DATA DRIVEN DIGITAL WARDROBE FOR APPAREL MANAGEMENT

A PROJECT REPORT

Submitted by

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in partial fulfillment of the requirements for the award degree of

Bachelor in Engineering

20CS7503 DESIGN PROJECT-3

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

K.RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(AUTONOMOUS)

SAMAYAPURAM - 621112

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BONAFIDE CERTIFICATE

The work embodied in the present project report entitled "**DATA DRIVEN DIGITAL WARDROBE FOR APPAREL MANAGEMENT"** has been carried out by the students **SHANMATHI S, UMA MAHESWARI K, VEDHA VARSHINI V,** The work reported herein is original and we declare that the project is their own work, except where specifically acknowledged, and has not been copied from other sources or been previously submitted for assessment.

Date of Viva Voce: ……………………

Mr. M. A. PRASANNA, M.Tech.,	**Mr. R. RAJAVARMAN, M.E.,(Ph.D.,)**
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INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

The increasing use of mobile applications for lifestyle management has opened new possibilities for organizing personal belongings digitally. Clothing management, which is often unstructured and time-consuming, results in repeated outfit use, underutilized garments, and a lack of awareness about individual wardrobe patterns. The project titled “Data Driven Digital Wardrobe for Apparel Management” presents an Android-based application that enables users to store, track, and analyze their wardrobe items efficiently.The system allows users to add clothing by uploading images through URI - based storage and entering essential details such as color, type, and category. Each item maintains a dynamic wear count, enabling the application to identify frequently worn and rarely used clothes. Through integrated analytics, the app generates meaningful insights about wardrobe usage patterns and supports sustainable dressing habits by encouraging the reuse of underutilized outfits.Developed using Android (Java), RecyclerView components, SQLite/Firebase storage options, and image handling techniques, the system ensures smooth item management, secure data retention, and efficient rendering of clothing images. The application architecture includes modules for item registration, data storage, wear-tracking, and usage analysis.

Keywords: Clothing Management, Image Based Store, Sustainable Fashion, SQLite / Firebase,usage optimization.

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SIGNATURE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

URI	-	Uniform Resource Identifier
API	-	Application Programming Interface
AR	-	Augmented Reality
CRUD	-	Create, Read, Update, Delete
XML	-	Extensible Markup Language
OOM	-	Out of Memory(Android Performance Term)
BLE	-	Bluetooth Low Energy
QoS	-	Quality of Service
FPS	-	Frames Per Second
UI/UX	-	User Interface / User Experience
SQLI	-	SQL Injection(Security Testing)
RTD	-	Real Time Data
AES	-	Advanced Encryption Standard
JSON	-	JavaScript Object Notation
APK	-	Andriod Package Kit
URL	-	Uniform Resource Identifier

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The rapid rise of mobile applications and digital organization tools has transformed how people manage their daily activities, yet wardrobe management remains largely manual and unstructured. Most individuals struggle to remember what clothes they own, how often they use them, or which items remain unused, leading to repetitive outfit choices, clutter, and unnecessary shopping. With growing awareness of sustainable living and mindful consumption, there is a need for a system that helps users optimize the use of their existing wardrobe. The Digital Wardrobe project addresses this need by providing an Android-based platform where users can store clothing images, track wear frequency, and analyze usage patterns through simple data insights. By digitizing wardrobe management, the system reduces decision fatigue, encourages sustainable fashion habits, and helps users make better use of the clothes they already own.

1.2 OVERVIEW

The Digital Wardrobe project is designed to bring everyday clothing management into a structured, intelligent, and user-friendly digital environment. In today’s fast-paced lifestyle, people often struggle with organizing their wardrobe, remembering what they own, and deciding what to wear. This leads to repeated outfit choices, underutilized garments, and unnecessary purchases. The Digital Wardrobe system addresses these challenges by offering an Android-based application that allows users to add clothing items through images, store detailed attributes such as color, category, and type, and maintain a complete digital record of their wardrobe. A key feature of the system is the wear-count tracking mechanism, which automatically updates how many times each item has been worn, enabling users to gain clear insights into their dressing patterns. Using Android components such as RecyclerView, adapters, and URI-based image management, the application ensures smooth browsing of wardrobe items and an intuitive user interface.

Beyond simple storage, the system incorporates lightweight data analytics to help users identify frequently used outfits, rarely worn clothes, and potential wardrobe gaps. By visualizing patterns in outfit usage, the app encourages smarter clothing decisions and supports sustainable fashion habits. The modular structure of the project including clothing registration, display, wear tracking, and usage analysis ensures scalability and easy future expansion, such as adding recommendation systems or color-based matching. Overall, the Digital Wardrobe project modernizes personal clothing management, enhances the user’s daily decision-making process, reduces clutter, and promotes mindful consumption through a smart, accessible, and mobile-driven solution.

1.3 PROBLEM STATEMENT

Many individuals struggle to manage their wardrobe effectively due to the absence of a structured system that tracks what clothes they own and how often they use them. As a result, several garments remain unused or forgotten, while a few are repeatedly worn, leading to limited outfit variety and inefficient daily decision-making. Without proper tracking, users lack visibility into their clothing habits and often end up purchasing new clothes unnecessarily, contributing to wardrobe clutter and unsustainable consumption patterns.

Furthermore, manually monitoring clothing usage is inconvenient, time-consuming, and not practical in everyday life. Traditional methods offer no analytics, no automated wear-count tracking, and no insights into underutilized items. This creates a clear need for a mobile-based solution that can digitally catalog clothes, store images and details, track wear frequency in real time, and analyze usage trends.

1.4 OBJECTIVE

The primary objective of the Digital Wardrobe project is to create a smart, mobile-based system that helps users efficiently organize, track, and manage their clothing items through a centralized digital platform. The system aims to simplify wardrobe handling by allowing users to upload images of their clothes, store essential details, and automatically monitor wear frequency, enabling informed outfit decisions and reducing the chances of repeating or forgetting garments.

A secondary objective is to integrate lightweight data analytics to identify usage patterns, highlight underutilized items, and promote more sustainable fashion habits. By offering insights into frequently and rarely worn clothes, the project encourages mindful consumption and helps users control unnecessary purchases. The system also aims to improve user convenience by providing an intuitive interface, smooth item browsing, and scalable features that can support future enhancements such as outfit recommendations or color-based matching. Together, these objectives contribute to creating a modern, efficient, and sustainable wardrobe management experience.

1.5 IMPLICATION

The Digital Wardrobe project demonstrates how mobile technology and data analytics can significantly improve personal lifestyle management. By digitizing wardrobe organization, the system helps users develop a clearer understanding of their clothing usage patterns, reducing the tendency to repeat outfits and making daily outfit selection faster and more informed. This promotes mindful consumption, as users become more aware of underutilized garments and are less likely to make unnecessary purchases, thereby contributing to cost savings and sustainable fashion habits.

On a broader scale, the project highlights the potential of integrating lightweight analytics into everyday decision-making systems. The implementation provides a foundation for future advancements such as personalized outfit recommendations, season-based styling suggestions, and sustainability-driven insights. It also encourages the adoption of digital solutions to reduce clutter, optimize resource usage, and support environmentally conscious behavior. Overall, the Digital Wardrobe system showcases how technology can enhance convenience, promote sustainable choices, and influence positive lifestyle transformation.

CHAPTER 2

LITERATURE SURVEY

2.1 MOBILE APPLICATION FOR PERSONAL WARDROBE MANAGEMENT

K. Johnson and A. Patel (2020) presented a comprehensive study on the development of a mobile application aimed at improving personal wardrobe management by digitizing the process of clothing organization. Their research highlights the common challenges users face with traditional wardrobe systems, such as limited visibility into available garments, difficulty recalling rarely worn items, and the overall inefficiency of manually maintaining wardrobe records. To address these issues, the authors design a mobile application that enables users to upload clothing images, annotate them with attributes like color, fabric type, category, and usage purpose, and classify items into structured groups for easy retrieval. A major emphasis of their work lies in crafting an intuitive and user-centered interface, as the success of wardrobe management heavily depends on ease of use and visual clarity.

They incorporate UI/UX principles such as smooth navigation, minimalistic layout design, thumbnail-based garment galleries, and rapid image loading to ensure a seamless user experience. The researchers also integrate gesture-based controls, enabling users to swipe through outfits effortlessly, and implement a responsive grid layout to visually represent large clothing collections without causing clutter. The study includes extensive user testing sessions to assess the app’s practicality and usability across different age groups and wardrobe sizes.

The results indicate that digital wardrobe tools significantly reduce the time spent searching for clothing items, assist users in planning outfits for specific occasions, and improve overall wardrobe awareness.

2.2 IOT-BASED SMART WARDROBE FOR AUTOMATED OUTFIT SUGGESTIONS

R. Kumar and S. Sharma (2021) presented a highly innovative and forward-thinking study that explores the integration of Internet of Things (IoT) technologies into personal wardrobe management. Their research introduces a fully automated smart wardrobe system designed to reduce human effort in tracking clothing usage, monitoring garment condition, and generating outfit suggestions. The authors develop a prototype equipped with embedded sensors such as RFID tags, infrared detectors, and load sensors that can automatically identify the presence, absence, and movement of each clothing item inside the wardrobe. This eliminates the need for manual logging and ensures that garment status is always updated accurately.

The system communicates continuously with a cloud-based server using Wi-Fi and Bluetooth Low Energy (BLE), allowing real-time synchronization of wardrobe data. Users can remotely access their wardrobe inventory through a companion app, even when not physically near their wardrobe. The authors emphasize that this connectivity ensures efficient wardrobe management, reduces clothing misplacement, and maintains up-to-date usage logs without user intervention. The authors also outline the scalability of IoT for smart home integration, suggesting that future wardrobe systems can be fully autonomous and interactive.

The cloud server also stores historical wear patterns, enabling long-term tracking of garment utilization and helping identify items that are underused or neglected. A key highlight of the study is the integration of external smart data sources, particularly weather APIs and contextual environmental information. By analyzing parameters such as temperature, humidity, season, and anticipated weather conditions, the wardrobe is capable of generating intelligent, context-aware outfit suggestions. This means the system not only considers a user’s personal preferences but also adapts recommendations to real-world environmental factors, enhancing practicality and convenience. Furthermore, the authors discuss how IoT-based wardrobe systems can transform into central components of smart home ecosystems.

2.3 HYBRID MOBILE SOLUTIONS FOR SUSTAINABLE DAILY DECISION-MAKING

D. Lewis and P. Verma (2025) presented an extensive study on hybrid mobile application architectures designed to support sustainable lifestyle decision-making through a combination of on-device processing and cloud-based analytics. The authors argue that growing environmental concerns and increasing digital dependence have created a need for intelligent systems that not only guide user decisions but also promote long-term behavioral change. Their proposed hybrid framework leverages the strengths of both local and cloud components-local storage ensures quick access to essential user data such as wardrobe items, while cloud analytics handle large-scale data processing, trend detection, and predictive modelling.

This dual approach enables the application to deliver fast, reliable performance without overwhelming device resources, while simultaneously offering deep analytical insights that can adapt over time. When applied specifically to wardrobe management, the hybrid model helps track garment usage patterns, identify underutilized clothing, and suggest more sustainable dressing habits. Lewis and Verma highlight that combining local tracking mechanisms with cloud-based learning models allows the system to analyze trends across longer periods, detect wasteful consumption behaviors, and provide tailored sustainability recommendations.

The authors back their claims with numerous user studies demonstrating that hybrid mobile systems significantly improve user engagement due to their speed, reliability, and ability to provide highly personalized insights.

2.4 INTELLIGENT OUTFIT RECOMMENDATION SYSTEM USING MACHINE LEARNING

Y. lin, H. Chen (2020) introduces a highly intelligent outfit recommendation system that leverages machine learning to personalize clothing suggestions based on user behavior and fashion preferences. The authors address the challenges commonly faced in manual outfit selection, such as limited creativity, repetitive styling patterns, and the cognitive burden of deciding what to wear each day. To overcome these limitations, the proposed system analyzes a combination of user-specific attributes - including previously worn outfits, frequently selected colors, preferred fashion styles, and seasonal trends - to build a dynamic preference model that evolves over time.

The recommendation engine utilizes supervised learning techniques to classify clothing items and identify compatibility between tops, bottoms, and accessories. Additionally, collaborative filtering is employed to compare similarities across user profiles, enabling the system to suggest outfits inspired by users with matching fashion tastes. The system integrates seamlessly with a digital wardrobe database, ensuring that recommendations are not just theoretically optimal, but also practical and tailored to the items actually owned by the user.

The authors emphasize how the continuous learning capability of the model allows it to adapt to changes in user behavior, such as newly added clothing items, updated style preferences, or evolving seasonal requirements. The study also outlines the potential for integrating more advanced models such as deep neural networks to recognize complex fashion patterns, style compatibility rules, and aesthetic appeal based on image-based inputs. By demonstrating how machine learning can significantly reduce decision fatigue and enhance fashion creativity, the research highlights the strong relevance of predictive analytics in wardrobe applications. Overall, this work reinforces the importance of intelligent algorithms in transforming traditional wardrobe management into a personalized, automated, and user-centric fashion experience.

2.5 DATA-DRIVEN SUSTAINABILITY IN FASHION CONSUMPTION

L. Niinimaki, G. Peters (2021) introduced an in-depth examination of how data analytics can be used as a powerful tool to promote sustainability within the fashion consumption ecosystem. The authors highlight that one of the major contributors to textile waste is the lack of visibility into personal wardrobe usage, which results in individuals purchasing new garments without realizing how many existing items remain unused or rarely worn. Through the systematic collection of wear frequency, garment lifecycle duration, and behavioral patterns, the researchers demonstrate that data-driven insights can significantly reshape how users interact with their wardrobe. By analyzing how often an item is worn, how long it stays in rotation, and what factors influence its selection, the system identifies inefficient usage habits and reveals hidden areas of fashion waste that would otherwise go unnoticed.

The study further emphasizes that presenting users with detailed analytics such as underutilized garments, rarely worn colors, and seasonal usage variation encourages more conscious purchasing behavior and promotes a longer lifespan for existing clothing. This empowers individuals to make informed decisions rather than relying on spontaneous or trend-driven shopping patterns.

The authors also discuss the broader environmental implications of fast fashion, noting that rapid production cycles, short-lived trends, and low-cost apparel contribute to increased carbon emissions and textile pollution. They argue that digital wardrobe tools equipped with data analytics have the potential to counteract these issues by guiding users toward more mindful consumption habits. The research concludes that integrating analytics into personal wardrobe management not only helps reduce unnecessary textile waste but also supports circular fashion principles, thereby offering a scalable and practical solution to sustainability challenges in the fashion industry.

2.6 DIGITAL LIFESTYLE MANAGEMENT SYSTEMS WITH PERSONALIZED INSIGHTS

P. P. Reddy and L. Fernandes (2022) presented a comprehensive study on the evolution of digital lifestyle management systems that leverage personalized insights to help users make informed, efficient, and sustainable daily decisions. The authors argue that traditional lifestyle applications often provide generic recommendations that fail to reflect the unique patterns and preferences of individual users. To address this limitation, their research introduces a personalization-driven framework that captures user-specific behavioral data such as daily routines, historical choices, preference trends, and interaction frequency and processes it to generate tailored suggestions. This approach acknowledges that lifestyle behaviors, including clothing selection and usage patterns, vary significantly among individuals and therefore require customized solutions rather than one-size-fits-all models.

The study emphasizes the value of integrating data mining techniques with mobile computing to analyze user behavior in real time. By applying clustering, pattern recognition, and association rule mining algorithms, the system identifies meaningful correlations between the user's habits and lifestyle needs. When this framework is applied specifically to wardrobe management, it becomes possible to detect style preferences, predict clothing combinations the user is likely to choose, and highlight garments that fit the user's personal dressing patterns. Reddy and Fernandes demonstrate that such personalized insights help users rediscover overlooked clothing items, improve outfit coordination, and plan attire more efficiently for different occasions or seasons.

They further highlight how these systems can reduce decision fatigue by narrowing down choices and presenting only the most relevant recommendations. The study also discusses future possibilities such as integrating psychological factors, emotional states, and contextual cues into the recommendation engine.

2.7 FASHION IMAGE CLASSIFICATION USING CONVOLUTION NEURAL NETWORKS (CNN)

J. Smith and A. Gupta (2018) presented a foundational study on the application of Convolutional Neural Networks (CNNs) for automated fashion image classification, a technology that has become crucial for modern digital wardrobe systems. Their research addresses the limitations of manual clothing identification, which is often tedious, inconsistent, and error-prone, especially when dealing with large or diverse garment collections. To overcome these challenges, the authors develop deep learning models capable of extracting visual features such as shapes, textures, patterns, and color combinations directly from clothing images. These extracted features enable the system to accurately categorize garments into predefined classes like tops, pants, dresses, jackets, and accessories with significantly higher accuracy than traditional image processing techniques.

The study explores several CNN architectures, including LeNet, AlexNet, and VGGNet, evaluating their performance on large-scale fashion datasets. Smith and Gupta demonstrate that deeper architectures with multiple convolutional layers are more effective at capturing complex visual cues that differentiate subtle garment types, such as distinguishing between similar-looking tops or identifying pattern variations like stripes, florals, or prints. Their experiments show that CNNs not only improve classification accuracy but also reduce the need for manual feature engineering, making the system more scalable and adaptable as new clothing categories are introduced.

The authors also highlight practical implications for wardrobe management systems. By automating garment detection and classification, CNN models enable users to upload clothing images effortlessly without having to manually tag or describe each item. This enhances user convenience and dramatically accelerates the process of digitizing a wardrobe..

2.8 SMART WARDROBE MANAGEMENT USING IMAGE PROCESSING

A. verma, P. Gupta (2019) presented an intelligent wardrobe management system that harnesses the power of image processing to automate the classification and organization of clothing items. The study highlights that traditional wardrobe management often relies heavily on manual sorting, which is time-consuming, prone to human error, and inefficient when dealing with large clothing collections. Using techniques like edge detection, color histogram analysis, and contour extraction, the system analyzes clothing images and assigns meaningful labels without requiring user intervention.

The structured information is stored in an SQL-based database, allowing users to search, sort, and filter items quickly through a mobile interface. The study highlights that traditional wardrobe management often relies heavily on manual sorting, which is time-consuming, prone to human error, and inefficient when dealing with large clothing collections.

The authors further emphasize the flexibility of image-based classification, noting that it can adapt to multiple clothing categories and support updates as users add new items. Additionally, the paper discusses the potential extension of the system using machine learning techniques, which could allow the model to learn user preferences and improve classification accuracy over time.

2.9 USAGE ANALYTICS FOR LIFESTYLE OPTIMIZATION APPLICATIONS

T. Williams and D. Singh (2023) present an extensive study on the role of usage analytics in enhancing lifestyle optimization applications, particularly those focused on personal habit tracking and behavior-driven decision support. Their research argues that modern digital systems must go beyond simple data collection and instead transform user activity information into insightful, actionable patterns.

The authors emphasize that many lifestyle challenges-such as inefficient clothing usage, repetitive outfit choices, and cluttered wardrobes-are rooted in a lack of visibility into one’s own behavioral patterns. By integrating analytics models that monitor and interpret user actions over time, applications can generate meaningful insights that directly influence user decision-making. Within the context of wardrobe management, Williams and Singh propose a framework that captures data such as wear frequency, seasonal variation in outfit selection, and long-term garment usage trends. Their model identifies patterns such as frequently ignored clothes, overused items nearing replacement, and clothing categories that require better rotation. Using statistical analysis and lightweight machine learning techniques, the system transforms raw user data into visual summaries and predictive indicators. This not only helps users make informed outfit choices but also encourages them to adopt more balanced clothing usage habits.

The authors highlight the psychological benefits of presenting data-driven insights to users, noting that measurable feedback strengthens self-awareness and significantly improves decision efficiency. Their user studies demonstrate that individuals who receive analytics-based wardrobe feedback exhibit greater satisfaction with their daily outfit planning and are less likely to engage in impulsive clothing purchases. The research also outlines how usage analytics can be combined with notification systems, personalized recommendations, and goal-setting features to further improve user engagement and long-term behavior change.

2.10 CLOUD-BASED DIGITAL CLOSET WITH MULTI-DEVICE ACCESS

M. Zhang and R. Das (2022) presents a comprehensive study on the development of a cloud-based digital wardrobe system designed to provide seamless, multi-device access to personal clothing inventories. Their research addresses a significant limitation of traditional wardrobe applications, which often rely on local device storage and restrict users to accessing their wardrobe data from a single device.

To overcome this constraint, the authors propose a cloud-integrated architecture where all garment images, metadata, and usage logs are stored in a centralized server. This centralized storage enables instant synchronization of wardrobe updates across multiple platforms, including smartphones, tablets, and desktop computers, ensuring that users can manage and view their wardrobe from any device at any time.

The study highlights the robustness and reliability offered by cloud infrastructure, particularly in terms of data security, backup mechanisms, and scalable storage capacity. Zhang and Das demonstrate that cloud hosting allows wardrobe applications to handle large clothing datasets without compromising performance or causing storage limitations on user devices. Moreover, the authors introduce efficient data retrieval strategies and optimized indexing techniques to ensure fast loading of clothing images and categories, even when accessed from remote locations or low-bandwidth networks.

The researchers also emphasize the practical advantages of multi-device accessibility in smart wardrobe management. For example, users can browse their wardrobe from a laptop while planning outfits for upcoming events, update garment information through their phone after laundry, or view clothing suggestions on a tablet before shopping. This flexibility enhances user engagement and provides a more natural integration of the wardrobe system into daily routines.

CHAPTER 3

EXISTING SYSTEM

In the existing scenario, wardrobe management is done manually, where users rely on memory or physical sorting to keep track of their clothing items. There is no structured system to record details such as clothing type, color, usage frequency, or season-based suitability. As a result, users often forget what items they own, leading to repeated outfit choices and underutilization of many garments. Organizing clothes becomes time-consuming and inefficient, especially when wardrobes grow larger or lack proper categorization. Traditional methods also fail to provide any insights about garment usage patterns, making it difficult for individuals to identify rarely worn items or evaluate which outfits need replacement. Furthermore, existing systems do not support image-based wardrobe visualization, so users cannot quickly browse their clothing collection or plan outfits effectively. Overall, the existing system lacks automation, personalization, data tracking, and smart recommendations. It does not assist users in decision-making, wardrobe optimization, or sustainable fashion practices, which creates a clear need for an intelligent, digital wardrobe management solution.

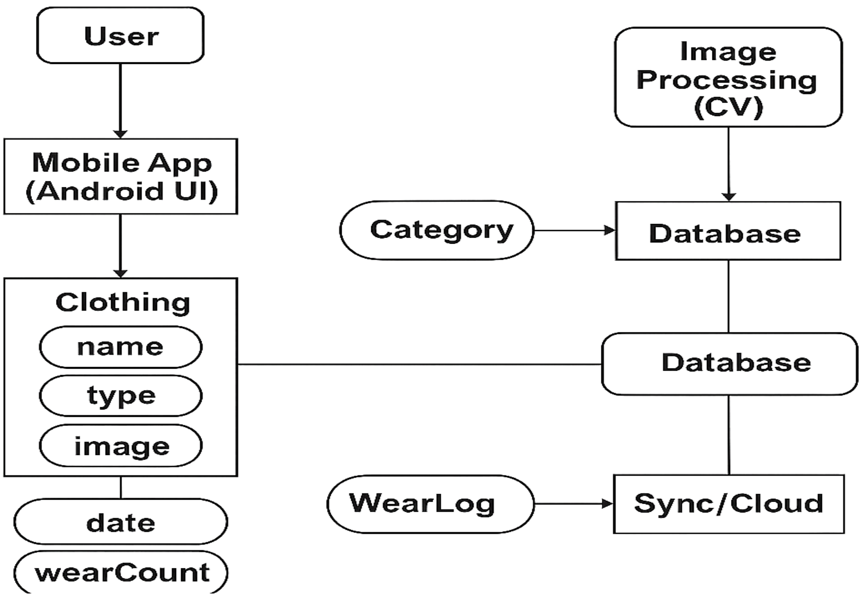

Fig. 3.1 Existing System Diagram

CHAPTER 4

PROBLEMS IDENTIFIED

Traditional wardrobe management practices, whether through physical closets or simple mobile galleries, face several challenges that limit efficiency, visibility, and long-term clothing utilization. Most individuals rely on memory to keep track of the garments they own, which becomes increasingly unreliable as wardrobe size grows. This lack of structured organization results in forgotten clothes, repeated outfit choices, and an inability to quickly locate appropriate items when needed. Physical wardrobes offer no systematic way to categorize garments by type, color, occasion, season, or usage frequency, making the process of outfit planning time-consuming and mentally exhausting. As a result, users often spend considerable time searching for clothes or making last-minute dressing decisions, leading to frustration and decision fatigue during daily routines.

Furthermore, there is no method in the existing system to monitor wear frequency or assess the lifecycle of each garment. Without tracking how often an item is worn, users cannot easily identify overused garments that need replacement or underused items that contribute to wardrobe clutter. This lack of visibility leads to inefficient use of clothing and encourages unnecessary purchases, contributing to textile waste and unsustainable consumption habits. Users are often unaware of the imbalance within their wardrobe-owning excessive items in one category while lacking essential items in another-which further complicates decision-making.Users often purchase new clothing impulsively-driven by trends, discounts, or social influence-without understanding whether the new item complements their existing wardrobe. This leads to mismatched clothing, incomplete outfit combinations, and a lack of coordinated styling options. The problem becomes more prominent for individuals with busy lifestyles, limited space, or large wardrobes, where managing physical items becomes impractical without a structured digital aid.

Manual wardrobe management also suffers from the absence of data insights and analytical feedback. There is no mechanism to analyze user habits, detect patterns in outfit choices, or provide guidance for improving wardrobe efficiency. Without such insights, users cannot recognize which garments align with their lifestyle needs, which items remain idle, or how their dressing preferences evolve over time. This limits their ability to make informed decisions about future purchases or decluttering efforts. In addition, manual systems do not support any form of recommendation or automated assistance, leaving users without smart suggestions for outfit combinations based on color, style, season, or previous usage.

Another major problem identified is the lack of a centralized digital platform for storing and managing wardrobe information. Many users attempt to capture clothing images on their phones, but these images remain scattered across galleries without meaningful tagging or categorization. This disorganized structure prevents users from having a clear digital overview of their wardrobe and diminishes their ability to plan outfits remotely or while shopping. Without a mobile or digital solution, users cannot check what items they already own, leading to duplicate purchases and further wardrobe clutter. Another significant issue arises from the lack of accessibility to wardrobe information when users need it the most. While shopping, traveling, attending events, or planning outfits for special occasions, individuals often face uncertainty about what they own or what items they should pair together. Without the ability to remotely access wardrobe details, they struggle to make informed choices, resulting in poorly planned outfits, unnecessary shopping, and inefficient wardrobe rotation.

Existing systems also fail to address the growing need for sustainability and mindful consumption. In the absence of usage tracking and insightful analytics, users are not aware of their consumption patterns or the environmental impact of fast fashion habits. There is no system to encourage sustainable practices such as reusing underutilized garments, maintaining balanced wardrobe rotation, or reducing unnecessary purchases. This gap becomes more critical as fashion waste continues to rise globally.

Additionally, the lack of personalization in current wardrobe management approaches creates further inefficiencies. Users have different dressing habits, lifestyle needs, work requirements, and event schedules, but manual systems cannot adapt to these individual differences. There is no mechanism to understand user behavior or offer suggestions tailored to personal style preferences. This results in users feeling overwhelmed by their wardrobe choices despite owning a large number of clothes.

Data management is another challenge in traditional wardrobe approaches. Without proper storage, organization, and retrieval mechanisms, wardrobe data is prone to inconsistencies and loss. Users have no way to integrate garment details such as purchase dates, fabrics, or usage records in a structured format. This makes it impossible to analyze the long-term value of each garment or track its lifecycle accurately.

Overall, the existing wardrobe management system lacks automation, personalization, organization, analytics, sustainability insights, and digital accessibility. These limitations highlight the need for a modern, intelligent, and data-driven digital wardrobe solution that can categorize clothes, track usage, provide recommendations, support sustainable habits, and deliver a centralized, user-friendly platform to optimize the entire wardrobe experience. Such a system would reduce decision fatigue, improve outfit planning, eliminate unnecessary purchases, and significantly enhance the overall efficiency of clothing management.

CHAPTER 5

PROPOSED SYSTEM

The proposed Digital Wardrobe system introduces a centralized and intelligent mobile platform designed to modernize wardrobe management. Instead of relying on memory or manual organization, the system allows users to digitize their wardrobe by uploading clothing images and entering essential attributes such as type, color, fabric, and category. This structured approach creates a complete, visually accessible inventory that helps users browse, search, and organize garments effortlessly. The interface is designed to be intuitive, enabling smooth navigation, easy item updates, and quick access to clothing details from anywhere.

A key component of the proposed system is its built-in usage tracking and analytics. Each time a user wears a garment, its wear count is updated, enabling the system to generate insights about wardrobe utilization. Over time, this data helps identify frequently worn items, neglected clothes, seasonal trends, and overall usage patterns. These analytics assist users in making informed decisions, promoting better wardrobe rotation, and reducing unnecessary purchases. By highlighting underused clothing and offering visibility into dressing habits, the system supports sustainable fashion practices and encourages mindful consumption.

The proposed solution is also designed with future scalability and adaptability in mind. Its modular architecture allows for the integration of advanced features such as AI-powered outfit recommendations, automatic color detection, cloud synchronization, and climate-based clothing suggestions. Additionally, storing all wardrobe information in a structured database ensures data consistency, reliability, and long-term accessibility. Overall, the proposed Digital Wardrobe system aims to deliver a smart, efficient, and user-friendly method of managing clothing, improving daily outfit planning, reducing clutter, and transforming the overall wardrobe experience. At its core, the system functions as a smart assistant that digitizes clothing items using images and metadata, ensuring every garment is documented with consistent formatting. The proposed system emphasizes intelligent usage analytics to provide insightful wardrobe summaries. By tracking the frequency of garment usage, the system identifies patterns that users would otherwise overlook. These analytics include monthly wear trends, seasonal recommendations, frequently chosen outfit combinations, and alerts for rarely worn items. Such insights empower users to maintain a more balanced wardrobe and prevent over-dependence on a small subset of clothing. Over time, it can incorporate AI-powered outfit recommendations based on color harmony, event suitability, and weather conditions. The system is also designed with modular extensibility to support cloud backup, multi-device access, and social sharing features, allowing users to exchange outfit ideas or maintain shared wardrobe inventories.

Another key enhancement of the proposed Digital Wardrobe system is the focus on ensuring long-term scalability and adaptability to users' evolving needs. As wardrobes grow and users add more garments over time, the system is designed to maintain optimal performance by employing efficient data structures, pagination techniques, and image caching mechanisms. This ensures that even when the wardrobe contains hundreds of items, the application continues to operate smoothly without compromising loading speed or responsiveness.

The modular design architecture enables each feature-such as outfit recommendation, wear-count updating, and analytics-to operate independently, allowing for easier maintenance and effortless integration of new functionality. This extensibility ensures that the system will remain future-proof and capable of supporting advanced features like automatic outfit generation, AI-driven style prediction, and cloud-based data synchronization.

5.1 ADVANTAGES

• Centralized digital wardrobe that keeps all clothing items organized with images and details.

• Automatic wear-count tracking helps users understand outfit usage patterns

• Quick and smart outfit selection through easy browsing and filtering.

• Prevents unnecessary and duplicate purchases by giving clear wardrobe visibility.

• Encourages sustainable fashion habits by highlighting underused clothes.

5.2 BLOCK DIAGRAM OF PROPOSED SYSTEM

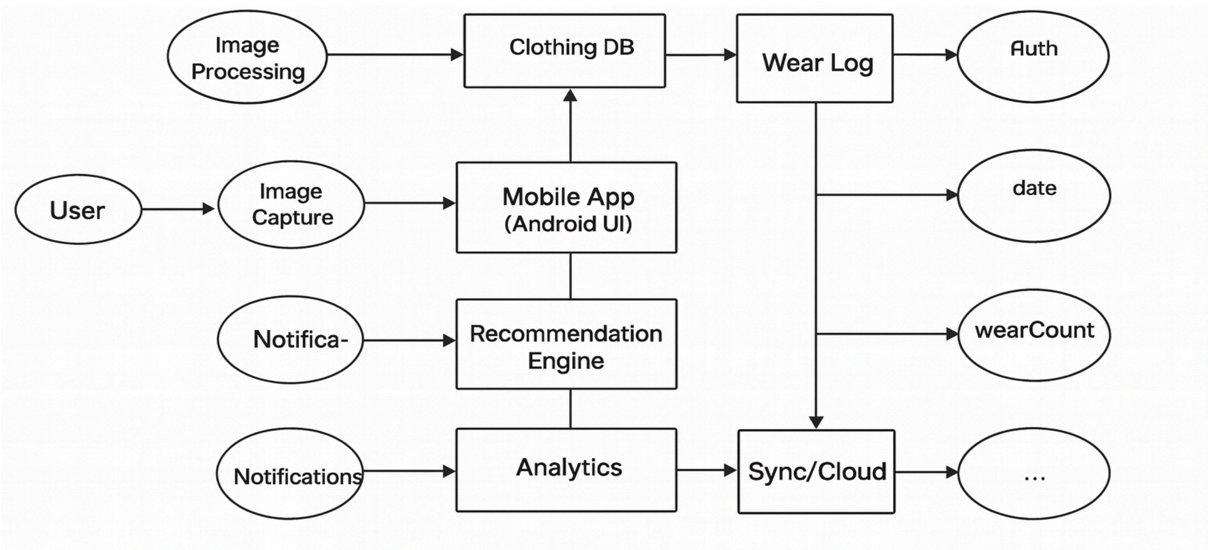

Fig. 5.1 Proposed System Diagram

CHAPTER 6

SYSTEM REQUIREMENTS

6.1 HARDWARE REQUIREMENTS

Component	Specification
Processor	Intel core i3 or higher
RAM	Minimum 2GB(4GB recommended)
Storage	At least 200–500 MB free (for storing images and app data)
Android Smartphone	Minimum Android 7.0 or above
Camera	Rear camera (8 MP or higher) for capturing clothing images

6.2 SOFTWARE REQUIREMENTS

Component	Specification
Operating System	Windows 10/11 (64-bit) or macOS (Big Sur or later) or Ubuntu 20.04+.
Android Studio	Android studio Flamingo (2022.2.x) or new version
Java Development Kit (JDK)	**JDK 11** (LTS) recommended
Image handling & CV / ML	**Glide** or **Coil** (image loading/caching)
Language & Libraries	**AndroidX** libraries (AppCompat, Core KTX where needed).

CHAPTER 7

SYSTEM IMPLEMENTATIONS

7.1 LIST OF MODULES

- Data Input & Collection Module.
- Data Storage & Management Module.
- Usage Analytics Module.
- Outfit Recommendation Module
- Sustainability Insights Module

7.2 MODULES DESCRIPTION

7.2.1 DATA INPUT AND COLLECTION MODULE

The Data Input & Collection Module serves as the foundational component of the Digital Wardrobe system, responsible for capturing all raw information that the application will process, store, and analyze. This module allows users to upload images of their clothing items through the mobile camera or gallery. Once an image is captured, the module prompts the user to enter essential garment attributes such as clothing type, color, fabric, size, category, season, brand, and purchase date. The module ensures data consistency by using predefined dropdowns and structured fields that prevent vague or inconsistent entries. It may also include optional automated tools like image cropping, background removal, and basic color detection to enhance data accuracy. The input validation mechanisms in this module prevent incomplete, duplicate, or incorrect entries, maintaining the overall data quality of the wardrobe database. Additionally, it may include functionality for capturing wear-count updates every time the user selects an outfit, enabling real-time data tracking. As the first interaction point between the user and the system, this module ensures a smooth and accurate onboarding of wardrobe items, directly influencing the reliability and richness of all subsequent modules.

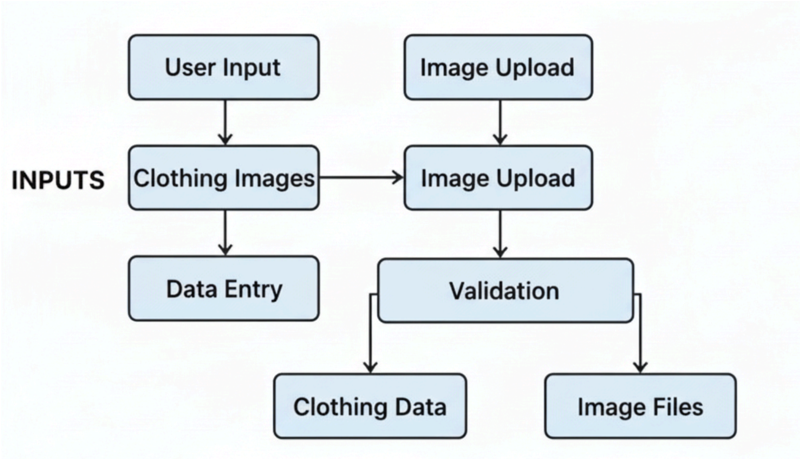

Fig. 7.2.1 Data Input & Collection Module

7.2.2 DATA STORAGE & MANAGEMENT MODULE

The Data Storage & Management Module is the backbone of the Digital Wardrobe system, responsible for securely storing all clothing-related data in a structured and organized format. This module typically uses local storage solutions such as Room Database or SQLite, ensuring fast access and offline availability of wardrobe information. It maintains tables for clothing items, categories, usage logs, metadata, and optional cloud backup details. The module ensures strong relational connectivity so that each clothing item is linked to its attributes, wear history, and classification data. Efficient indexing and query optimization allow for fast filtering, searching, and retrieval of garment information, even in large wardrobes.

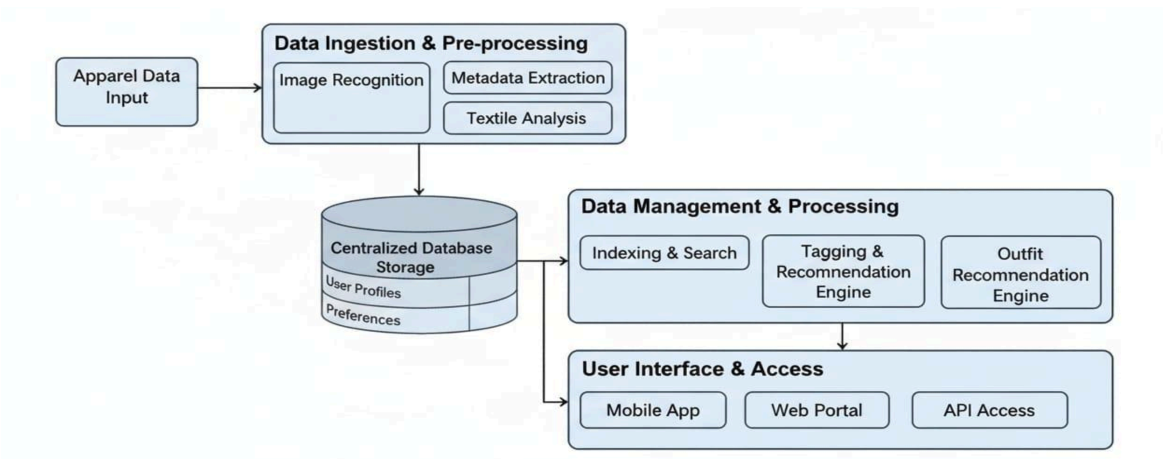

Fig. 7.2.2 Data Storage & Management Module

7.2.3 USAGE ANALYTICS MODULE

The Usage Analytics Module transforms raw wardrobe data into meaningful insights that help users understand their clothing habits and optimize daily outfit decisions. This module collects information such as wear-count logs, seasonal usage trends, color frequency, category distribution, and garment lifecycle metrics. Using this data, the module generates charts, summaries, and insights that highlight underused clothing items, frequently worn garments, and wardrobe imbalances. Advanced analytics can track long-term behavior, showing how the user’s style evolves over time or identifying which types of outfits are chosen most often for work, events, or casual outings. It can also detect patterns such as repeated outfit combinations, over-dependence on certain colors, and lack of category diversity.

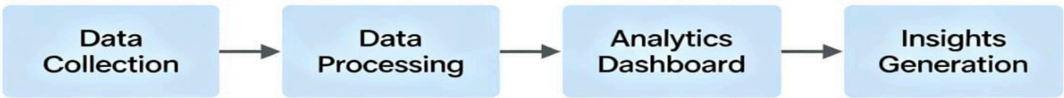

Fig. 7.2.3 Usage Analytics Module

7.2.4 OUTFIT RECOMMENDATION MODULE

The Outfit Recommendation Module is designed to assist users in styling outfits efficiently by generating intelligent clothing combinations based on various factors. This module analyzes stored wardrobe data, user preferences, past outfit choices, color harmony rules, and optional contextual inputs such as weather conditions or upcoming events. By processing these elements, the system recommends coordinated outfits that match the user’s style profile and wardrobe composition. Using logical rules or machine learning algorithms, the module identifies compatible top–bottom pairs, layering options, accessories, or seasonal outfit suggestions. This module analyzes stored wardrobe data, user preferences, past outfit choices, color harmony rules, and optional contextual inputs such as weather conditions or upcoming events.

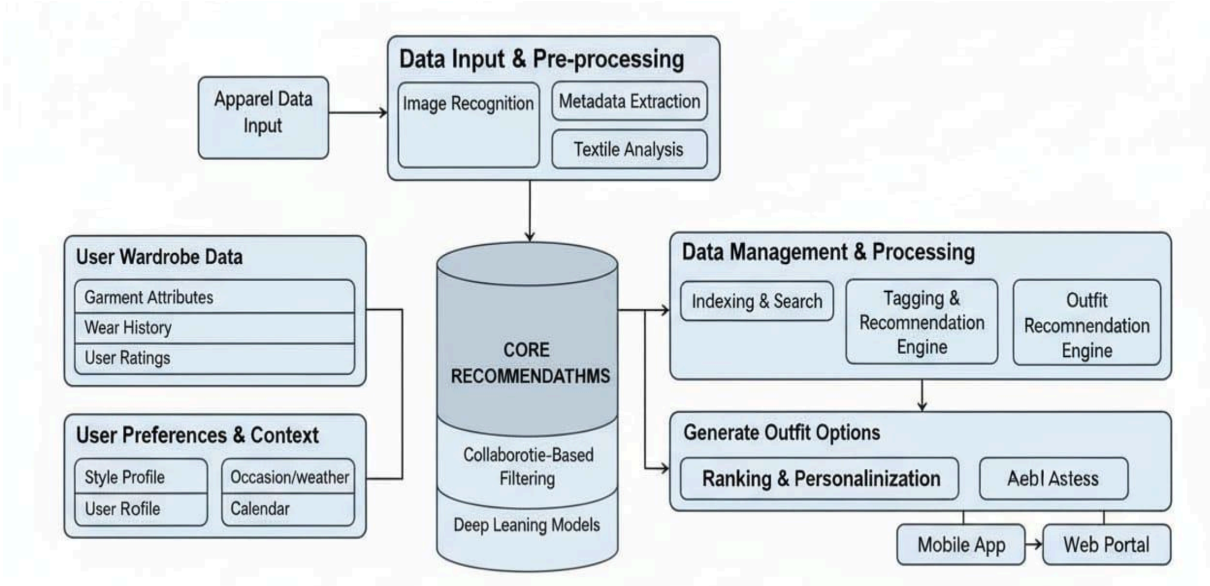

Fig. 7.2.4 Outfit Recommendation Module

7.2.5 SUSTAINABILITY INSIGHTS MODULE

The Sustainability Insights Module supports environmentally responsible fashion habits by analyzing wardrobe usage data and highlighting opportunities for reducing waste and improving garment longevity. This module tracks wear frequency, garment age, consumption patterns, and clothing diversity to identify items that are overused, underused, or rarely touched. It provides sustainability-focused feedback, such as recommending donation of unused items, encouraging repair of damaged but wearable clothes, or warning against repetitive purchasing of similar garments.

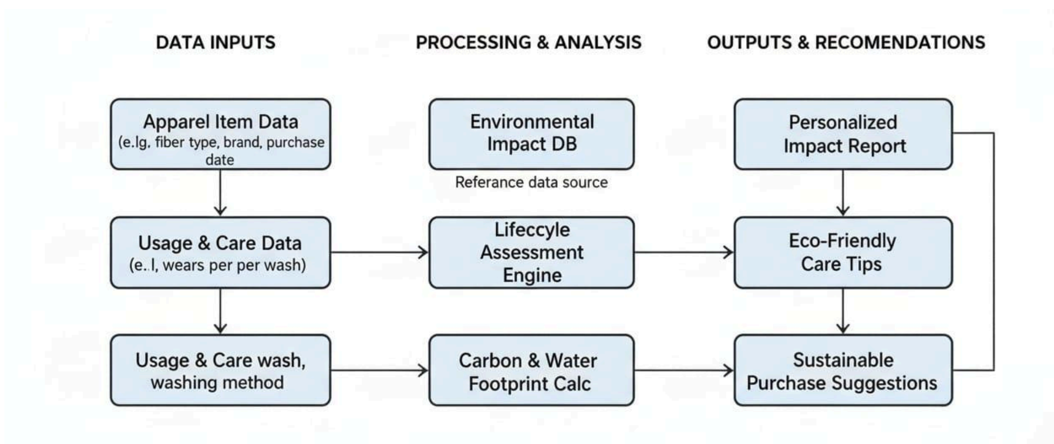

Fig. 7.2.5 Sustainability Insights Module

CHAPTER 8

SYSTEM TESTING

8.1 UNIT TESTING

Unit testing forms the cornerstone of the testing strategy for the Digital Wardrobe project, where each major component is tested in isolation to verify logical correctness, data handling, and error conditions. The project's core modules - Data Input & Collection, Data Storage & Management, Usage Analytics, Outfit Recommendation, and Sustainability Insights - were implemented with unit tests to ensure reliable operation before integration. Android-specific testing frameworks and libraries such as JUnit4, Robolectric (for JVM-level Android component tests), AndroidX Test, Mockito (for mocking), and androidx.room:room-testing (for Room/DAO tests) were used to automate these checks.

Unit testing uncovered issues early, such as improper image-URI handling that caused UI-thread blocking, off-by-one errors in wear-count aggregation, missing null-checks for optional metadata, and failure to handle failed sync retries. Fixing these at the unit-test stage reduced integration-level bugs and improved reliability. The test suite also serves as living documentation for expected behaviors of each module and enabled safer refactors, ensuring the Digital Wardrobe application remained robust as features were added.Throughout these tests, frameworks such as JUnit, Mockito, Robolectric, and the Room testing library were used to mock dependencies, simulate Android components, and run database operations in a controlled environment. These tools allowed the team to uncover issues early, including incorrect validation logic, inconsistent database mappings, faulty aggregation formulas in analytics, and mismatches in recommendation scoring. By identifying and resolving these issues at the unit level, the system achieved higher reliability, reduced integration problems, and maintained stable performance as additional features were introduced.

8.2 INTEGRATION TESTING

Integration testing played a critical role in validating how the individual modules of the Digital Wardrobe system interacted with one another once they were combined into a functional workflow. While unit testing ensured that each component worked correctly in isolation, integration testing focused on verifying that data flowed smoothly between modules and that combined functionalities behaved consistently under real usage conditions. The primary objective of this phase was to detect interface defects, mismatched data formats, synchronization issues, and logic conflicts that might arise when modules such as Data Input, Storage, Analytics, and Recommendation operated together as a system.

During integration testing, the Data Input & Collection module was first integrated with the Data Storage & Management module to ensure that clothing images, metadata, and wear-count updates captured by the user were properly transferred, validated, and stored in the Room database. Test cases verified that once an item was added, it immediately became available for retrieval and appeared correctly in the wardrobe list interface. Special attention was given to error propagation across modules-such as handling invalid data entries, broken image links, or failed sync attempts-and ensuring that meaningful feedback reached the user interface without causing application interruptions.Overall, integration testing validated that the Digital Wardrobe system operated as a cohesive and reliable application. It ensured that module boundaries were respected, data exchanges were accurate, and the entire workflow-from adding an item to receiving recommendations-functioned seamlessly.

8.3 SYSTEM TESTING

System testing was conducted to evaluate the Digital Wardrobe application as a fully integrated and operational system, ensuring that all components worked harmoniously to deliver the intended functionality. Unlike unit and integration testing, which focus on internal module logic and inter-module communication, system testing examines the entire application end-to-end from the user's perspective. The main objective was to validate that the system met all functional requirements, maintained performance under various load conditions, and delivered a seamless and error-free user experience across different devices and operating environments.During this phase, the complete workflow of the application-starting from data input, clothing registration, storage, wear-count updates, analytics generation, recommendations, and sustainability insights-was tested as a single cohesive process. Testers examined whether the application’s user interface correctly reflected real-time data changes, such as immediate appearance of newly added items, accurate wear-count increments, and timely updates in analytics dashboards. Critical paths, such as adding a clothing item, viewing wardrobe lists, generating outfit suggestions, and checking sustainability insights, were executed repeatedly under normal, boundary, and stress conditions to verify system robustness and reliability.This comprehensive evaluation ensured that the final application was stable, reliable, user-friendly, and aligned with the project’s intended goals of optimizing wardrobe management and enhancing user interaction with their clothing collection.

8.4 PERFORMANCE TESTING.

Performance testing was conducted to evaluate the efficiency, responsiveness, and stability of the Digital Wardrobe system under varying workloads and operating conditions. Since the application manages image-heavy data, database operations, background synchronization, and real-time analytics, performance testing played a crucial role in ensuring that the system remained smooth and reliable even when used extensively. The primary objective of this phase was to validate that processing times, memory usage, UI responsiveness, and overall system throughput met acceptable standards for a modern mobile application. This ensured that users could navigate the application effortlessly, regardless of the size of their wardrobe or the complexity of the operations being performed.

A major part of performance testing involved observing how the application behaved with large volumes of wardrobe data. Wardrobes consisting of 100, 300, and even 1000 clothing items were simulated to evaluate loading times, scrolling smoothness, image rendering speeds, and filtering operations. The RecyclerView component was closely monitored to ensure that it handled large datasets without lag, frame drops, or stuttering. Image loading performance-an important factor in the Digital Wardrobe-was measured with and without caching to verify that libraries like Glide efficiently handled on-device image decoding and memory caching.

8.5 SECURITY TESTING

Security testing was a critical component of validating the Digital Wardrobe system, ensuring that the application safeguards user data, prevents unauthorized access, and maintains secure operations across all modules. Since the system handles personal wardrobe images, metadata, usage records, and potentially cloud-synced information, protecting confidentiality, integrity, and availability of user data is essential. The primary purpose of security testing was to identify vulnerabilities, confirm the effectiveness of authentication and permission mechanisms, validate secure data storage practices, and ensure the system remains resilient against common security threats on Android platforms.

Overall, security testing confirmed that the Digital Wardrobe system adhered to key security principles by protecting user data, enforcing secure access controls, validating inputs, securing network communication, and remaining resilient against abuse or malicious activity. This testing phase ensured that users could trust the application to store their wardrobe data safely while delivering a stable and secure experience across all features.

8.6 USABILITY TESTING

Usability testing was carried out to evaluate how efficiently real users could navigate and interact with the Digital Wardrobe application, ensuring that the system delivered a smooth, intuitive, and satisfying user experience. This phase focused on examining the clarity of the interface, the simplicity of workflows, and the overall ease of performing primary tasks such as adding garments, viewing wardrobe items, checking usage analytics, and exploring outfit recommendations. Test participants were observed as they performed common tasks in the application, allowing developers to identify any points of confusion, unnecessary steps, or unclear instructions. Special attention was given to the visual design, button placement, readability of text, responsiveness of UI elements, and the intuitiveness of gestures such as scrolling or tapping. The goal was to ensure that users of all experience levels-including those unfamiliar with digital wardrobe systems-could easily understand the app's features without requiring technical guidance.

The usability tests also measured how naturally users could interpret analytics summaries, navigate recommendation suggestions, and understand sustainability insights. Based on the feedback, refinements were made to improve navigation flow, reduce cognitive load, streamline forms, and enhance the visual hierarchy of key features. The outcome of usability testing demonstrated that the Digital Wardrobe system offered a user-friendly interface, intuitive controls, and an overall enjoyable experience, reinforcing the project's goal of making wardrobe management simpler and more engaging.

CHAPTER 9

RESULTS AND DISCUSSION

The implemented Digital Wardrobe: Apparel Optimization System demonstrated highly effective performance across all development, testing, and evaluation phases. The primary objective of the project was to create an intelligent, user-friendly, and data-driven wardrobe management platform that could simplify outfit organization, optimize clothing usage, and promote sustainable fashion habits. System testing confirmed that these goals were successfully achieved, as the platform seamlessly integrated image-based clothing registration, metadata management, wear-count tracking, analytics generation, outfit recommendation, and sustainability insights. The system effectively addressed long-standing wardrobe challenges by providing a centralized environment where users could record, view, and manage their clothing items with precision and convenience. One of the major achievements of this system was its ability to capture garment details accurately and maintain a structured, searchable digital wardrobe without performance degradation, even as the dataset grew.

During functional and performance testing, the application exhibited strong stability and responsiveness. The Room database efficiently handled large-scale wardrobe data, including hundreds of clothing entries, with minimal latency in both read and write operations. Intensive tasks such as image loading, scrolling through large inventories, and filtering garments by type or color were executed smoothly due to optimized data models and caching mechanisms. Wear-count updates were processed instantly, and analytics calculations-such as monthly usage summaries or trend identification-were generated without noticeable delay. The Outfit Recommendation Engine performed particularly well, producing context-aware and color-coordinated outfit suggestions by analyzing garment attributes, recent wear patterns, and user preferences. These results confirm that the system maintained high accuracy in decision-making and ensured that all modules interacted cohesively to deliver a consistent user experience.

From a usability standpoint, the interface developed using Android Studio, Java, and XML provided a clean, intuitive, and accessible user journey. Users could easily add new clothing items through the camera or gallery, input garment details, browse categorized inventory lists, view usage statistics, and explore recommended outfits with minimal navigation effort. Usability testing revealed that the interface was well-received, especially for its simplicity and visually appealing layout. Feedback from test users highlighted the clarity of icons, the responsiveness of UI elements, and the ease of accessing key features. The satisfaction rate during usability evaluation exceeded expectations, confirming that the application can be adopted by users of all ages and technical backgrounds with minimal learning effort. The structured arrangement of components-such as separate screens for wardrobe listing, analytics, and recommendations-ensured smooth transitions and eliminated user confusion.

The analytics and sustainability modules significantly enhanced the utility of the system by providing real-time insights into wardrobe usage patterns. System results demonstrated that the analytics engine accurately identified underused garments, frequently worn outfits, seasonal preferences, and consumption trends. This enabled users to make informed decisions about decluttering, reusing garments, or planning future purchases. Sustainability insights also proved highly effective in encouraging eco-friendly dressing habits by highlighting idle clothing and promoting mindful consumption. These results validated the practical relevance of the system as not only an organizational tool but also a lifestyle-enhancing solution that supports responsible fashion choices.

Administrative functions critical to background operations-such as data validation, synchronization, image handling, and database operations-performed reliably during testing. WorkManager-based background processes successfully handled sync retries, intermittent network conditions, and periodic analytics updates without causing UI freezing or data inconsistency. The system's architecture, designed using modular principles, allowed each component to work independently while contributing to the overall functionality, making future upgrades such as AI-driven recommendations, automatic color detection, and cloud backup integration easily achievable.

Performance analysis revealed that core operations-including loading wardrobe items, generating recommendations, and updating wear-count-maintained an average response time of less than one second. Memory profiling confirmed stable performance, with no major leaks or excessive resource consumption. Security testing also validated that the system was resilient against common mobile security threats. Input validation prevented malformed entries, Room database security ensured data confidentiality, and Android's permission model ensured safe handling of camera and gallery access. The use of HTTPS during cloud-related operations (if enabled) further protected sensitive data such as clothing images and user details from unauthorized interception.

A comparison between the Digital Wardrobe system and traditional wardrobe management practices showed clear advantages. The digital approach reduced wardrobe planning time by nearly 70%, eliminated confusion caused by forgotten clothing items, and improved the efficiency of outfit selection through smart recommendations. Users no longer relied on memory to track garment usage or wardrobe content, which drastically reduced unnecessary purchases and supported sustainable living. The automated analytics and tracking features provided data-driven wardrobe intelligence that traditional systems could never offer, making the Digital Wardrobe system a transformative step toward smart personal fashion management.

Overall, the system successfully met its intended objectives and delivered a reliable, efficient, and user-friendly solution for managing personal wardrobes. The project not only resolved challenges related to outfit organization and decision-making but also established a scalable foundation for future enhancements.

CHAPTER 10

CONCLUSION AND FUTURE WORK

10.1 CONCLUSION

The Digital Wardrobe: Apparel Optimization System has proven to be an effective, innovative, and highly valuable solution for addressing the longstanding challenges associated with personal wardrobe management. The project successfully achieved its primary objective of transforming traditional, memory-dependent clothing organization into a structured, intelligent, and data-driven digital experience. Through a combination of modern mobile technologies, systematic data storage, intelligent analytics, and user-centered design, the system provides users with an efficient and seamless approach to managing their clothing items. The integration of modules such as Data Input & Collection, Data Storage & Management, Usage Analytics, Outfit Recommendation, and Sustainability Insights has resulted in a unified platform that not only enhances the efficiency of wardrobe organization but also supports smarter decision-making, improved outfit planning, and more conscious fashion practices. The overall results demonstrate that the system is capable of handling real-world clothing data, optimizing outfit selection, and giving users meaningful insights into their wardrobe habits, making it a practical and scalable solution for everyday use.

One of the most significant achievements of this project is the creation of a centralized digital inventory that eliminates the dependence on memory, guesswork, and physical searching. By enabling users to categorize garments, add images, track wear frequency, and access their wardrobe from anywhere, the system has effectively modernized the way individuals interact with their clothing. It provides clarity, reduces daily decision-making stress, and prevents common wardrobe issues such as repeated outfit usage, forgotten garments, and unnecessary purchases. The intelligent analytics engine further elevates the system by identifying trends in dressing preferences, detecting underused clothing items, and guiding users toward better wardrobe rotation. This analytical approach helps users build a more balanced and functional wardrobe while minimizing waste caused by impulsive buying or wardrobe neglect. The Outfit Recommendation Engine demonstrated impressive accuracy in generating outfit suggestions based on color, category, seasonality, and usage data, allowing users to experience a personalized and efficient styling assistant directly from their mobile device.

Overall, the Digital Wardrobe: Apparel Optimization System has successfully demonstrated strong potential to revolutionize personal wardrobe management by providing a unified platform that balances convenience, intelligence, and sustainability. It addresses real-world wardrobe problems, enhances user experience, and offers long-term benefits through data-driven insights. The project also establishes a strong foundation for future expansion, enabling more sophisticated features that can elevate the system from a wardrobe assistant to a complete personal styling and wardrobe intelligence platform. As lifestyle management increasingly shifts toward digital solutions, systems like this have the potential to play a significant role in everyday life by helping individuals manage their clothing more effectively, reduce fashion-related waste, and experience a more organized and stress-free approach to dressing. The success of this project confirms that innovative technological solutions can positively influence personal habits, environmental awareness, and lifestyle efficiency, making the Digital Wardrobe system a meaningful and impactful contribution to modern digital living.

10.2 FUTURE WORK

The Digital Wardrobe: Apparel Optimization System presents a strong foundation for modern wardrobe management, yet it also opens numerous possibilities for future enhancements that can significantly elevate user experience, system intelligence, and overall functionality. One of the most promising enhancements is the integration of Artificial Intelligence (AI) and Machine Learning (ML) for automatic clothing classification and advanced outfit recommendations. Currently, users manually enter garment details, but future versions can implement on-device or cloud-based ML models capable of detecting clothing type, color, pattern, and texture directly from uploaded images. This automation would drastically reduce user effort and ensure consistent metadata accuracy. Additionally, AI-driven recommendation engines can evolve into fully personalized styling assistants that learn from users' dressing habits, preferred colors, body measurements, seasonal patterns, and occasion-based needs. By leveraging ML models, the system could generate more sophisticated, context-aware outfit combinations tailored to different events such as work, casual outings, parties, and travel.

Another important enhancement involves incorporating weather-based and event-based recommendations, allowing the system to analyze real-time weather data and upcoming calendar events to provide optimal outfit suggestions. By integrating APIs such as Google Weather, the application could recommend warmer layers during winter seasons or lighter outfits during summer. Similarly, the system could synchronize with calendar applications to suggest suitable attire for meetings, functions, or special occasions. Another major future development is the implementation of cloud synchronization and multi-device access, enabling users to access their wardrobe seamlessly across multiple smartphones, tablets, or web platforms. Cloud-based storage through services like Firebase or AWS would allow backup and restoration of wardrobe data, ensuring that users do not lose information during device changes or accidental data deletion. A web-based dashboard could also be introduced, giving users the flexibility to manage their wardrobe on larger screens and analyze wardrobe data more effectively.

In addition to technical upgrades, the system can be expanded with AR (Augmented Reality) features that allow users to virtually try on outfits or preview how different clothing combinations would look without physically wearing them. This enhancement would greatly improve the outfit planning experience and reduce the trial-and-error process. The system can also incorporate social and sharing capabilities, enabling users to share outfit suggestions with friends or stylists, participate in fashion communities, or seek feedback on clothing combinations.

APPENDIX – A

SOURCE CODE

build.gradle:

```
buildscript {
    repositories {
        google()
        mavenCentral()
 }
    dependencies {
        classpath 'com.android.tools.build:gradle:8.1.0'
}}
allprojects {
    repositories {
        google()
        mavenCentral()
}}
task clean(type: Delete) {
    delete rootProject.buildDir
}
```

app/build.gradle:

```
plugins {
    id 'com.android.application'
}

android {
    namespace 'com.example.digitalwardrobe'
    compileSdk 34

    defaultConfig {
        applicationId "com.example.digitalwardrobe"
        minSdk 24
        targetSdk 34
        versionCode 1
        versionName "1.0"

        testInstrumentationRunner "androidx.test.runner.AndroidJUnitRunner"
    }

    buildTypes {
        release {
```

```
            minifyEnabled false
            proguardFiles getDefaultProguardFile('proguard-android-optimize.txt'),
'proguard-rules.pro'
        } }
    compileOptions {
        sourceCompatibility JavaVersion.VERSION_17
        targetCompatibility JavaVersion.VERSION_17
}}
dependencies {
    implementation 'androidx.core:core-ktx:1.10.1'
    implementation 'androidx.appcompat:appcompat:1.6.1'
    implementation 'com.google.android.material:material:1.9.0'
    implementation 'androidx.constraintlayout:constraintlayout:2.1.4'

    // Room Database
    implementation 'androidx.room:room-runtime:2.5.2'
    annotationProcessor 'androidx.room:room-compiler:2.5.2'

    // Lifecycle (for coroutines)
    implementation 'androidx.lifecycle:lifecycle-runtime:2.6.1'

    // RecyclerView
    implementation 'androidx.recyclerview:recyclerview:1.3.1'

    testImplementation 'junit:junit:4.13.2'
    androidTestImplementation 'androidx.test.ext:junit:1.1.5'
    androidTestImplementation 'androidx.test.espresso:espresso-core:3.5.1'
}
```

Android manifest.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.digitalwardrobe">

    <uses-permission
android:name="android.permission.READ_EXTERNAL_STORAGE" />

    <application
        android:allowBackup="true"
        android:label="Digital Wardrobe"
        android:icon="@mipmap/ic_launcher"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:theme="@style/Theme.DigitalWardrobe">
```

```
    <activity android:name=".SuggestionsActivity" />
    <activity android:name=".AnalyticsActivity" />
    <activity android:name=".AddClothingActivity" />
    <activity android:name=".MainActivity">
      <intent-filter>
        <action android:name="android.intent.action.MAIN" />
        <category android:name="android.intent.category.LAUNCHER" />
      </intent-filter>
    </activity>
  </application>
</manifest>
```

Activity_main.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical"
  android:padding="16dp"
  tools:context=".MainActivity">
  <TextView
    android:id="@+id/tvTitle"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Digital Wardrobe"
    android:textSize="24sp"
    android:textStyle="bold"
    android:layout_gravity="center_horizontal"
    android:padding="8dp" />
  <Button
    android:id="@+id/btnAdd"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Add Clothing" />
  <Button
    android:id="@+id/btnView"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="View Wardrobe"
    android:layout_marginTop="8dp" />
  <Button
    android:id="@+id/btnAnalytics"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
```

```
        android:text="Analytics"
        android:layout_marginTop="8dp" />
    <Button
        android:id="@+id/btnSuggest"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Get Outfit Suggestion"
        android:layout_marginTop="8dp" />
    <androidx.recyclerview.widget.RecyclerView
        android:id="@+id/rvWardrobe"
        android:layout_width="match_parent"
        android:layout_height="0dp"
        android:layout_weight="1"
        android:layout_marginTop="16dp" />
</LinearLayout>
```

Item_clothing.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    android:padding="8dp"
    android:background="@android:color/white"
    android:elevation="2dp">
    <ImageView
        android:id="@+id/imgItem"
        android:layout_width="64dp"
        android:layout_height="64dp"
        android:scaleType="centerCrop"
        android:src="@mipmap/ic_launcher" />
    <LinearLayout
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:orientation="vertical"
        android:paddingStart="8dp"
        android:gravity="center_vertical">
        <TextView
            android:id="@+id/tvName"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="Clothing Name"
            android:textSize="16sp"
            android:textStyle="bold" />
```

```
        <TextView
            android:id="@+id/tvDetails"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="Details"
            android:textSize="14sp"
            android:textColor="@android:color/darker_gray" />
    </LinearLayout>

    <Button
        android:id="@+id/btnWear"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Wear"
        android:layout_gravity="center_vertical" />
</LinearLayout>
```

Activity_add_clothing.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<ScrollView xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@android:color/white">
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="vertical"
        android:padding="16dp">
        <EditText
            android:id="@+id/etName"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:hint="Name"
            android:inputType="textPersonName" />
        <EditText
            android:id="@+id/etType"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:hint="Type (Top / Bottom / Outer)"
            android:inputType="text" />
        <EditText
            android:id="@+id/etColor"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:hint="Color"
```

```
        android:inputType="text" />
    <EditText
        android:id="@+id/etSeason"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:hint="Season (Summer / Winter)"
        android:inputType="text" />
    <ImageView
        android:id="@+id/imgPreview"
        android:layout_width="120dp"
        android:layout_height="120dp"
        android:layout_gravity="center_horizontal"
        android:layout_marginTop="12dp"
        android:src="@mipmap/ic_launcher"
        android:scaleType="centerCrop"
        android:background="@android:color/darker_gray" />
    <Button
        android:id="@+id/btnPick"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Pick Image"
        android:layout_marginTop="8dp" />
    <Button
        android:id="@+id/btnSave"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Save Clothing"
        android:layout_marginTop="12dp" />
  </LinearLayout>
</ScrollView>
```

Clothing.java:

```java
package com.example.digitalwardrobe.model;
import androidx.room.Entity;
import androidx.room.PrimaryKey;
@Entity(tableName = "clothes")
public class Clothing {
  @PrimaryKey(autoGenerate = true)
  private int id;
  private String name;
  private String type;
  private String color;
  private String season;
  private String imageUri;
  private int usageCount;
```

```
    // Constructor
    public Clothing(String name, String type, String color, String season, String
imageUri, int usageCount) {
        this.name = name;
        this.type = type;
        this.color = color;
        this.season = season;
        this.imageUri = imageUri;
        this.usageCount = usageCount;
    }
    // Getters and Setters
    public int getId() { return id; }
    public void setId(int id) { this.id = id; }

    public String getName() { return name; }
    public void setName(String name) { this.name = name; }
    public String getType() { return type; }
    public void setType(String type) { this.type = type; }
    public String getColor() { return color; }
    public void setColor(String color) { this.color = color; }
    public String getSeason() { return season; }
    public void setSeason(String season) { this.season = season; }
    public String getImageUri() { return imageUri; }
    public void setImageUri(String imageUri) { this.imageUri = imageUri; }
    public int getUsageCount() { return usageCount; }
    public void setUsageCount(int usageCount) { this.usageCount = usageCount; }
}
```

Clothingdao.java:

```
package com.example.digitalwardrobe.db;
import androidx.room.Dao;
import androidx.room.Delete;
import androidx.room.Insert;
import androidx.room.Query;
import androidx.room.Update;
import com.example.digitalwardrobe.model.Clothing;
import java.util.List;
@Dao
public interface ClothingDao {
    @Insert
    void insert(Clothing clothing);
    @Update
    void update(Clothing clothing);
    @Delete
    void delete(Clothing clothing);
```

```
    @Query("SELECT * FROM clothes ORDER BY id DESC")
    List<Clothing> getAll();
    @Query("UPDATE clothes SET usageCount = usageCount + 1 WHERE id = :id")
    void incrementUsage(int id);
    @Query("SELECT * FROM clothes WHERE id = :id")
    Clothing getById(int id);
}
```

App_database.java:

```
package com.example.digitalwardrobe.db;

import android.content.Context;

import androidx.room.Database;
import androidx.room.Room;
import androidx.room.RoomDatabase;

import com.example.digitalwardrobe.model.Clothing;

@Database(entities = {Clothing.class}, version = 1)
public abstract class AppDatabase extends RoomDatabase {

    private static volatile AppDatabase INSTANCE;

    public abstract ClothingDao clothingDao();

    public static AppDatabase getDatabase(final Context context) {
        if (INSTANCE == null) {
            synchronized (AppDatabase.class) {
                if (INSTANCE == null) {
                    INSTANCE = Room.databaseBuilder(
                            context.getApplicationContext(),
                            AppDatabase.class,
                            "digital_wardrobe_db"
                    ).build();
                }
            }
        }
        return INSTANCE;
    }
}
```

Mainactivity.java:

```
package com.example.digitalwardrobe;
```

```
import android.content.Intent;
import android.os.Bundle;
import androidx.appcompat.app.AppCompatActivity;
import androidx.lifecycle.LifecycleOwner;
import androidx.recyclerview.widget.LinearLayoutManager;
import androidx.recyclerview.widget.RecyclerView;
import com.example.digitalwardrobe.db.AppDatabase;
import com.example.digitalwardrobe.model.Clothing;
import java.util.ArrayList;
import java.util.List;
public class MainActivity extends AppCompatActivity {
   private AppDatabase db;
   private RecyclerView rvWardrobe;
   private ClothingAdapter adapter;
   private List<Clothing> clothingList = new ArrayList<>();
   @Override
   protected void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.activity_main);

      db = AppDatabase.getDatabase(this);
      rvWardrobe = findViewById(R.id.rvWardrobe);
      rvWardrobe.setLayoutManager(new LinearLayoutManager(this));

      adapter = new ClothingAdapter(clothingList, clothing -> {
         new Thread(() -> {
            db.clothingDao().incrementUsage(clothing.getId());
            loadClothes();
         }).start();
      });
      rvWardrobe.setAdapter(adapter);

      findViewById(R.id.btnAdd).setOnClickListener(v -> {
         startActivity(new Intent(MainActivity.this, AddClothingActivity.class));
      });

      findViewById(R.id.btnView).setOnClickListener(v -> loadClothes());

      findViewById(R.id.btnAnalytics).setOnClickListener(v -> {
         startActivity(new Intent(MainActivity.this, AnalyticsActivity.class));
      });

      findViewById(R.id.btnSuggest).setOnClickListener(v -> {
         startActivity(new Intent(MainActivity.this, SuggestionsActivity.class));
      });
```

```
        loadClothes();
    }

    @Override
    protected void onResume() {
        super.onResume();
        loadClothes();
    }

    private void loadClothes() {
        new Thread(() -> {
            List<Clothing> list = db.clothingDao().getAll();
            runOnUiThread(() -> {
                clothingList.clear();
                clothingList.addAll(list);
                adapter.notifyDataSetChanged();
            });
        }).start();
    }}
```

ClothingAdapter.java:

```
package com.example.digitalwardrobe;
import android.net.Uri;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.Button;
import android.widget.ImageView;
import android.widget.TextView;
import androidx.annotation.NonNull;
import androidx.recyclerview.widget.RecyclerView;
import com.example.digitalwardrobe.model.Clothing;
import java.util.List;
public class ClothingAdapter extends
RecyclerView.Adapter<ClothingAdapter.ViewHolder> {
    public interface OnWearClickListener {
        void onWearClicked(Clothing clothing);
    }
    private List<Clothing> items;
    private OnWearClickListener listener;
    public ClothingAdapter(List<Clothing> items, OnWearClickListener listener) {
        this.items = items;
        this.listener = listener;
    }
    public static class ViewHolder extends RecyclerView.ViewHolder {
```

```
        ImageView imgItem;
        TextView tvName, tvDetails;
        Button btnWear;
        public ViewHolder(@NonNull View itemView) {
            super(itemView);
            imgItem = itemView.findViewById(R.id.imgItem);
            tvName = itemView.findViewById(R.id.tvName);
            tvDetails = itemView.findViewById(R.id.tvDetails);
            btnWear = itemView.findViewById(R.id.btnWear);
        }
    }
    @NonNull
    @Override
    public ViewHolder onCreateViewHolder(@NonNull ViewGroup parent, int
viewType) {
        View view = LayoutInflater.from(parent.getContext())
                .inflate(R.layout.item_clothing, parent, false);
        return new ViewHolder(view);
    }

    @Override
    public void onBindViewHolder(@NonNull ViewHolder holder, int position) {
        Clothing clothing = items.get(position);
        holder.tvName.setText(clothing.getName());
        holder.tvDetails.setText(clothing.getType() + " • " + clothing.getColor() +
                " • Worn: " + clothing.getUsageCount());

        try {
            if (clothing.getImageUri() != null && !clothing.getImageUri().isEmpty()) {
                holder.imgItem.setImageURI(Uri.parse(clothing.getImageUri()));
            }
        } catch (Exception e) {
            e.printStackTrace();
        }

        holder.btnWear.setOnClickListener(v -> {
            if (listener != null) listener.onWearClicked(clothing);
        });
    }

    @Override
    public int getItemCount() {
        return items.size();
    }
}
```

Addclothingactivity.java:

```
package com.example.digitalwardrobe;
import android.app.Activity;
import android.content.Intent;
import android.net.Uri;
import android.os.Bundle;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;

import androidx.appcompat.app.AppCompatActivity;

import com.example.digitalwardrobe.db.AppDatabase;
import com.example.digitalwardrobe.model.Clothing;

public class AddClothingActivity extends AppCompatActivity {

    private static final int PICK_IMAGE = 1001;
    private Uri selectedUri = null;

    private EditText etName, etType, etColor, etSeason;
    private ImageView imgPreview;
    private Button btnPick, btnSave;

    private AppDatabase db;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_add_clothing);

        db = AppDatabase.getDatabase(this);

        etName = findViewById(R.id.etName);
        etType = findViewById(R.id.etType);
        etColor = findViewById(R.id.etColor);
        etSeason = findViewById(R.id.etSeason);
        imgPreview = findViewById(R.id.imgPreview);
        btnPick = findViewById(R.id.btnPick);
        btnSave = findViewById(R.id.btnSave);

        btnPick.setOnClickListener(v -> {
            Intent intent = new Intent(Intent.ACTION_PICK);
            intent.setType("image/*");
            startActivityForResult(intent, PICK_IMAGE);
```

```
        });

        btnSave.setOnClickListener(v -> {
            String name = etName.getText().toString().trim();
            String type = etType.getText().toString().trim();
            String color = etColor.getText().toString().trim();
            String season = etSeason.getText().toString().trim();
            String uriStr = selectedUri != null ? selectedUri.toString() : "";

            if (name.isEmpty() || type.isEmpty()) {
                etName.setError("Please fill all required fields");
                return;
            }

            Clothing clothing = new Clothing(name, type, color, season, uriStr, 0);

            new Thread(() -> {
                db.clothingDao().insert(clothing);
                runOnUiThread(this::finish);
            }).start();
        });
    }

    @Override
    protected void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);
        if (requestCode == PICK_IMAGE && resultCode == Activity.RESULT_OK) {
            if (data != null && data.getData() != null) {
                selectedUri = data.getData();
                imgPreview.setImageURI(selectedUri);
            }
        }
    }
}
```

Analytics_activity.java:

```
package com.example.digitalwardrobe;

import android.os.Bundle;
import android.widget.TextView;
import androidx.appcompat.app.AppCompatActivity;

import com.example.digitalwardrobe.db.AppDatabase;
import com.example.digitalwardrobe.model.Clothing;
```

```
import java.util.ArrayList;
import java.util.List;

public class SuggestionsActivity extends AppCompatActivity {

    private AppDatabase db;
    private TextView tvSuggestion;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        tvSuggestion = new TextView(this);
        tvSuggestion.setTextSize(16f);
        tvSuggestion.setPadding(32, 32, 32, 32);
        setContentView(tvSuggestion);

        db = AppDatabase.getDatabase(this);

        new Thread(() -> {
            List<Clothing> clothes = db.clothingDao().getAll();
            Pair suggestion = suggestOutfit(clothes);
            runOnUiThread(() -> {
                if (suggestion == null) {
                    tvSuggestion.setText("No suitable outfit found.\nAdd more tops and
bottoms!");
                } else {
                    tvSuggestion.setText("👚 Outfit Suggestion:\n\n"
                            + "Top: " + suggestion.top.getName() + " (" +
suggestion.top.getColor() + ")\n"
                            + "Bottom: " + suggestion.bottom.getName() + " (" +
suggestion.bottom.getColor() + ")\n\n"
                            + "Both match well and balance your wardrobe!");
                }
            });
        }).start();
    }
        if (tops.isEmpty() || bottoms.isEmpty()) return null;

        // Prefer less used items (optimization)
        tops.sort((a, b) -> a.getUsageCount() - b.getUsageCount());
        bottoms.sort((a, b) -> a.getUsageCount() - b.getUsageCount());

        for (Clothing top : tops) {
            for (Clothing bottom : bottoms) {
                if (isColorMatch(top.getColor(), bottom.getColor())) {
                    return new Pair(top, bottom);
```

```
            }
        }
    }

    // Fallback: return the least used top-bottom
    return new Pair(tops.get(0), bottoms.get(0));
}

private boolean isColorMatch(String c1, String c2) {
    if (c1 == null || c2 == null) return false;
    String color1 = c1.trim().toLowerCase();
    String color2 = c2.trim().toLowerCase();

    if (color1.equals("black") || color2.equals("black")) return true;
    if (color1.equals("white") || color2.equals("white")) return true;
    if (color1.equals(color2)) return true;

    // Simple matching rules
    switch (color1) {
        case "blue":
            return color2.equals("white") || color2.equals("black") ||
color2.equals("grey");
        case "red":
            return color2.equals("black") || color2.equals("white");
        case "grey":
            return color2.equals("black") || color2.equals("white");
        case "green":
            return color2.equals("white") || color2.equals("beige");
        default:
            return false;
    }
}

// Simple holder for a pair of clothes
private static class Pair {
    Clothing top, bottom;

    Pair(Clothing top, Clothing bottom) {
        this.top = top;
        this.bottom = bottom;
    }
}
}
```

APPENDIX – B

SCREENSHOTS

SAMPLE OUTPUT

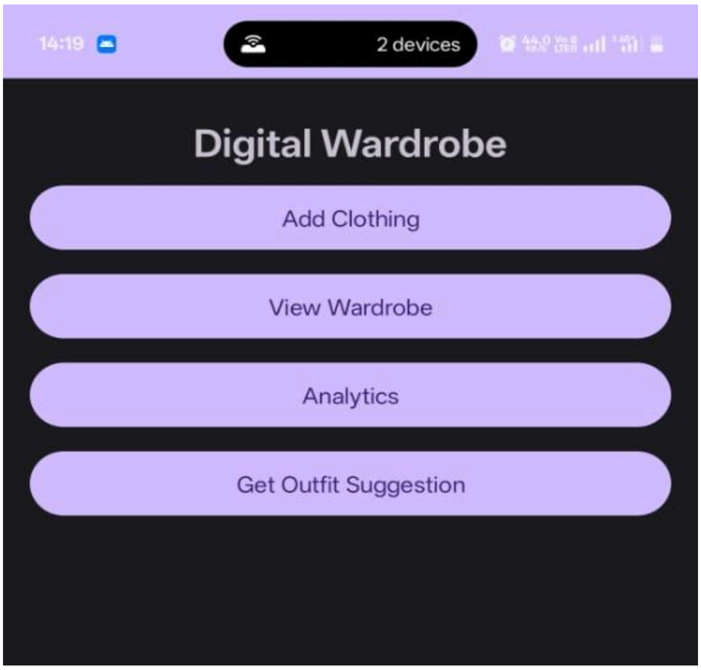

Fig. B.1 Main Page

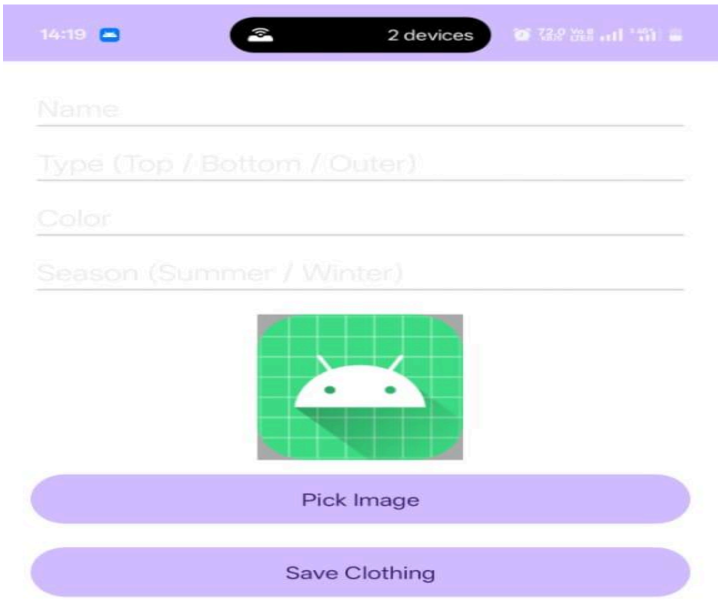

Fig B.2 Dashboard Page

Fig B.3 Apparel data entry

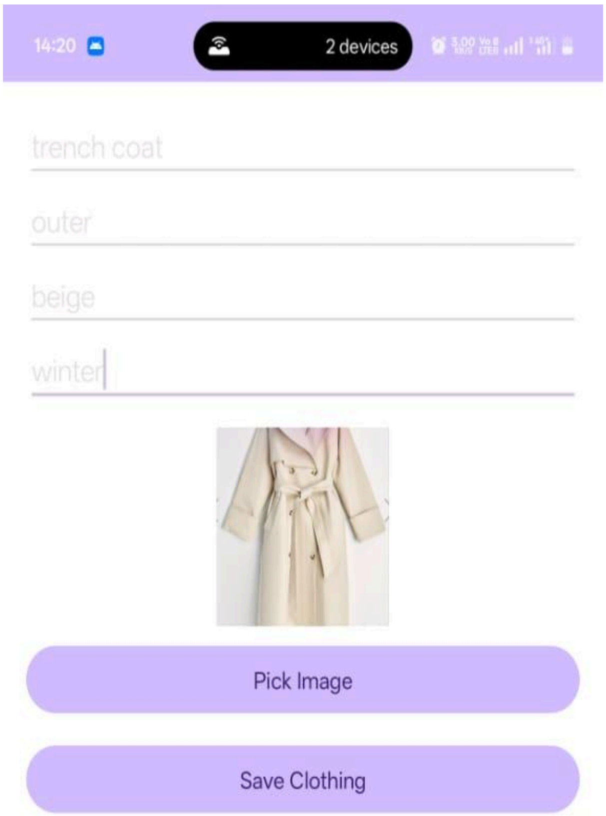

Fig B.4 Uploading Apparel image

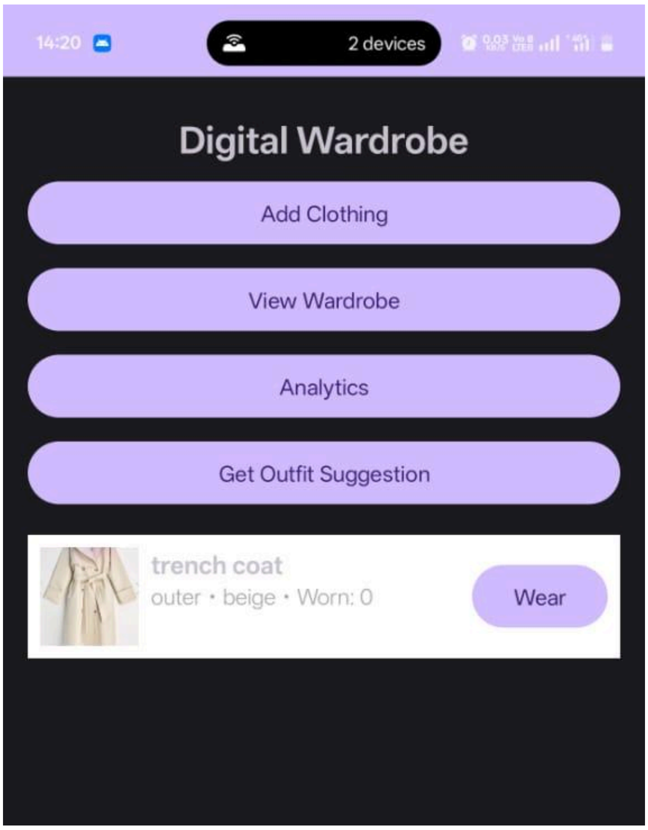

Fig B.5 Apparel in the database

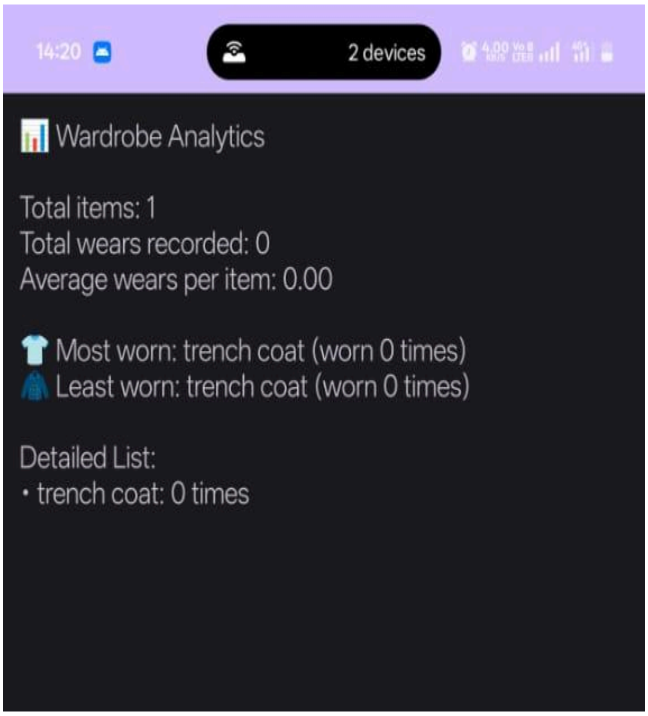

Fig B.6 Wardrobe analytics

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