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EV7 Solo Electric Bicycle Sales Recommendation System Using Knowledge Based Method

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ABSTRACT

One outlet that offers various types of electric bicycles is EV7 Solo. EV7 Solo is a large shop that sells electric bicycles of various brands and types. The services provided by the team at the shop currently still work using traditional methods, where customers need to come directly to the shop to choose and buy products. The density of potential buyers coming at the same time makes the service from EV7 Solo slow and makes potential buyers feel uncomfortable. Therefore, it is necessary to develop a recommendation system that can help customers choose products. electric bicycle. This research aims to design an Electric Bicycle Product Selection Recommendation System using knowledge-based methods. The system development method used in this research is Rapid Application Development (RAD), which includes the stages of business modeling, data modeling and process modeling. Knowledge-based recommendation systems have the advantage of prioritizing user needs for products by calculating the similarities between customer needs and electric bicycle product attributes. This knowledge-based electric bicycle product selection recommendation system model provides five search attributes for electric bicycle products, namely brand, price, mileage, color and maximum speed. By using 30 sample data, the results of the knowledge-based recommendation method modeling can provide recommendations for electric bicycle products based on criteria set by customers through calculating the similarity between customer needs and the attributes listed on the electric bicycle product. Product Data: Electric bicycle products with the highest similarity value will be recommended to customers, such as the Powell a400 Black electric bicycle product which received the highest similarity value of 0.795. The results of this research can serve as a guide for developing a recommendation system in selecting electric bicycle products.

I. Introduction

An electric bicycle or commonly called an electric-bike (E-Bike) is a bicycle with an electric power source that comes from a battery [1]. People are getting easier to work thanks to technological advances. However, technological advances require energy. For illustration, about all motorized vehicles in the world use fossil-based fuels. The need for new energy sources is increasing so as to solve energy shortages and ultimately improve people's welfare. In today's digital age, information technology has become a very important element in everyday life. To face the need for online commerce in this digital era, many stores choose to expand their services by conducting online sales transactions [2]. Electric bicycles are a technological advancement that seems quite interesting. Electric bicycles are an environmentally friendly way of transportation and are gaining popularity among people, especially in urban areas. People can move around without worrying about air pollution or traffic jams with electric bikes.

Among the many electric bike models available in the market, EV7 Solo is one of the most prominent in the field of electric bikes as it has various types of electric bikes available. On the other hand, EV7 Solo has a limited number of services, which makes EV7 Solo's services slow and

inconveniences customers. The Electric Bike Sales Recommendation System with Knowledge Based Method makes it easier for customers to choose available electric bikes, maximizing EV7 Solo's services with its limitations. One important part of a sales system is serving potential customers. The system operates by collecting information from users either directly or indirectly. The recommendation system is very useful for providing a recommendation to its users, so that users can feel the interaction between the system and the user [3]. The recommendation support system is able to present individualized product recommendation results to customers, not just presenting a list of popular products, but giving advice on products that are likely to be suitable for users. Thus, each customer gets different recommendations, according to their interests and identity. Despite this, the selection of recommendations for each customer is provided that the system must have an understanding of the customer [4].

Given the variety of products offered, a recommendation system must be created to help customers choose products before buying. If the selected product does not match the needs, it can cause losses for both parties, both for customers and stores. The recommendation system developed is web-based so that customers can open it anytime and anywhere. Through the web and the recommendation system in it, product promotion activities can be carried out [5].

User knowledge-based recommendation systems are used in recommending products that can meet the needs of users and are known as knowledge-based recommendation systems. This method allows prioritization for each user, according to their needs for the proposed product. Therefore, knowledge-based recommendation systems have their own advantages. Products that have the most priority will be recommended to users [6].

This research aims to create a knowledge-based recommendation model for electric bicycle selection systems. This model is useful in developing and improving recommendation systems for choosing electric bicycles.

II. Method

The research process begins by formulating a problem and conducting a literature review. Problem solving requires data collection through observation and recording techniques. Once the data is collected, the next step is to develop the system utilizing the Rapid Application Development (RAD) software development method. According to the Rapid Application Development (RAD) system development approach, it is a life cycle strategy that aims to provide faster system development and is very flexible to changes that occur during the system development process [7]. In this research, the RAD method is only implemented up to the modeling stage which consists of three stages, namely (1) business modeling, (2) data modeling, and (3) process modeling [6] The Rapid Application Development (RAD) approach was chosen because it has advantages, such as shorter development cycles, greater flexibility, increased user involvement, and the ability to reduce the risk of errors[8]. There are 5 attributes used by researchers, namely brand, color, price, mileage, and maximum speed. The research stages carried out are as follows:

A. Business Modeling

At this stage, modeling is done to design business roles with the aim of determining the data to be created, the parties responsible for creating the data, how the information flow functions, and what processes are involved with the data. Researchers collect data and observe system requirements while creating business modeling using workflow diagrams.

B. Data Modeling

In this phase, the required data is modeled based on business modeling and the attributes are determined. In this phase, researchers compile data modeling based on product information and attributes obtained using knowledge-based methods.

C. Process Modeling

In this session, the implementation of business roles is defined in the context of data design. The author utilizes the Unified Modeling Language (UML) to generate use case diagrams that

identify business procedures. In addition, this phase also designs the system's user interface that includes input and output patterns.

III. Results and Discussion

A. Business Modeling

The business design for the electric bicycle selection recommendation system designed has 2 types of access rights, namely admin and customer. An overview of the workflow of the recommendation system can be seen in Figure 1 as follows:

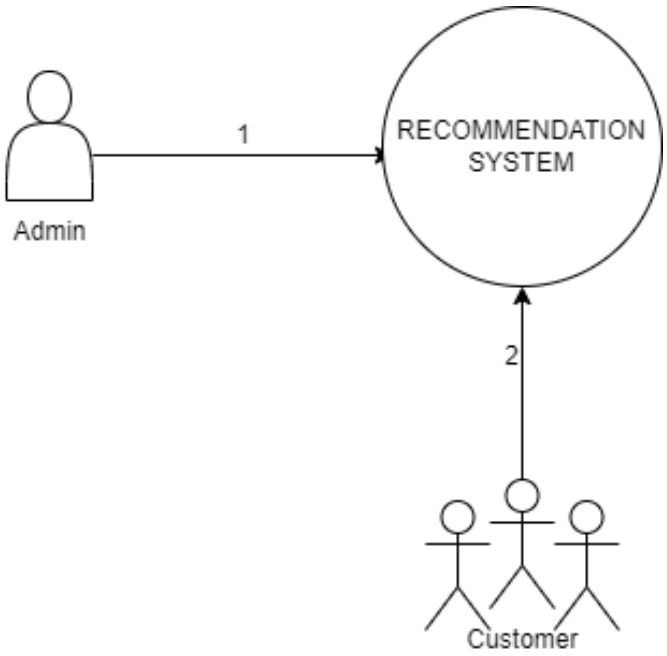

Fig 1. Workflow of the Recommendation System

From Figure 1 it can be described that:

1. Admin can manage electric bicycle product information, manage information Determine product characteristics using a recommendation system and determine the importance of attributes used to calculate proximity using an information-based proposal approach that is able to provide product recommendations, making it easier for consumers to find electric bikes as desired.
2. Consumer search for products in the recommendation system along with inputting criteria for available attributes, the system will present search results in the form of suggested electric bikes according to their needs.

B. Data Modeling

The information used in this research is data on electric bicycle products available at EV7 Solo, a kiosk that offers various types of electric bicycles in Solo, including the brands exotic, powelldd, aviator, aima, and others. For the purpose of modeling knowledge-based recommendations, we used 30 sample electric bicycle product data, each with 5 attributes. Details regarding the electric bicycle product data used are available in Table 1.

Table 1. Electric Bicycle Product Table

No	unit type	Attribute				
		Merk	Color	Mileage	Maximum speed	Price
1	Electric Bike	AIMA C501 G.TOSCA	Tosca Green	70 KM	35 KM/ hr	4,850,000
2	Electric Bike	AVENGER AVR 773 YL	Yellow	40 KM	25 KM/ hr	3,400,000
3	Electric Bike	AVIATOR AT225 PNKT	Pink	40 KM	25 KM/ hr	3,299,000
4	Electric Bike	EXT VLC CR BATMAN	Black	40 KM	25 KM/ hr	3,500,000
5	Electric Bike	EXT VLC CR PONY T	Pink	40 KM	25 KM/ hr	3,500,000
6	Electric Bike	EXT VLC SUPERMAN	Deep Blue	40 KM	25 KM/ hr	3,500,000
7	Electric Bike	EXTC BROSWY3.0	Cream	40 KM	25 KM/ hr	3,525,000
8	Electric Bike	EXTC BROSWY3.0	Purple	40 KM	25 KM/ hr	3,525.,000
9	Electric Bike	EXTC BROSWY3.0	Tosca Green	40 KM	25 KM/ hr	3,525,000
10	Electric Bike	EXTC EV-922 DBLUET	Deep Blue	40 KM	25 KM/ hr	3,499,000
11	Electric Bike	EXTC EV-922 PURPLT	Purple	40 KM	25 KM/ hr	3,499,000
12	Electric Bike	EXTC EV-922 RED T	Red	40 KM	25 KM/ hr	3,499,000
13	Electric Bike	EXTC GROZA RX BLUE	Blue	40 KM	25 KM/ hr	3,600,000
14	Electric Bike	EXTC STNGR 3.5 GRT	Green	40 KM	25 KM/ hr	3,899,000
15	Electric Bike	EXTC STNGR 3.5 PKT	Pink	40 KM	25 KM/ hr	3,899,000
16	Electric Bike	EXTC VLC V4 BLUE T	Blue	40 KM	25 KM/ hr	3,450,000
17	Electric Bike	EXTC X-630 BLACK T	Black	40 KM	25 KM/ hr	3,750,000
18	Electric Bike	EXTC X-630 BLU T	Blue	40 KM	25 KM/ hr	3,750,000
19	Electric Bike	EXTC X-630 GREY T	Grey	40 KM	25 KM/ hr	3,750,000
20	Electric Bike	EXTC X-630 RED T	Red	40 KM	25 KM/ hr	3,750,000
21	Electric Bike	FASTRON SLX 6.0 PK	Pink	40 KM	25 KM/ hr	3,425,000
22	Electric Bike	FASTRON SLX 6.0 YL	Yellow	40 KM	25 KM/ hr	3,425,000
23	Electric Bike	GODA GD148 LYCN UN	Pastel Purple	40 KM	25 KM/ hr	3,800,000
24	Electric Bike	PACIFIC ARMOUR PUR	Purple	40 KM	25 KM/ hr	4,800,000
25	Electric Bike	PACIFIC VERTEX ORN	Orange	60 KM	30 KM/ hr	4,500,000
26	Electric Bike	POWELLDD A400 BLCK	Black	60 KM	30 KM/ hr	3,700,000
27	Electric Bike	POWELLDD A400 GRN	Green	60 KM	30 KM/ hr	3,700,000
28	Electric Bike	POWELLDD A400 PINK	Pink	60 KM	30 KM/ hr	3,700,000

No	unit type	Attribute				
		Merk	**Color**	**Mileage**	**Maximum speed**	**Price**
29	Electric Bike	POWELLDD F203 HJ	Green	60 KM	30 KM/ hr	3,550,000
30	Electric Bike	AVIATOR AT223 PNKT	Pink	30 KM	20 KM/ hr	2,850,000

The technique used in the design of knowledge-based recommendation is case-based, where the similarity value between the user's desire and the data of a product is calculated using the similarity method[9].

In calculating similarity, use the following equation:

$$Sim\ (user, Item) = \sum(W * S)$$

Information:

Sim (user, item) = similarity value

W = Attribute weight

S = Comparative Value

The study uses 5 attributes, each of which is weighted 1/5 or 20% in decimal 0.2.

From the information listed in Table 1 regarding data on electric bicycle products, if customers want to find electric bicycle products using the following criteria: Brand = powelldd, price = 3,600,000, color = black mileage = 60 KM.

In this context, the knowledge-based recommendation model in determining the choice of electric bicycle products is as follows:

If the customer chooses the Powelldd electric bicycle brand, then from 30 examples of electric bicycle product data will be filtered based on the Powelldd brand so that 4 Powelldd products remain. Information about Powelldd products that have been filtered based on the customer's choice of electric bicycle brand can be found in Table 2.

Table 2. Powelldd Product Table

No	Unit Type	Attribute				
		Merk	Color	Mileage	Maximum Speed	Price
1	Electric Bike	POWELLDD A400 BLCK	Black	60 KM	30 KM/Hr	3,700,000
2	Electric Bike	POWELLDD A400 GRN	Green	60 KM	30 KM/Hr	3,700,000
3	Electric Bike	POWELLDD A400 PINK	Pink	60 KM	30 KM/Hr	3,700,000
4	Electric Bike	POWELLDD F203 HJ	Green	60 KM	30 KM/Hr	3,550,000

The 4 filtered powelldd products will undergo a similarity calculation process using the knowledge-based recommendation method used to match customer needs based on price, color, and mileage. The similarity calculation process is carried out as follows:

Product 1

Product 1, when compared to customer requirements, has a price difference of 100,000 more expensive, but is suitable in terms of color and mileage. Therefore, the results of the similarity calculation between the user and Product 1 are as follows:

Sim (user, product 1) = (0,2*1) + (0,2*1) + (0,2*1) + (0,2*0) + (0,2*(1-100.000/4850000) = 0,2 + 0,2 + 0,2 + 0 + 0,195 = 0,795

Product 2

Product 2, when compared with customer requirements, has a price difference of 100,000 more expensive, but it is suitable in terms of color and not in terms of mileage. Therefore, the results of the similarity calculation between the user and Product 2 are as follows:

Sim (user, product 2) = (0,2*1) + (0,2*0) + (0,2*1) + (0,2*0) + (0,2*(1-100.000/4850000) = 0,2 + 0 + 0,2 + 0 + 0,195 = 0,595

Product 3

Product 3, when compared with customer needs, has a price difference of 100,000 more expensive, but does not match in terms of color and mileage. Therefore, the results of calculating the similarity between users and Product 3 are as follows:

Sim (user, product 3) = (0,2*1) + (0,2*0) + (0,2*1) + (0,2*0) + (0,2*(1-100.000/4850000) = 0,2 + 0 + 0,2 + 0 + 0,195 = 0,595

Product 4

When compared with customer needs, Product 4 has a cheaper price of 50,000, but is not suitable in terms of color, and is not suitable in terms of mileage. Therefore, the results of calculating the similarity between users and Product 4 are as follows:

Sim (user, product 4) = (0,2*1) + (0,2*0) + (0,2*1) + (0,2*0) + (0,2*(1-50.000/4850000) = 0,2 + 0 + 0,2 + 0 + 0,197 = 0,597

Based on the results of similarity calculations using case-based and knowledge-based recommendation methods, it can be concluded that the highest similarity value that meets customer needs is product 1, namely the POWELLDD A400 BLCK electric bicycle, with a value of 0.795

C. Process Modeling

Software engineering modeling is presented in Requirements analysis and described using the Unified Modeling Language (UML) method. UML (Unified Modeling Language) is a method of visual modeling that is used as a means of designing object-oriented systems[10]. As a basis for building an effective web information system, UML (Unified Modeling Language) is applied as a tool in the design process. UML's ability to visualize models in a detailed and structured manner makes it an ideal tool to support the process of designing and building object-oriented software. A use case diagram is an example of a UML diagram created. The recommendation system process is modeled with two actors: admin and customer. Figure 2 shows the design of the recommendation system process in the form of a use case diagram, where the Admin can manage product data, attributes, and attribute weights, while customers can view products, carry out searches, and see

recommendation results in the system. The recommendation system process design in the form of a use case diagram can be seen in Figure 2.

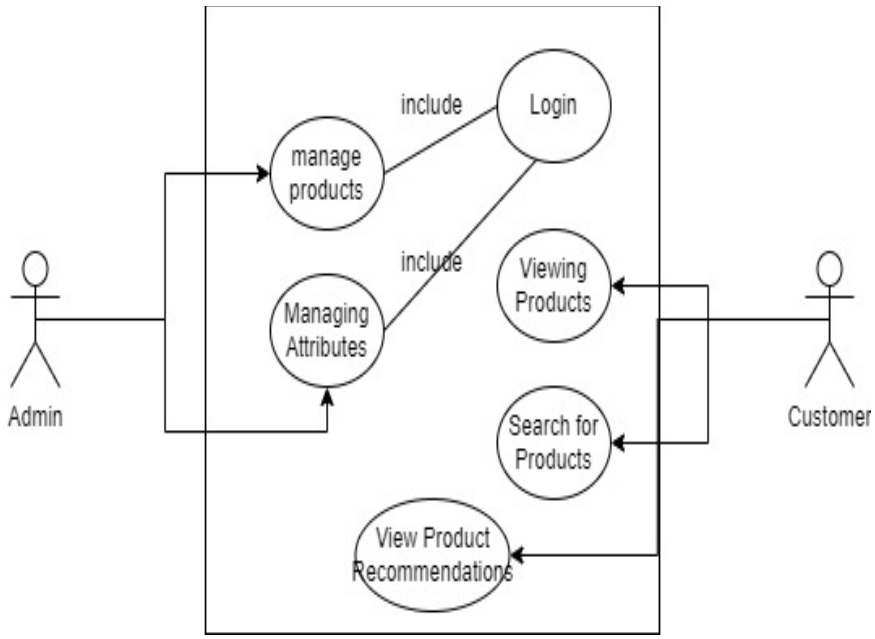

Fig 2.Use Case Diagram of Recommendation System

Based on the process modeling results shown in Figure 2, the recommendation system interface design for selecting electric bicycle products from the perspective of customer access rights is as follows:

1. Product design

On the product page, the display is used to display all packages offered. The design of the product page can be seen in the following figure.

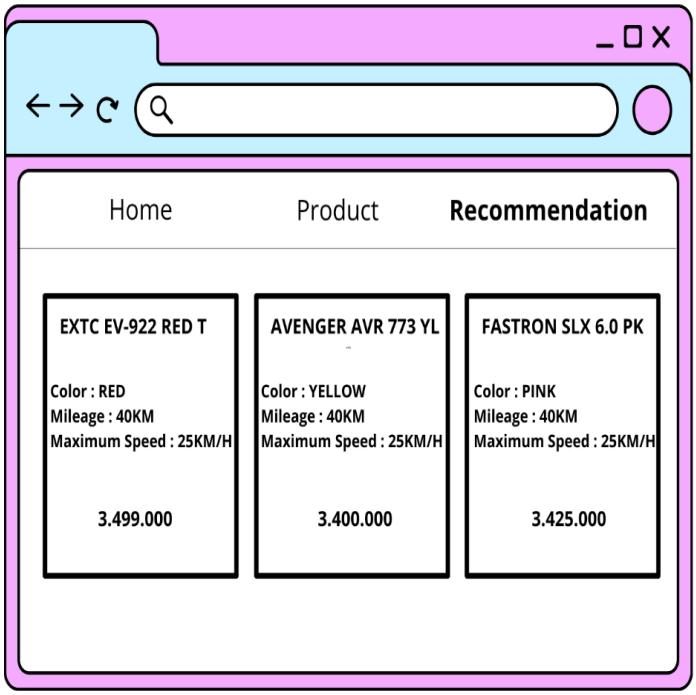

Fig 3.Recommendation system homepage

2. Product search design

On the product search page, users can search for products that customers want. The design of the product search page can be seen in the following figure.

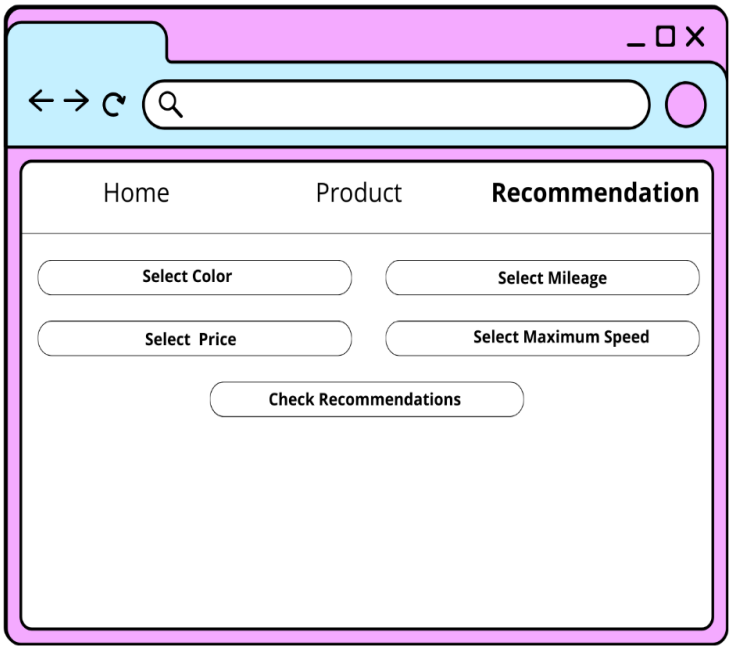

Fig 4.Product Search Design

3. Design of recommendation results

On the recommendation results page, the display is used to display products that have been searched by customers. The design of the recommendation results page can be seen in the following figure.

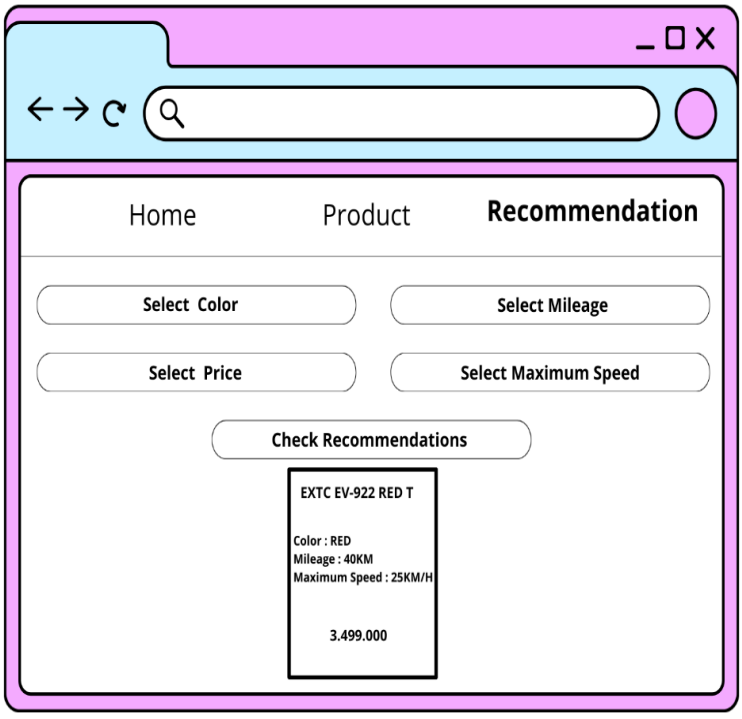

Fig 5.Result Recommendation Design

IV. Conclusion

Based on the research findings, it can be concluded that designing knowledge-based recommendations for a decision system for selecting electric bicycle products includes five search attributes: brand, price, mileage, color and maximum speed. From modeling this method with 30 data samples, the system can provide recommendations for electric bicycles referring to the standards desired by buyers, by calculating the similarity values between customer needs and the attributes contained in each electric bicycle product. The electric bicycle with the highest similarity value, namely 0.795, will be presented as a recommendation result. This knowledge-based recommendation design can be used as a reference to improve the recommendation system for determining electric bicycle products

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