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AI-Based Fashion Recommendation Engine

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Abstract: *Fashion decision-making involves multiple personal and contextual factors including body type, occasion, weather conditions, and emotional state. Traditional styling advice and most existing recommendation platforms provide generalized suggestions that fail to adapt to individual user contexts. This paper presents an AI-Based Fashion Recommendation Engine that integrates body type classification, hybrid recommendation algorithms, contextual analysis, secure user authentication, and a dynamic rating feedback mechanism. The system analyzes structured user inputs such as body shape, occasion type, weather data, mood, and style preferences to generate personalized outfit recommendations. Real-time API integration enables seamless product discovery, while a feedback-driven rating system enhances continuous learning and personalization. The architecture follows a modular three-tier design ensuring scalability, responsiveness, and secure data handling. Experimental evaluation demonstrates improved recommendation relevance, high user satisfaction scores, and effective personalization through accumulated feedback.*

Keywords: Fashion Recommendation System, Hybrid Recommender, Context-Aware AI, Body Type Classification, Collaborative Filtering, User Authentication, Rating System

I. INTRODUCTION

Fashion plays a significant role in personal confidence, professional appearance, and social interaction. Selecting an appropriate outfit is not a simple task; it depends on various interconnected factors such as body type, event type, environmental conditions, and emotional state. However, traditional fashion advice systems—including fashion blogs and generic online recommendations— provide one-size-fits-all suggestions that lack personalization.. Additionally, existing e-commerce platforms focus primarily on product similarity or purchase history, often ignoring contextual parameters like weather and mood. This creates a fragmented user experience where users must manually interpret styling advice and separately search for products.

With advancements in Artificial Intelligence and Machine Learning, it is now possible to build intelligent systems that analyze multiple dimensions of user data simultaneously. The proposed AI-Based Fashion Recommendation Engine aims to bridge this gap by delivering context-aware, body-type-specific, and mood-sensitive outfit suggestions integrated directly with product discovery mechanisms. Cloud-assisted programming environments allow users to submit source code to remote servers where compilation and execution are performed, and results are returned instantly. This approach reduces device-side processing requirements while ensuring consistent execution across different platforms. When combined with mobile applications, cloud- based execution enables lightweight yet powerful programming solutions suitable for learning, experimentation, and rapid testing.

II. LITERATURE REVIEW AND MOTIVATION

Several research studies have explored recommendation systems in the fashion domain. Early systems relied on content-based filtering techniques that matched products based on attributes such as color, fabric, or category. While effective for similarity detection, these systems lacked personalization depth. Recent advancements introduced collaborative filtering techniques, leveraging user behavior and ratings to improve recommendations. Hybrid

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recommendation models combining content-based and collaborative filtering approaches have shown higher accuracy. However, most existing systems fail to integrate contextual parameters such as body shape, weather conditions, and emotional state simultaneously.

Recent Research in body type classification highlights the importance of silhouette-based styling for enhancing visual balance and user confidence. Similarly, contextual AI research demonstrates that mood and environmental factors significantly influence clothing preferences. Despite these findings, limited research focuses on a unified system that combines body type analysis, contextual awareness, authentication mechanisms, and dynamic feedback loops within a single scalable platform. This gap motivates the development of the proposed system.

Existing mobile programming platforms often focus on isolated functionalities, such as code editing or online execution, without providing a comprehensive and integrated solution. Several systems lack essential features such as persistent storage, execution history, secure user management, and seamless language switching. Additionally, limited scalability and rigid system design make it difficult to extend these platforms with new features or technologies. These limitations highlight the need for a unified, mobile- friendly programming environment that combines cloud execution, multi-language support, and user-centric design.

The primary problem addressed in this work is the absence of a lightweight yet functional mobile programming platform that supports real-time code execution and personalized user experience. Most available tools either depend on high-resource desktop environments or provide incomplete functionality on mobile devices. Furthermore, the lack of persistent data management and structured execution feedback reduces their effectiveness for continuous learning and practice.

III. PROPOSED SYSTEM ARCHITECTURE

A. System Overview

The proposed AI-Based Fashion Recommendation Engine is designed using a modular and scalable architecture to deliver personalized, context-aware outfit suggestions. The system integrates user profiling, hybrid recommendation algorithms, contextual intelligence, secure authentication, and real-time data integration within a unified framework. The architecture emphasizes personalization accuracy, system security, responsiveness, and extensibility to support future enhancements without major structural changes.

The system follows a three-tier architectural model consisting of the presentation layer, application logic layer, and data integration layer. This layered design ensures clear separation of concerns, improved maintainability, and efficient communication between system components.

B. Architectural Layers

The overall system architecture is organized into the following key layers:

Presentation Layer:

The presentation provides an interactive and user-friendly interface through which users can register, log in, manage their profiles, and generate outfit recommendations. It handles user inputs such as body type, occasion, mood, weather preferences, and styling choices. The interface is designed to ensure smooth navigation and responsive interaction across devices.

This layer also displays personalized outfit recommendations along with rating options that allow users to provide feedback. Proper input validation and structured form handling ensure data accuracy before it is transmitted to the backend system.

Application Logic Layer:

The application logic layer manages the core intelligence of the system. It processes user profile data, contextual inputs, and historical rating information to generate accurate recommendations. This layer includes multiple functional modules such as body type classification, contextual analysis, hybrid recommendation computation, and feedback processing.

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Data Integration Layer:

The data integration layer is responsible for managing persistent storage and external service communication. It stores user profiles, authentication credentials, recommendation history, and rating data in a structured database. Secure encryption techniques are applied to protect sensitive information. The modular structure of this layer ensures that additional data sources or e-commerce platforms can be integrated seamlessly without affecting other system components.

System Workflow:

The system workflow begins when a user logs into the application and enters contextual and personal information. The input data is transmitted to the application logic layer, where it is processed and converted into structured feature representations. The hybrid recommendation engine evaluates product data using content similarity, collaborative filtering, and contextual relevance scoring. Ranked outfit suggestions are then generated and returned to the presentation layer for display.

After viewing the recommendations, users can provide ratings and feedback. This data is stored in the database and used to refine future recommendations, creating a continuous learning loop within the system.

This structured workflow ensures efficient data processing, accurate personalization, and smooth interaction between system components.

IV. METHODOLOGY

The development of the proposed AI-Based Fashion Recommendation Engine was carried out using a structured and incremental approach to ensure proper integration of personalization, contextual intelligence, and secure user management. Initially, a detailed requirement analysis was conducted to identify essential functional components such as user authentication, profile management, body type classification, contextual input handling (occasion, weather, mood), hybrid recommendation logic, and rating feedback integration. Non-functional aspects including performance efficiency, security, scalability, and responsiveness were also considered during planning. Based on the identified requirements, a modular three-tier architecture was designed consisting of the presentation layer, application logic layer, and data integration layer. The presentation layer manages user interactions such as profile input, recommendation viewing, and rating submission. The application logic layer processes contextual data and implements the hybrid recommendation algorithm. The data integration layer handles database management and external API communication, including weather data retrieval and product discovery.

The hybrid recommendation mechanism combines content-based filtering, collaborative filtering, and contextual scoring. Content- based filtering matches user preferences with product attributes, while collaborative filtering utilizes rating data to identify patterns among similar users. Contextual analysis incorporates occasion formality levels, weather conditions, and mood-based color psychology to enhance recommendation relevance. Secure user authentication is implemented using encrypted password storage and token-based session management to ensure data protection. A dynamic rating system allows users to rate recommendations on a five-point scale, and the collected feedback is used to refine future suggestions.

V. RESULTS

The developed AI-Based Fashion Recommendation Engine was evaluated under practical usage conditions with participation from students and young professionals. Users created profiles, generated outfit recommendations for different occasions, and provided ratings using the integrated feedback mechanism. The system successfully generated personalized outfit suggestions based on body type, contextual parameters, and user preferences. Recommendations were displayed with relevant product details, and users were able to explore items through integrated product links. The rating system functioned effectively, allowing users to provide feedback that influenced subsequent recommendations.

User feedback indicated that contextual personalization significantly improved recommendation relevance compared to generic fashion suggestions. Weather-aware and body-type-based filtering were particularly appreciated for practical

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usability. The dynamic rating system contributed to improved personalization over repeated sessions, as returning users received more refined recommendations aligned with their preferences.

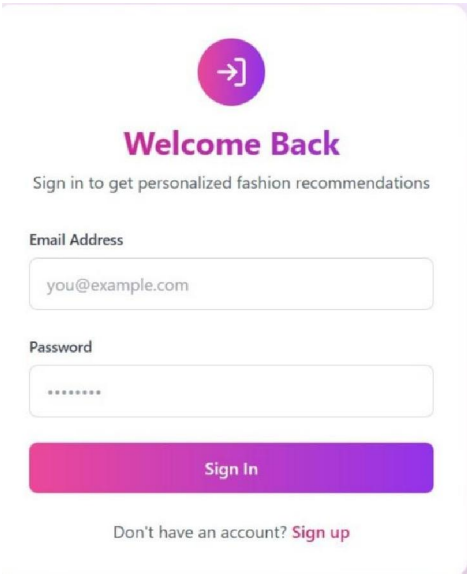

Fig. 1: Login Interface of an AI-Based Fashion Recommendation Engine

The Login Interface of the AI-Based Fashion Recommendation Engine serves as the primary entry point for users to access the system. It is designed with a clean and user-friendly layout that allows users to securely register or log in using their email ID and password. The interface includes essential components such as input fields for email and password, a login button, and a registration option for new users. Proper input validation mechanisms are implemented to ensure that empty or invalid credentials are handled appropriately. Passwords are securely encrypted before storage, and authentication tokens are generated upon successful login to maintain secure user sessions. The interface includes essential components such as input fields for email and password, a login button, and a registration option for new users. Proper input validation mechanisms are implemented to ensure that empty or invalid credentials are handled appropriately. Passwords are securely encrypted before storage, and authentication tokens are generated upon successful login to maintain secure user sessions

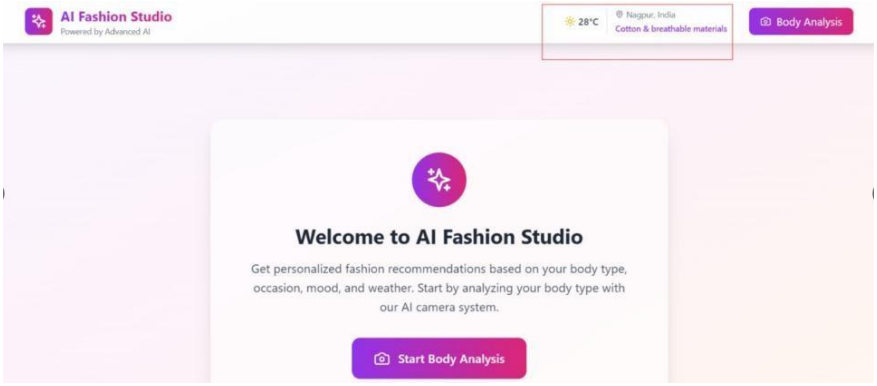

Fig.2: Dashboard Interface of AI-Based Fashion Recommendation Engine

The above figure illustrates the main dashboard of the AI-Based Fashion Recommendation Engine after successful user login. The interface displays a welcome panel introducing the system and its core functionality of generating personalized fashion recommendations based on body type, occasion, mood, and weather conditions. At the top of the

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interface, real-time weather information and location details are displayed, demonstrating successful integration of external weather APIs. The system also provides fabric suggestions based on current environmental conditions, enhancing contextual personalization.

A prominent "Start Body Analysis" button enables users to initiate the body type analysis process using the integrated AI-based detection system. Additionally, a dedicated "Body Analysis" option is available for accessing detailed classification features. The layout is designed to be clean, intuitive, and user-friendly, ensuring smooth navigation and clear presentation of contextual information. This interface confirms successful integration of personalization modules, real-time data retrieval, and interactive recommendation features within a unified dashboard environment.

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VI. COMPARATIVE ANALYSIS

Feature	Traditional Fashion Blogs	Standard E-commerce Platforms	Proposed System
Body Type Personalization	No	Partial	Yes
Weather Awareness	No	No	Yes
Mood-Based Suggestions	No	No	Yes
Authentication & Profile Persistence	No	Yes	Yes
Rating-Based Learning	No	Limited	Yes
Hybrid Recommendation Model	No	Partial	Yes

The proposed system uniquely integrates all personalization dimensions into a single intelligent framework.

VII. CONCLUSION

This paper presented an AI-Based Fashion Recommendation Engine integrating body type analysis, contextual intelligence, hybrid recommendation algorithms, secure authentication, and dynamic feedback learning. Experimental evaluation demonstrates improved recommendation relevance and user satisfaction. The modular architecture ensures scalability and future extensibility. The system contributes to the domain of context-aware recommendation systems by introducing a unified personalization framework that considers physical, environmental, and emotional parameters simultaneously.

Future enhancements include image-based body detection, trend forecasting using time-series analysis, conversational AI integration, and mobile application deployment.

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