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## CLOTHING PRODUCT SELECTION RECOMMENDATION SYSTEM WITH KNOWLEDGE BASED RECOMMENDATION METHOD

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ARTICLE INFO	ABSTRACT
Received:	<i>The market which is the largest wholesaler of clothing in Central Java is the Klerer market area and its surroundings. One of the clothing stores in the area is the Simple Inc Store. Simple Inc Store is a large kiosk that sells clothing products in the form of various types of shirts, t-shirts, jackets, sweaters and pants. Sales of products in these stores are still done conventionally, namely customers come directly to the store to choose and buy products. The number of clothing products that are sold makes customers experience difficulties in the process of selecting clothing products. Therefore, it is necessary to develop a recommendation system that can assist customers in choosing clothing products. The purpose of this study is to build a Recommendation System for Selection of Clothing Products by applying the Knowledge Based Recommendation method. The research method used in this research is Rapid Application Development (RAD) which consists of 5 stages, namely Business Modeling, Data Modeling, Process Modeling, Application Generation, and Testing. Knowledge based recommendation has the advantage of being able to set the level of user priority based on the user's needs for the product. Knowledge based recommendation on the recommendation system for the selection of clothing products can provide 5 choices of search attributes for clothing products, namely brand, price, material, color and size. clothing product selection recommendation system can display clothing product information, perform clothing searches based on customer needs based on a choice of 5 attributes and can display clothing product recommendations. Clothing products with the highest similarity value are displayed as clothing product</i>
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*recommendations. The results of the system testing using the blackbox testing method show that the functions in the recommendation system for selecting clothing products have successfully run as expected.*

**KEYWORDS**

clothing, knowledge, RAD, recommendations, system



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## INTRODUCTION

The market in society has an important role, namely as an economic center. As the center of economic activity, the market is a meeting place for consumers and producers. In the field of consumption, the market plays a role in providing basic needs in the form of clothing or food and other additional needs, while in the distribution sector, the market has a role in disseminating manufactured goods needed by the community (Aliyah, 2017). One of the markets which is the largest wholesaler of clothing in Central Java is the Klewer market area and its surroundings (Gonta, 2017). Traders in the area are grouped into large kiosks, medium kiosks and small kiosks. Among the traders in the area sell various kinds of goods such as clothes, batik, shoes, bags and others (Sulistyono, 2016). One of the clothing stores in the area is the Simple Inc Store.

Simple Inc Store is a large kiosk that sells clothing products in the form of various types of shirts, t-shirts, jackets, sweaters and pants. Sales of products in the store from large to small scale. The shop has customers not only from within the city but also from outside the city. Sales of products in these stores are still done conventionally, namely customers come directly to the store to choose and buy products. For customers who are out of town, the first purchase usually comes directly to the shop the store then the next purchase can be over the phone. The strategy in selling new products is limited to providing wholesale prices without a minimum purchase on an offline system for product promotion (Faizal, 2018). The obstacle faced by customers today is in the process of selecting products before making a purchase, because the store has not fully utilized information technology while the products sold are of various types. The product marketing process is only limited to uploading product photos via whatsapp status. The results of this study indicate that the use of social media as a clothing promotion can use social media such as: whatsapp (Ariyadi, 2019). However, the use of whatsapp as a promotional media still has drawbacks, namely if the customer wants to buy a product, the customer must be careful in reading every data sent via whatsapp because the information sent via whatsapp is sometimes incomplete and does not support the recommendation feature according to customer needs.

Based on these problems, it is necessary to develop a recommendation system that can make it easier for customers to choose products before making a purchase because the products offered are diverse. The recommendation system developed is based on a website so that it can be accessed by customers anywhere and anytime (Albert, 2020). Websites can be used as promotional media (Oktaviani, 2020). A website-based recommendation system is needed to minimize errors in choosing products so as not to cause harm to both the customer and the store. The recommendation system can help

customers in selecting products based on customer needs (Larasati, 2021) . The recommendation system is intended for inexperienced individuals to evaluate the large number of alternatives (Rokhim, 2016). The recommendation system will offer the possibility of filtering information so that only information that matches the needs and preferences of users will be displayed in the system (Irfan, 2014). The recommendation system is used to provide advice to prospective buyers regarding information that helps make decisions in purchasing products (Lavindi, 2014). For the store, the recommendation system can be used as a promotional media (Aryani, 2019). In addition, the recommendation system will make it easier for product providers to market their products and become an added value for the welfare of product providers (Dewantara, 2020). The recommendation system is one of the right marketing strategies to attract buyers (Tommy, 2019). The recommendation system model that is applied is based on knowledge about users and recommends products according to user needs using a knowledge based recommendation model (Rahmawati, 2018). The knowledge based recommendation method can cover several search criteria according to user needs (Julia, 2021). Knowledge based recommendation is a method that utilizes the perzonalization rule on the knowledge base (Ricci, 2011). Knowledge based recommendation has the advantage of being able to set the level of user priority based on the user's needs for the product. The product that has the most priority will be used as a recommendation for users (Simangunsong, 2019).

## RESEARCH METHOD

The system development method used in this research is the Rapid Application Development (RAD) software development method which consists of five stages, namely (1) Business Modeling; (2) Data Modeling; (3) Process Modeling; (4) Application Generation (5) Testing and Turnover (Deli máa , 2017). The RAD method is more appropriate to use because it has a dynamic level, short processing time, for the needs of current information quickly and the closeness of characteristics with users (Irnawati, 2018). The stages of the research carried out can be seen in Figure 1.

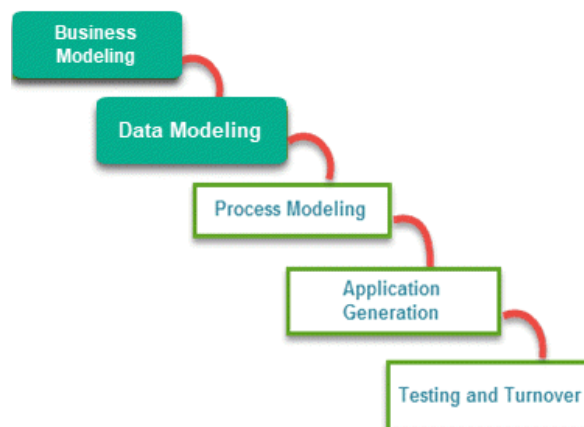


Figure 1. Rapid Application Development (RAD)

### 1. Business Modeling

This stage of modeling is carried out to model business functions to find out what information should be created, who should make the information, how the flow of

that information, what processes are related to that information. This stage is the author collect materials and make observations of system requirements where this business modeling stage will be modeled using a workflow diagram.

2. Data Modeling

This stage models what data is needed based on business modeling and defines its attributes and their relationship with other data. Stages In this case, the author creates a relationship between database tables for base modeling data so that it can be seen what attributes are needed and how the relationship the data.

3. Process Modeling

This stage implements the business functions that have been defined related to data definition. In this stage the author uses the Unified Modeling Language (UML) which includes making use case diagrams as identification of business processes . In addition, at this stage the author also models the recommendation system process based on product and attribute data obtained using the Knowledge Based Recommendation method.

4. Application Generation

This stage implements process and data modeling into a program. Stages In this case, the author is programming a recommendation system with a programming language PHP, HTML, and CSS according to the design that has been made.

5. Testing and Turnover

This stage tests the components that are made. In this stage, the author does testing using the blackbox testing method to find out whether the system functionality can operate properly or not

## RESULT AND DISCUSSION

### 1. Business Modeling

The business model of the clothing product selection recommendation system developed consists of 2 access rights, namely admin and customer. Business modeling on the recommendation system for selecting clothing products is described in the form of a Workflow diagram which can be seen in Figure 2.

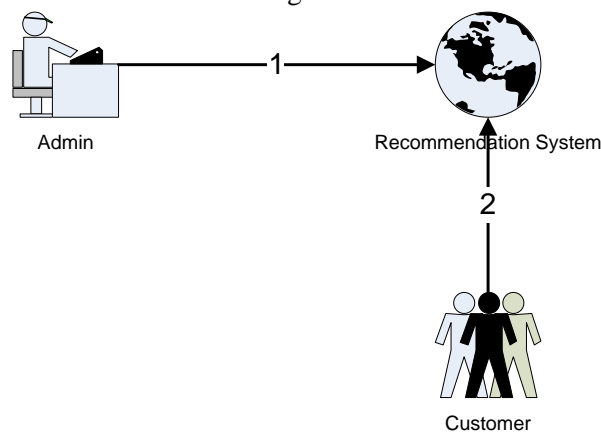


Figure 2. Recommended System Workflow Diagram

- a. The admin manages clothing product data, manages product attribute data through a recommendation system and sets attribute weights for similarity calculations with the knowledge based recommendation method that can provide clothing product recommendations, making it easier for customers to search for clothing products as needed.
- b. Customers can view product information and can search on the recommendation system by entering criteria on the attributes provided according to their needs then the recommendation system will display search results in the form of recommended clothing products.

## 2. Data Modeling

The data model used in this clothing product selection recommendation system consists of admin tables, product types and product attributes. The data model is described in the form of relations between database tables which can be seen in Figure 3.

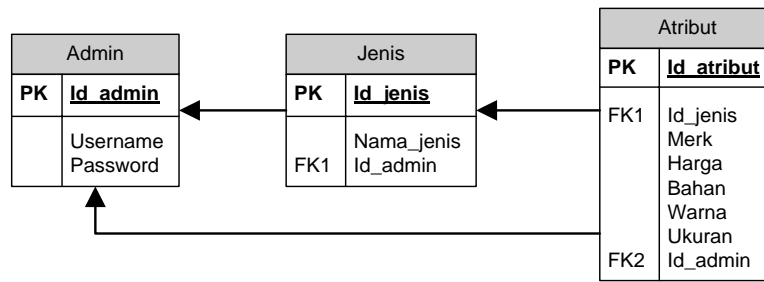


Figure 3. Database Table Relations

- a. The admin table consists of the id\_admin field as the primary key, username and password.
- b. The type table consists of the type id\_type as the primary key, type\_name and id\_admin as a foreign key for relations to the admin table.
- c. The attribute table consists of the id\_attribute field as the primary key, id\_type as a foreign key for relations to the table type, brand, price, material, color, size and id\_admin as a foreign key for relations to the admin table.

## 3. Process Modeling

The modeling of the recommendation system process consists of 2 actors, namely admin and customer. The modeling of the recommendation system process is presented in the form of a use case diagram which can be seen in Figure 4.

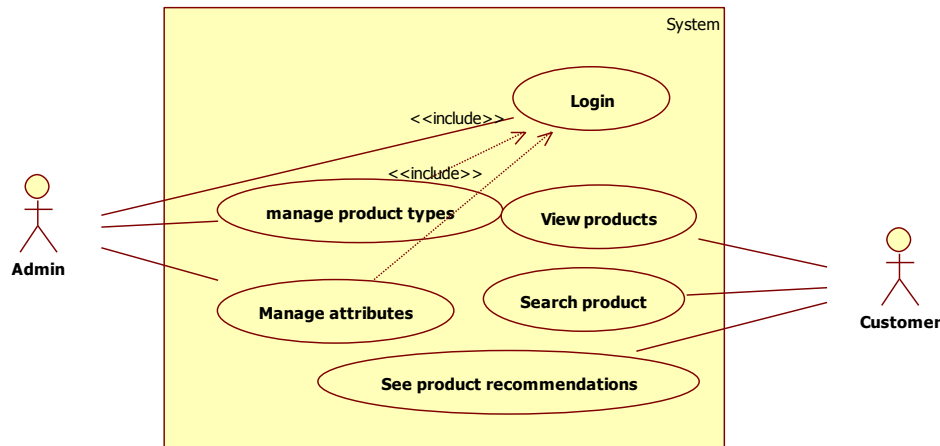


Figure 4. Use Case Diagram of Recommended System

- a. Admin can login to the recommendation system and can manage product type data and attribute data.
- b. Customers can view products, perform product searches and view product recommendation results on the recommendation system.

Based on the process model, the product search process applies the knowledge based recommendation method to provide recommendations for clothing products that suit customer needs. In this study, the authors use data on clothing products sold at the Simple Inc Store. In this study, to create a process modeling using the knowledge based recommendation method, researchers used 6 samples of jacket type clothing product data with 5 attributes for each product, namely brand, price, material, color and size. The data on the clothing products used can be seen in table 1.

Table 1. Clothing Products

N o	Clothing Type	Attribute				
		Brand	Price	Ingredient	Color	Size
1	jacket	Changer	100000	nylon	black	L
2	jacket	Changer	110000	nylon	blue	XL
3	jacket	Maternal	120000	cotton	black	XL
4	jacket	Maternal	120000	cotton	blue	XL
5	jacket	Hampank	130000	parachute	black	XL
6	jacket	Hampank	120000	parachute	blue	L

Knowledge-based recommendation modeling uses case-based techniques by calculating the level of similarity between customer needs and product data items owned. Similarity is an assessment used to calculate the similarity value of a case to another case, one of the commonly used methods is the sum of weights (Kadmiel, 2016).

The formula for calculating the similarity value in knowledge based recommendation is as follows:

$$\text{Sim}(\text{user}, \text{item}) = W_1 * S_1 + W_2 * S_2 + \dots + W_n * S_n \quad (1)$$

Information:

Sim(user,item) = Similarity to a calculated case

W = Attribute weight

S = Comparison Value

In this study using 5 product attributes in the form of brand, price, material, color and size with the weight of each attribute made the same as follows:

- a. Brand = 20% = 0.2
- b. Price = 20% = 0.2
- c. Material = 20% = 0.2
- d. Color = 20% = 0.2
- e. Size = 20% = 0.2

Based on table 1 data on clothing products, if the customer wants to find clothing products with the following criteria:

- a. Type of clothing = jacket
- b. Price = 120000
- c. Color = black
- d. Size = XL

The highest price for products sold at the Simple Inc Store is 300000. Then the knowledge based recommendation process model in determining clothing product recommendations is by calculating the similarity value by matching customer needs in the form of price, color and size. The similarity calculation process is as follows:

Product 1

Product 1 when compared to customer needs, in terms of price there is a price difference of 20000 cheaper, in terms of appropriate color and in terms of size it does not match, so the results of the similarity calculation between the user and product 1 are as follows:

$$\text{Sim}(\text{user}, \text{product1}) = (0.2*0) + (0.2*(1-20000/300000)) + (0.2*0) + (0.2*1) + (0.2*0) = 0 + 0.187 + 0 + 0.2 + 0 = \mathbf{0.387}$$

Product 2

Product 2 when compared with customer needs, in terms of price there is a price difference of 10000 cheaper, in terms of color it does not match and in terms of size it fits, so the results of the similarity calculation between the user and product 2 are as follows:

$$\text{Sim}(\text{user}, \text{product2}) = (0.2*0) + (0.2*(1-10000/300000)) + (0.2*0) + (0.2*0) + (0.2*1) = 0 + 0.193 + 0 + 0 + 0.2 = \mathbf{0.393}$$

Product 3

Product 3 when compared with customer needs, in terms of the price is appropriate, in terms of appropriate color and in terms of size, so the results of the similarity calculation between the user and product 3 are as follows:

$$\text{Sim}(\text{user}, \text{product3}) = (0.2*0) + (0.2*(1-0/30000)) + (0.2*0) + (0.2*1) + (0.2*1) = 0 + 0.2 + 0 + 0.2 + 0.2 = \mathbf{0.6}$$

#### Product 4

Product 4 when compared with customer needs, in terms of price, it is appropriate, in terms of color it is not appropriate and in terms of size is appropriate, so the results of the similarity calculation between the user and product 4 are as follows:

$$\text{Sim}(\text{user}, \text{product4}) = (0.2*0) + (0.2*(1-0/30000)) + (0.2*0) + (0.2*0) + (0.2*1) = 0 + 0.2 + 0 + 0 + 0.2 = \mathbf{0.4}$$

#### Product 5

Product 5 when compared to customer needs, in terms of price, there is a price difference of 10000 more expensive, in terms of appropriate color and in terms of appropriate size, so the results of the similarity calculation between the user and product 5 are as follows:

$$\text{Sim}(\text{user}, \text{product5}) = (0.2*0) + (0.2*(1-10000/30000)) + (0.2*0) + (0.2*1) + (0.2*1) = 0 + 0.193 + 0 + 0.2 + 0.2 = \mathbf{0.593}$$

#### Product 6

Product 6 when compared to customer needs, in terms of price, it is appropriate, in terms of color it does not match and in terms of size it does not match, so the results of the similarity calculation between the user and product 6 are as follows:

$$\text{Sim}(\text{user}, \text{product6}) = (0.2*0) + (0.2*(1-0/30000)) + (0.2*0) + (0.2*0) + (0.2*0) = 0 + 0.2 + 0 + 0 + 0 = \mathbf{0.2}$$

Based on the calculation of similarity case based with the knowledge based recommendation method, it can be concluded that the highest similarity value according to customer needs is product 3 with a value of 0.6, namely the Maternal jacket product.

## 4. Application Generation

Making a clothing selection recommendation system application using a programming language PHP, HTML and CSS . The results of the implementation of the clothing product recommendation system are as follows:

### a. Homepage

The Home page contains a brief description of the clothing selection recommendation system.



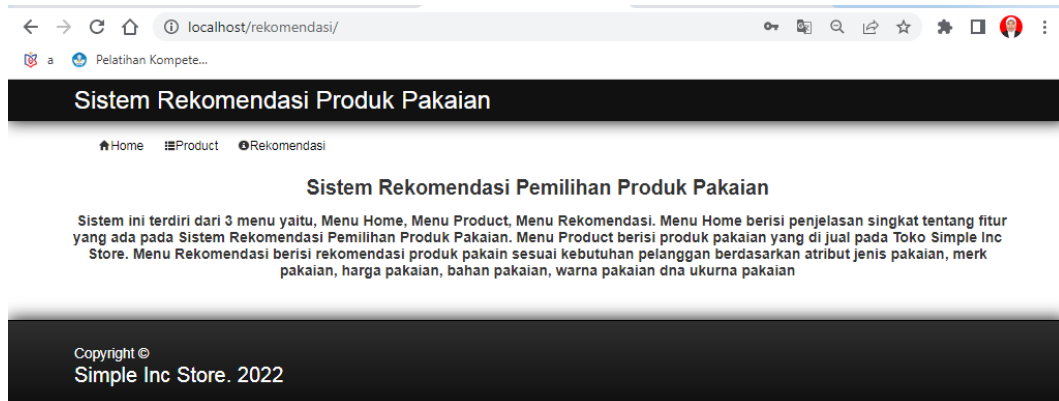


Figure 5. Home Page

b. Product Page

The product page contains the types of products sold at the Simple Inc Store store.

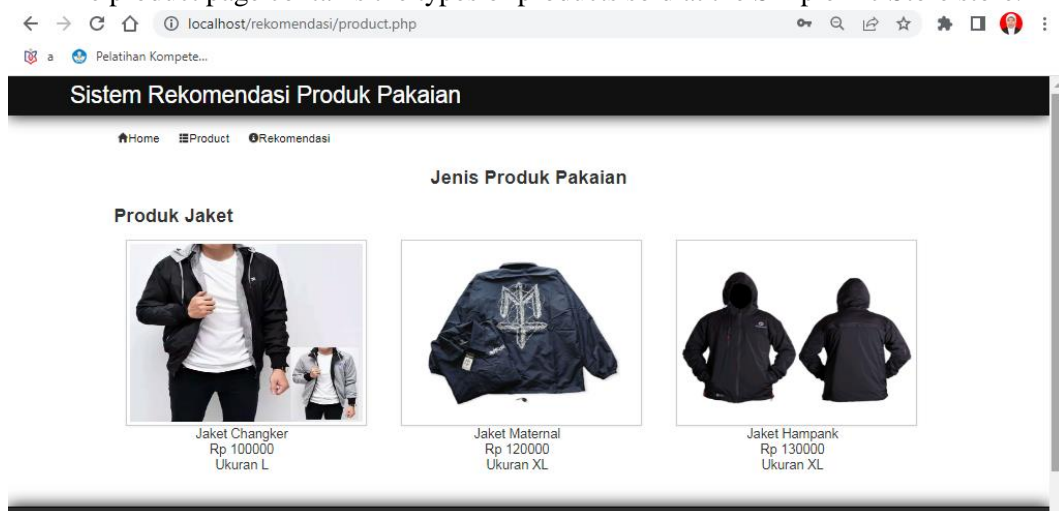
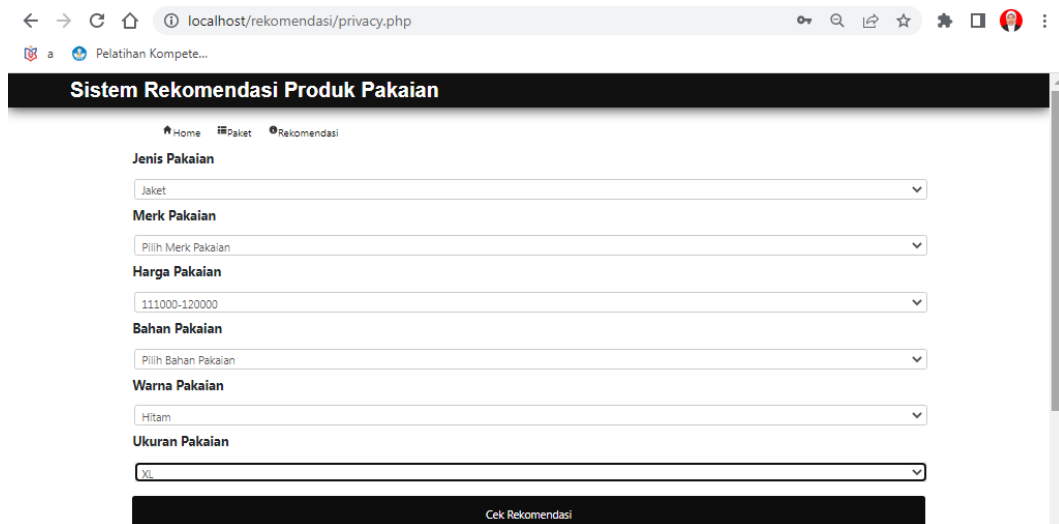


Figure 6. Product Page

c. Recommended Page

The recommendation page is used to search for clothing products according to customer needs which include types of clothing, brands, prices, materials, colors and sizes.



The screenshot shows a web browser window with the URL localhost/rekomendasi/privacy.php. The page title is 'Sistem Rekomendasi Produk Pakaian'. There are three navigation tabs: Home, Paket, and Rekomendasi. The main content area contains a form with the following fields:

- Jenis Pakaian: Jacket
- Merk Pakaian: Pilih Merk Pakaian
- Harga Pakaian: 111000-120000
- Bahan Pakaian: Pilih Bahan Pakaian
- Warna Pakaian: Hitam
- Ukuran Pakaian: Xs

A 'Cek Rekomendasi' button is located at the bottom of the form.

Figure 7. Product Page

d. Recommended Results Page

The recommendation result page contains clothes that are recommended to customers based on customer needs that have been previously inputted.

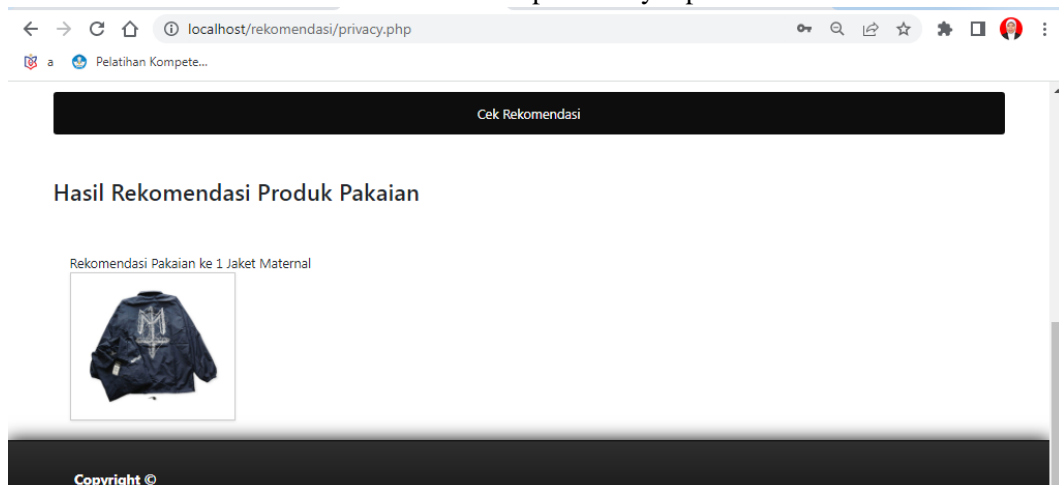


Figure 8. Product Page

5. Testing and Turnover

The testing of the Recommendation System for the Selection of Clothing Products is carried out using the blackbox testing method to test the system's functionality. Tests are carried out on admin access rights and customer access rights. The results of system testing on admin access rights can be seen in table 2, while the results of system testing on customer access rights can be seen in table 3.

Table 2 . Admin Test

Function	Expected results	Test result	Information
Login	Valid data, enter the main menu page	The system accepts login access and displays the main menu n page	Succeed
Managing Product Type	Product type data can be added, changed and deleted	The system can add, change and delete product type data	Succeed
Manage attributes	Attribute data can be added, changed and deleted	The system can add, modify and delete attribute data	Succeed

Table 3 . Customer Test

Function	Expected results	Test result	Information
View products	Show pages containing clothing products	The system displays the clothing product page	Succeed
Looking for products	Show recommendations page to search for products	The system displays a recommendation page to search for products	Succeed
View recommendation results	Shown page containing the results of clothing recommendations	The system displays the clothing recommendation result page	Succeed

Based on the results of system testing using the blackbox testing method, it can be concluded that the functions in the recommendation system for selecting clothing products can run as expected..

## CONCLUSION

Based on the results of the research that has been done, it is concluded that the recommendation system for the selection of clothing products can display clothing product information, search for clothing based on customer needs with a choice of 5 attributes, namely brand, price, material, color and size and can display the results of clothing product recommendations. The recommendation system for selecting clothing products was successfully built by applying the Knowledge based recommendation method by calculating the similarity value between customer needs and the attributes possessed by each clothing product. Clothing products with the highest similarity value will be displayed as a result of clothing product recommendations. The results of the

system testing using the blackbox testing method show that the functions in the recommendation system for selecting clothing products have successfully run as expected.

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