysis, design, coding, testing, and to the maintenance phase.

Keywords— *Decision Support System; Fuzzy Logic; SDLC Waterfall*

I. INTRODUCTION

In everyday life people often confronted with various problems, especially specialized in determining a choice or a decision. The decision making process can sometimes be difficult due to various factors.

Decision problem also experienced by the school, in this case the SMK (Vocational High School), which is an educational institution that requires an election decision in selecting the appropriate department for the students in SMK. Lack of information related to departments in vocational as well as ignorance of the potential student's interests and talents that they have so that decisions can be influenced by the decision of parents, relatives and friends. This course will give a bad effect on students later in the day when students will attend school. Will answer the problem we need a system that can support the student's decision in determining the direction.

A decision will be taken based on ability, talent and even interests owned by learners and in the design of a decision support system must be well thought out and carefully about the decision in accordance with the chosen majors. Decision-making system will involve fuzzy logic in the decision granting aid.

The model works by using a fuzzy logic through the degree's members from a value and then be used to determine the desired results and all of it on the terms of the rules that have been determined. Broadly speaking, fuzzy logic is able to handle the kind of uncertainty factor that can be used in the decision making process.

Android with the capabilities and advantages that are able to master a variety of mobile devices and the development of applications that are open to anyone who has the ability in android application development.

II. LITERATURE REVIEW

A. Information System

The system is a collection of elements that are interconnected and work together to achieve certain goals. The information system is a collection of hardware and computer software, procedures, documentation, forms and the person responsible for obtaining, moving, management, distribution of data and information, see Figure 1.

According to McLeod (2004), the information is useful data that is processed so that it can be used as a basis for making the right decision [1].
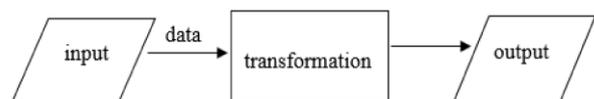

Fig. 1. System Elements [1]

According to Robert A.Leitch and K. Roscoe Davis in [2] information system can be defined. A system within an organization that reconcile the needs of daily transaction processing, support the operation, managerial and strategic activities of an organization and provide certain outside parties with reports that is required.

Component - Component Information System:

- Block Input.
- Block Model.
- Block Output.
- Block Technology.
- Block Database.
- Blocks Control.

B. Decision Support System

According to Alter the quotation by Abdul Kadir, a decision support system or Decision Support Systems (DSS) is a system of interactive information that provides information, modeling, and manipulation of data are used to help make decisions in situations semistructured and situations that are not structured in which no one knows for sure how the decision should be made.

According to Daihani Decision Support System is a computer-based system intended to help decision makers in utilizing data and specific models to solve various problems of semi-structured and unstructured [3]. As shown in Figure 2, SPK consists of three major components or subsystems, namely:

1) Data Subsystem (Data Base)

Data Subsystem is a component of DSS as the data provider for the system. Data saved in a set of data (data base) that is organized by a system that Data Base Management Systems (DBMS). DSS Database comes from two sources, namely internal sources (from within the organization or company) and external sources (from outside the organization or company).

2) Model Subsystem (Base Model)

The model is an imitation of the real world. Processing of various models made in the base models. Storage of various models in the model is done in a flexible base to assist the user in modifying and refining the model.

3) Dialog Subsystem (User System Interface)

Subsystem dialog is a facility that is capable of integrating systems installed with the user interactively. Through this dialogue subsystem articulated and implemented a system so that users can communicate with the system designed.

The relationship between these three components can be seen in the image below.
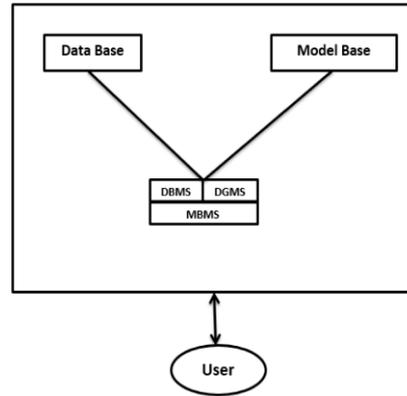

Fig. 2. The Main Components of DSS [3]

C. Fuzzy Logic

[4] explained that the fuzzy logic as one of the components of the software, has been widely applied in various fields of life. One of the most important applications is to help people in making the decision maker.

Application of fuzzy logic for decision support is indispensable when a growing number of conditions that require a decision that can only be answered with 'yes' or 'no'. This comes as a result of the uncertainty that accompanies the received data or information as a result of processing fuzzy data. Basically related to how humans handle imprecision and information are uncertain. He mimicked how people use the estimated consideration (approximate reasoning) in terms of dealing with the impresion, uncertainty, inaccuracy, inexactness, ambiguity, vagueness, qualitativeness, subjectivity and perception experienced every day in making decisions, See Figure 3.

Fuzzy logic is a superset (part surrounding) boolean logic conventionally developed to handle the concept of partial truth values between "complete truth" and "a complete mistake". Transition from the truth value of "the complete truth" to "complete error" is displayed in the fuzzy sets and not in crisp sets.
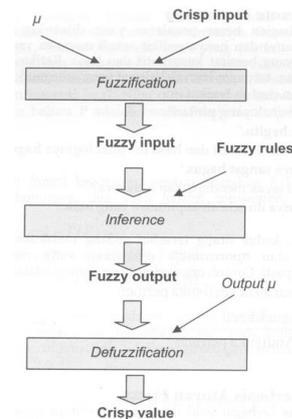

Fig. 3. Complete Block Diagram for Fuzzy rule-based Systems [5]

D. Android

Module 12 explained that the introduction of Android Android is an operating system for mobile phones based on Linux. Android provide platform that is open source for developers to create a application. Initially, Google Inc. acquired Android Inc. Which develops software for mobile phones located in Palo Alto, California USA. Then to develop Android, formed the Open Handset Alliance, the consortium of 34 companies hardware, software, and telecommunications, including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, and Nvidia. The first phone that uses the Android operating system is the HTC Dream, which was released on October 22, 2008. At the end of 2009 is estimated in this world there are at least 18 types of mobile phones that use Android [6].

III. METHODOLOGY

A. Data Collection

Data collection was conducted to determine the needs that will be required in a decision support system that will be made and there are several methods done in collecting data.

1) Interview

Stages of data collection using interviews were conducted to gather information and find the problems that occur in the selection of majors in SMK.

2) Field Research (Observation)

It is done to look at the facts that occurred through problems to find out solution.

3) Library Research

Data collection through literature study conducted to find information related to data and information technology to be used in the development system.

B. Development Model

The methodology used to develop the system that is the System Development Life Cycle (SDLC) using Model Falls (Waterfall), see Figure 4. Model Falls provide software approach life forms, sequential or ordered starting from the analysis, design, coding, testing, and support phase or maintenance [7].
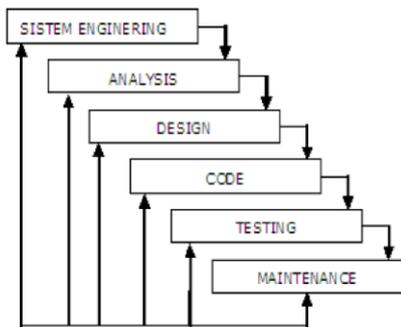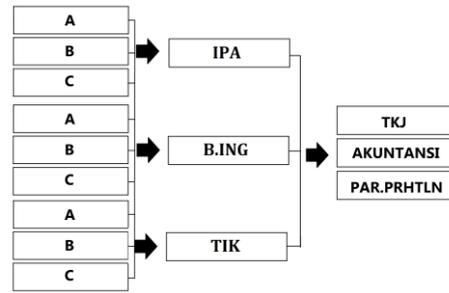

Fig. 4.   SDLC Waterfall Model [7]

Fig. 5.   Tree Diagram Analysis Determination Vocational Courses

1) System Engineering

The design of the system is necessary, because it is part of a larger system. Making the decision support systems can begin to see and search for what is needed by the system. Of the system needs to be implemented into the decision support system that will be created. So at this stage the necessary planning includes:

- Establish the target system, the school (SMK).

- Establish system constraints in decision support systems, namely process decision support systems are intended only for the admin in charge of managing the data base (see the result/decision) incoming students.

In determining the majors in vocational influenced by 3 factors. These factors include: the score of IPA, B.ING, and TIK. Which is further illustrated in the diagram tree analysis system determining vocational majors as in figure 5.

From the tree diagram analysis system determining the vocational department above, it can be seen that in the determination of the vocational department system design is influenced by three subjects namely Natural Sciences (IPA), English (B.ING), and Information Technology and Communication (TIK) are subsequently used as input variables. These three factors each have three sets were used as a function of membership in the fuzzy inference system, see Table 1.

Variables determining the value of the department can be grouped into three criteria, that is, COMPUTER AND NETWORK ENGINEERING (TKJ), ACCOUNTING (Akuntansi) and TOURISM HOSPITALITY (Pariwisata dan Perhotelan), represented in Table 2 the formation of fuzzy membership function of variable concentrations of the Department is represented in Figure 6.

At variable concentrations Department is divided into three fuzzy sets, that is Computer and Network Engineering (Teknik Komputer dan Jaringan/TKJ), Accounting (Akuntansi), Tourism and Hospitality (Pariwisata dan Perhotelan). In Table 3 are shown majors using fuzzy logic which is divided into three equations.

TABLE I. NEEDS INPUT AND OUTPUT

Input	Fuzzy Variabel	Fuzzy Set	Universe Discussion
Input	Natural Sciences (IPA)	A	81-100
		B	65-90
		C	55-70
	English (B.ING)	A	81-100
		B	65-90
		C	55-70
	Information Technology and Communication (TIK)	A	81-100
		B	65-90
		C	55-70
Output	Recommendation	Computer and Network Engineering	80-100
		Accounting	65-90
		Tourism and Hospitality	55-75

TABLE II. FUZZY ASSOCIATION OF ELECTION DEPARTMENT IN VOCATIONAL HIGH SCHOOL

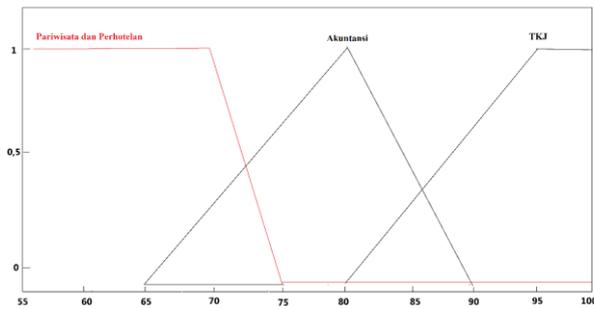| Universe Discussion	Fuzzy Set	MF Model	Domain	Parameter
55-100	Tourism and Hospitality	Trapmf	55-70	[55 65 70]
	Accoun ting	Trimf	65-90	[65 80 90]
	Computer and Network Engineering	Tramf	80-100	[80 95 100]

Fig. 6. Functions Membership Department at Vocational High School

Rule Editor works as IF- THEN rules, based on the description of variable-input and output variables are defined in the FIS editor. In the analysis of the determination of SMK majors assessed on 3 factors. Membership functions for each of these parameters includes 3 fuzzy sets. So the FIS (Fuzzy Inference System) rule obtained by combining the input between variable by combining the input between variable invitation fuzzy set obtained by the number of fuzzy sets for each variable raised to the number of input variables.

TABLE III. THREE EQUATION FOR MAJORS USING FUZZY LOGIC

No	Equation	Department	Explanation
1	$\mu_{Pariwisata\ Perhotelan}(X) = \begin{cases} 1 & ;55 \geq X \leq 70 \\ \frac{75-X}{75-70} & ;60 \leq X \leq 75 \\ 0 & ;55 < X \geq 75 \end{cases}$	Hospitality Tourism (Pariwisata dan Perhotelan)	Hospitality Tourism fuzzy set represented by trapezoidal membership function (Trapmf) which owns the domain [0 55 70 75] with the highest degree of membership (=1) lies in the value of 55 X ≤ 70. If the degree of membership Hospitality Tourism exceeds 70 then the value is nearer to the Tourism Hospitality membership Accounting.
2	$\mu_{Akuntansi}(X) = \begin{cases} 1 & ;x \leq 65\ atau\ X \geq 90 \\ \frac{X-65}{80-65} & ;65 \leq X \leq 90 \\ \frac{90-X}{90-80} & ;80 \leq X \geq 90 \end{cases}$	Accounting (Akuntansi)	Accounting fuzzy set membership function represented by triangles (trimf) has domain [65 80 90] with the highest degree of membership Accounting (=1) is located at 80. If the value of the membership degree in Accounting diminishing of the number 80, the degree of membership approaching Accounting degree of membership Tourism hospitality. So the degree of membership in the set membership degree in Accounting will wane. While the degree of membership in the set of Hospitality Tourism will increase. However, if the membership degree in Accounting exceed the value of 80, then the membership degree in Accounting approaching the degree of membership Computer and Network Engineering.
3	$\mu_{TKJ}(X) = \begin{cases} 1 & ;X \geq 100 \\ \frac{X-80}{80-80} & ;80 \geq X \geq 100 \\ 0 & ;x \geq 80 \end{cases}$	Computer and Network Engineering (Teknik Komputer dan Jaringan)	Computer and Network Engineering fuzzy set represented by trapezoidal membership function (Trapmf) having domain [80 85.1001 million] with the highest degree of membership (=1) is located on the X ≥ 90. If less than 90 degrees of membership Computer and Network Engineering then Computer and Network Engineering membership approaching membership Accounting.

TABLE IV. RULE ON FUZZY LOGIC

Rule To	Rule
1	If (IPA is A) AND (BI is A) and (TIK is A)then (PJ is T)
2	If (IPA is A) AND (BI is B) and (TIK is C)then (PJ is T)
3	If (IPA is A) AND (BI is A) and (TIK is B)then (PJ is T)
4	If (IPA is A) AND (BI is C) and (TIK is B)then (PJ is T)
5	If (IPA is A) AND (BI is C) and (TIK is C)then (PJ is T)
6	If (IPA is A) AND (BI is A) and (TIK is B)then (PJ is T)
7	If (IPA is A) AND (BI is A) and (TIK is C)then (PJ is T)
8	If (IPA is A) AND (BI is C) and (TIK is C)then (PJ is T)
9	If (IPA is B) AND (BI is B) and (TIK is B)then (PJ is A)
10	If (IPA is B) AND (BI is B) and (TIK is A)then (PJ is A)
11	If (IPA is B) AND (BI is C) and (TIK is A)then (PJ is A)
12	If (IPA is B) AND (BI is C) and (TIK is C)then (PJ is A)
13	If (IPA is B) AND (BI is C) and (TIK is B)then (PJ is A)
14	If (IPA is B) AND (BI is B) and (TIK is C)then (PJ is A)
15	If (IPA is B) AND (BI is B) and (TIK is A)then (PJ is A)
16	If (IPA is B) AND (BI is A) and (TIK is A)then (PJ is A)
17	If (IPA is B) AND (BI is A) and (TIK is B)then (PJ is A)
18	If (IPA is C) AND (BI is C) and (TIK is C)then (PJ is P)
19	If (IPA is C) AND (BI is A) and (TIK is C)then (PJ is P)
20	If (IPA is C) AND (BI is A) and (TIK is B)then (PJ is P)
21	If (IPA is C) AND (BI is B) and (TIK is B)then (PJ is P)
22	If (IPA is C) AND (BI is C) and (TIK is C)then (PJ is P)
23	If (IPA is C) AND (BI is A) and (TIK is A)then (PJ is P)
24	If (IPA is C) AND (BI is B) and (TIK is C)then (PJ is P)
25	If (IPA is C) AND (BI is C) and (TIK is B)then (PJ is P)
26	If (IPA is C) AND (BI is C) and (TIK is A)then (PJ is P)
27	If (IPA is C) AND (BI is B) and (TIK is A)then (PJ is P)

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FIS Rule thus obtained as much as 27 Rule. This stage is the rules of fuzzy logic, rules can be created to express the relation between input and output. Each rule is an implication. Operator is used to connect the input rules are the operators AND, which states between input-output is IF-THEN. In Table 4 is shown in a fuzzy logic rule.

2) Software Requirement Analysis.
At this stage of system requirements analysis requirements gathering process is carried out in the development of decision support systems. In order to understand the basis of the program will be made, so at this stage to know the scope of information, the functions required, the performance capability to generate and interface (Interface) users of social media. Analysis of the system needs to have the process as shown in Table 5 :

a) Identification of the problem.
Data collection is done in the region, namely in the school environment in general still use manual selection system.

b) To analyze the needs of covering the needs of data.
Analysis of the data needs to see the ability of social media, in particular can be a medium for sharing information (Information Sharing).

TABLE V. HARDWARE AND SOFTWARE REQUIRMENTS ANALYSIS

No	Types of Needs	List of Needs
1	Hadware	Line Internet/Modem.
		Komputer/Laptop.
		Handphone.
2	Software	Operating System (Windows 7)
		Android Studio

3) Design.
The design phase of a gradual process that focuses on four main parts, namely : data structures, software architecture, detailed procedures, and characteristics associated with the user Human-Computer Interaction (HCI). Furthermore, at this stage the system will also be designed in detail at the interface (Interface) of the Decision Support System that is at the initial appearance of the application until the results of the decision / recommendation on the application department, as shown in Table 6.

4) Coding
Software coding is the process of writing the language program so that the software can be run by machines. This process must be done carefully, because if something goes wrong in writing programming language, then the final result interrupted (error).
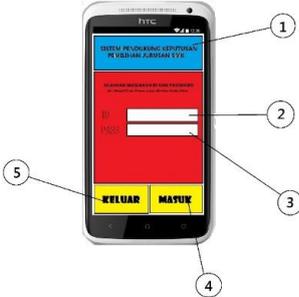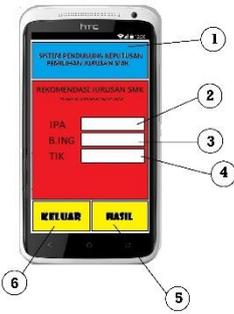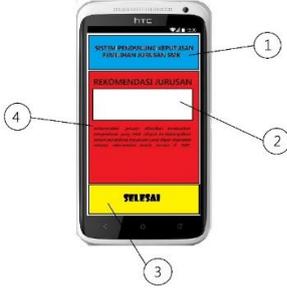
5) Testing.
In this process will be tested is the source code that has been made by focusing on the inside of the soft device. The purpose is to ensure that all statements have been tested and ensure also that the inputs used will produce output as planned. At this stage of testing is divided into two parts, internal testing and external testing.

Internal testing aims to illustrate that all statements already done testing, while external testing aims to find errors and ensure output is produced as expected.

6) Maintenance.
System maintenance is done after the process of decision support systems have been used by the user or consumer. Changes will be made if there is a mistake, therefore, a decision support system should be adjusted again to accommodate the changing needs in accordance with the needs and desires of users/consumers in this school (SMK) as a decision support system users recommendations on vocational department.

TABLE VI.   DESIGN APPLICATION

No	Design	Description
1		1 : Sentence initial appearance Decision Support Systems 2 : Login to the Decision Support System
2		1 : Sentence Log Into Application Decision Support System 2 : Box Input ID 3 : Box Input Password. 4 : Button Go to the application of Decision Support Systems 5 : Exit Button
3		1 : Sentence Log Into Application Decision Support System. 2 : Box Input Value IPA. 3 : Box Input Value B.ING. 4 : Box Input Value TIK. 5 : Button Processing the recommendation. 6 : Exit Button
4		1 : Sentence Log Into Application Decision Support System. 2 : Results Recommendation of SMK majors. 3 : Done using Decision Support system stability. 4 : Remarks result of recommendations.

IV. CONCLUSION

The use of decision support system for the selection of majors in vocational high schools have an advantage to provide an alternative elections in the school department. Decision support systems can help the committee prospective students in the division of departments using the system.

Development of systems that we've made already at the design stage of the application on android based smarthphone.

The selection decision system development department in this vocational high school selection process based on the input values majors subjects. Presumably this research that we made can be used as a reference for practitioners and researchers to create a decision support system that will be more complex for selection in the selection of majors and not just based on the criteria of value of subjects but can include other criteria in making the selection process of the department.

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