Dress Code Selection Recommender System Based on Smartphone

1st Venus Lidzikri Adhitya
School of Computing
Telkom University
Bandung, Indonesia
venuslaadhitya@gmail.com

2nd Muhamad Irsan
School of Computing
Telkom University
Bandung, Indonesia
irsanfaiz@telkomuniversity.ac.id

3rd Muhammad Faris Fathoni
School of Computing
Telkom University
Bandung, Indonesia
mfarisfwork@telkomuniversity.ac.id

4th Diky Zakaria
Department of Mechatronics and Artificial Intelligence
Universitas Pendidikan Indonesia
Bandung, Indonesia
dikyzak@upi.edu

*Corresponding author: venuslaadhitya@gmail.com
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***Abstract*—In the era of rapidly developing information technology, the existence of smartphones has become an integral part of everyday life. Appearance and choice of dress code play a crucial role in a person's self-image. Therefore, this research aims to design a smartphone-based dress code selection recommendation system. This system will use clothing usage data, user preferences, and event context to provide relevant dress code recommendations. With this solution, it is hoped that users can easily and efficiently choose the appropriate dress code, increase self-confidence, and create a pleasant dressing experience. This research contributes to the development of smartphone-based applications to support users' lifestyle and personal appearance. This application not only provides dress code inspiration, but also makes it easier for users to make decisions regarding clothing choices. Model testing using Machine Learning with the K-Nearest Neighbor (KNN) algorithm shows satisfactory accuracy, precision and recall, namely 83.67%, 83.82% and 99.34%. This application has the potential to be a useful tool helping users live an informed fashion lifestyle and according to personal preferences, and also minimize the waste of time that would occur when choosing clothes.**

Keywords—Application, Clothes, Dress Code, Recommendation, Smartphone

I. INTRODUCTION

In the era of rapidly developing information technology, the role of smartphones has become irreplaceable in everyday life. A smartphone can also be defined as a mobile phone that works using Smartphone devices work using all operating system (OS) software that provides standard and basic relationships for application developers [1]. Smartphones are not just a communication tool, but also a supporter of lifestyle and appearance. Related to this, the use of smartphones can be increased through the development of a smartphone-based dress code selection recommendation system.

Dress code selection is an important aspect of social and professional life, influencing how one wants to be perceived by the surrounding environment. By utilizing recommendation technology, smartphone users can more easily find dress codes that suit various contexts of events or activities. The dress code is also closely related to the social media they often use in consuming fashion [2]. With this recommendation system, it is expected that smartphone users can optimize their appearance without the difficulty of choosing the right dress code[3]. In addition, this system can also provide fashion inspiration, increase self-confidence, and provide a more enjoyable dressing experience. Inspiration related to current fashion allows users to follow trends [4].

In this research, the design involves the use of android. Android is an operating system that is open source, giving developers the freedom to create applications. The advantages of the Android operating system really help Android smartphone users enjoy a variety of applications [5]. This research aims to design and develop a recommendation system [6] for choosing a dress code that can be accessed via a smartphone. This system will utilize clothing usage data, user preferences, and event context to provide relevant and appropriate recommendations.

II. METHODS

In designing this application, the dress code selection recommendation system is integrated with machine learning using the K-Nearest Neighbor (KNN) algorithm. KNN is a classification method that utilizes learning data to classify objects based on the closest distance from them. By projecting the learning data into a multi-dimensional space, each dimension represents a feature of the analyzed data. K-NN is also the most frequently used measurement method to determine the similarity of two vectors [7].

To maximize the functionality and data storage of the application, a connection with Cloud SQL as a storage database is implemented. The fashion recommendation image data set will be stored in Cloud SQL, ensuring the accessibility and security of the data required by the recommendation system.

This research focuses on designing the application interface, utilizing the Android camera feature through the Android Studio Jetpack library known as CameraX. CameraX is a collection of libraries designed to simplify the use of cameras on Android devices [8]. The advantage of CameraX lies in its ability to provide better control over the

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device's camera functionality with easy integration and efficient handling.

The system also utilizes Jetpack Compose written in the Kotlin programming language. Jetpack Compose is a modern toolkit for building user interfaces (UI) in Android applications. Jetpack Compose is written in Kotlin and the code can be reused or shared easily [9]. This advantage supports the efficiency of developing and maintaining application code. The structure of the application framework can be seen in Figure 1. This overview includes the interaction between the recommendation system, machine learning, Cloud SQL, CameraX, and Jetpack Compose. Careful integration between these components is key to the application's success in providing accurate dress code recommendations that match user preferences.

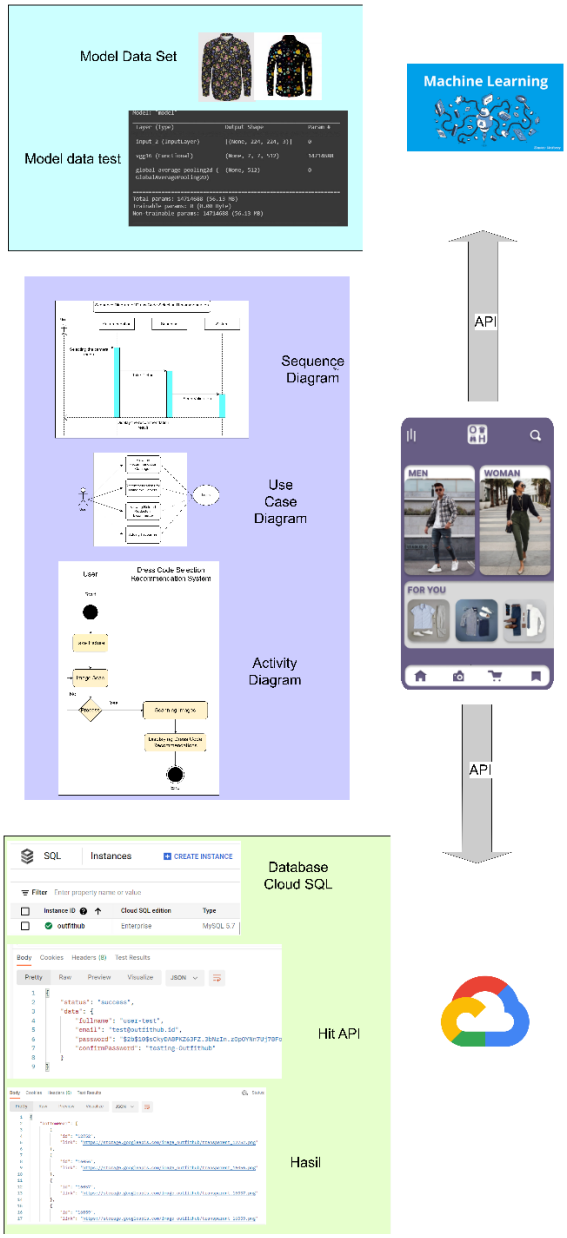

Fig. 1. Application Framework

As such, this research methodology incorporates critical aspects of application development, from the implementation of machine learning algorithms, data management with Cloud SQL, to the use of camera features with CameraX and interface development with Jetpack Compose. It is expected that the thoughtful integration of these various technologies can create an application that is efficient, intuitive, and responsive in providing dress code recommendations to users.

III. Results and Discussion

A. Application Architecture Design

a) *Use Case Diagram*

Use Case Diagram is basically a representation of a user's interaction with the system and describes the specifications of a user case. Use Case Diagram can be seen as shown in Figure 2.

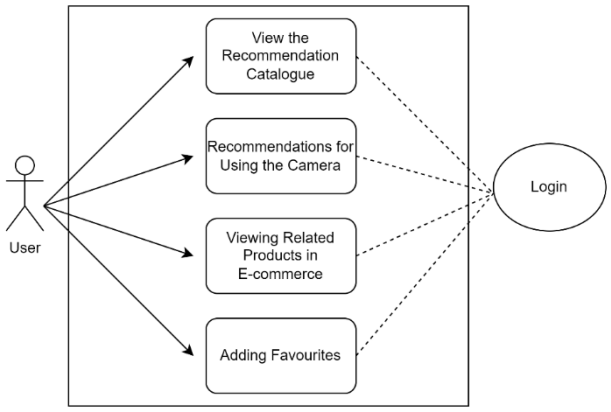

Fig. 2. Use Case Diagram actor user

b) *Activity Diagram*

Activity diagrams are useful for representing the moving or dynamic parts of a system. In terms of function, Activity diagrams are like flowcharts, which are useful for showing the flow of control from one activity to another [10]. Activity Diagram can be seen as shown in Figure 3.

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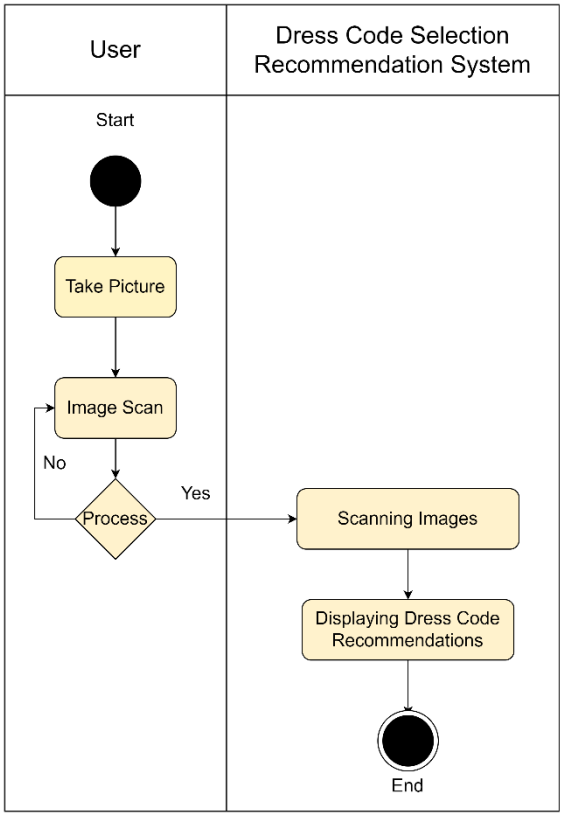

Fig. 3. Activity Diagram

c) *Sequence Diagram*

Sequence diagram is a type of UML diagram that visually depicts the way components interact with each other in a process. This type of diagram will display the sequence of actions and communication of each component in the system, such as users and objects. Sequence Diagram can be seen as shown in Figure 4.

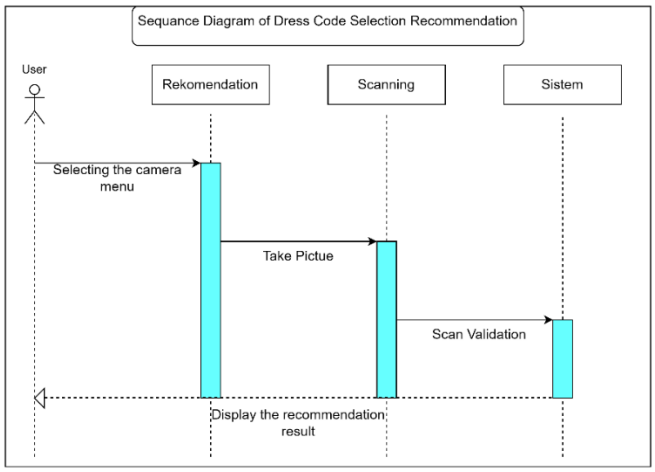

Fig. 4. Sequence Diagram Dress code selection recommendation

d) *Login Page Display*

On the login page there is a username and password filling form, login button and forgot password. the login page functions as the first-time access when using the application [11]. This page appears when the application is first run. The Login page can be seen as shown in Figure 5.

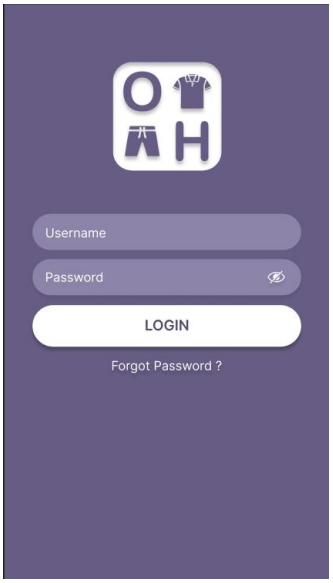

Fig. 5. Login Page Display

e) *Dashboard Page Display*

*D*ashboard page has some information such as menu, men's clothing catalogue, women's clothing catalogue, search, home button, camera button, related product button, and favorite button. The Dashboard page is an initial menu that is displayed after login. Dashboard is one of the information displays that can present data in visual form [12] The Dashboard page can be seen as shown in Figure 6.

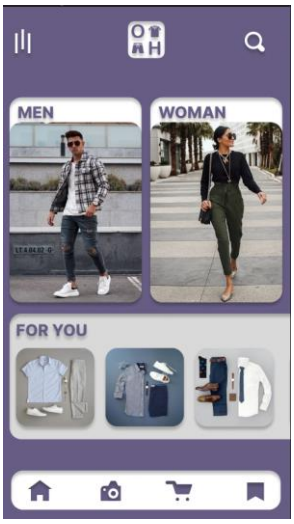

Fig. 6. Dashboard Page Display

f) *Camera Page View*

The Camera page has a camera view captured by an android camera and also a camera button to capture images. This camera page serves to perform face detection [13]. The camera feature will run when the button is pressed. In

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addition, there are limits to capturing images in the form of curved lines. The Camera page can be seen as shown in Figure 7.

Fig. 7. Camera Page View

g) Display of Recommendation Page

The Recommendation page contains fashion information that is displayed to users to choose which one they like. On the Recommendations page, users are presented with a selection of clothes to choose from [14]. This page is also the main feature referred to in this study. The login page view can be seen as shown in Figure 8.

Fig. 8. Display of Recommendation Page

B. Machine Learning

In machine learning there are several processes in the design of this application. The process can be seen as shown in Figure 9.

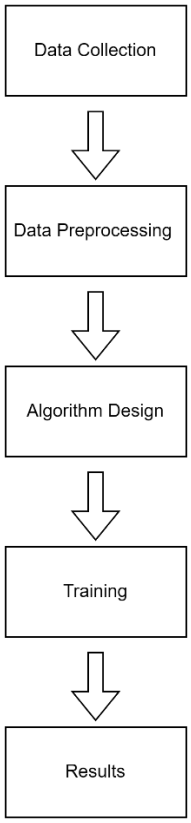

Fig. 9. Machine Learning Process

a) Data Collection

The research data source used in the study, which involves the clothing dataset available from Kaggle.com. The amount of data contained in the dataset is 44,000 images from many clothing categories such as shirts, pants, accessories, shoes, and many more. Then filtering the data that will be used is only from the category of clothes and pants. In this study, the data used for clothes and pants were 2,500 images.

b) Data preprocessing

After all the data has been successfully obtained, the next research stage is data preprocessing. Preprocessing is an important step in the data mining process [15] Then the data enters the classification phase so that the results obtained are more accurate. In this research, the processing stage is divided into 3 processes, namely data filtering, data label attribute reduction, and segmentation.

c) Method Design

One method that is often used to classify data is the K-Nearest Neighbor Method. The KNN method is a method of determining classification based on basic examples that do not build, clear and declarative category representations, but depend on category labels in training documents, such as test documents [16] Because the K-Nearest neighbor method classifies objects based on their attributes and training samples [17]. The KNN method used in this study is divided

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into 2 parts, namely training data and test data so that it is based on predictions. There are steps from the KNN method, namely determining the parameter k, calculating the k-training data that is closest to the data in the test, sorting the distance parameters based on the smallest value, and determining the test data group based on the k-majority label. The distance calculation that is often used in the KNN method is using the Euclidean distance calculation [18]. The value of k in KNN is a variable number of nearest neighbors that will be taken for the classification process [19]. A high value of k will reduce the effect of noise on classification but make the boundaries between each classification more blurred [18].

d) Training Data

In this research, training is carried out using data on the dataset to train the K-Nearest Neighbors method. Training data is done by running a script that contains the source code and configuration that we have set on our computer. Training datasets are used from clothing data that has been pre-processed using KNN before. The data that will be used for training is divided into two, namely 70% for training datasets and 30% for testing datasets [17]. In the training stage, 1750 data or 30% of the dataset is used.

e) Data Testing

In this research, the K Nearest Neighbors method is used for testing. Testing is done on the dataset to measure the performance of the KNN method, such as accuracy, precision, and recall. This testing stage explains how to use the KNN method to determine the accuracy value. Accuracy is a measure that determines the degree of similarity between a measurement result and the value measured. The performance obtained from the KNN method will prove how accurate the method model is. Testing is done on 30% or 750 data from the entire dataset. The source code for the implementation of the KNN method can be seen in Table 1 below.

TABLE I. SOURCE CODE OF KNN METHOD IMPLEMENTATION

Desc	Source Code
Load	dataset = pd.read_csv('baju_transparan_full.csv')
Split	x = dataset.iloc[:, 0:7]) y = dataset.iloc[:, 7] x_train, x_test, y_train, y_test = train_test_split(x, y, random_state=0, test_size=0.3)
Train	classifier = KNeighborsClassifier(n_neighbors=3 , metric='euclidean') classifier.fit (x_train, y_train)
Test	y_pred = classifier.predict(x_test)
Result	accuracy = accuracy_score(y_test, y_pred) precision = precision_score(y_test, y_pred, average=None) recall = recall_score(y_test, y_pred, average=None) print("Accuracy:", accuracy) print("Precision:", precision) print("Recall:", recall)

f) Test results

Based on the results of the classification of clothing using the KNN method with testing data totaling 1750 data, testing methods in this study were carried out with various KNN method neighborhood values with parameter values K = 3 to K = 11 values as shown in Table 2 below.

TABLE II. KNN METHOD TESTING

No	K	Accuracy	Precision	Recall
1	3	75,49%	82,36%	87,16%
2	4	80,61%	82,92%	93,76%
3	5	81,27%	82,31%	95,92%
4	6	81,83%	84,39%	96,77%
5	7	82,34%	83,46%	96,83%
6	8	83,67%	83,82%	99,58%
7	9	83,28%	84,28%	99,34%
8	10	83,06%	83,58%	98,29%
9	11	82,93%	84,19%	97,35%

The test results for each parameter value K3 to K11 show the highest accuracy value, which is 83.67% for parameter k = 8, and the lowest accuracy value, which is 75.49% at k = 3. With the accuracy results obtained, it is known that the high level of closeness between the values obtained and the actual value. Testing with parameter k = 11 shows the highest precision value of 84.19%, testing with parameter k = 5 shows the lowest precision value of 82.31%. This result proves that the k11 experiment has a high match of clothing data in retrieving the required information. Testing with parameter k = 8 shows the highest recall value of 99.58%, testing with parameter K = 3 shows the lowest recall value of 87.16%. So that the experiment on the parameter value k8 has an almost perfect system success rate in finding information.

C. Database

a) Cloud SQL

The data base used is cloud SQL. Google cloud SQL is very easy to use and does not require other software. SQL is a concept of database operation, especially for selection and data entry, which allows data operations to be done easily automatically [20]. The type of database used is MySQL version 5.7. Cloud SQL is one of the services provided by google cloud service. The use of cloud SQL does not need to pay attention to things like infrastructure design because it will be managed by google cloud service. The data stored in cloud SQL are, User account information, such as use rid, email, password, and images uploaded by the user through the application. The SQL cloud can be seen as shown in figure 10.

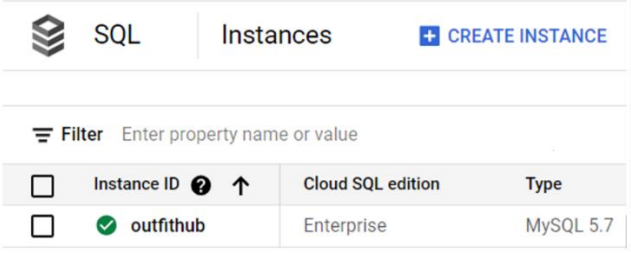

Fig. 10. Cloud SQL

b) Hit API

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API stands for Application Programming Interface. application Programming Interface (API) is used as a link between the client and the server, testing the Application Programming Interface (API) endpoint using Postman tools by displaying the results of the test in the form of data in JSON (JavaScript Object Notation) format used to store and transfer data (Shandy Arshad). in Hit API the application makes a request to the database using a customized URL, for example when the user will log into the application the URL used is "https://backend-emvqwfvxaa-et.a.run.app/api/v1/login". If the user successfully logs in then the backend on the cloud will retrieve as shown in Figure 11.

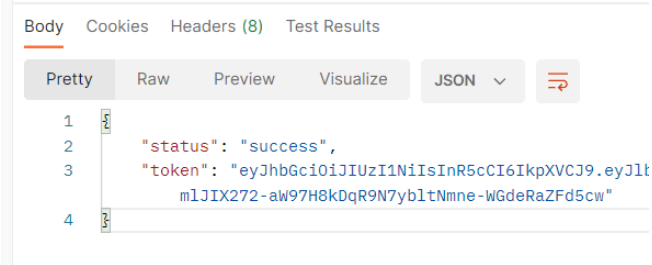

Fig. 11. Back-end view

IV. Conclusion

In the era of ever-evolving information technology, the use of smartphones is not only limited to communication functions but has also become a lifestyle supporter. In this context, this research aims to design and develop a smartphone-based dress code selection recommendation system. It can be said that smartphones are tools that cannot be separated from everyday life[21].

The research methodology includes the use of the Android operating system, integration of machine learning with the K-Nearest Neighbor (KNN) algorithm, use of Cloud SQL as a storage database, utilization of the Android camera feature with CameraX, and interface development with Jetpack Compose.

The results and discussion highlight the application architecture design with use case, activity, and sequence diagrams. The main pages, such as login, dashboard, camera, and recommendation, are explained with their visual appearance. In the machine learning section, the process of data collection, preprocessing, and KNN method design are explained in detail. Tests of the KNN method were conducted with various values of the K parameter, and the results showed varying accuracy, precision, and recall. The results of testing the model performed by Machine Learning show that this application provides an accuracy of 83.67%, precision of 83.82% and recall of 99.34% performed using the K-Nearest Neighbor (KNN) algorithm.

The database uses Cloud SQL, containing user account information and images uploaded through the application. The use of an API to interact with the database is also described. Thus, the design of this app successfully achieved its goal of providing an effective camera-based solution to support users in their outfit selection. The app not only provides dress code inspiration, but also enhances the shopping experience and assists users in developing their personal style. Overall, this app can be considered as a positive contribution in the development of camera-based mobile solutions for the fashion world.

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