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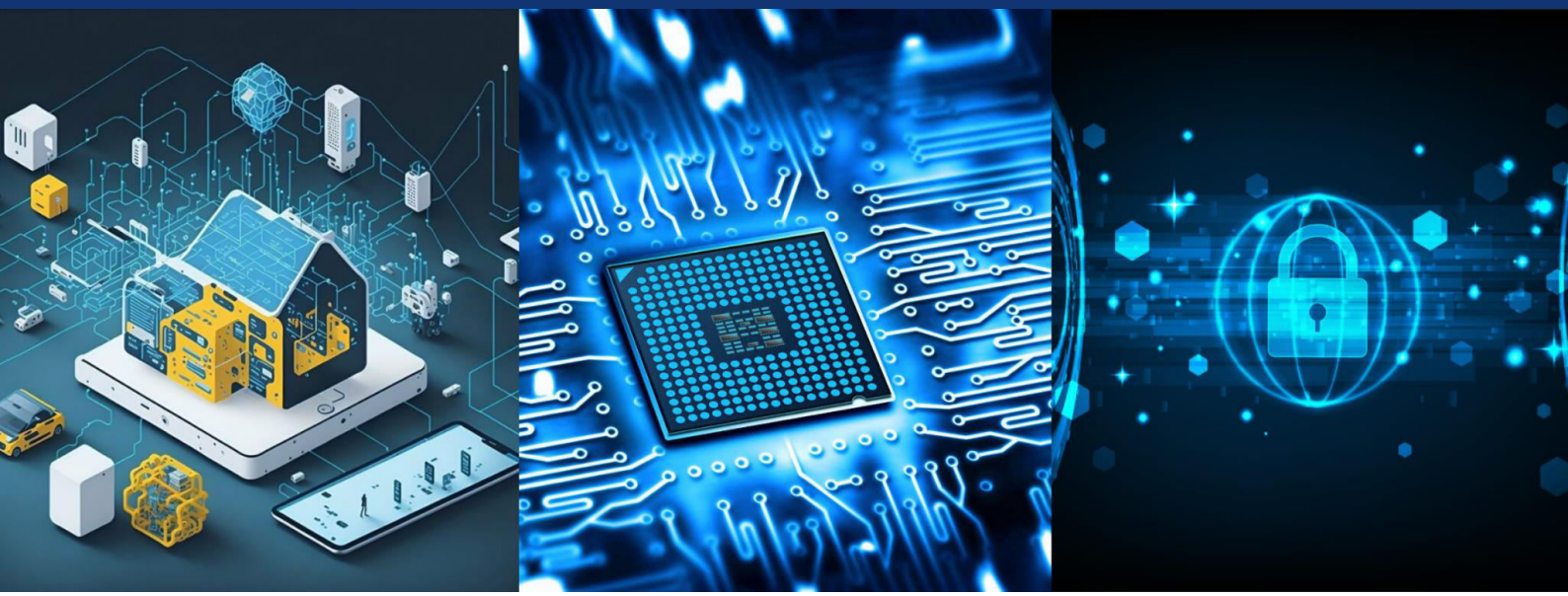

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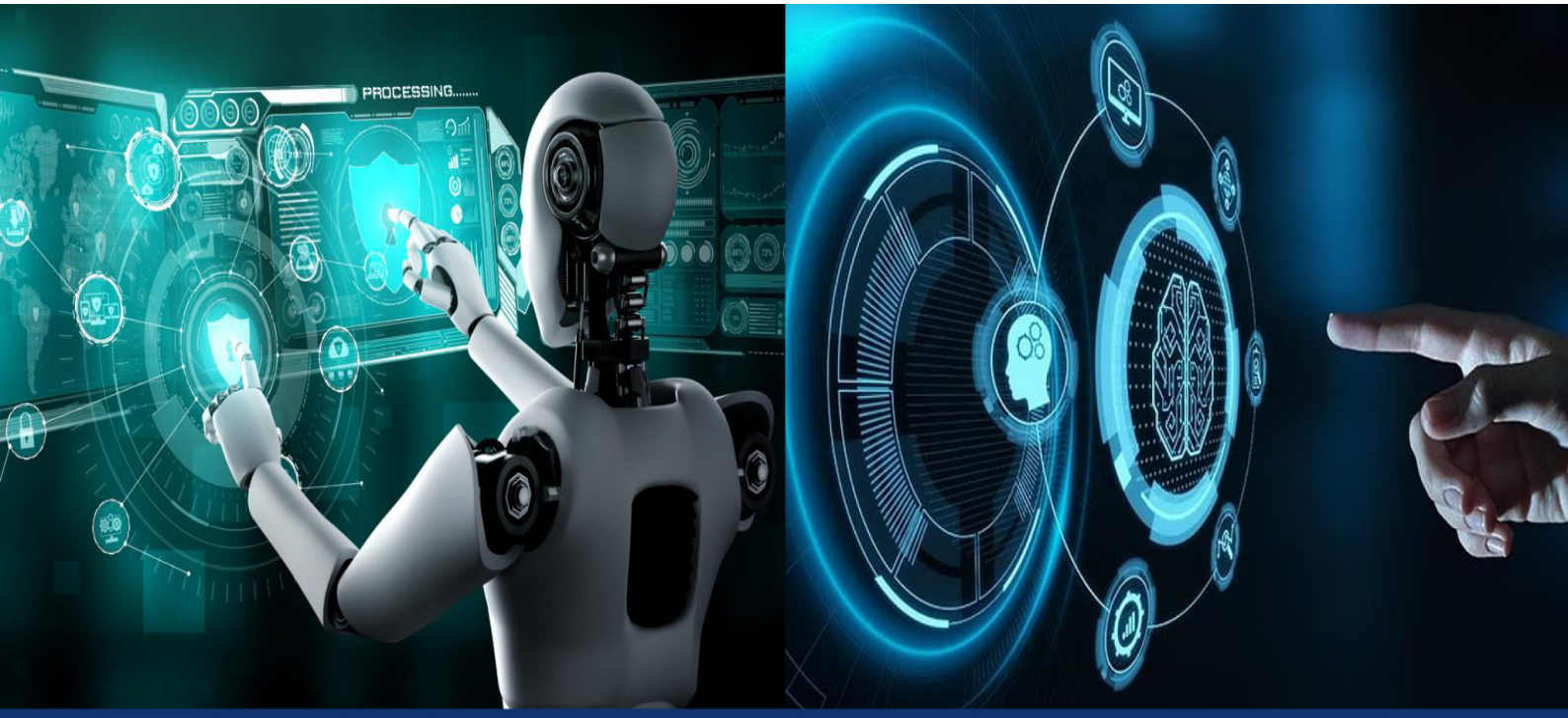

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AI-Powered Outfit Matching and Virtual Try-on Platform using Python Tech Stack

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ABSTRACT: The AI-Powered Outfit Matching and Virtual Try-On Platform enhances personal fashion experiences by offering intelligent clothing recommendations and realistic try-on capabilities. The system consists of four major modules: outfit matching, virtual try-on, wardrobe management, and an e-commerce-linked recommendation system. Utilizing Python-based technologies and AI tools such as Color Thief for dominant color extraction and Hugging Face for virtual outfit overlays, the platform analyzes clothing images uploaded by users and generates matching combinations based on established color harmony theories including complementary, analogous, and neutral matches. The backend is developed using FastAPI, enabling efficient RESTful API services and image processing. The frontend, designed with React and Tailwind CSS, provides users with a responsive, user-friendly interface that displays matched outfits with score-based rankings and direct purchase links. Users can upload wardrobe items, manage their virtual closet through tagging and categorization, and receive recommendations that are not only style-appropriate but also integrated with online shopping platforms like Amazon and Myntra.

KEYWORDS: AI, Virtual Try-On, Color Theory, Outfit Recommendation, Wardrobe Management, FastAPI, Color Thief, React, Tailwind CSS, Hugging Face, E-commerce Integration.

I. INTRODUCTION

Outfit selection is often a time-consuming and subjective task. Many individuals struggle with combining garments, resulting in indecision and dissatisfaction. Our project proposes an intelligent web platform that combines AI, color theory, and virtual try-on technologies to suggest matching outfits and simulate how they appear on users. Unlike existing tools, our platform unifies four key features in one system: Outfit Matching Module – Users upload images of shirts and pants. The system uses Color Thief to extract dominant colors and apply color theory principles to suggest visually harmonious outfit combinations. Matches are scored and categorized as analogous, complementary, or neutral based on RGB distance. Virtual Try-On Module – Users can see how outfits look on themselves or a virtual model using AI overlays powered by Hugging Face. This helps in visualizing clothing without needing to physically try them on. Recommendation System Module – The system integrates with e-commerce platforms (e.g., Amazon, Myntra) to display live links for buying suggested clothing items. It also considers user preferences and history to offer personalized suggestions. Wardrobe Management Module – A virtual wardrobe allows users to upload, tag, and organize their clothing collection. This feature includes sorting options by color, type, and occasion, helping users maintain a neat and easily accessible closet.

Together, these features create a seamless, AI-enhanced fashion assistant that aids users in outfit coordination, purchase decisions, and wardrobe organization.

II. SYSTEM MODEL AND ASSUMPTIONS

The proposed system is designed to operate in a client-server architecture. It assumes that each user maintains a local or cloud-based wardrobe repository, where clothing images are organized into distinct folders representing different garment types (e.g., shirts, pants). These images are expected to be clear and contain a single clothing item per frame against a neutral background for optimal processing accuracy.

The key assumptions include:

1. Categorized Clothing Images: Users upload images classified into 'tops' and 'bottoms' directories. Folder naming conventions or metadata tags assist in classification.

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2. Dominant Color Validity: Each clothing item has a dominant color that meaningfully contributes to the color harmony logic used in matching.
3. RGB Consistency: Color extraction using ColorThief assumes reasonably lit and unfiltered images, ensuring consistent RGB readings.
4. User Interaction through Web Interface: It is assumed that users can interact via a responsive UI to upload, review, and receive recommendations.
5. API Connectivity: Frontend and backend communicate via secure REST APIs, and internet access is assumed for dynamic recommendation links.
6. Cloud Storage Integration: Clothing images and associated metadata are securely stored and retrieved using cloud services like AWS or Superbase.

Based on these assumptions, the system processes wardrobe images, identifies pairable garments using defined algorithms, and presents results with interactive controls and visuals.

III. OUTFIT MATCHING MODULE

This module uses the ColorThief library to extract dominant RGB values from clothing images. Once extracted, each top-bottom pair is compared using the Euclidean distance formula:
Based on distance, matches are classified as: Analogous (low distance): Score 5, Neutral (moderate distance): Score 3, Complementary (high contrast): Score 4
These categories are rooted in standard color harmony theory. The module outputs match type, score, and a preview grid of suggested outfits. The backend exposes a REST API (GET /match-outfits) that returns JSON data containing image URLs and match metadata.

IV. VIRTUAL TRY-ON MODULE

This module allows users to visualize how selected outfits would appear on a person. By integrating Hugging Face APIs and models for segmentation and garment overlay, the system superimposes selected clothing images onto model images. The process involves: Foreground extraction using rembg, Pose estimation and clothing alignment, Composited output rendered in the frontend. This feature enhances user confidence in selections and simulates a realistic dressing room experience.

V. WARDROBE MANAGEMENT MODULE

This module allows users to organize, store, and retrieve digital representations of their clothing. Each item is associated with metadata such as category, color, upload date, and frequency of use.

Functional Details: Image Tagging: Users can tag clothing with custom attributes (e.g., “formal,” “summer”). Category Sorting: Items are auto-classified into tops, bottoms, or other groups using filename patterns or user input. Usage Tracking: Tracks how often an item is matched or selected to inform future suggestions. Cloud Sync: Uses Superbase or AWS for persistent storage, ensuring wardrobe data is accessible across sessions. Search and Filter UI: Enables users to search by color, type, or occasion.

VI. RECOMMENDATION SYSTEM MODULE

The Recommendation System Module provides a curated list of fashion marketplace links like Amazon, Myntra, ASOS, and others. These static links are displayed in a dedicated section called “Fashion Marketplaces.” Users can click on any “Visit Store” button to browse or shop from those platforms. The module does not generate recommendations per outfit but serves as a quick-access hub to trusted online stores. This feature enhances convenience without requiring complex integration or dynamic fetching and easily access the different marketplaces,

VII. RESULT AND DISCUSSION

The system was tested with multiple outfit sets. Matches with analogous and complementary color schemes were frequently rated highest by users. Visual outputs demonstrated realistic try-on performance and intuitive UI experience.

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The real-time performance of the system remains optimal with a lightweight Python backend, and the color-based matching logic offers explainability and reliability without requiring deep learning training.

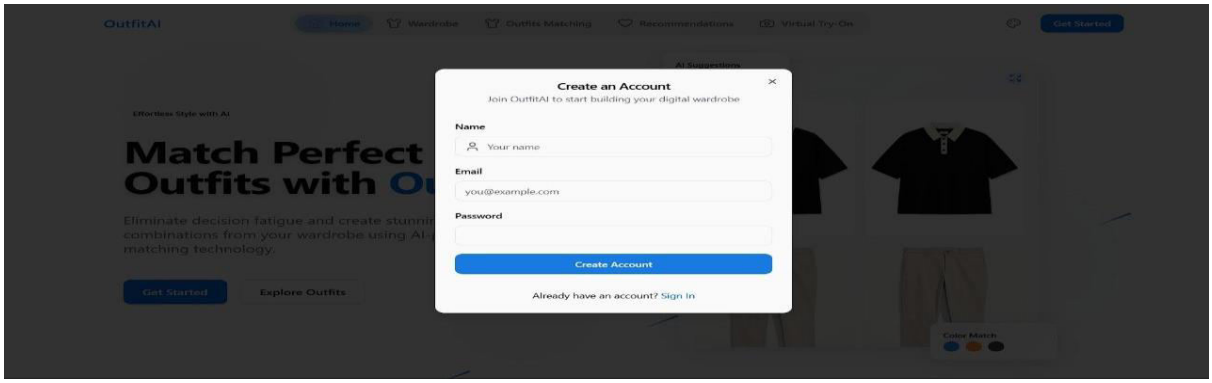

Fig.1 Sign up Page

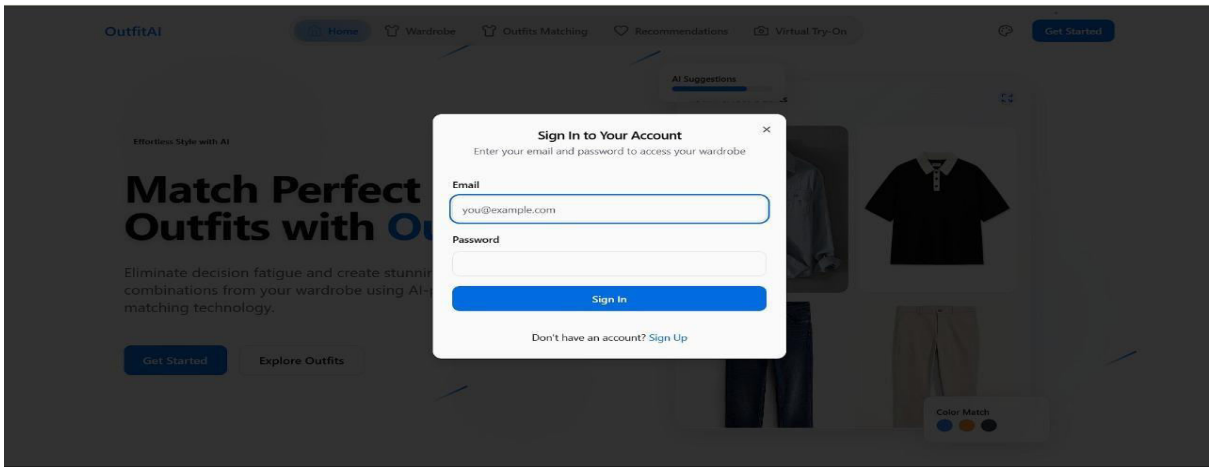

Fig.2 Sign in Page

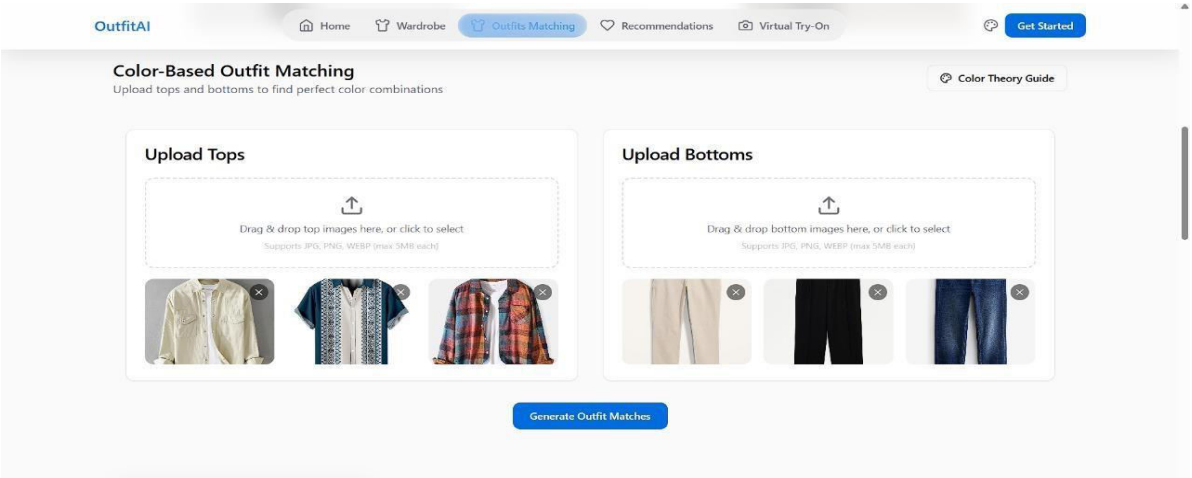

Fig.3 Upload a Dresses to Generate Outfit Matching

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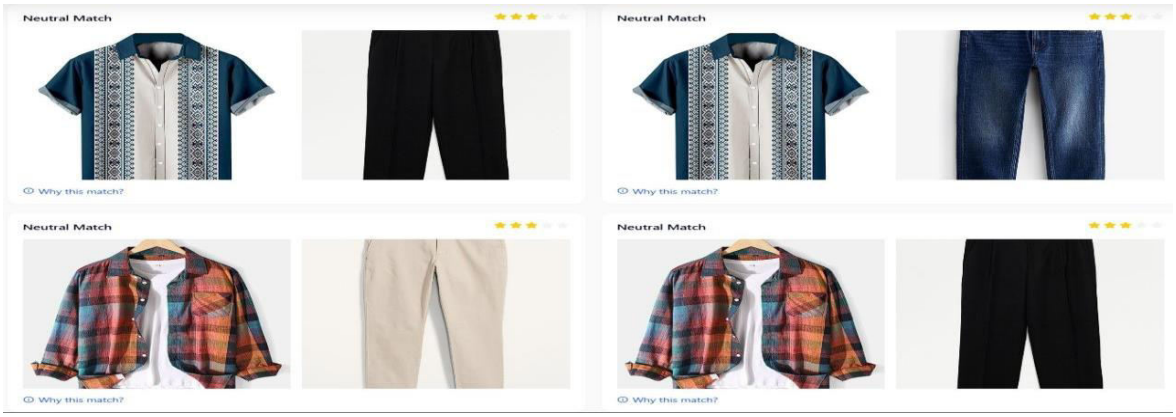

Fig.4 Combination of Outfit Matching

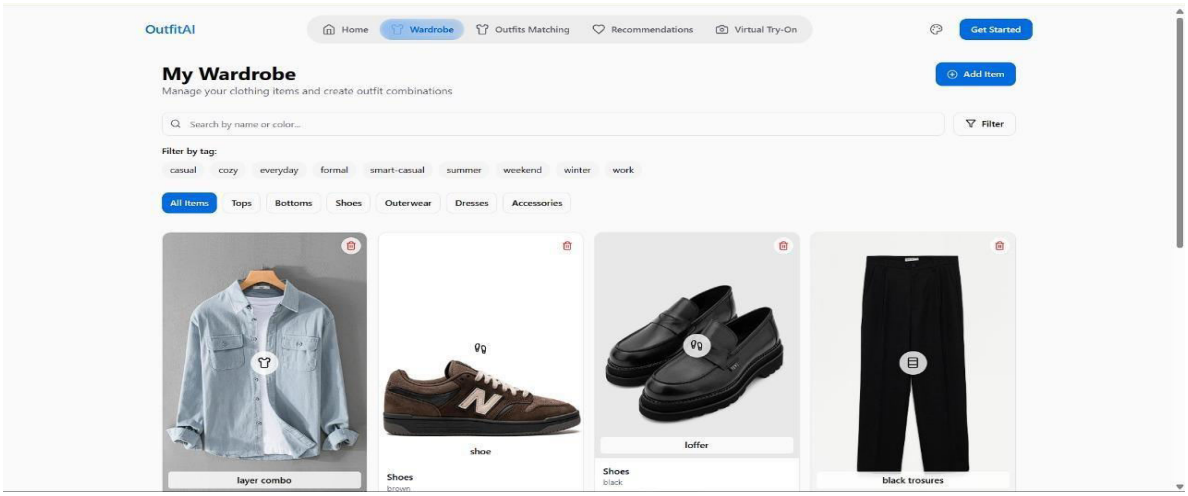

Fig.5 Wardrobe Page

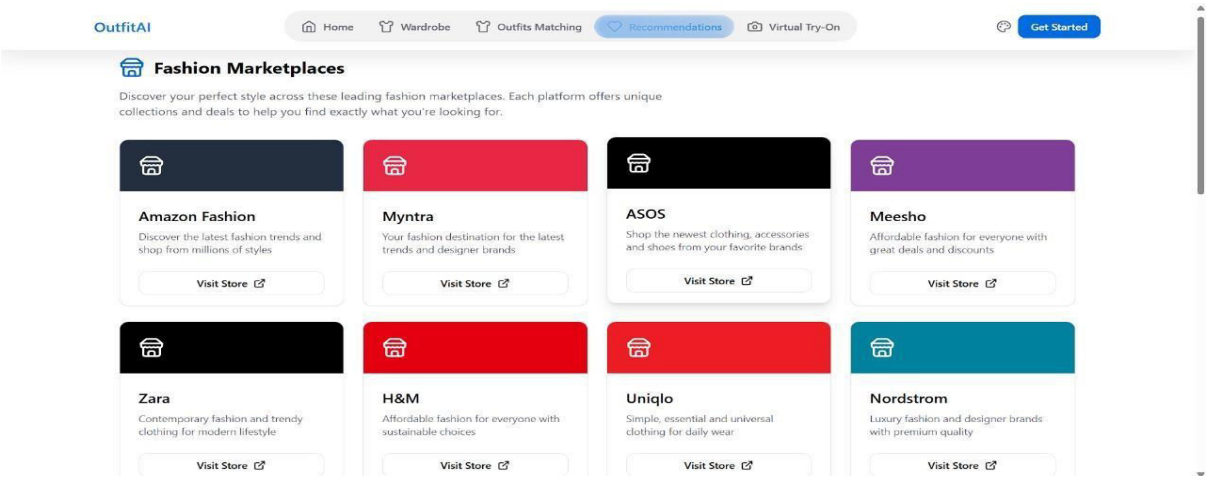

Fig.6 Recommendation Page

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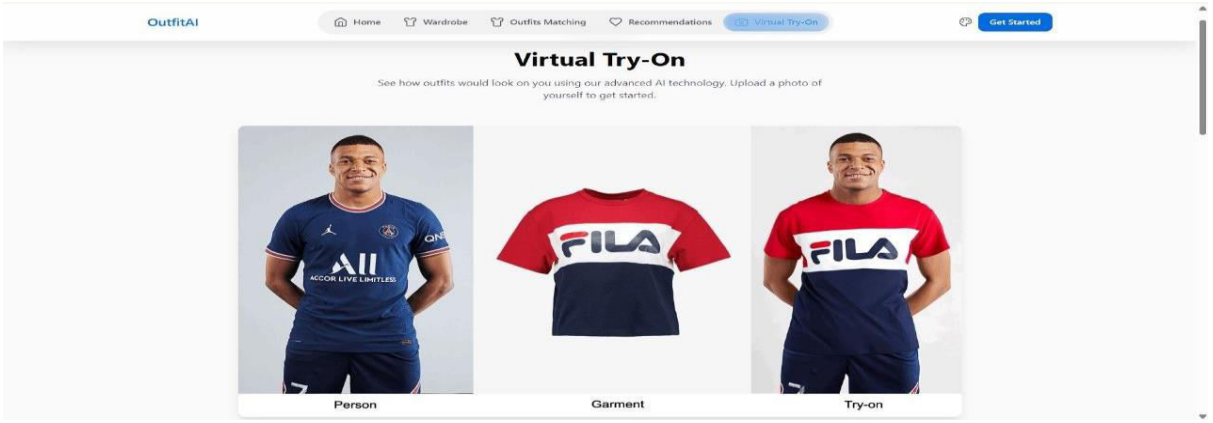

Fig.7 Virtual Try-On Page

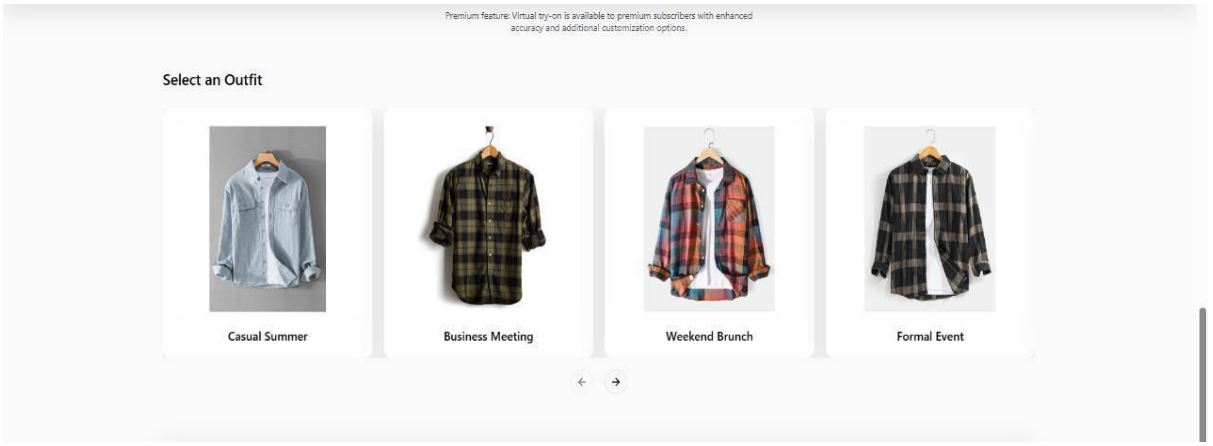

Fig.8 Garment Selection Section in the Virtual Try On page

VIII. CONCLUSION

The proposed AI-powered outfit matching and virtual try-on system offers a comprehensive solution to modern fashion challenges. It simplifies outfit coordination, enhances shopping decisions, and promotes sustainable wardrobe management. With modular architecture and extensible features, it serves as a robust prototype for future developments in AI-driven fashion tech.

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