Journal of Information Systems Engineering and Management
2025, 10(60s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Wardrobe Wizard: ML-Driven Outfit Planning

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ARTICLE INFO

Received: 12 Dec 2024

Revised: 17 Feb 2025

Accepted: 27 Feb 2025

ABSTRACT

Introduction: This research paper presents the design and implementation of a Wardrobe Wizard, it is a cutting-edge system that is used to integrate the outfit planning using generative AI and machine learning for analyzing the clothing items. The system will allow the users to upload the wardrobe items or the clothing images. This clothing image or the wardrobe data is processed to extract the features, classify them into categories, and store the information in the database for smooth future reference and efficient data retrieval. By utilizing advanced ML models like CNN and Generative AI, the Wardrobe Wizard will help the user to interact with the wardrobe content and it will also answer the real time queries. The system's architecture ensures seamless integration of clothing classification, outfit recommendation and AI interaction, which contribute to make it a user-friendly platform.

Objectives: Wardrobe Wizard provides a unique solution, compared to the ordinary wardrobe applications, which focuses on real-time capabilities and scalability. Moreover, the paper searches for potential system enhancements, such as multi-language wardrobe support, personalized user experiences through authentication, and optimization for mobile platforms. The future advancement can involve integrating virtual try-on, trend analysis and predictive models for deeper insights into fashion content. Wardrobe Wizard displays the potential of fashion technology and Generative AI, which offers an efficient way to analyze and interpret the wardrobe data.

Methods: The Wardrobe Wizard system allows the users to upload the clothing images or provide the wardrobe data for the processing. The system then extracts the features, and then classifies them into categories. It can also extract additional metadata if any of the wardrobe items have it. This information is then stored into the database for efficient retrieval and future preferences. Then the system further uses the AI generated recommender engine, so that the users can interact with the wardrobe content and get real- time answers to all of the queries.

Results: The Wardrobe Wizard using the Generative-AI System is definitely a new, innovative product changing the face of interaction with wardrobe content. Combining clothing classification, metadata extraction, and AI-driven recommendation capabilities, the system makes wardrobe content accessible and more user-friendly.

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Conclusions: The project illustrates a huge leap in how people consume and interact with wardrobe content. It combines clothing recognition and generative AI to create an efficient, interactive, and user- centric solution. A system that is indeed a huge leap forward for smarter wardrobe content analysis, making it accessible and leading the way for further advancements in the field.

Keywords: Wardrobe Wizard, Outfit Recommendation, Machine Learning, Generative AI, CNN, Fashion Technology, Image Classification, Recommender System.

INTRODUCTION

Fashion and clothing choices are greatly affected by personal identity and confidence but choosing the correct outfit can always be a time consuming task,especially for the people with a huge wardrobe . Traditional Wardrobe planning systems mostly depend on users' insights, some simple recommendation filters or manual choices. Because of this the system is not able to learn from the users habits and as well as adjust to the various fashion trends. In the time of automation and customization are essential,an Artificial Intelligence and Machine Learning based system for outfit planning is necessary. The design and development of Wardrobe Wizard, which is an AI-powered system which is created using generative techniques and machine learning to suggest fashionable clothing combinations, is presented in this paper.

In this system,the users are allowed to upload the pictures of their clothes to the wardrobe system and then the convolutional neural network(CNN) will group them as per the categories. The clothing items will always be stored in a structured database so that the outfit creation for the system becomes easier and quicker. The system examines various different attributes such as users gender,body type,clothing type,colour as well as current fashion trends so that it can recommend a proper outfit to the user.

The main advantage of Wardrobe Wizard is that it can smartly and quickly suggest the outfit to the user. The system powerfully suggests outfit combinations with respect to both user preferences and fashion aesthetic instead of just making some combination of clothing items . Besides adopting up to date style features the system also recommends the clothing items for various different events and also the different body types.With the degree of proper recommendation, the work of managing one's wardrobe becomes more special and pleasurable .

Online fashion retail systems, virtual try on systems as well as daily outfit planning systems can make use of wardrobe wizards to make their work more efficient .If a user wants to decide what to wear depending on weather event and the availability of clothes in the wardrobe,this system is well suited for it. It can also be used in the ecommerce platform to increase the user engagement and to suggest more styling outfits. Additionally the system is developed with the help of Machine Learning techniques for real time fashion trends and detailed outfit suggestions like not just suggesting outfit but also recommending accessories,footwear etc .

As compared to traditional recommendation systems the wardrobe wizard system combines the machine learning algorithms,database driven wardrobe management system and classification so that it can provide a complete solution for planning fashionable outfits. With the help of a wardrobe wizard system the users can make more easy,creative and effective clothing decisions by automating the outfit planning procedure .

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OBJECTIVES

The design and development of Wardrobe Wizard, which is an AI-powered system which is created using generative techniques and machine learning to suggest fashionable clothing combinations, is presented in this paper. In this system, the users are allowed to upload the pictures of their clothes to the wardrobe system and then the convolutional neural network (CNN) will group them as per the categories. The clothing items will always be stored in a structured database so that the outfit creation for the system becomes easier and quicker. The system examines various different attributes such as users gender, body type, clothing type, colour as well as current fashion trends so that it can recommend a proper outfit to the user. The main advantage of Wardrobe Wizard is that it can smartly and quickly suggest the outfit to the user. Besides adopting up to date style features the system also recommends the clothing items for various different events and also the different body types.

METHODS

1.Image Preprocessing and Feature Extraction

We employ Convolutional Neural Networks (CNNs) to recognize and extract pertinent visual features from clothing images. The definition of the convolution operation is

$$f(i,j) = \sum\sum I(i+m, j+n) \cdot K(m,n) \text{ ------ } \mathbf{(1)}$$

where f(i,j) f(i,j) is the resultant feature map, I is the input image, and K is the kernel (filter). The standard 2D cross-correlation used in convolutional neural networks to extract visual patterns is represented by equation (1). This makes it possible for the model to represent spatial hierarchies in the texture, shape, and patterns of the fabric.

2.Garment Classification

$$P(x) = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}} \text{ --------- } \mathbf{(2)}$$

The softmax function utilized in CNN's last classification layer to carry out multi-class clothing item categorization is shown in equation (2). In the final CNN layer, each piece of clothing is given a category label (such as shirt, dress, or jeans) based on softmax activation: where K is the total number of clothing categories and zj is the raw output for class jj. This probability distribution facilitates the classification of wardrobe items into multiple classes.

3.Outfit Recommendation

Outfit compatibility is calculated by vector similarity using a content-based filtering technique. The formula for cosine similarity is

$$cos\ cos\ (\theta) = \frac{A \cdot B}{|A||B|} \text{ ------- } \mathbf{(3)}$$

The cosine similarity between two feature vectors, A and B, which represent distinct articles of clothing, is calculated by equation (3). In order to determine how similar two objects are in terms of visual characteristics like color, texture, or style, it will measure the angle between vectors in a high-dimensional space.

4.Personalization and Filtering

$$Score_{outfit} = \sum_{i=1}^{n} w_i \cdot f_i(x) \text{ -------- } \mathbf{(4)}$$

A weighted sum used for customized scoring is represented by equation (4). In this case, f stands for a feature (such as color match, season suitability, or body type relevance), and w is the weight that corresponds to that feature according to how important it is to the user. Weighted rule-based scoring is used to match recommendations to user preferences (such as color, body shape, and weather.

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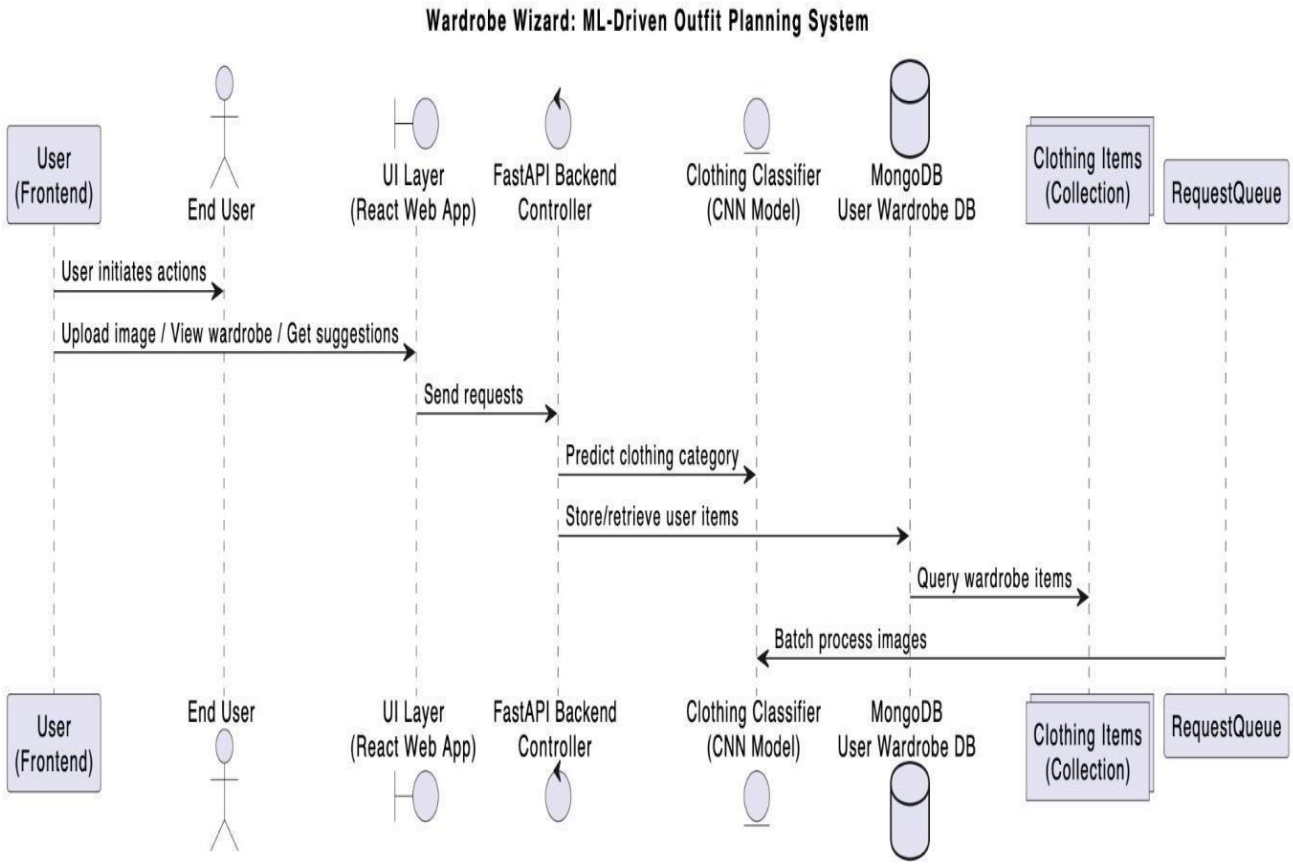

Fig. 1 Component Interaction Diagram

RESULTS AND DISCUSSION

The Wardrobe Wizard platform's home screen is shown in Figure 2. It serves as the main interface through which users can start communicating with the system. Users can access features like uploading clothing items, choosing preferences, and seeing suggested outfits from this page. For a smooth user experience, the layout is made to be simple and easy to use.

The upload section, shown in Figure 4, lets users upload pictures of specific items of clothing from their closet. Following upload, each item is classified using the CNN model of the system and stored in the database with metadata. This serves as the basis for later creation of significant outfit combinations.

The wardrobe management feature is shown in Figure 6. Users can see every article of clothing they have previously uploaded that is linked to their user ID here. The user can browse the wardrobe, go over the categories, and manually change outfit combinations in this section if needed. The component interaction diagram is shown in Fig. 1.

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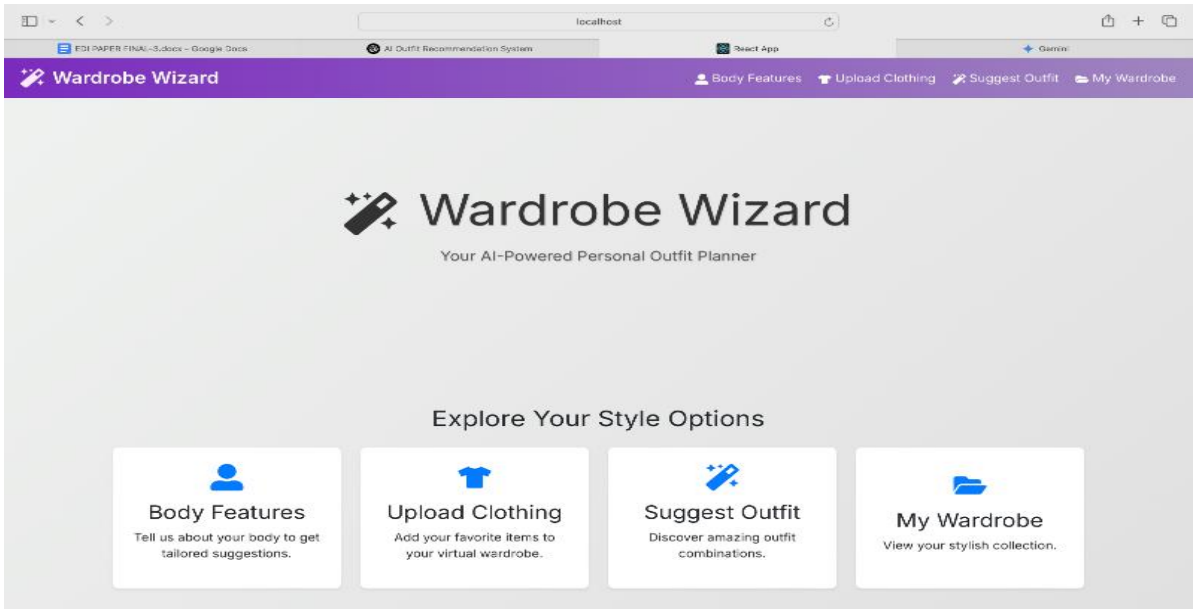

Fig. 2 Home Page

The Wardrobe Wizard platform's home screen is shown in Figure 1. It serves as the main interface through which users can start communicating with the system. Users can access features like uploading clothing items, choosing preferences, and seeing suggested outfits from this page. For a smooth user experience, the layout is made to be simple and easy to use.

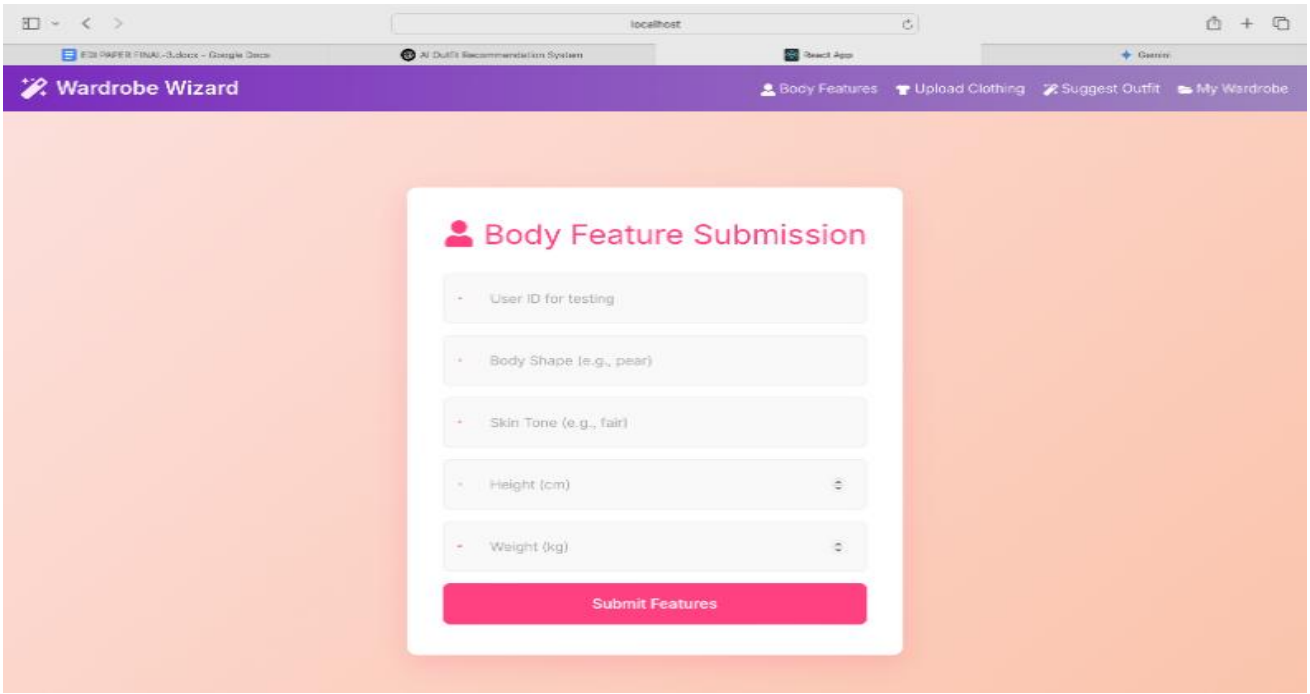

Fig 3 User features selection and submission

The feature selection interface is shown in Figure 2, where users can enter optional personal information like body type, favorite colors, or preferred styles. The experience is highly customized to

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meet the needs of each user thanks to these inputs, which improve the system's capacity to produce more precise and customized outfit recommendations.

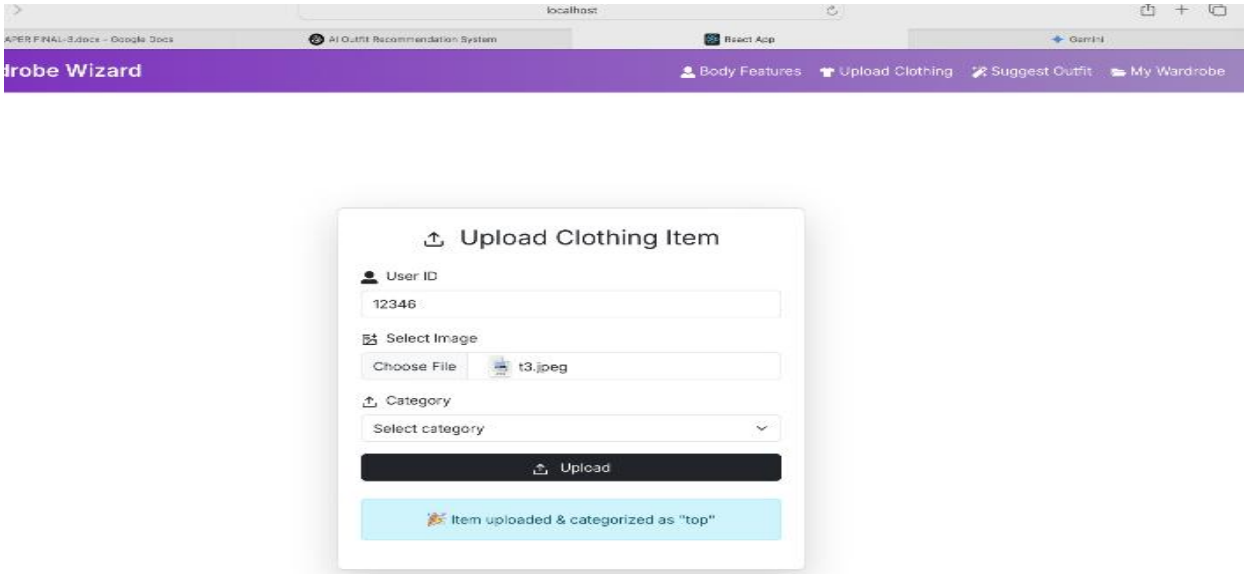

Fig. 4 User clothing item upload page

The upload section, shown in Figure 3, lets users upload pictures of specific items of clothing from their closet. Following upload, each item is classified using the CNN model of the system and stored in the database with metadata. This serves as the basis for later creation of significant outfit combinations.

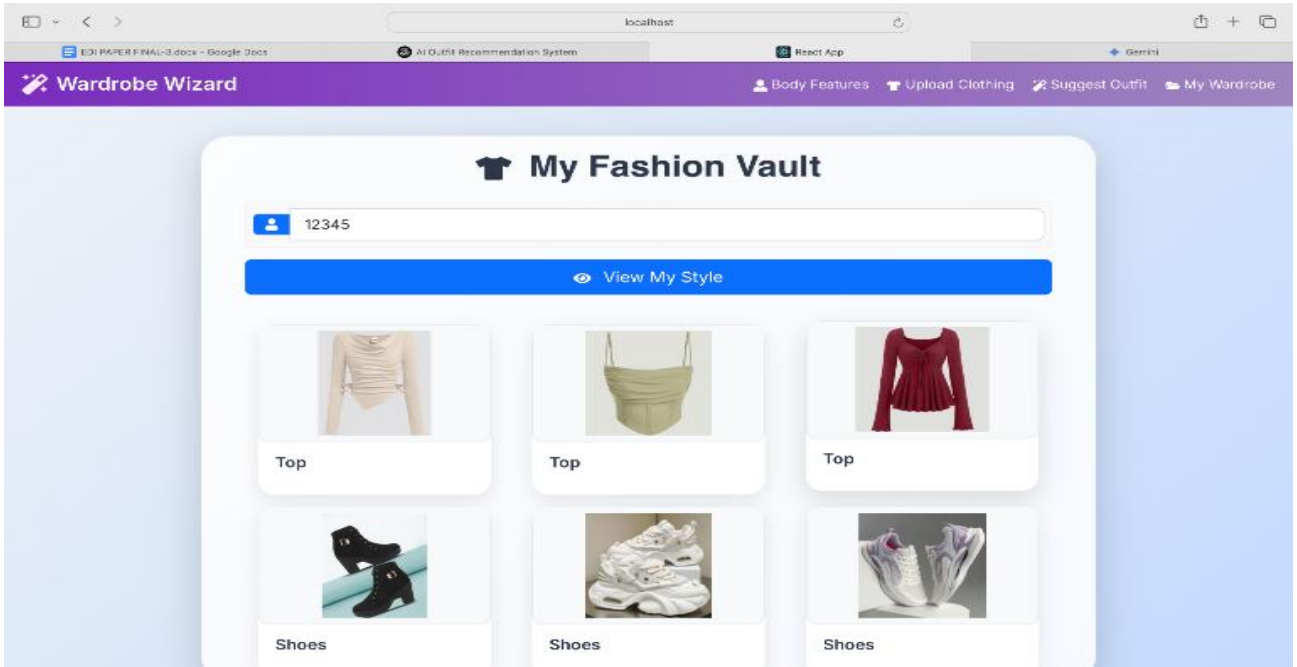

Fig. 5 Suggesting Outfits

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The interface where users receive outfit recommendations generated by AI is depicted in Figure 4. Fashion trends, body type, clothing type compatibility, and color coordination are some of the criteria used to curate these combinations. Offering unified, fashionable, and customized ensembles from the user's current wardrobe is the aim.

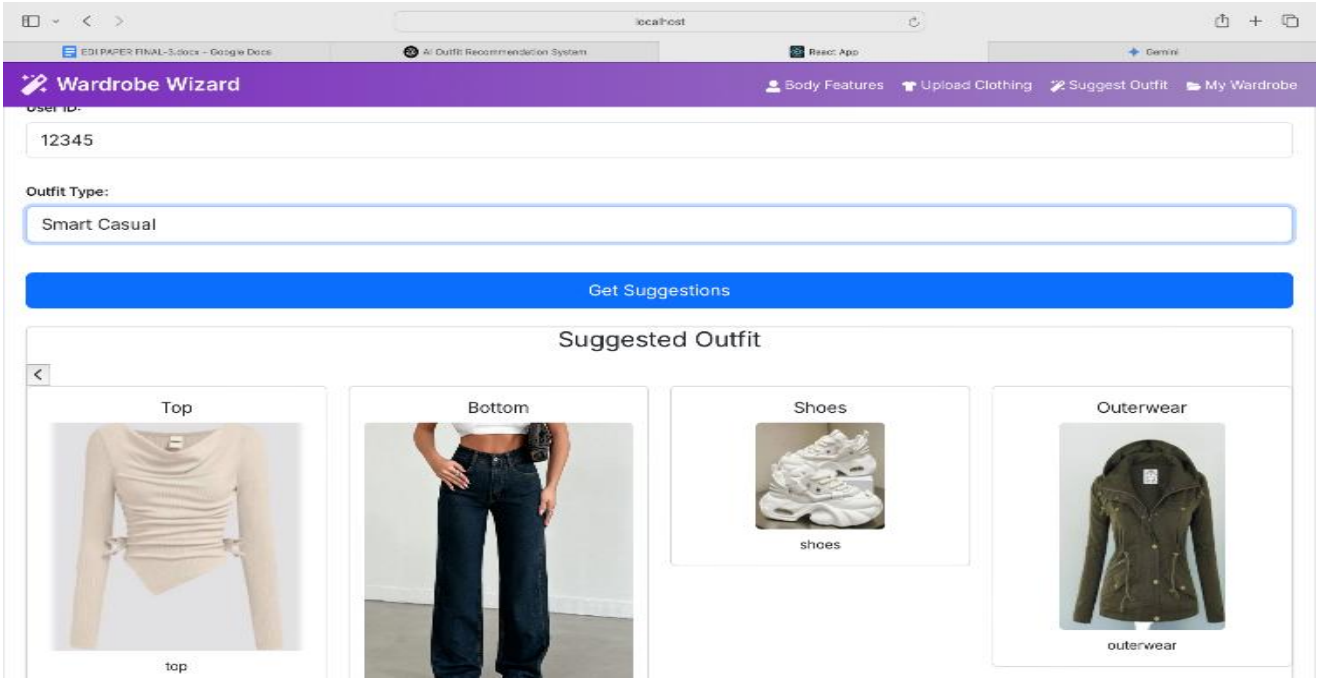

Fig. 6 Viewing the fashion Wardrobe

The wardrobe management feature is shown in Figure 5. Users can see every article of clothing they have previously uploaded that is linked to their user ID here. The user can browse the wardrobe, go over the categories, and manually change outfit combinations in this section if needed. The component interaction diagram is shown in Fig. 1.

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