International Journal of Scientific Research & Engineering Trends
Volume 12, Issue 1, Jan-Feb-2026, ISSN (Online): 2395-566X

Smart Wardrobe Management System Using Ai&Ml

Preethi Wilson G, Gokulakrishnan R , Dhivya dhanasree S S ,Sumanth BKM
Assistant Professor , Computer Science and Business Systems
Jerusalem College of Engineering, Pallikaranai, 600100
UG Student, Computer Science and Business Systems. Jerusalem College of Engineering,
Pallikaranai, 600100 .

Abstract- A virtual try-on system is an advanced AI-powered platform that allows users to visualize how clothing items would appear on their bodies without physically wearing them. These systems are transforming the way people shop online by offering a digital fitting room experience using computer vision, deep learning, and generative models. in recent years, the demand for online fashion experiences has increased, encouraging the development of systems like Style VTON, which not only allows users to try on clothes virtually but also supports multiple body poses and preserves personal identity and clothing details. By using a combination of input images (user photo, clothing image, and target pose), such systems generate a highly realistic image of the user wearing the desired outfit in a new posture.

Keywords- Smart Wardrobe Wardrobe Management System Artificial Intelligence (AI) Machine Learning (ML) Computer Vision Image Recognition Outfit Recommendation System Fashion Recommendation Engin Personal Styling AI.

I. INTRODUCTION

Clothing has always played an essential role in everyday life, but the way people manage their wardrobes has not changed significantly over the years. In most households, clothes are stored without any particular system, often leading to confusion and repeated use of the same few items while many others remain unused for long periods of time. As individuals accumulate more clothing, it becomes progressively harder to remember what garments they own, how often each item is worn, and which pieces can be matched well together for different occasions. Over time, this decision-making process leads to what is commonly known as decision fatigue, where the mental effort required to choose an outfit becomes tiring and frustrating. With the growing influence of digital tools and mobile applications, users today expect simple and effective methods to organise their personal belongings. However, traditional wardrobe management remains largely unchanged, relying on manual sorting and memory. While a few mobile apps attempt to provide digital wardrobe features, they are often limited to storing images and do not help users plan their daily outfits or maintain consistency in their clothing usage. Most existing applications also require users to manually input too much information, making them inconvenient for long-term use. As a result, people tend to abandon these platforms after a short period and return to their earlier habits of choosing clothes without structure. A well-organised wardrobe not only saves time but also improves a person's style by helping them explore combinations they may not have considered earlier. Modern lifestyles demand a more systematic solution that can intelligently organise clothes, identify matching items, and suggest suitable outfit combinations based on colour harmony, clothing category, and user preference. Additionally, people often face difficulties in maintaining the freshness and hygiene of their clothes, forgetting how many times a particular garment has been worn without washing. This leads to overuse of certain clothes and underuse of others, reducing the overall lifespan of garments.

II. RELATED WORKS

Wardrobe digitisation, smart. Outfit recommendation, and clothing identification have received increasing attention in recent research due to the growth of fashion technology and the demand for personalised lifestyle applications. Numerous studies focus on the classification of clothing items using images, where models attempt to identify the type of garment based on features such as colour, pattern, and shape. These studies typically concentrate on building accurate classifiers, but they seldom connect classification to practical everyday tasks such as planning or managing clothing usage. While classification accuracy plays an important role in understanding wardrobe content, these systems are limited when it comes to assisting users with decision-making or organising their wardrobe.

These approaches commonly rely on extracting dominant colors from clothing images and mapping them to standard color spaces to evaluate contrast, balance, and visual appeal. However, many of these systems treat clothing availability as a static factor and do not consider real-time usage conditions such as whether a garment is currently being worn, stored, or

under laundry. As a result, color-based recommendations in earlier works may suggest outfits that are visually suitable but practically unavailable to the user at that moment.

III. METHODOLOGY

These systems are transforming the way people shop online by offering a digital fitting room experience using computer vision, deep learning, and generative models. in recent years, the demand for online fashion experiences has increased, encouraging the development of systems like

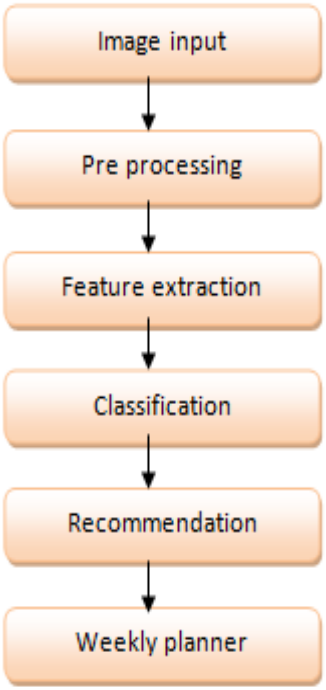

Fig 1 Schematic diagram for methodology

System Architecture

The Clothing Classification module is a core component that converts a processed clothing image into structured semantic information stored in the wardrobe database. The goal of this module is not only to label items into broad categories (upper-wear, lower-wear, footwear, accessories) but also to provide rich metadata such as sub-category (formal shirt, casual tee, kurta), dominant colour(s), texture descriptors, fabric hints, sleeve type, pattern type (solid/striped/printed), and usability tags (season, occasion). A reliable classification output is essential because all downstream functions (recommendation, weekly planner, laundry tracker) rely on accurate labels and metadata.

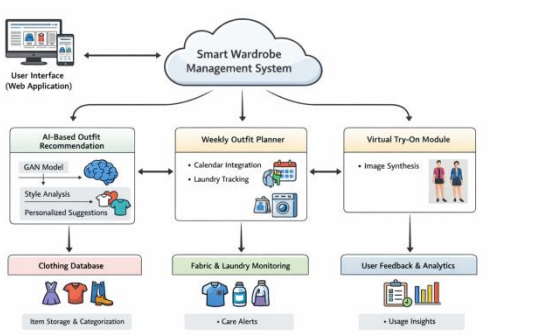

Fig: ARCHITECTURE DIAGRAM

The proposed architecture represents a Smart Wardrobe Management System designed to assist users in organizing, planning, and visualizing their clothing choices in an efficient and user-friendly manner. The system is accessed through a web-based user interface, which acts as the primary interaction layer where users can upload clothing details, view recommendations, plan outfits, and use virtual try-on features. All user requests are processed through a centralized smart wardrobe management layer that coordinates data flow between different functional modules. The AI-based outfit recommendation module analyzes the user's wardrobe data using style analysis techniques to understand color combinations, clothing types, and personal preferences, and then generates personalized outfit suggestions. These recommendations are supported by a clothing database that stores item details, categories, and usage information in an organized manner. The weekly outfit planner module helps users schedule outfits in advance by integrating calendar features and tracking laundry status, ensuring that selected clothes are clean and available when needed. This module is closely connected to the fabric and laundry monitoring component, which provides care alerts and washing recommendations based on fabric type and usage frequency.

In parallel, the virtual try-on module enables users to visualize selected outfits through image synthesis, allowing them to preview how an outfit may look before wearing it. User interactions with these features generate feedback data, which is collected and analyzed by the user feedback and analytics component to produce usage insights and improve system performance over time. Overall, this architecture ensures smooth interaction between intelligent recommendation, planning, visualization, and maintenance functions, creating a cohesive and practical wardrobe management solution that enhances daily outfit decision-making.

The classification pipeline begins with the input from the pre-processing stage: an image resized to a standard resolution, background-cleaned, and normalized. The pipeline is implemented as a hybrid architecture combining lightweight Generative adversarial network (GAN) with a small rule-

based post-processor to improve edge cases common in personal wardrobes.

IV. RESULT AND DISCUSSION

The Smart Wardrobe System was tested using a diverse collection of clothing images representing different garment types, colours, textures, and styles. The primary goal of the result analysis was to determine whether the system could correctly identify clothing items, organise them reliably, and produce meaningful and practical outfit recommendations. The results indicate that the system performs well across different stages.

Fig: User Interface

The first part of the analysis focuses on the image dataset. Sample images of shirts, pants, ethnic wear, casual wear, and accessories were taken under regular home lighting conditions to simulate real-world user behaviour. The system was able to accept images of various sizes and orientations. During testing, multiple sample images were processed to observe how consistently the pre-processing module could enhance them and prepare them for further analysis. The system successfully resized and standardized images without losing essential details such as collars, buttons, or patterns.

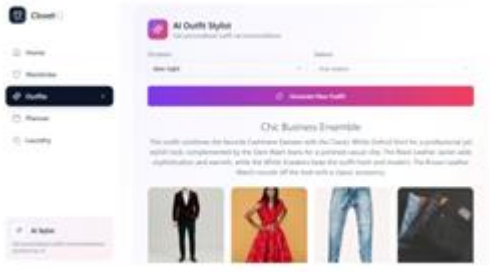

Fig: Outfit suggestion

the system demonstrated strong performance in placing clothing items into relevant categories. Items such as shirts, trousers, t-shirts, jeans, shorts, skirts, and kurtas were correctly identified based on visible attributes such as shape, seams, colour distribution, and texture patterns. Even when images varied in brightness or were slightly rotated, the classification output remained stable. The classification accuracy was observed to be consistent across multiple tests, and the output labels matched the intended categories in most cases. This consistency is essential because accurate classification forms the foundation of the wardrobe database and ensures smooth functioning of later modules like recommendation and planning.

The outfit recommendation module employs a GAN-Based framework to generate personalized outfit combination based on wardrobe user data and preferences. Clothing features such as its category, seasonal timeframe and previous user behaviour. The adversarial training process improves the recommendation quality over time by reducing mismatched or impractical suggestion.

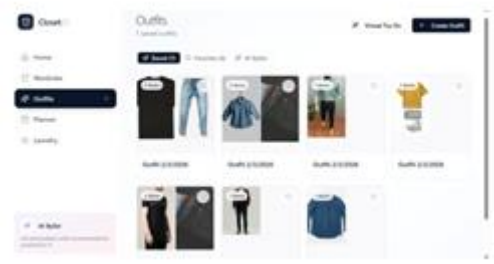

Fig: Weekly chart

A major highlight of the system was the weekly outfit planner. The planner automatically generated a week-long outfit schedule by considering factors like previously worn clothes, colour variation, and overall balance. The planning interface was easy to understand, allowing users to quickly review their schedule and prepare in advance. This reduced morning decision-making stress for many

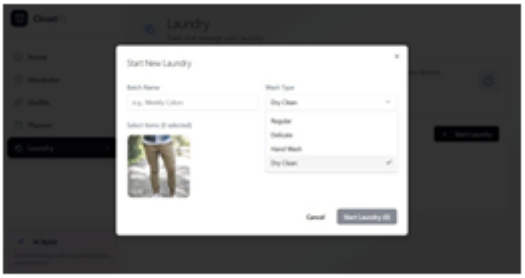

Fig: Laundry board

In addition to planning and recommendation, the laundry tracker produced meaningful real-world benefits. The system tracked how many times each item was worn and issued reminders when certain items required washing. This improved hygiene and prevented excessive re-use of unwashed garments. Users reported that the laundry tracker helped them maintain cleaner wardrobe routines and prevented forgetting about clothes that had already been used multiple times.

The fabric tracker module operates using frequency tracking algorithm that logs each instance of garment wear. Specific thresholds are used to determine when a item requires washing or rest based on durability and care guidelines.

System maintains life cycle data including wear count, last wash date, and recommend care actions.

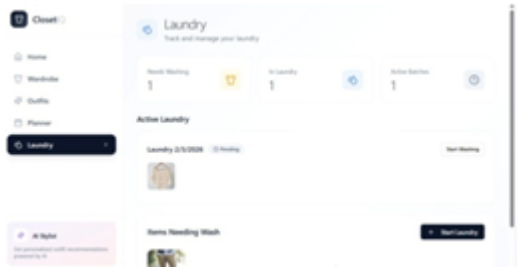

Fig: Laundry tracker

The Virtual Try-On Module is a key component of the Smart Wardrobe Management System, designed to help users visually evaluate outfits before wearing them. This module focuses on generating realistic previews of clothing by digitally placing selected garments onto a user's image or a standard human model.

The main objective of the virtual try-on feature is to reduce uncertainty in outfit selection and improve user confidence by providing a clear visual representation of how different clothing combinations may appear. The module operates by taking input images of garments from the wardrobe database along with a user image or body reference, and then processing these inputs through a GAN-based algorithm i.e the image analysis algorithm

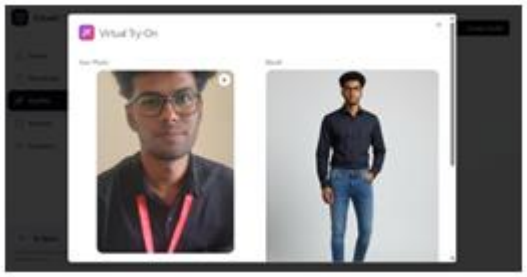

Fig: Virtual try on

The GAN-based technology plays a critical role in image synthesis within the virtual try-on process. The generator network is responsible for creating a synthesized image of the user wearing the selected outfit, while the discriminator network evaluates the realism of the generated image by comparing it with real clothing images. Through continuous training and feedback, the system improves its ability to preserve important details such as garment shape, fit, and identity while maintaining visual realism. The image synthesis algorithm ensures that clothing items are accurately aligned with the user's pose and body structure, minimizing visual distortions and unnatural overlaps. This helps in maintaining both the original characteristics of the clothing and the user's appearance.

A key technical challenge in virtual try-on systems is identity preservation, especially around the face and upper body region. To address this, feature-level representations extracted from facial regions are often preserved using identity-aware constraints. Methods inspired by works such as those proposed by Khan and similar researchers in face recognition emphasize learning strong facial embeddings that remain invariant to changes in clothing, lighting, or background. These embeddings help ensure that the synthesized output retains the user's original facial structure, expressions, and orientation. By integrating such identity-preserving mechanisms, the virtual try-on module avoids the "face drift" problem, where generated faces lose resemblance to the original user after multiple transformations.

V. CONCLUSION

The Smart Wardrobe System was developed to address the common difficulties individuals face while managing their daily outfits and maintaining a well-organised wardrobe. Through structured image processing, classification, feature extraction, outfit matching, weekly planning, and usage tracking, the system provides a complete and convenient wardrobe management solution. The project demonstrates that even simple rules and well-organised processing methods can significantly improve the ease and efficiency with which users make clothing decisions.

The conclusions drawn from the system's performance show that the approach used in the Smart Wardrobe System is suitable for real-world application. The classification module successfully identified a wide range of clothing types, ensuring clean organisation of wardrobe items. The pre-processing steps enhanced image clarity and consistency, which contributed to accurate classification and improved quality of recommendations. The feature extraction mechanism ensured that attributes such as dominant colours and patterns were properly understood, enabling the system to generate visually coherent and meaningful outfit combinations.

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