# The Decision Support System for Product Purchasing

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## *ABSTRACT*

*In the development of the technology, the variety of notebook has become diverse. It can be differed by its rice, model, type, and functionality, such as weight, screen size, processor, hard disk, memory (RAM), and graphic card. All of that diversity has become the consideration by the one who looking for a notebook. There has a problem where the buyer is so confused in deciding which notebook that is suitable with their needs. Decision support system is considered as one of the solutions to handle that kind of problem. Fuzzy Tahani Algorithm that uses the relative and qualitative natural language as the user input criteria is believed to be able to help the notebook buyer in making the decision. The result is shown that the decision support system for purchasing multi criteria product such as notebook, based on the user input criteria with the Fuzzy Tahani algorithm, is able to help the user to get the alternative product that can be recommended to them.*

Keywords: *Decision Support System, Fuzzy Tahani, Notebook*

## 1. Introduction

Notebook variety nowadays has become so diverse due to the development technology. The diversity occur because of the notebook that can be categorized as multi-criteria product. The important notebook criteria can be described by its price, weight, screen size, processor speed, hard disk capacity, memory capacity (RAM), and graphic card capacity (VGA). All those notebook criteria will be caled as parameter of the system.

Everyone can have parameters which are different with any others. That problem appears because of the difference of usage of the notebook. For example, there are many people buy laptop for the gaming reason, multimedia reason, file storage system reason, business system, or any other reason to use their laptop. The things that should be prevented by the notebook buyer is buying a notebook that is over the necessity or below the requirements. As a result, every people are looking for the notebook which is complying with their usage which become their notebook criteria.

Those notebook criteria can be subjective assessment or objective assessment (Hamdani et. al, 2011). Then appear a problem that decides what parameter that should be taken as considerations in buying a notebook. Even they sometimes cannot clearly explain or tell the specifications of a notebook which covers their need to the seller. As a result, they buy a notebook that actually doesn't match their criteria or their expectation.

Due to the complexity of making the decision in buying the right product, the decision support system in making of this kind of decision is really important. Decision support systems (DSS) are computer technology solutions that can be used to support complex decision making and problem solving. The system of this project will process the recommendation result by using the Fuzzy Tahani Algorithm. A good decision support system should cover the objective assessment and subjective assessment (Setiawan, 2012). Those two assessments are expected to be covered in this decision support system.

## 2. Related Work

The decision support system (DSS) was first introduced in the early of 1970 by Michael S. Scott Morton as Management decision system. It is a computer based system which is addressed to help the decision maker by taking the advantage of the data and model to solve many problems which is unstructured (M.C. ER, 1988). Decision support systems should be consist of some components which are model management, user interface management, and decision support architecture (Stanciu, 2009).

Decision support systems (DSS) are computer technology solutions that can be used to support complex decision making and problem solving. In figure1 is explained how the decision support system workflow. It started from bunch of data, then it is pursed to be informations. After that become a knowledge, then is pursedto the end result process which is decision.
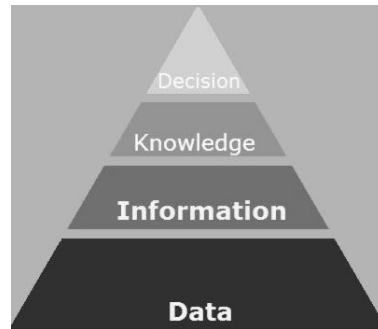
**Fig. 1** Decision support system workflow

Decision Support (DSS) is a broad field concerned with supporting people in making decisions. It is a part of decision sciences, which it shares with normative and descriptive approaches to decision making (Bohanec 2011).

A lot of research on the decision support system has been conducted. Syarifah in 2013 has done the development of the decision support system for product purchasing but she concerned to the mobile phone choosing, which is actually almost the same as notebook. She developed that decision support system by the goals of finding the most appropriate algorithm to be used for the decision support system. The algorithms that were used and to be compared were AHP (Analytical Hierarchy Process) and Topsis. Actually it is realizing that the election of algorithm is really important to get the accurate result; it is much depending to the decision that will be made. Quite huge differences are shown in the result of that algorithm. The most appropriate algorithm will result much more accurate decision support system.

For the notebook itself, many people use the algorithm of AHP (Analytical Hierarchy Process), Fuzzy, or any other multi-criteria decision making algorithm. Hamdani et al in 2011 has done the decision support system for notebook. They developed the decision support system with the Fuzzy Tahani Algorithm. They believed that the Fuzzy Tahani Algorithm is the one that is most appropriate for building the decision support system for the notebook.
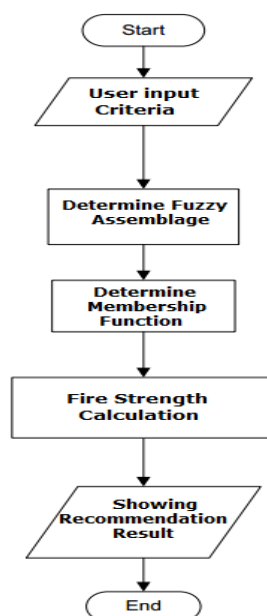


**Fig. 2** The detailed design of the system

Marji et al. has also done developing the decision support system in different case which is the decision support system for choosing the appropriate car in the car rental company. The one that is noticed in their research is on the detailed of design implementation, below is the design detailed design of the system as shown in figure 2.

## 3. Research Methodology

The datasets of  the system in this project is gathered from the crawling process of the e-commerce website. There will be a crawling process, which crawl the website pages, and catch an important information then store it in a database.

After the datasets has been gathered, then the user can input the criteria. According to the user input, the system should output the recommendation result. The system is also expected to be able to rank the result from the most relevant to the user input, base on the algorithm process system. The system is expected to help the buyer in buying a notebook which match with the criteria of the user. Below is described the workflow of the system.
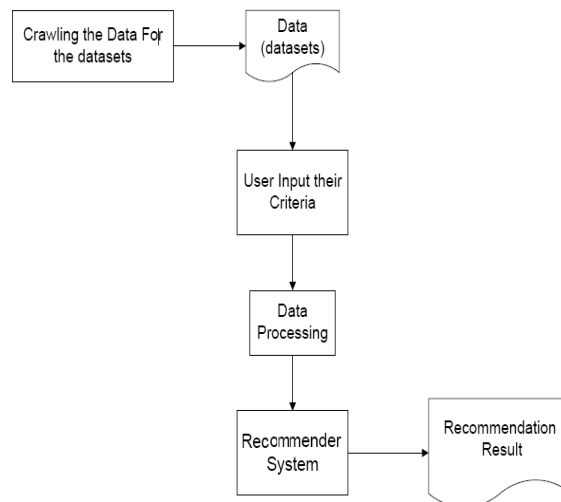


**Fig. 3** Workflow of the system

## 4. Result

*A. Description of the System*

The decision support system for the purchasing notebook with the Fuzzy Tahani algorithm is used for obtaining the product recommendation of notebook that has the suitable criteria to the user input criteria. The system is used the linguistic reasoning as an input for the recommendation, as a result, it will be easy to be used as the assessment parameters because the language that is used is easy to be understood. With the use of the logic of the Fuzzy Tahani algorithm in the system, so that the system is expected to be able to solved the problem which is considered as relative in the case of notebook purchasing. In that method of algorithm, accordingly the result that is obtained should have the flexibility based on the membership function of the fuzzy sets from every single variable.

As a decision support system, indeed the recommendation result is in an alternative form, where the alternative result in the recommended list are not binding with the user decision although the data that is shown should be valid according the system process.

In the decision support system, the decision maker is free to make its own decision that is taken, but the role of the decision support system is expected to help with providing some the recommendation of product that can be considerations in making the decision for the user use the decision support system.

### B. System Implementation

#### 1) Crawling Process

In implementing this system, at the first step, we have to able to gather the notebook data that will be used as the datasets. In this system, the data will not be inputted manually, since we decide to make the datasets automatically by getting the data from the e-commerce website. To make the automation, we have to make the script to make a crawler for the product list of the e-commerce website and store it on the database. That crawling process is done with the Java code and Selenium which is the browser automation. The data that needs to be recorded in that crawling process are the product specifications which should conclude the seven most decisive parameters that has decided in the data analysis process which are the price, weight, screen size, hard disk capacity, processor speed, memory capacity of the graphic card.

| 49 | ASUS A450LC - WX050D ( RED ) | 6799000 | http://www.lazada.co.id/asus-a450lc-wx050d-red-111... | Lazada |
| 53 | Asus A450LC-WX049D - Biru | 6799000 | http://www.lazada.co.id/asus-a450lc-wx049d-biru-11... | Lazada |
| 70 | ASUS A450LC - WX050D ( RED ) | 6799000 | http://www.lazada.co.id/asus-a450lc-wx050d-red-108... | Lazada |
| 102 | Samsung NP535U3C-A02ID - Series 5 Ultrabook - Mera... | 6799000 | http://www.lazada.co.id/samsung-np535u3c-a02id-ser... | Lazada |
| 112 | ASUS A450LC - WX048D | 6799000 | http://www.lazada.co.id/asus-a450lc-wx048d-108751.... | Lazada |
| 137 | ASUS A450LC - WX048D | 6799000 | http://www.lazada.co.id/asus-a450lc-wx048d-111734.... | Lazada |
| 155 | Asus A450LC-WX048D - Hitam | 6799000 | http://www.lazada.co.id/asus-a450lc-wx048d-hitam-1... | Lazada |
| 194 | ASUS - A450LC - WX049D ( BLUE ) | 6799000 | http://www.lazada.co.id/asus-a450lc-wx049d-blue-10... | Lazada |

**Fig. 4** Sample of the crawling result for the datasets

| 4007 | Ukuran Layar (in) | 14.0 | 305 |
| 4025 | Ukuran Layar (in) | 17.3 | 306 |
| 5 | Ukuran Layar (in) | 11.6 | 44 |
| 36 | Ukuran Layar (in) | 11.0 | 45 |
| 54 | Ukuran Layar (in) | 11.0 | 46 |
| 72 | Ukuran Layar (in) | 14.0 | 49 |

**Fig. 5** Sample of Notebook specification that is gathered from the crawling process

Above are the sample of crawled data that has been gathered from the crawling process in the figure 5 which is the notebook data and figure 6 for the specifications.

All the data that is gathered from that crawling process are expected to able to used as the datasets for the recommendation system.

#### 2) Mainpage User Interface Design

In this implementation phase, we are providing the interface for the user to be able to put their notebook criteria as easy as possible that is required for the algorithm to do the process. The system is expected to be as user-friendly as possible. Below are the screenshot of the user to input their criteria on the recommendation system.

**Fig. 6** Screenshot of Home Interface of the System

As the screenshot in Figure 6, the user may input ignore if they don't want that parameters to be involved to their input criteria. The ignore value will be considered that the user will accept all the value of the ignored variables. All of the parameters have three selections. The three selections are the low level, medium level and the high level, for example the price has cheap, medium, and expensive.



**Fig. 7** Sample of Parameter choice drop down list

All that three value as shown in figure 7 is determined for its certain range of value. For example, the expensive itself, we have to decide lower limit, middle limit, and higher limit. All that 3 points value is described in the system.



**Fig. 8** – Priority Setter

The priority setter as shown in figure 8, is can be used to decide how decisive is the parameter of the recommended result. Higher priority will affect much on the recommendation system. Priority can be set in order, from the first priority until the seventh priority. Those seven priority setter can be inputted by each of the criteria. There has priority calculation process behind the system, which the highest priority will be more decisive. All ignored criteria cannot be set as a priority.

| Nama Kriteria | Kriteria Bawah | Kriteria Tengah | Kriteria Atas | Action |
|:---:|:---|:---|:---|:---:|
| murah | 0 | 5000000 | 7500000 | Edit Value |
| sedang | 7500000 | 10000000 | 15000000 | Edit Value |
| mahal | 15000000 | 25000000 | 40000000 | Edit Value |

**Fig. 9** Sample of Interface to see Determined Value of the parameter

In figure 9, All of the 3 points are determined. But the user may configure those all values from the providing menus on the system. The user may edit all those value to be suitable to the user opinion. By choosing the edit value the user may update the value the desired criteria as shown on figure 10.

| Nama Parameter | Value Parameter Bawah | Value Parameter Tengah | Value Parameter Atas | Action |
|:---:|:---|:---|:---|:---:|
| mahal | 15000000 | 25000000 | 40000000 | UPDATE |

**Fig. 10** The interface to update the value of each parameter

In the main page of the system, as we see on the figure 6, after the user has already inputted their criteria of the system, the user can submit it, and then the recommendation system will take a while for calculating and processing the algorithm to find the recommended product according to the relevance of the user input. The algorithm is working behind the system, so that the user will directly go through the recommendation result that is expected to have the high of accuracy.

*3) Recommendation Result*

After the user input their criteria, the algorithm is processed behind it. The Fuzzy Tahani algorithm that is processed is used for calculating the relevance of the data. The top 10 most relevant product will be shown as the product recommendation result.

### RECOMMENDED PRODUCT:

HOME

| NAMA Produk | Fire-Strength | Most Covered Parameter |
|:---|:---:|:---|
| Xenom Phoenix PX17S-LZ12 DOS Hitam – 17.3" - 750 GB + 256 GB SSD | 18.28 | kecepatan prosesor, kapasitas vga, kapasitas harddisk, kapasitas ram, |
| Lenovo Thinkpad L421 With Windows 7 Pro NAL (National Academic License) - 14" - Hitam | 18.05 | kapasitas vga, ukuran layar, harga, kecepatan prosesor, |
| Asus X450JF-WX023D - Abu-Abu | 17.9 | harga, kapasitas harddisk, ukuran layar, kecepatan prosesor, |
| Toshiba Satellite C40D-A106 - Hitam | 17.83 | harga, kapasitas vga, ukuran layar, kecepatan prosesor, |
| Toshiba Satellite C40D-A106R - Merah | 17.83 | kapasitas vga, ukuran layar, kecepatan prosesor, harga, |
| Asus A450LC-WX049D - Biru | 17.32 | ukuran layar, harga, kecepatan prosesor, berat, |
| Asus A450LC-WX048D - Hitam | 17.32 | berat, ukuran layar, harga, kecepatan prosesor, |
| Asus A450LC-WX050D - Merah | 17.32 | berat, ukuran layar, harga, kecepatan prosesor, |
| Asus A550CC-XX470D - Merah | 17.27 | kapasitas harddisk, ukuran layar, harga, kecepatan prosesor, |
| Asus A550CC-XX471D - Putih | 17.27 | kapasitas harddisk, ukuran layar, harga, kecepatan prosesor, |

**Fig. 11** Sample of the recommended result interface

From the screen shot in figure 11, it shows the top 10 relevant data that is made to be a sample from the user input criteria. In first column shows the product title of the recommended product. The next or the right column shows the fire strength which is the relevance point of the recommended product. Since in this sample, the user put all the seven parameters which there have no ignored variable, so the maximum relevance point or the fire strength is 7 in the case if the priority is not set. But when the priority is set, the maximum fire strength will be much depending to the priority setter, which the fire strength will be multipled to certain number depending on how the product is prioritized. Highest priority will be multiplied by seven. Seven is obtained becuase there are seven criteria that can be inputted on the system. Below in table 1 is described how the priority can be calculated.

**Table 1** Priority Calculation

| Priority | Calculation |
|---|---|
| First (1st) Priority | Fire Strength will be Multiplied by 7 |
| Second (2nd) Priority | Fire Strength will be Multiplied by 6 |
| Third (3rd) Priority | Fire Strength will be Multiplied by 5 |
| Fourth (4th) Priority | Fire Strength will be Multiplied by 4 |
| Fifth (5th) Priority | Fire Strength will be Multiplied by 3 |
| Sixth (6th) Priority | Fire Strength will be Multiplied by 2 |
| Sevent (7th) Priority | Fire Strength will be Multiplied by 1 |

After calculation of the fire strength from the algorithm and priority on the figure 11 case, the highest fire strength is 18.28 which is called as the most recommended product. And the other 9 products are called the alternatives product. The most recommended product get the score 18.28, which means on that recommended product, some of the parameters are not covered. Becuase it may not in the maximum fire strength point. Then the covered parameter of each recommended product will be shown on the recommendation result pages.

*4)  Product Detail Page*
In the product recommended result page, the user may click every notebook, and then the user can see the detail of the notebook in the product detail page. On this page, the system also should provide the 'where to buy' function which should be able to show the e-commerce that sells the product with the direct link. The sample of product detail page interface is shown in figure 12.



**Fig. 12** Sample of Interface of Product Detail Page

## 5. Conclusion

After doing this project which is the decision support system of purchasing product with the fuzzy tahani algorithm, the conclusion can be formed. After accomplishing the analyzing, designing, building, and testing process, it conclude that the decision support system of this project is working as a tool that is believed to be able to help the notebook buyer in making the decision to which notebook that is appropriate and suitable to their needs. The system has been tested and run well as it expected. Futhermore, the system can

be trusted as a guidance to buy a notebook, that could be provided for the e-commerce site to facilitate their customer in making decision of which notebook that is suitable to the buyer needs.

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