FashionDesignAI: AI-Based Fashion Recommendation and Styling Platform

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Abstract— Artificial intelligence technology is being used by digital platforms to track market trends, create personalized experiences, and improve user engagement, which causes the fashion industry to change quickly. Because their design relies on users choosing fashion items through manual tagging, static filters, and past purchase patterns, fashion recommendation systems encounter difficulties. Because users require specific outfit advice that takes into account their upcoming events, physical characteristics, and style preferences, the systems are unable to offer useful styling recommendations.

In order to handle situations that arise during their current established boundaries, users of current fashion platforms must perform extensive manual product comparisons, which causes cognitive overload. Users must visualize appropriate outfit combinations and comprehend how their clothing items fit their personal style, seasonal context, and color compatibility. Because consumers must make decisions without intelligent styling assistance, online fashion experiences have three detrimental effects.

The researchers developed a FashionDesignAI Recommendation and Styling Platform which uses machine learning and modern web technologies to deliver customized outfit recommendations for FashionDesignAI Recommendation and Styling Platform. The system generates fashion recommendations by assessing multiple user factors which include their gender and body shape and the specific event and their selected colors and current fashion trends. The platform operates as a virtual styling assistant which uses user preferences and interactive browsing and outfit visualization to guide users in making informed fashion choices.

The proposed solution enhances online fashion platforms through its dual implementation of data-driven intelligence and user-focused design elements. The system serves e-commerce fashion websites and virtual styling applications and academic research into AI recommendation systems because it provides personalized user experiences with minimal decision-making requirements. The platform demonstrates artificial intelligence applications which improve digital fashion experiences through better quality and accessibility and wider application range.

Index Terms— Artificial Intelligence, Fashion Recommendation, Machine Learning, Personalization, Web Application, Styling System

I. INTRODUCTION

Online platforms strive to secure user attention which has created greater difficulties for the fashion industry to operate in its current digital marketplace. Fashion applications of today use three main elements which include personalization features and visually attractive content and contextual elements to enhance both user engagement and their purchasing behavior. The basic filtering methods which fashion recommendation systems used in the past together with historical purchase data have formed the foundation for their product recommendation system. The system needs users to devote their time and mental resources for decision-making because it operates that way which prevents platforms from successfully handling both emerging fashion trends and personal styling requirements. Users face difficulties with outfit selection because traditional systems only give them basic styling advice which does not help them understand how different outfits will work with their body shape and the occasion and their personal taste.

Current online fashion platforms rely on static recommendation systems and general user behavior patterns to operate their services. E-commerce platforms use customer data which includes browsing patterns and product popularity and purchase rates to determine item suitability. The methods provide basic numerical suggestions about fashion choices but fail to deliver detailed explanations which show how particular outfits match specific users or different situations. Current systems only let users see partial outfit combinations while their understanding of how colors and seasons and situations work together in fashion design remains weak. Online users experience difficulties accessing the methods because they lack both consistency and availability across different platforms. There exists a gap between scalable AI-driven personalization methods and complete context-aware fashion recommendation systems which provide natural styling support.

To overcome these limitations, this work presents an **AI-based Fashion Recommendation and Styling Platform** designed to analyze user preferences, recommend suitable outfits, and enhance the online fashion decision-making process That proposed system uses artificial intelligence and preference-driven logic to mimic personalized styling assistance depending on individual user attributes.

User profiles are constructed using inputs such as gender, body type, occasion, color preference, and seasonal context, enabling the system to approximate human-like styling judgments. The team assesses multiple fashion items together with their complete outfit options to identify which items succeed in serving various usage situations. The platform supports intelligent recommendation of clothing items by assessing them across key styling dimensions such as occasion relevance, color harmony, seasonal suitability, visual compatibility, and overall aesthetic appeal. The proposed system enables users to obtain recommendations through its ability to modify recommendation rules according to their changing preferences and current situation needs which differs from conventional fashion platforms that use fixed filters and established categories. The system generates appropriate outfit combinations through its method of combining multiple preference factors while it presents users with their outfit strengths and weaknesses together with different styling choices.

The core contributions of this work are summarized as follows:

1) An AI-driven fashion recommendation framework that analyzes user preferences across demographic, physical, and contextual attributes;

2) A multi-dimensional outfit evaluation model that assesses clothing items based on factors such as color compatibility, occasion relevance, seasonal suitability, and aesthetic coherence;

3) A customizable preference-based recommendation mechanism that adapts suggestions according to individual user needs and styling priorities;

4) A comparative outfit selection approach that enables users to evaluate multiple clothing options and combinations through preference-aligned scoring;

5) An AI-powered styling assistance module that generates actionable suggestions for improving outfit selection and visual appeal;

6) A user-centric and privacy-conscious design methodology that operates without reliance on sensitive personal or behavioral data while delivering meaningful personalization.

The remainder of this paper is structured as follows. Section II reviews related work in the areas of fashion recommendation systems and AI-driven personalization. Section III outlines the objectives that guided the development of the proposed platform. Section IV describes the overall system architecture along with key design considerations. Section V presents the main features and innovations introduced in this work. Section VI discusses the advantages of the proposed system in comparison with existing fashion recommendation solutions, and Section VII highlights its potential applications. Finally, Section VIII concludes the paper and outlines future enhancement directions, followed by the list of references.

II. LITERATURE REVIEW

Traditional fashion recommendation systems have primarily relied on rule-based filtering, manual product tagging, and collaborative filtering techniques to suggest clothing items to users.

While these approaches have been widely adopted in early e-commerce platforms, recent studies highlight their inherent limitations in addressing personalized styling needs. Most conventional systems depend heavily on historical purchase data and user-item interactions, which require large volumes of user activity to generate reliable recommendations. This dependence often results in cold-start problems, delayed personalization, and limited adaptability to evolving fashion trends, thereby reducing the effectiveness of early-stage recommendation and styling support [1]–[4].

Modern fashion platforms have incorporated machine learning techniques to improve recommendation accuracy through content-based and hybrid filtering models. These systems analyze attributes such as color, category, and brand to generate suggestions based on similarity measures. However, such models largely focus on individual clothing items rather than complete outfit combinations, limiting their ability to provide holistic styling guidance. Furthermore, optimization is often driven by engagement metrics such as click-through rates and purchase frequency, which restricts qualitative understanding of aesthetic compatibility, occasion relevance, and user satisfaction [5], [6]. Existing frameworks typically generate aggregate recommendations without offering personalized explanations, making it difficult for users to understand why certain fashion items are suggested over others [7], [8].

Advancements in artificial intelligence have enabled more sophisticated fashion analysis using techniques such as computer vision, natural language processing, and deep-learning-based representation models. Image-based fashion recognition systems extract visual features including color, texture, pattern, and silhouette, while NLP-based models analyze textual descriptions and user reviews to enhance recommendation relevance [9], [10]. In parallel, preference modeling frameworks utilize user attributes such as body type, lifestyle, and contextual needs to approximate personalized styling behavior [11], [12]. Despite these advancements, many existing solutions operate as isolated components and lack unified architectures that integrate preference analysis, outfit-level evaluation, and interactive recommendation workflows suitable for real-time styling assistance.

Recent research in generative AI and human–AI interaction highlights the potential for intelligent systems to provide synthetic feedback, styling explanations, and interpretable recommendations that align with human decision-making processes [13]–[15]. However, these techniques are rarely applied comprehensively within fashion recommendation platforms, particularly in systems focused on usability, transparency, and decision support. Additionally, privacy-preserving approaches seek to reduce reliance on sensitive user data through preference abstraction and rule-based personalization, yet such methods remain underexplored in practical fashion applications [16], [17]. A major research challenge is still bridging the gap between user-centric, explainable styling systems and AI fashion recommendation models.

According to earlier studies, machine learning-based personalization and visual content evaluation capabilities have significantly advanced fashion recommendation systems. A combined platforms

that allows users to evaluate their multi-attribute preferences while receiving outfit recommendations through a system that preserves transparency and safeguards user data has not yet been developed by current research. By combining intelligent recommendation systems with contextual styling assessment and user interaction systems that allow users to make customized fashion choices, the system offers a solution to this issue.

III. OBJECTIVES

- To create a framework for AI-based fashion recommendations that provides tailored outfit recommendations based on context and user preferences.
- To provide intelligent fashion recommendations by analyzing important user attributes like body type, occasion, color preference, and seasonal relevance.
- To produce outputs that are simple to understand and combine useful styling advice with outfit compatibility scoring.
- To make it possible to compare various outfit options effectively and support well-informed styling choices with less effort on the part of the user.
- To minimize reliance on sensitive user data in order to adopt a privacy-conscious personalization strategy.
- To improve styling accuracy and user engagement by combining interactive visualization with AI-driven analysis.

IV. SYSTEM ARCHITECTURE AND DESIGN

A scalable, modular system for styling assistance and AI-driven fashion recommendations is the AI-Based Fashion Design platform. Its architecture allows the user interface, backend processing components, and intelligent recommendation logic to all function together smoothly. The modular design ensures dependable handling of user preference data, efficient processing of recommendation workflows, and adaptability to evolving fashion trends and system requirements.

A. Architectural Overview

The **FashionDesignAI** system comprises three primary modules that operate collaboratively to execute end-to-end fashion recommendation and styling assistance. The high-level system architecture illustrating the interaction between the frontend interface, backend processing engine, and AI recommendation layer is shown in Fig. 1.

Frontend (User Interface): The frontend layer is designed using React 18+, TypeScript, and Vite to provide a dynamic and intuitive interface for user preference input, fashion category browsing, outfit visualization, and recommendation display. Tailwind CSS ensures a consistent and responsive layout across devices, while Zustand is employed for efficient application state management. The interface is structured in a modular manner, with clearly separated components for preference selection, outfit recommendation display, product browsing, and user interaction management.
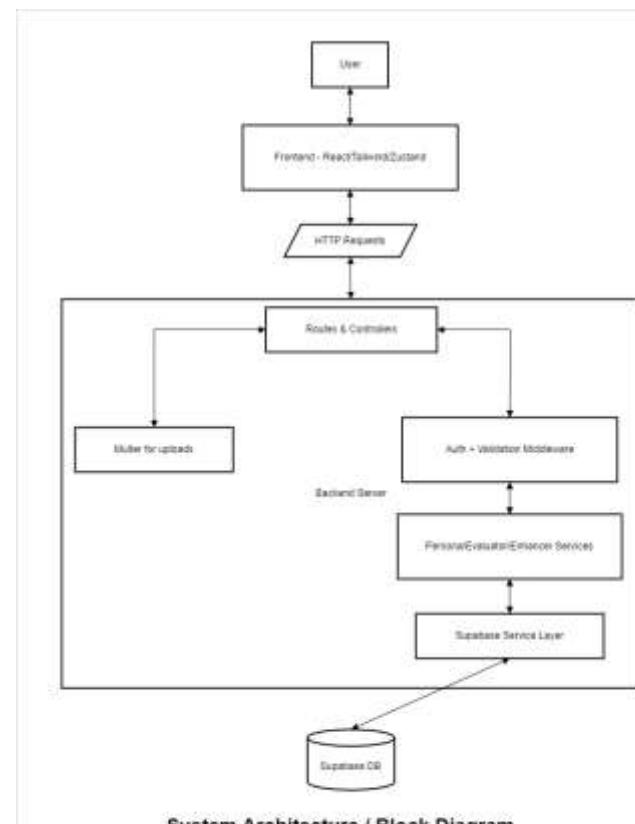
System Architecture / Block Diagram

Backend (Processing Engine): The backend was implemented using Node.js in combination The backend is implemented using **Node.js** in combination with the **Express** framework and manages the core application logic. Its duties include managing application workflows, processing user preference data, responding to recommendation requests, and facilitating communication between the recommendation engine and the frontend. Fashion items and configuration data are stored continuously through a database service. Key services provided by the backend include:

- Safe API routing and request processing.
- Preference for data validation and processing.
- Integration with the AI recommendation logic for filtering and outfit creation.

AI Evaluation Layer: The AI recommendation layer acts as the main intelligence unit. It examines contextual factors and user preferences to create personalized fashion recommendations. The system evaluates clothing items and outfit combinations based on factors like overall aesthetic coherence, color compatibility, occasion suitability, and seasonal relevance. This layer enables intelligent styling assistance by simulating human-like fashion decision logic.

B. Functionality Workflow

The operational workflow of **FashionDesignAI** proceeds through the following stages. The overall user interaction and navigation flow across these stages is illustrated in Fig. 2.
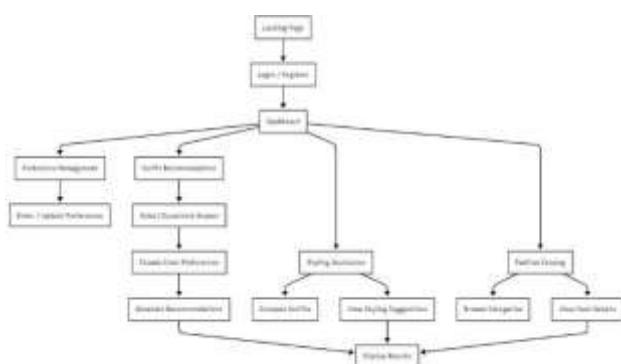
Figure 2. Proposed User Navigation Flow in application
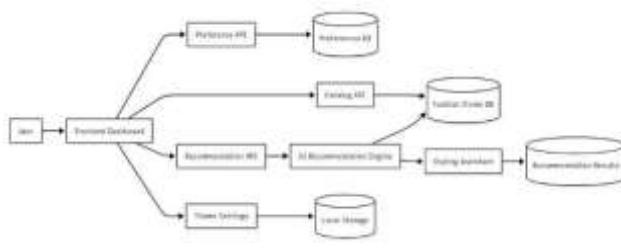
Figure 3. Data Flow Diagram

1) **User Authentication:** Secure user registration and login to access personalized fashion recommendation features and saved preferences.
2) **Persona Management:** Creation and management of user preference profiles containing attributes such as ge body type, color choices, and seasonal requirements.
3) **Outfit Selection:** Selection of fashion categories and multiple clothing items to generate outfit combinations aligned with user preferences.
4) **AI Analysis:** Execution of AI-driven recommendation logic that evaluates clothing items and outfit combinations based on criteria including occasion relevance, color compatibility and aesthetic coherence.
5) **Result Display:** Generation of personalized outfit recommendations, presented through an interactive and visually structured interface.
6) **Enhancement:** AI-driven suggestions for improving generating enhanced patterns.

The internal movement of data between system components during preference processing, AI-recommendation, and result visualization is depicted in Fig. 3.

C. Design Considerations

The architectural design of the **FashionDesignAI** platform incorporates the following key considerations to ensure robustness, usability, and long-term adaptability:

- **Modularity:** Components are independently maintainable and extendable to accommodate new fashion features or system features.
- **Scalability:** Supports concurrent evaluation of multiple ads and personas with minimal performance degradation.
- **Privacy** Relies on preference-based inputs without collecting sensitive personal or behavioral data.
- **Interoperability:** Enables seamless integration with external fashion data sources, AI services, and future system extensions.

V. KEY FEATURES AND INNOVATIONS

The **FashionDesignAI** platform incorporates several distinctive features and innovations that differentiate it from conventional fashion recommendation systems. These capabilities leverage AI-driven analysis, preference-based personalization, and user-centric design methodologies to provide meaningful styling assistance and improved fashion decision-making.

A. AI Based Preference Modeling

FashionDesignAI enables users to define their styling preferences through intuitive input mechanisms. The system processes these inputs using AI-based logic to construct structured preference profiles, encompassing:

- **Demographics:** Gender, age group, and general user category.
- **Psycho-graphics:** Color choices, fashion style inclination, and aesthetic interests.
- **Behavioral Traits:** Occasion type, seasonal relevance, and situational requirements.

These preference profiles are utilized to ensure consistent and relevant outfit recommendations across multiple user interactions while maintaining privacy and simplicity.

B. AI-Driven Outfit Recommendation

The platform supports intelligent outfit recommendation using preference-aware AI analysis. Users can explore multiple clothing options and outfit combinations based on predefined criteria such as occasion, visual compatibility, and style coherence. The sequence of interactions between system components during the recommendation process is illustrated in Fig. 4.

- Quantitative scores for recommended outfits.
- Qualitative explanations that clarify why specific combinations are suggested.

C. AI Styling Enhancement Suggestions

Following outfit recommendation, **FashionDesignAI** offers targeted styling suggestions by analyzing outfit strengths and limitations, while preserving user control by avoiding automatic modifications.
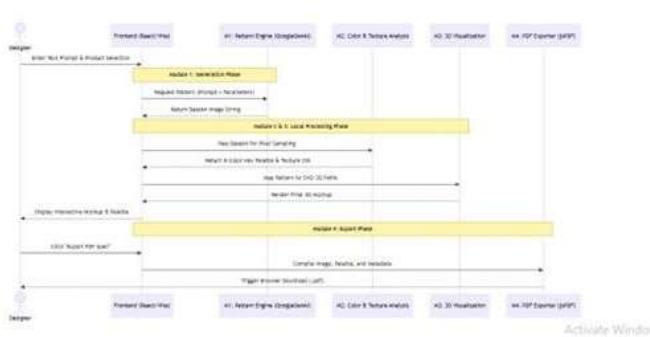
Figure 4.   Sequence Diagram
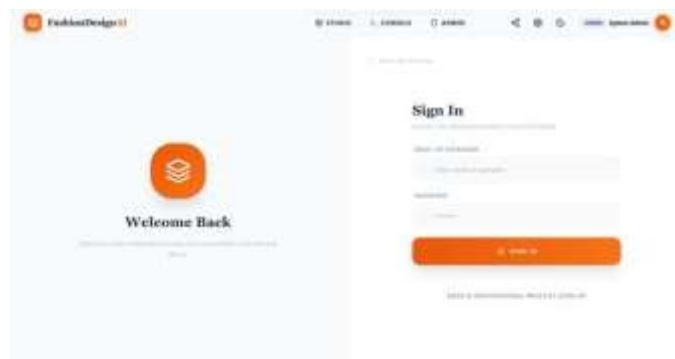
Figure 5.   Landing Page

Figure 6.   Login and Generation Studio

D. Additional Innovations

The primary user-facing interfaces of the **FashionDesignAI** platform are illustrated in **Figs. 5–9**, showcasing the main dashboard, preference selection workflow, outfit recommendation view, styling assistance interface, and personalized result display. Together, these interfaces show how the system prioritizes usability, clarity, and interactive fashion exploration.

VI. ADVANTAGES OVER EXISTING SYSTEMS

The FashionDesignAI platform has several benefits over traditional fashion recommendation and browsing systems. It uses AI to analyze preferences and offers a user-friendly, privacy-focused design. This creates a more efficient workflow than conventional systems.

- **Minimized Manual Browsing Effort:** The FashionDesignAI platform lowers the need for manual browsing by giving smart outfit suggestions based on user preferences.
- **Improved Time and Decision Efficiency:** The AI-driven recommendation process helps reduce the time needed to find suitable clothing combinations, making it easier for users.
- **Enhanced Styling Accuracy:** By evaluating clothing combinations using multiple user preference factors, it improves the relevance and consistency of the suggested fashion pairs.

- **Early Styling Validation:** Preference-driven feedback allows users to review, compare, and refine outfit choices before final selection, improving confidence in fashion decisions.
- **Privacy-Conscious Personalization:** The system relies on preference-based inputs rather than continuous behavioral tracking, supporting ethical and privacy-aware personalization.
- **Support for Outfit Comparisons:** The platform enables structured comparison of multiple outfit options through compatibility scoring and styling explanations, supporting informed fashion selection.
- **Clear and Actionable Insights:** Detailed quantitative scores accompanied by qualitative explanations help users clearly interpret evaluation results and make well-informed marketing decisions.


Figure.7 Admin Dashboard
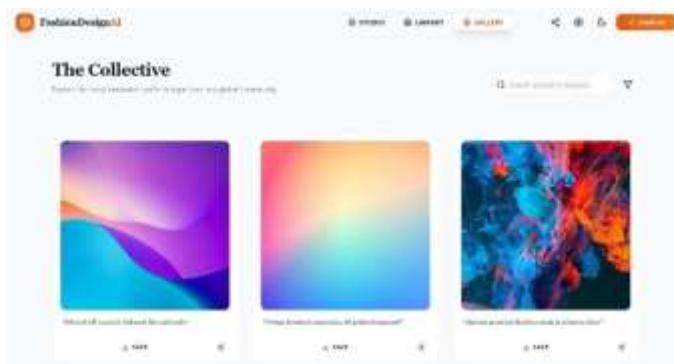
Figure.8 Gallery
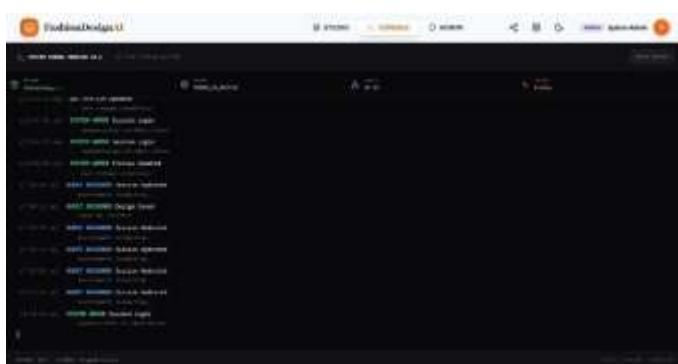
Figure 9. Admin Console Panel

Table I
COMPARISON OF FASHIONDESIGNAI WITH TRADITIONAL FASHION RECOMMENDATION SYSTEMS

Feature	Traditional Systems	FashionDesignAI
Styling Approach	Manual filters or rule-based suggestions	AI-driven preference-based recommendations
Evaluation Speed	Slow, user-independent	Rapid, automated
Cost	High due to manual browsing	Reduced, leveraging AI-based logic
Privacy	User behavioral and purchase data	Privacy-conscious, preference-based inputs
Format Support	Individual clothing items	Outfit-level recommendations
Insight	Basic product suggestions	Compatibility scoring with styling explanations

VII. POTENTIAL APPLICATIONS

The FashionDesignAI platform offers several applications that increase its value beyond simple fashion browsing. It provides effective styling support through an AI system that analyzes user preferences and gives smart outfit suggestions to users, designers, and business clients.

- **Online Fashion Retail Platforms:** These platforms enable personalized outfit recommendations for customers. This leads to better customer engagement, greater purchase confidence, and an improved user experience.
- **Small and Medium Enterprises (SMEs):** They offer an affordable and automated fashion recommendation solution. This solution does not require expensive systems or detailed user information.

- **Fashion Designers and Styling Professionals:** They receive help in evaluating outfit combinations, color coordination, and occasion suitability. This support aids creative decision-making and validates styling choices.
- **Academic and Research Institutions:** These institutions conduct research on fashion recommendation systems, user preference modeling, and AI-driven personalization systems.
- **Outfit Comparison and Styling Optimization:** The system allows users to compare different outfit combinations. This feature helps them improve their fashion selection process over time.

VIII. REAL-USER VS. AI-PERSONA EVALUATION: KEY OBSERVATIONS

This section examines how closely AI-driven fashion recommendations align with real user preferences in the context of outfit selection and styling assistance. The purpose of this analysis is not to position AI recommendations as replacements for human judgment, but rather to evaluate their effectiveness, limitations, and practical role as decision-support tools in fashion selection. By comparing AI-generated outfit suggestions with feedback from real users, this study aims to understand where automated recommendations perform well and where human subjectivity and contextual factors introduce variation—particularly in areas such as aesthetic appeal, comfort perception, and occasion suitability.

To ground the analysis, real-user responses collected through a structured survey were used as a reference baseline against which AI persona behavior was interpreted.

A. outfit Stimuli
- Two distinct outfit combinations were evaluated to represent contrasting styling approaches:

Outfit A (Stylish / Trend-Oriented)
Headline: Express Your Style. Stand Out with Confidence.
Copy: This outfit emphasized modern design elements, vibrant color coordination, and trend-focused aesthetics. It was designed to appeal to users with creative, fashion-forward preferences who value visual impact and contemporary styling.

Outfit B (Classic / Practical)
Headline: Comfort Meets Elegance for Everyday Wear.
Copy: This copy was designed to emphasize a palette of neutral colors, comfort-driven design, and functional appropriateness. It was targeted at users who value functionality, flexibility, and ease of wear in all aspects of daily and working life.

B. Observed Patterns in Real-User Feedback

The analysis of real-user feedback revealed that the overall preferences were generally in line with the expected patterns as identified by the AI-powered recommendation algorithm. Users with creative or fashion-focused tastes preferred Outfit A. In contrast, users who valued functionality, comfort, or a minimalist style favored Outfit B. This finding shows that the recommendation system using AI effectively identifies the main trends in user preferences when looked at as a whole.

Evaluation of real user responses showed that most outfit preferences aligned with the trends predicted by the AI-based recommendation system. Users who had profiles reflecting creativity, trend awareness, or a strong aesthetic lean were more likely to prefer Outfit A. In contrast, participants who focused on practicality, comfort, or functionality more often chose Outfit B. This overall alignment suggests that the AI recommendation logic effectively identifies key styling trends when considering user responses as a whole.

At the same time, a smaller group of users made choices that did not fully match these expected patterns. In some cases, individuals chose Outfit A even though their preferences leaned toward comfort or practicality. They often mentioned situational factors like special occasions or social visibility. On the other hand, some users preferred Outfit B even though they showed a creative or fashion-forward side.

These observations show an important part of how people make fashion choices. Outfit selection is affected by more than just stable personal style preferences. Real users consider their fashion options by balancing their long-term aesthetic identity with short-term factors. These factors include comfort needs, the social environment, perceived appropriateness, past wardrobe experience, and intended use. Consequently, survey-based fashion preferences might reflect temporary priorities instead of consistent, long-term styling behavior.

C. AI-Based Recommendation Tendencies and Limitations

The AI-based outfit recommendations showed more stable results than actual user feedback which showed different patterns of response. The system connected user traits, such as being creative, expressive, or trend-oriented, to their preference for eye-catching and stylish outfits. This was evident in their choice of Outfit A. The evaluation process identified comfort and functionality as important factors. However, these aspects were considered less important than how well the outfits matched in terms of aesthetics, which led to strong results.

AI-driven fashion recommendation systems face a major limitation since they rely on common patterns between user traits and fashion matching methods. The models can identify general preference patterns, but they struggle to understand specific user choices. These choices depend on actual user preferences for comfort and practicality, as well as weather conditions that compete with visual appeal.

These limitations do not mean that AI-based fashion recommendations are wrong. Instead, they show a methodical guess of user behavior based on logical assumptions about what users do. Human fashion choices vary because people have different priorities and face different situations. This makes AI-driven systems work best as tools to support decisions. They help users choose outfits rather than accurately predicting their specific fashion choices.

D. Implications for the Use of AI-Based Fashion Recommendations

The findings of this study indicate that AI-driven fashion recommendations are best understood as tools for identifying overall styling trends rather than as precise predictors of individual user choices. AI-based systems demonstrate effectiveness through their capability to identify common preference patterns while detecting what users want from recommended outfits and showing their limitations for different user demographics. The solution becomes essential when users begin the process of selecting outfits and exploring different styling options.

To ensure that AI-based fashion recommendations are applied in a practical and responsible manner, the following considerations should be taken into account:

- AI recommendations serve as style guides which do not account for how users select their outfits based on short-term needs and their current circumstances and what makes them feel comfortable.
- The system should use recommendation outputs to assess how different user groups prefer various options instead of trying to determine what each user will specifically choose.
- The system should use user feedback to make critical styling and selection decisions from the available options whenever this option exists.
- Users should consider AI-generated suggestions as preliminary exploration tools which help them develop their final styling decisions.

The AI persona evaluations will decrease initial project uncertainty when users follow the established evaluation conditions but maintain all user behavior patterns which occur in natural situations.

II. CONCLUSION

The FashionDesignAI system offers a novel AI-based solution for fashion recommendation and styling support with the goal of enhancing fashion choice in digital spaces. Through the analysis of user preference and context information, the system allows users to browse for appropriate fashion combinations, determine the strength of fashion styling, and alleviate uncertainty in fashion decision-making tasks without the need for intensive behavioral data collection. In this regard, the FashionDesignAI system solves several issues related to traditional fashion browsing systems.

The results from this study show that when real-user preferences for outfits are combined, they tend to match the recommendations from the AI system. This confirms that the AI system can identify major fashion trends. However, the varying preferences among some users highlight a limitation: fashion choices depend on preferences as well as context.

These findings highlight the role of FashionDesignAI as a decision support tool instead of a predictive tool for fashion choices. By combining AI insights with specific user input and understanding the differences in real-world fashion styling behavior, the platform allows for informed fashion exploration.

Instead of treating artificial intelligence as a decision-maker, this research presents FashionDesignAI as a support system for fashion recommendations and styling. The main benefit of this system is that it provides fast, consistent, and repeatable results

This can reduce uncertainties and help identify consistent styling patterns for various user preferences. Such capabilities are particularly important for building user confidence in choosing outfits. Users can explore and refine their fashion choices before making a final selection. FashionDesignAI works best as a styling assistant. This tool aids in fashion exploration and helps narrow down outfit options.

Fashion relies not only on technology but also on comfort and personal experiences. Thus, using FashionDesignAI can lead to better-informed and more balanced fashion decisions.

III. Future Enhancements

The Fashion AI system's current iteration demonstrates the potential of deep learning-based Content-Based Image Retrieval (CBIR). However, the following enhancements are recommended in order to transform a prototype into a tool that is ready for the market:

The system currently only uses visual similarity. MLLMs like CLIP and LLaVA will be included in later iterations. As a result, users will be able to combine text input and image uploads with a "Hybrid Search" feature. A user might, for instance, upload a picture of a dress and write, "Find this in a floral print with a mandarin collar." This will aid the AI in comprehending the particular request as well as the image. We suggest incorporating Generative Adversarial Networks (GANs) to enhance the "Unified Generative Studio" feature. This will make it possible for users to view fashion items digitally positioned onto an uploaded photo or avatar through the "Virtual Try-On" feature. The system could display a realistic preview of fit, drape, and silhouette by utilizing top-notch 3D garment simulation techniques, akin to CLO. The "Physical Sampling Waste" present in the current system could be greatly reduced by this modification.

Only a static dataset indexed with Pickle files is available in the current system. Developing an Automated Web Crawler that gathers information from active e-commerce websites like Zara, H&M, or ASOS is a significant future improvement. This will enable the system to provide Personalized Recommendations, which offer products that not only match the query but also fit the user's distinct wardrobe style, going beyond simple visual similarity.

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