BEST
Journal of Applied Electrical & Science Technology – University of PGRI Adi Buana Surabaya
p-ISSN 2715-2871
e-ISSN 2714-5247

APPLICATION OF KNOWLEDGE BASED METHOD IN MOBILE APPLICATION-BASED CAT FEED RECOMMENDATION SYSTEM

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***Abstract*— The selection of appropriate cat food frequently presents a challenge for Giant pet shop customers, attributed to extensive product variations and often unvaried recommendations from seller. To overcome this, this study designs a mobile application-based cat food recommendation system by implementing the knowledge-based method and constraint-based approach. This system allows users to receive product suggestions based on attributes such as brand, taste, cat age, weight, price, and type of food. Data collection was carried out through literature studies and direct observations at Giant pet shop, while system development followed the waterfall model which includes needs analysis, design with UML diagrams, and implementation. The results of the study show that the developed system is able to help users choose cat food that suits their needs, while also making it easier for admins to manage product data.**

Keywords—Recommendation System, Knowledge Based, Constraint Based, Cat Food, Mobile Application

I. INTRODUCTION

Maintaining feline health necessitates the provision of nutritionally balanced and nutrient-rich food, tailored to the cat's age and breed. [1]. Balanced nutrition and adequate nutrients in cat food are crucial for sustaining feline health and physiological equilibrium[2]. In terms of cat food, there are various types of cat food products that are classified by age, brand, taste, size and also price. Generally, cat food can be divided into two, namely wet food and dry food[3]. Giant pet shop is a place where people can buy various types of pet needs, especially cat food. Giant pet shop has been established since 2022 and is currently located at Jl. Delanggu- Polanharjo, Krecek, Kec. Delanggu, Klaten Regency, Central Java. Giant pet shop customers frequently encounter difficulties in selecting suitable cat food due to the extensive product variety available. While sales personnel provide recommendations, these are often perceived as monotonous and biased towards high-demand products, consequently overlooking less popular yet relevant options.

Based on the problems above, a recommendation system can be the right solution to make it easier for customers to determine the right product when customers are confused when faced with a variety of product choices.

A cat food recommendation system can be the right solution when confused when choosing the right cat food so that it can help in providing complete, accurate and appropriate recommendations for the needs of pet cats[3]. Optimal system functionality necessitates the implementation of a knowledge-based recommendation method utilizing a constraint-based approach, enabling users to input specific attributes and receive corresponding product recommendations. [4].

This study aims to design a recommendation system by implementing the knowledge-based recommendation method as a modeling of a cat food recommendation system and with a constraint-based approach. Modeling of these methods can be implemented as a reference in creating and adding innovation to the design of this system. With this system, it will later be easier for customers to find cat food products that suit their needs[5].

II. METHODS

Data collection was conducted through direct observation at Giant pet shop and extensive literature review from relevant books and journals. Subsequent to data acquisition, a thorough analysis will be performed to ascertain system requirements. [3].

This study employs a Knowledge-Based method with a Constraint-Based approach to develop a recommendation system, ensuring that generated results are precise and appropriate to user inputs. [6][7].

The selection of the knowledge-based method with a constraint-based approach is based on the system's need to deliver recommendations aligned with explicit user preferences, such as food type, cat age, or price. This approach differs from the Analytical Hierarchy Process (AHP), which is more suitable for decision-making that requires hierarchical weighting of criteria, but lacks flexibility in real-time user interaction.

Meanwhile, the content-based filtering approach relies on user history and product features to suggest similar items. Although effective, it requires substantial user data and may not perform well in cold-start scenarios. Thus, the knowledge-based method is selected for its suitability in deterministic recommendation systems still in the early stages of development.

At this stage, the research will use the method of collecting and developing the system. Data collection is conducted to comprehensively and accurately investigate the research problem. [8].

p-ISSN 2715-2871
e-ISSN 2714-5247

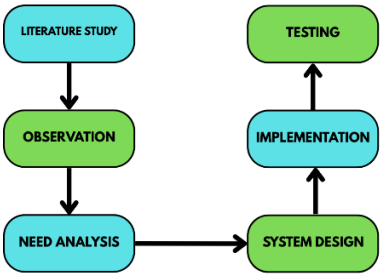

Figure 1 Research Diagram

The data collection flow that the author will use is as follows:

1) Literature Study

Literature Study is used by the author to collect data through library studies with related literature, documents and references, which will later be used to obtain a comprehensive picture of the problem to be studied[8].

2) Observation

At this stage, observations and data collection will be carried out which will later be obtained from Giant pet shop to obtain more in-depth information[9].

The system development method that will be used by the author is the waterfall method which is often also called the sequential linear model with the following method stages:

3) Needs Analysis

At this stage, researchers must analyze what is needed in creating a system, such as the needs of the features contained in the system, the tools to be used, design, and so on.

4) System Design

The next step is for researchers to design, design the database and design the interface mock up and create a mobile application for implementing the knowledge-based method in the cat food recommendation system. In this process, the system design is designed using UML diagrams including use case diagrams, activity diagrams, and class diagrams.

5) Implementation

After going through the needs analysis and system design stages, the next stage is implementation, where the design that has been made needs to be implemented in the form of a mobile application. The mobile application in this study was built using the react native.

6) Testing

In this system testing session, it is carried out to check whether the system is functioning properly by providing appropriate recommendation results based on the input indicators used by the user so that it can be a reference for whether this system can help the user or not.

III. RESULT AND DISCUSSION

1) Need Analysis Results

Data obtained from direct observation at Giant pet shop, comprising 66 products, is presented in the following tables. These data include 6 variables or attributes utilized as parameters for the recommendation system.

a) Brand Data

Table 1 Brand Data Table

Brand	Amount
Meo	15
Bolt	12
Furlove	10
Whiskas	9
Life Cat	8
Felibite	4
Excel	4
Cat Choize	4
Total	**66**

b) Flavor Data

Table 2 Flavor Data Table

Flavour	Amount
Tuna	26
Salmon	17
Tuna dan Chicken	6
Mackerel	4
Chicken	4
Tuna dan Sardine	2
Gourmet	1
Sardine	1
Seafood	3
Beef	1
Chicken dan Salmon	1
Total	**66**

c) Age Data

Table 3 Age Data Table

Age	Amount
Adult	40
Kitten	16
All Ages	10
Total	**66**

d) Weight Data

Table 4 Weight Data Table

Weight	Amount
400 Gram	20
80 Gram	20
500 Gram	10
1 Kg	10
800 Gram	4
480 Gram	2

p-ISSN 2715-2871
e-ISSN 2714-5247

Total	**66**

e) Prices Data

Table 5 Prices Data Table

Price	Amount
Under Rp. 10.000	25
Under Rp. 20.000	22
Under Rp. 30.000	19
Total	**66**

f) Types Data

Table 6 Types Data Table

Type	Amount
Dry	28
Wet	38
Total	**66**

2) System Design Results

In this system design, it is designed using UML and there are use cases and also activity diagrams to further clarify the function of the existing system. The system delineates two primary actors: administrators (admins) and users. Administrators possess comprehensive system access, including product management functionalities such as addition, deletion, and editing. Administrator access is contingent upon successful login with a registered account. Conversely, users are restricted to system usage without product management capabilities, and do not require account login for system access. [10].

a) Use Case

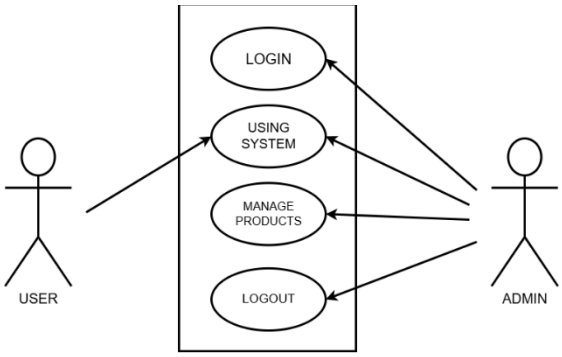

Figure 2 Use Case

b) Activity Diagram

Activity Diagram is a way to convey a workflow or system work plan in the form of a visual representation. In the activity diagram, it will provide an overview of the system workflow that runs from start to finish. The following will show four recommendation system workflows that are being designed by the author by showing the flow that will be carried out by the user when accessing the features in this system.

a) Login

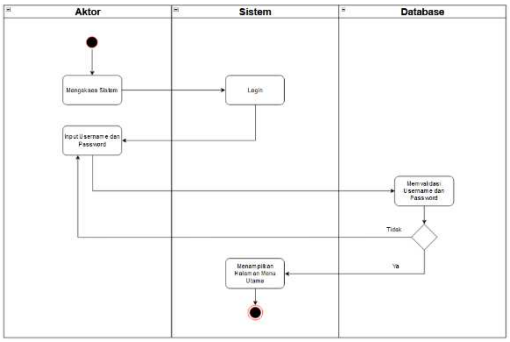

Figure 3 Activity Diagram Login

b) Using System

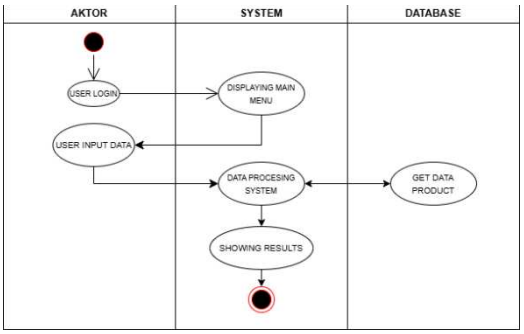

Figure 4 Activity Diagram Using System

c) Manage Products

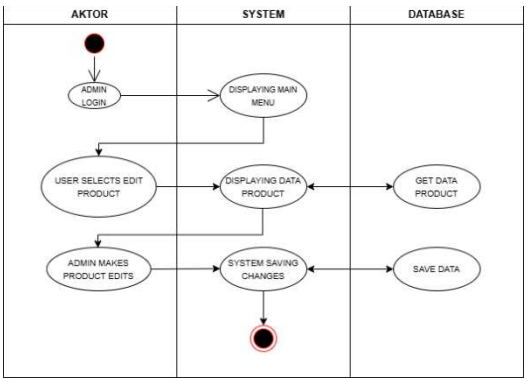

Figure 5 Activity Diagram Manage Products

d) Logout

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e-ISSN 2714-5247

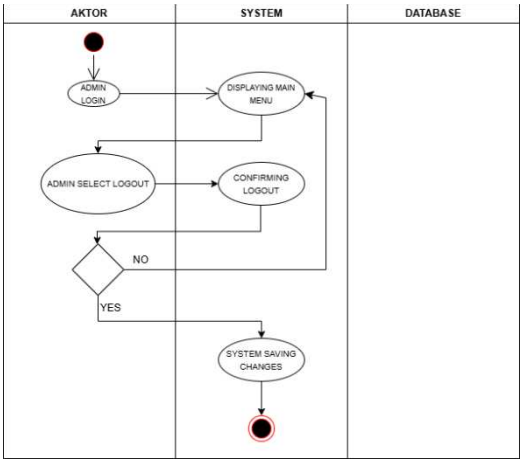

Figure 6 Activity Diagram Logout

3) Implementation

a) Home Page

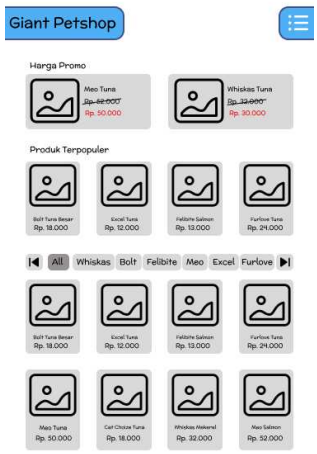

Figure 7 Homepage

On the homepage, selected products will be displayed, such as promotional products and the most popular/best-selling products. In addition, all products will be displayed and can be filtered based on brand category.

b) Recommendation Form Page

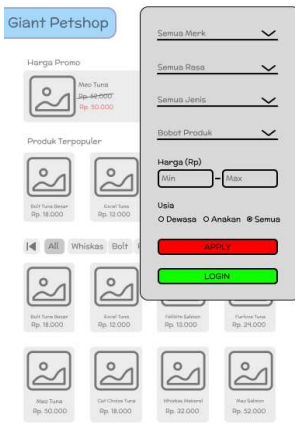

Figure 8 Recommendation Form Page

In the recommendation form can be used when the user is on the homepage, the user can click the button in the upper right corner and a recommendation form will appear that can be used by the user. In addition to the recommendation form, there is also a button on this pop up to login admin

c) Login Page

Figure 9 Login Page

On the login page, users can log in using a registered admin account to get full access as an admin.

d) Recommendation Results Page

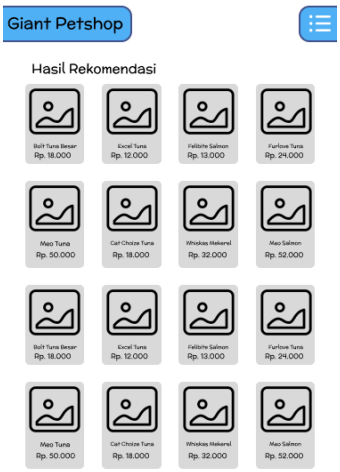

Figure 10 Recommendation Results Page

On the recommendation results page, all recommendation results will be displayed based on the compatibility of the data entered by the user with existing products.

e) Products Page

Figure 11 Products Page

On the product page it will appear when one of the products is clicked and will display the details of the product that has been selected.

4) Testing

p-ISSN 2715-2871
e-ISSN 2714-5247

In this system testing session, it is done to check whether the system has functioned properly by providing appropriate recommendation results based on the input indicators used by the user so that it can be a reference whether this system can help the user or not. The testing method used is using precision and recall to calculate the match between the inputted data and the recommendation results. Later, testing will be carried out 10 times with various variations of the inputted indicators as follows.

Table 7 Test Indicator Table

Test To	Number of Attributes	Test Indicator
1	2 Attributes	Brand: Whiskas, Type: Dry
2	2 Attributes	Flavor: Tuna, Price: Under 20.000
3	2 Attributes	Age: kitten, Weight: 400 Gram
4	3 Attributes	Brand: Meo, Flavor: Tuna, Type: Wet
5	3 Attributes	Age: Adult, Weight: 1 Kg, Price: Under 30.000
6	3 Attributes	Brand: Bolt, Flavor: Salmon, Age: All Age
7	4 Attributes	Brand: Felibite, Flavor: Tuna and Chicken Weight: 500 Gram, Type: Dry
8	4 Attributes	Flavor: Tuna and Sardines, Age: Adult, Price: Under 20.000, Type: Wet
9	5 Attributes	Brand: Life Cat, Flavor: Salmon, Age: kitten, Price: Under 20.000, Type: Wet
10	6 Attributes	Brand: Furlove, Flavor: Chicken, Age: All Ages, Weight: 80 Gram, Price: Under 30.000, Type: Wet

Table 8 Test Table

Test To	Displayed	Not Displayed	Relevant	Recall	Precision
1	2	0	2	100%	100%
2	25	0	18	100%	72%
3	6	0	6	100%	100%
4	6	0	4	100%	66,70%
5	2	0	2	100%	100%
6	2	0	2	100%	100%
7	1	0	1	100%	100%
8	1	0	1	100%	100%
9	2	0	2	100%	100%
10	2	0	1	100%	50%
TOTAL				100%	88,90%

From the test results, the precision value obtained a value of 88.90%, which indicates that the level of accuracy of the results displayed is appropriate and relevant to the indicators inputted at the testing stage. With a relatively high precision value, it shows that the system is able to provide recommendations that are appropriate and relevant to user needs so that this will be able to help users in finding the products they need.

The test results also obtained a recall value of 100% which reflects the completeness parameter in the extraction of all relevant data items according to user preference specifications. By achieving optimal recall, the system can guarantee that the totality of products that are compatible with user needs is successfully represented. This condition has a vital role in overcoming the volume of intense interactions and presenting comprehensive alternative solutions for users. Based on the evaluation data, it can be articulated that the implementation of testing is able to produce constructive impacts that meet the objective criteria of the research.

In addition to the aforementioned testing, the author also conducted live testing to evaluate the usefulness of the developed application. The user testing process was conducted through direct interviews with case studies. Twelve cat owners participated in the testing process. Each participant was asked to use the recommendation feature by entering their preferences, including taste, cat age, food type (dry/wet), and other information.

Results showed that ten out of twelve users agreed that the provided recommendations met their expectations and needs. Two users suggested enhancing the system by expanding the range of available brands. This feedback supports the claim that the system holds potential in assisting users in selecting appropriate cat food. The evaluation serves as a preliminary assessment and is planned to be followed up with larger-scale surveys in the future implementation phase.

5) Discussion of Methods and Development Potential

The knowledge-based method with a constraint-based approach offers advantages in terms of transparency and control over the recommendation process. This system allows users to explicitly set preferences and constraints, making the recommendations more tailored to specific needs. However, its primary limitation lies in the dependency on complete and accurate domain knowledge. If product information or user preferences are lacking, the quality of recommendations may degrade.

Potential developments for this method include integration with other approaches such as content-based or collaborative filtering to generate more adaptive recommendations. Additionally, incorporating machine

p-ISSN 2715-2871
e-ISSN 2714-5247

learning techniques to dynamically refine constraint representations based on user interactions could be a promising research direction.

IV. CONCLUSIONS

In conclusion, the implementation of a cat food recommendation system leveraging the knowledge-based method and constraint-based approach facilitates users in identifying products aligned with their needs. Furthermore, it streamlines product management for administrators and enables more diverse food recommendations for customers.

This research can be a reference for creating a similar recommendation system that uses the knowledge-based method with a constraint-based approach. As well as suggestions for developing a recommendation system in this study, it can be developed to be more complete and complex, such as adding details of each product such as explanations, product stock in stores to further assist users and can also add feature needs for store owners to manage products such as suppliers, purchase prices, margins, cashier systems, and financial reports so that the system in this study can be more helpful from the user and store owner side.

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