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Vogue AI: Next Gen Fashion Stylist

In partial fulfilment of the requirements for the degree of
Bachelor of Science in Computer Science

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Certificate



We accept the work contained in the report titled

“Vogue AI: Next Gen Fashion Stylist”

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January 05, 2026

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

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Specially dedicated to
My supervisor, parents and teachers
(UNAIZA MUKHDOOM)
My supervisor, family and teachers
(MEHAK)

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UNAIZA MUKHDOOM
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Vogue AI: Next Gen Fashion Stylist

ABSTRACT

The fashion and apparel industry faces complex challenges in delivering personalized styling service that account for the relationship among physical attribute, circumstances, and individual inclinations. The whole process of dressing up has numerous interdependent variables that affect what the individual wears. These are the corroboration of skin tone with weather, the fittingness of events, and the need of culture and the self-expression of aesthetics. The traditional form of shopping and the existing fashion technologies fail to provide comprehensive guidelines on these dimensions. They in particular do not focus on such important aspects as skin tone, undertone, face shape, and body proportions. The absence of this gap results in bad choices, ineffective wardrobes, and insecurity, as well as repeated fashion mistakes. Users do not know what colors, outfits and trends to use without the help of real time experts.

Modern strategies such as using the Flutter framework for cross-development, ensuring compatibility across both android and iOS devices, marked the development process. Forthcoming features include and a modern Material 3 design theme to enhance user engagement and functionality.

The thesis develops an intelligent AI-powered fashion recommendation system for Pakistani market. Mobile application uses OpenCV for facial features analysis including skin tone, undertone, eye color, hair color and face shape detection. It provides scientifically-backed seasonal color palettes and personalized styling with digital wardrobe system. Application scrapes fashion data from Pakistani brands Khadi, Sapphire, Gul Ahmed, Nishat Linen and Akaram. Flutter-Dart app with Firebase. Intelligent Dialog flow chatbot in English-Urdu. Fit Me analyzes body type and scores of the user pic.

The report outlines the technical strategies adopted to develop these features, the methods used in addressing them and the results of the built application. It also discusses recommendations made regarding future updates and improvements, which focus on the improvement of accessibility, contents, and the overall user experience.

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CHAPTER 1

INTRODUCTION

1.1 Background

The fashion industry has shaped cultural identities, the expression of the individual and the economic statuses of the world in general over the course of many years. Fashion industry is amongst the largest exporters of textile and apparel in Pakistan that make about 60 percent of the total exports of the country. The fashion is also characterized by bright colors, rich embroidery, cultural patterns that the Eastern women use, and are founded on their traditions. These may be observed in the shapes of sarees, shalwar kameez or happy clothes like wedding and Eid. Nonetheless, the industry is still aggressive but not able to provide customized styling approaches that may accommodate personal physical peculiarities and cultural conditions.[1]

The basic personal determinants like skin color, face shape and body shape are ignored by the traditional fashion retailing and styling and this results in generic recommendation that fails to increase customer satisfaction. The color suit and the dressing is an aspect that customers usually trouble in Pakistan due to the ethnic and regional variations in the country, which has resulted in varied skin complexion, including fair, dark brown and dark olive. It is discovered that females can be made to feel more about themselves and feel more inspired with the help of the advertisements with color-tone models; however, local media and shopping are still exclusive. This imbalance has the effect of causing inappropriate fashion choices of the user, more dissatisfaction, and low confidence.

1.2 Literature Review

1.2.1 Digital Fashion Platforms and Virtual Styling Tools

Digital fashion apps have redefined the interaction between the user and the clothes and styling, with the use of AI to provide virtual try-ons, and more. They usually combine computer vision to emulate reality, eliminating the necessity to perform physical tests and resolving such issues as high returns in e-commerce.[2]

Through AI, platforms such as Style DNA can make personalized outfit recommendations, what the user likes to wear, as a result of having the understanding of style and body shape, and even assists them in organizing virtual wardrobes so that they can easily visualize various outfits. Acloset and Smart Closet have the same experience of providing a way to create an outfit by uploading photos of clothes users have with them and integrating e-commerce features into wardrobe planning, respectively.

More recent technologies like FITs rely on deep learning and real-time image processing to understand body structure, identify facial features, and assist users using AI chatbots, and applications like PoseSmart are based on pose estimation to minimize a typical size-related problem when using online shopping. Other apps such as Smart Closet are also sustainable fashion since machine learning methods are used to suggest eco-friendly options, which allow users to view the simulation of outfits in real-life. Nevertheless, even with such stunning characteristics, the majority of the platforms remain oriented primarily on Western fashion trends and fail to consider such aspects of the Eastern culture as traditional embroidery, modest style of dressing, and local fashion trends.

1.2.2 Personalized Styling and Outfit Recommendations System

The personalized styling systems apply AI to analyze the user characteristics like the skin color, the shape of the face and the individual preferences, and give them a custom recommendation that improves confidence and prevents disillusionment. Machine learning models are used in a number of systems to extract the features and match them to produce the correct suggestions. In the study, an AI-based stylist can customize the recommendation based on such aspects as mood or occasion, whereas in the work, NLP-based Chatbot could be used to talk about the fashion with the help of the advice they provide. Colorwise.me and Fits AI are platforms that analyze facial features to create seasonal palettes using color, and the AI stylist of Face tune and House of Color are platforms that give advice based on the color harmony of the image. Style DNA also provides online color analysis by using selfie-based tests.

1.2.3 Mobile App Development for Fashion

Personal styling and fashion technology are now based around mobile applications. Mobile apps provide flexibility and convenience that is unattainable by desktop or web-based system with a high level of smartphone use. The study by [5] has revealed that fashion- and styling-related content is more consumed by users through mobile devices, which is why fashion applications have to be cross-platform compatible. The mobile platforms can be used in fashion technology due to the ability to take selfies, scan clothes in real time and get personalized suggestions, which means that users can get styling information, manage virtual wardrobes and engage with AI stylists at any place and any time.

1.2.4 Accessibility and User Engagement

The personal styling applications and fashion should not only be accessible at the general level. It possesses such capabilities as multi-language support, flexibility of display and adaptive user interface that can serve the needs of diverse users. These characteristics can be used by users with visual disabilities or other language inclinations. Research has revealed that the level of satisfaction and retention is likely to be higher in apps that possess such features. The multi-language support has become a usual characteristic, the chatbot also works with the English and Roman Urdu language, and the users who may not be inclined to the English interface have a chance to use it.

It is also possible to enhance the user experience with the inclusion of increased social engagement functionality such as outfits suggestions with social media or discussion of style choices. Research hypothesizes that uploading and discussing fashion choices in online communities brings about the collaborative styling mood and improves interactions with the site; the integration of the above in the fashion application will provide the user with captivating experience.

Nevertheless, the project is not directed at developing exclusive machine learning algorithm and high-level personalized proposals to access high premium content that are not delivered. It is the desire to enhance digital learning and access to the resources.

1.2.5 Existing Gaps and Opportunities

In spite of these developments there are major gaps in AI fashion systems especially with respect to Eastern and Pakistani cultures. Under the Pakistani market, the use of AI in the fashion sector is underrepresented because of the barriers to digital access, especially among women, as the digital industry has seen some progress in marketing AI-generated fashion shows to showcase the potential of the technology to empower women. Studies also identify the lack of virtual size-and-fit technologies relative to Western markets, which results in high rates of returns because the recommendations do not align with the needs of the local environment, but cultural stories do not consider adventures of immersion with technology and artificial intelligence. The gap in skills in the industry can be filled by providing training programs that integrate conventional fashion knowledge with the latest AI technology. Vogue AI directly addresses these issues by providing the analysis of skin tone and face shape, a culturally conscious chatbot, and Eastern fashion data, a Pakistan-specific free Android application.

1.3 Problem Statement

The Pakistani fashion industry has been developing at a very high pace as the revenues of the industry are set to grow to US 1.45 billion in 2025 and the growth rate is projected to be 10.87% per year until 2030 but the industry still has significant issues in the delivery of a personalized styling solution to the Eastern woman. Conventional shopping patterns do not take into consideration personal factors of skin color, shape of faces, the body, and cultural inclination, which result in unsuitable clothes, lack of confidence and discontent. It has been shown that beauty ideals promoted in the media have a detrimental impact on the self-concept

of Pakistani women, and e-commerce suffers due to cart abandonment rates of 79.5% due to doubts about fit, color precision, and general look, increasing return rates to 25.3% in 2025 as style preferences changed. The inflation of clothing is 9.18% and monthly price growth is 1%, which means that people cannot afford professional advice on how to wear clothes that would fit their style, occasion, mood, weather conditions, and cultural standards including modesty or traditional embroidery. Its inclusivity is seen to be low, especially to the various undertones of South Asia, and studies in the different lines of fashion have proven that quality, size, and comfort factors were the sources of dissatisfaction in more than 70 percent of women between the ages of 18 and 45 years. The level of environmental and social consciousness is also low, particularly among Millennials and Gen Z who have to make their way in a greenwashed world and sustainability issues. The virtual size-and-fit tools in online retail remain inferior to those of the Western markets, which causes increased rates of returns and lack of trust. Altogether, these complications lead to decision fatigue, trial-and-error shopping, and the absence of culturally applicable digital solutions - which is why the direction in the localized AI platform, such as Vogue AI, should serve the interests of Pakistani preferences, language, climate, and fashion-specific needs as well as provide users with confidence-enhancing guidance.

1.4 Aims and Objectives

The objective of Vogue AI is to create an AI-powered mobile app that delivers personalized, culturally relevant fashion recommendations for Eastern women in Pakistan. It integrates skin tone, face shape, and contextual factors like mood, weather, and cultural events to simplify outfit selection. Aligned with 2025 hyper-personalization trends, it aims to reduce “nothing to wear” frustration and enhance user confidence through smart fashion curation. The objectives are:

- i. To create a responsive, user-friendly fashion application designed just for the females of Pakistan so that the application will run seamlessly on Android devices through the Flutter framework.
- ii. To analyze user’s skin tone, face shape using cv algorithm, ensuring personalized and culturally relevant outfit recommendations for Pakistani women
- iii. To develop a secure and personalized user profile system, allowing users to save their style data, preferences, and recommendations with encrypted storage.

- iv. To provide multilingual Chatbot assistance (English & Urdu) for accessible, real-time
- v. fashion guidance tailored to local cultural norms and user needs.
- vi. To implement trend scraping from Pakistani brands, enabling users to explore up-to-date fashion items from stores like, Sapphire, Sana Safinaz, and Limelight.
- vii. To integrate FitMe ranking and smart outfit evaluation, helping users compare different outfits based on color harmony, modesty preferences, and body suitability.
- viii. Deploy, test, and optimize the app for Android, ensuring fast performance, free availability, and continuous updates with new features, fashion datasets, and sustainability trends.

1.5 Scope of Project

The project aims the development of extensive fashion App. The scope includes an interactive mobile application development for android platforms by Flutter framework ensuring a seamless experience to all users when accessing this academic material.

Vogue AI seeks to solve the specific fashion problems of Eastern women, especially in Pakistan, through an AI-enhanced personalized mobile application that is easily accessible. It is designed to suggest culturally relevant looks, taking into account the user's skin tone, face shape, body type, preferred style, mood, and level of modesty or ethnic design. Users include women, who are older than 18 who need every day, work, and festive (like Eid and wedding) outfits and who need clothes for Pakistan's various climates.

The FitMe AI ranking system that evaluates outfits, scan and share for instant feedback, and multi-lingual chatbot that guides users interactively through the system are other features. These systems use image processing and datasets for skin tone and face shape analysis, and track fashion trends from 20 popular Pakistani brands in real time, supplemented with datasets for other needed information. An admin panel will handle user data to update AI models and keep recommendation algorithms for user growth and variation. Weather, cultural events and other relevant data are used to make real-time recommendations.

In this project, an administration panel will be developed to ease the management and administration of users. It will also have a website that explains the features of the application, as well as the download options.

But the project does not intend to develop original machine learning algorithms or highly personalized recommendations to access high premium content beyond resources provided. It basically aims to enhance digital education and resource access.

CHAPTER 2

ANALYSIS

2.1 Requirement Gathering

Requirements definition was also quite essential during the initial stages of this project; it made sure that the final platform had something to contribute to people, especially women in Pakistan who want an individualized fashion advice. This stage involved using surveys and interviews to gather the feedback of women of various ages and backgrounds on their fashion problems and the features needed on the new platform.

The reactions that this feedback gave therefore revealed major bottlenecks such as confusion with the skin tone in relation to colors, inability to find the right outfits to wear in different situations, inability to receive personalized styling information and access to fashion recommendations that were culturally-relevant. The results of the survey showed that many women were confused as to what color and type of clothes they wore that best suited their natural complexion. Others were sophisticated and specialized needs such as jewelry suggestions based on the face shape, the outfit analysis and score, managing wardrobe, and providing bilingual services (English-Urdu) to be more accessible. According to, when users are involved in the process of gathering requirements, it becomes easy to obtain a final product that is highly acceptable to the users and thus enhances its usability.

In addition to this contribution of end users, the team cross-examined the fashion leadership sites and styling applications like Pinterest, Stitch Fix, and other AI-powered fashion recommendation systems in determining the ideal practice in fashion application designs. Observations made based on this initial study have ranked the application in the roadmap among the project priorities.

Some of the lessons that were learnt during this stage were:

- Promoting fashion choices among women on which they make informed decisions depending on their physical characteristics and personal fashion preferences.
- Revamping the old method of trial and error to choose fashions to a system of data and a personalized style selection, to make the process of choosing fashions easier.
- Individualization of the application will be to every individual user based on skin tone, face shape, body shape, and style choices.

Some of the advanced functionalities include AI-assisted color analysis, face shape recognition including jewelry suggestions, outfit rating (FitCheck), and smart chatbot support.

- A unique fashion styling application that would cater to the Pakistani market, including the cultural preferences, including the integration of the local brands..

2.2 Functional and Non-functional Requirements

2.2.1 Functional Requirements

Functional Necessities describe the primary functions and functionalities of the application for Vogue AI. Following are included:

- Register: The user registers with email/ password (or Google) and fills out a short profile questionnaire about the type of body, height, weight, purpose and style preferences.
- Photo Analysis: A user will capture a picture to know the skin tone, hair color, and eye color.
- Dashboard: include:
- FitMe Review: review of user's uploaded fit, colors, and style.
- Chatbot: fashion advice and outfit recommendations
- Virtual Wardrobe: Design wardrobes and get day-by-day wardrobes.
- Trend Integration: Check out clothes of Pakistan styles that match your style and your color scheme that is suggested.
- Profile Management: Update and alter individual information, fashion analysis, tastes.
- Such a structure helps customers to subscribe to the number of outfits proposed every day, and fashion becomes convenient and personalized.

2.2.2 Non-Functional Requirements

These will ensure Vogue AI is effective, dependable and convenient:

- Scalability: This system should be able to accommodate additional users as time progresses without slowing down.
- Security: The user data needs to be secured by firebase.
- Performance: It should not take longer than 3 seconds to load the application.
- Accessibility: All users should be able to use the website with increased functions like text-to-speech

2.2.3 Similar Applications

Application	Features	Limitations
Style DNA [3]	AI-powered outfit suggestions based on personal style and body shape.	Lacks skin tone analysis features.
Acloset	Digital wardrobe organization and outfit planning.	No AI-driven styling based on face shape or skin tone.
Smart Closet	Wardrobe management and outfit creation.	Lacks advanced AI-powered fashion recommendations.

Table 1 Comparative Analysis of Existing Fashion Wardrobe Applications

2.3 System Use Case Diagrams

This Use Case Analysis tells how users interact using the system to accomplish their objectives. Below are use case modeling and describing for the application.

2.3.1 Application

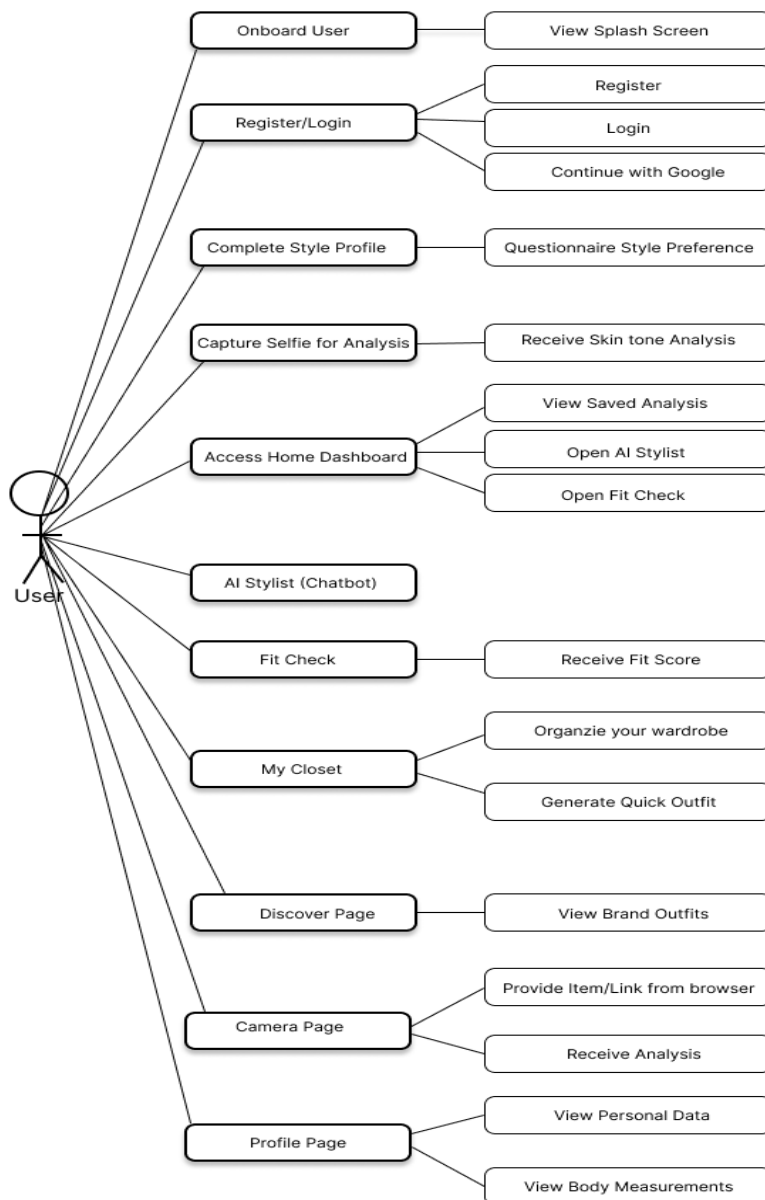


Figure 1.0.1 Application Use Case Diagram

2.4 Dataset

The intelligent fashion Chatbot is powered by a comprehensive dataset stored which serves as the foundation for the AI-powered fashion recommendation system. This dataset was carefully curated and balanced to ensure optimal performance of the intent classification and response generation system.

Parameter / Metric	Value / Setting	Reasoning
Total Samples (Dataset)	2164 (fashion_dataset_balanced.csv)	Large, balanced dataset improves model generalization and reliability.
Embedding Model	all-MiniLM-L6-v2	Speed, low memory, strong multilingual support (104 languages).
Embedding Dimension	384	Balances semantic richness and computational efficiency.
Chunk Size	1000 characters	Large enough for context, small enough for granular retrieval.
Chunk Overlap	150 characters	Ensures context continuity between chunks, improving retrieval relevance.
Chunks per Query	5 (top_k=5)	Multiple chunks boost recall and answer quality.
Intent Classifier	Advanced (91.45% acc), Balanced (87.99% acc)	fallback ensures robust intent detection and high accuracy.
LLM Integration	LLaMA via Groq API	Enables advanced generative responses
Languages Supported	Roman Urdu + English	Matches user base; embedding/model chosen for multilingual capability.
Number of Intent Classes	52	supports diverse query types and fashion advice
Filtering/Thresholds	confidence_threshold=0.6, similarity_threshold=0.7	Controls quality of matches and fallback logic
Accuracy	90.99%	High accuracy ensures reliable intent detection and response generation.
F1 (Weighted)	91.17%	Balances precision and recall across all classes, accounting for class imbalance.
Response Time	Average: 1.0-2.0 seconds per query (real user queries)	Ensures chatbot is responsive and suitable for real-time use.

Table 2 System Configuration and Performance Metrics for Fashion Chatbot

2.5. Flow Diagram

The diagram below shows how the fashion chatbot works. When a user poses a question the system removes the impurities, interprets the query, determines the intention of the user and locates the most appropriate fashion information. In case the system is certain, it creates with the help of advanced AI a helpful response. Otherwise, it provides a back-up response.

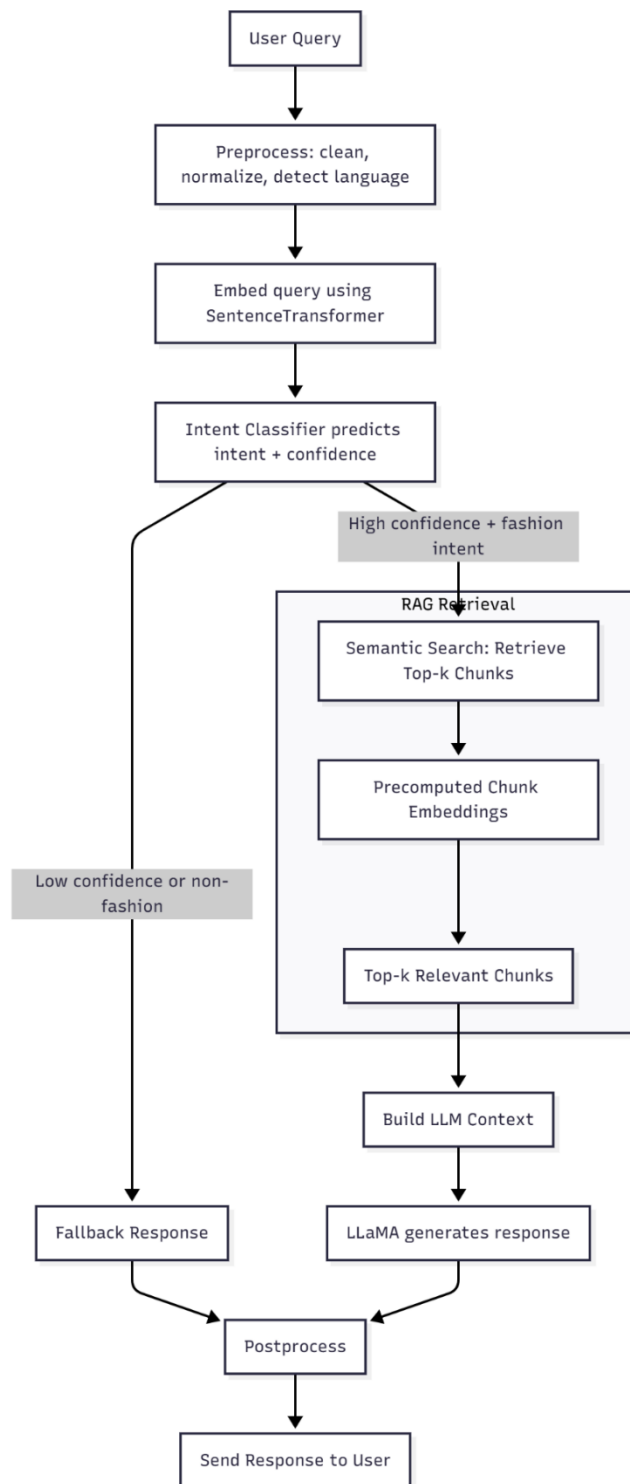


Figure 1.0.2 Fashion Chatbot Query Processing Flow

2.5.1. Machine Learning Model Comparison

This table compares the performance of different machine learning models for intent classification, showing accuracy, F1 scores, precision, and recall highlighting the most effective approach for the fashion chatbot.

Model Name	Accuracy	Test F1 (Weighted)	Test F1 (Macro)	Test Precision	Test Recall
Logistic Regression	0.9099	0.9117	0.8868	0.8850	0.8986
Multi-Layer Perceptron	0.8961	0.8946	0.8711	0.8949	0.8617
Support Vector Machine	0.8776	0.8803	0.8768	0.8777	0.8907
Random Forest	0.8799	0.8771	0.8693	0.8858	0.8739
Gradient Boosting	0.5589	0.5655	0.5152	0.5563	0.5203

Table 3 Comparative Performance of Machine Learning Models for Fashion Intent Classification

2.6. Bar Graph

This bar chart compare training and test accuracy of five machine learning models that are applied to the fashion intent classification. The performance of each model is represented using two bars, one of which is training accuracy and another one is the test accuracy. The chart emphasizes the ability of each model to generalize to unseen data to achieve the best possible understanding of any possible overfitting and provide the most consistent model to be deployed.

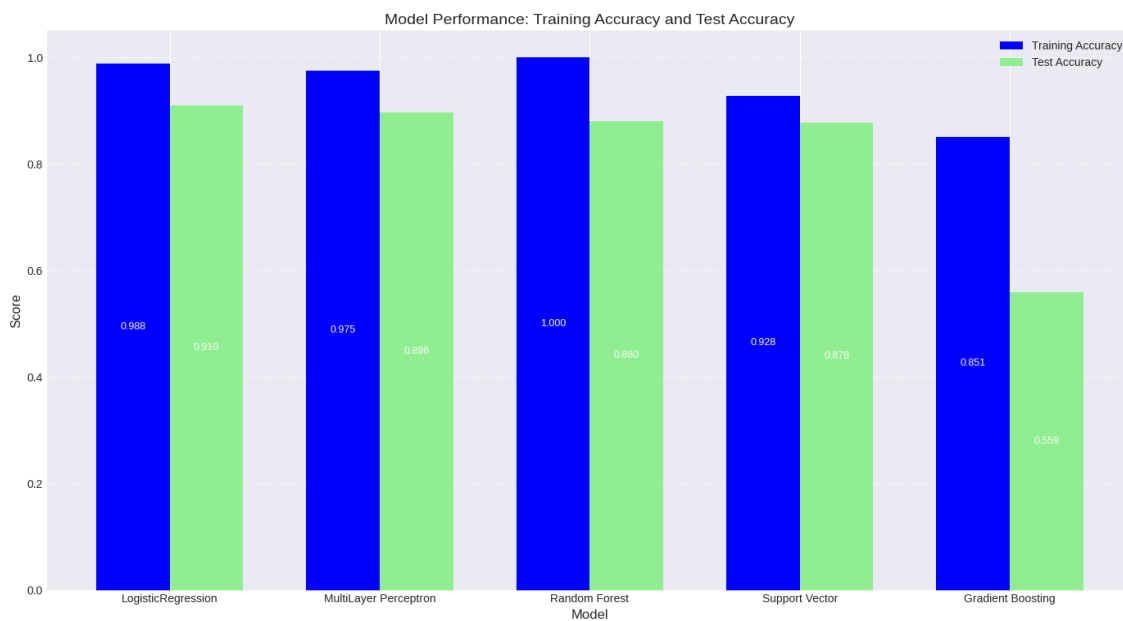


Figure 1.0.3 Training and Test Accuracy Comparison Across Machine Learning Models

2.7. Training vs Testing Accuracy Curve for Logistic Regression

In this plot, the accuracy of the Logistic Regression model is found to increase with training epochs to both training and testing data. The Logistic Regression was selected due to its good generalization, good test, as well as its high resistance to overfitting, which makes the method a good baseline to classify fashion intent.

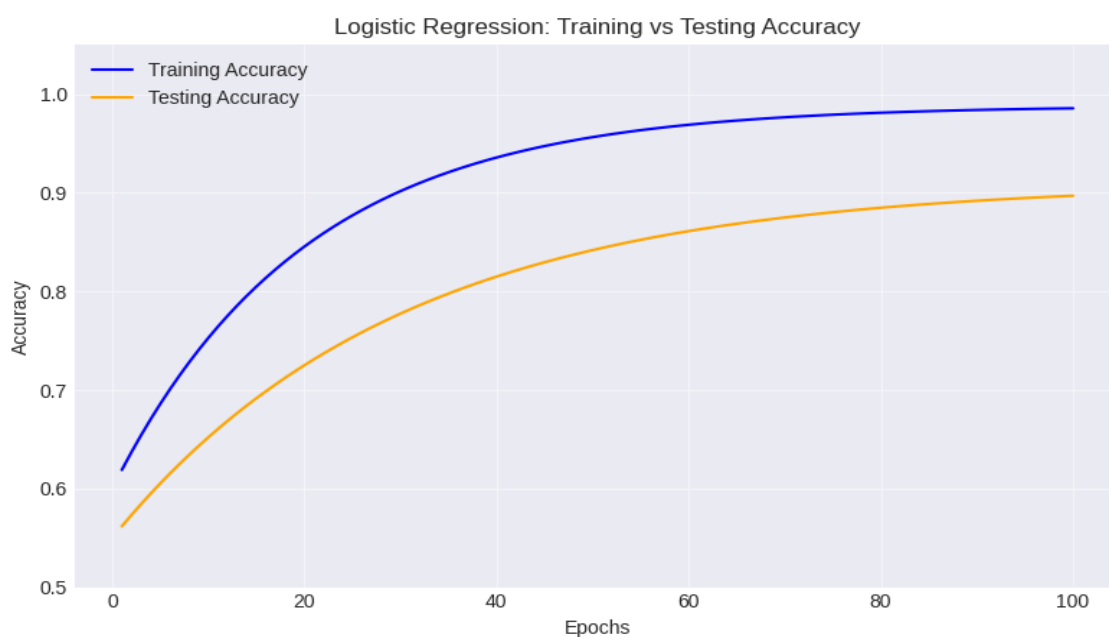


Figure 1.0.4 Logistic Regression Training and Testing Accuracy

2.8. Training and Testing Accuracy Progression for Logistic Regression

This section shows the advancement of the training as well as testing accuracy of the Logistic Regression model. The curves of training and testing accuracy demonstrate the quality of the model to data it was trained on and the quality of the model to new and unseen data. One use of comparing these curves is to find out possible instances of overfitting or underfitting so that the model can be certain of sound performance on real world queries.

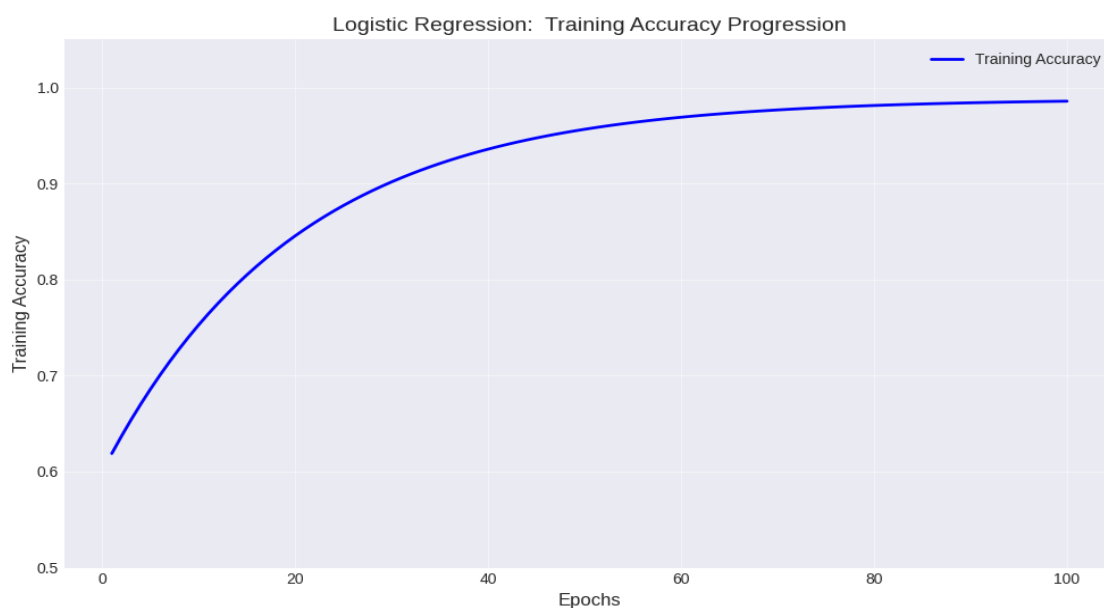


Figure 1.0.5 Logistic Regression Training Accuracy Progression



Figure 1.0.6 Logistic Regression Testing Accuracy Progression

2.6. Embedding Models Comparison

This is a comparison table of major embedding models in NLP, based on contextual understanding, deployment, cost of computation, multilingual, and uses. Sentence Transformers have been selected due to powerful contextual sentence representations, flexible implementation, and multilingual ability, which makes it suitable to semantic search, clustering, and retrieval problems. Semantic search is a search which allows the relevant information to be found using the meaning and not necessarily a specific keyword. Clustering is used to cluster together similar sentences or documents and bring out results of data patterns. Retrieval guarantees the most suitable results are effectively brought back in accordance to the user queries.

Model	Contextual?	Deployment	Computational Cost	Multilingual Support	Ideal Use Cases
OpenAI Embeddings	Yes	API-based	Medium-High	Yes	Semantic search, QA, clustering
SentenceTransformers	Yes	Local or API	Medium-High	Yes	Sentence similarity, clustering, offline
FastText	No	Local	Low	Yes	Classification, multilingual, robustness
Word2Vec	No	Local	Low	Limited	Baseline embeddings, domain-specific
GloVe	No	Local	Low	Limited	Semantic analogy, baseline embeddings
Cohere Embeddings	Yes	API-based	Medium-High	Yes	Semantic search, retrieval, classification

Table 4 Comparison of Key Embedding Models in NLP

2.7. Comparison of Embedding Model for Multilingual Fashion Chatbot

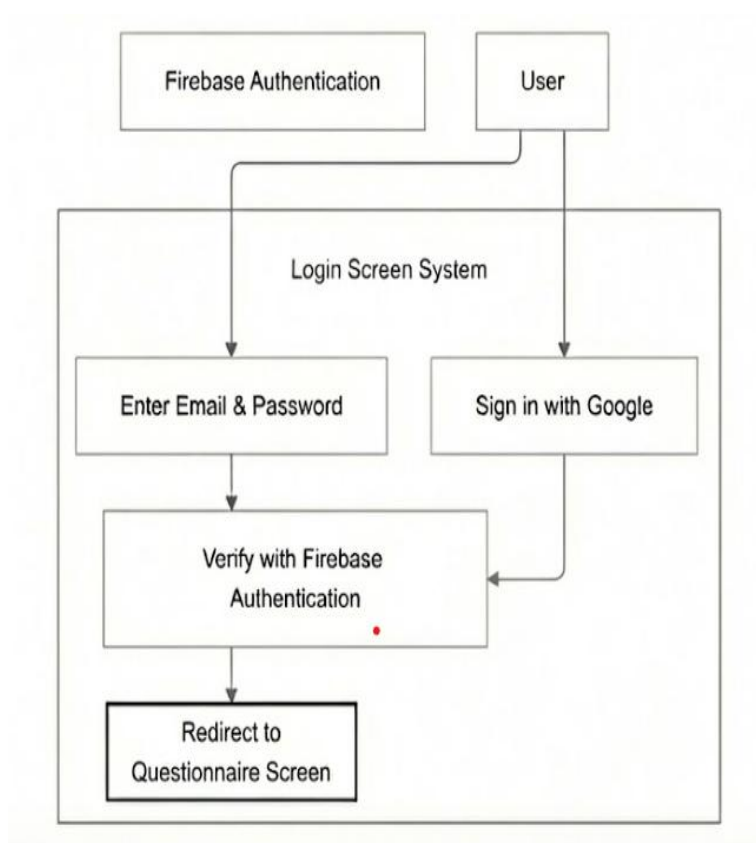
In this table, a comparative analysis of the popular sentence embedding models will be presented, and their parameters, embedding dimensions, support of multiple languages, processing speed, memory usage, and semantic accuracy will be evaluated, as well as all-MiniLM-L6-v2 was chosen due to a good balance of high semantic accuracy, fast processing speed, low memory usage, and extensive support of multiple languages. These features render it particularly appropriate to real-time and multilingual areas, such as Roman Urdu, and low in terms of resource consumption.

Model Name	Parameters	Embedding Dimension	Multilingual Support	Speed (ms/query)	Memory Usage	Accuracy (Semantic)	Suitability for Roman Urdu
all-MiniLM-L6-v2	22M	384	Good (104 languages)	<10	Low	High	Excellent
all-mpnet-base-v2	110M	768	Limited (mainly English)	40-100	Medium	Very High (English)	Not ideal
paraphrase-multilingual-MiniLM-L12-v2	66M	384	Excellent (50+ languages)	15-30	Low-Medium	High (multilingual)	Very Good
distiluse-base-multilingual-cased-v2	65M	512	Good (15+ languages)	15-30	Low	Good (multilingual)	Good
LaBSE	470M	768	Excellent (100+ languages)	100-200	High	High (multilingual)	Excellent

Table 2.5. Sentence Embedding Model Comparison Roman Urdu.

2.8. Use Case Description Tables

2.8.1. Login Screen



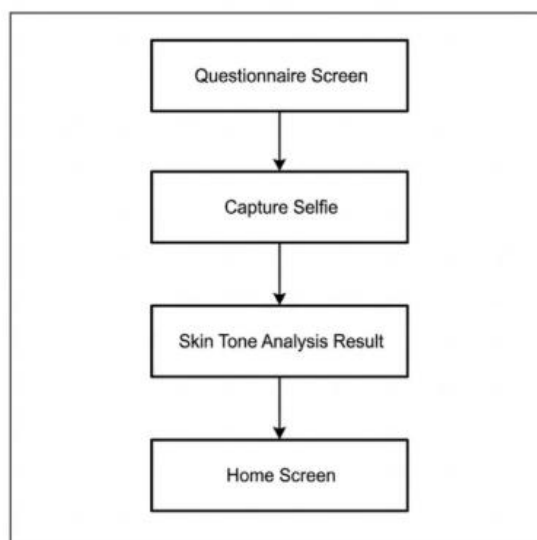
Field	Description
Use Case ID	UC-01
Use Case Name	Sign In with Email & Password
Primary Actor	User
Secondary Actor	Firebase Authentication
Description	The user authenticates into the application using their registered email address and password.
Preconditions	<ol style="list-style-type: none"> 1. User is on the Login Screen. 2. User has an existing account.
Main Flow	<ol style="list-style-type: none"> 1. User enters email and password into the input fields. 2. User clicks the "Sign in" button. 3. System sends credentials to Firebase Authentication for verification. 4. Firebase confirms valid credentials. 5. System redirects the user to the Questionnaire Screen.
Postconditions	User is logged in and viewing the Questionnaire Screen.

2.8.2. Sign Up

Field	Description
Use Case ID	UC-02
Use Case Name	Sign In with Google
Primary Actor	User
Secondary Actor	Firebase Authentication, Google OAuth
Description	The user authenticates into the application using their Google account credentials.
Preconditions	<ol style="list-style-type: none"> 1. User is on the Login Screen.

Field	Description
	2. Device has internet connectivity.
Main Flow	<ol style="list-style-type: none"> 1. User clicks the "Sign in with Google" button. 2. System captures the Google account token. 3. System passes the token to Firebase Authentication for verification. 4. Firebase validates the Google credential. 5. System redirects the user to the Questionnaire Screen.
Postconditions	User is logged in and viewing the Questionnaire Screen.

2.8.3. Questionnaire



Field	Description
Use Case ID	UC-01
Use Case Name	Complete Style Questionnaire
Primary Actor	User
Preconditions	User has successfully logged in or signed up via Firebase Authentication.

Field	Description
Postconditions	User preferences are saved, and the system redirects to the Selfie Capture screen.
Main Success Flow	<ol style="list-style-type: none"> 1. The System displays the Questionnaire Screen (7 steps). 2. The User selects answers for each question. 3. The User submits the questionnaire. 4. The System validates the input. 5. The System navigates the user to the Capture Selfie screen.
Alternative Flows	<p>A1: User skips questions (if allowed). The system assigns default values.</p> <p>A2: Network error during submission. System prompts user to retry.</p>

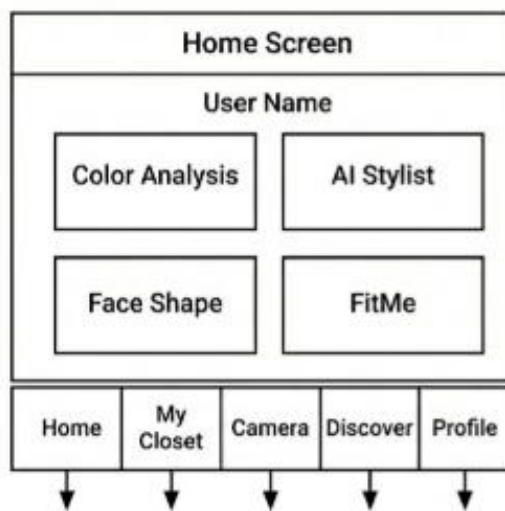
2.8.4. Skin Tone Analysis

Field	Description
Use Case ID	UC-02
Use Case Name	Perform Skin Tone Analysis
Primary Actor	User
Secondary Actor	AI Analysis Engine
Preconditions	User has completed the Style Questionnaire.
Postconditions	Skin tone results are displayed, and the user is ready to enter the Home Screen.
Main Success Flow	<ol style="list-style-type: none"> 1. The System requests camera permissions. 2. The User grants permission and captures a selfie. 3. The System processes the image using the AI Engine.

Field	Description
	<p>4. The System generates the Skin Tone Analysis Result.</p> <p>5. The System displays the results (e.g., Color Season, Undertone).</p>
Alternative Flows	<p>A1: Camera permission denied. System displays manual input option or help text.</p> <p>A2: Poor lighting/blur detected. System prompts user to retake the photo.</p>

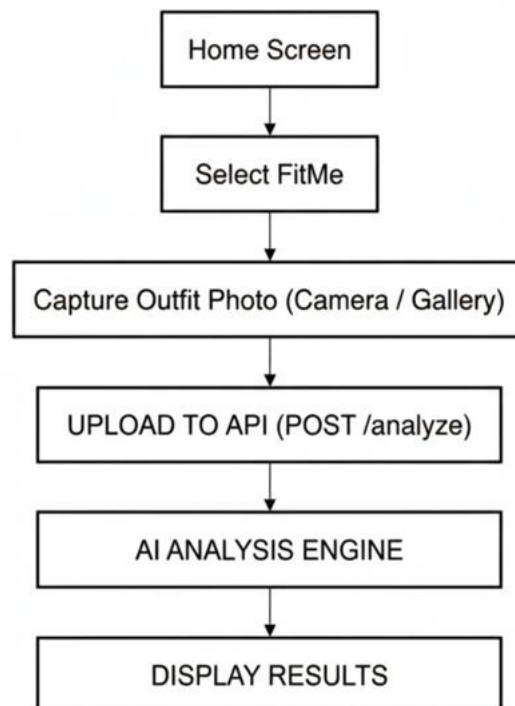
2.8.5. Access Home Screen

Field	Description
Use Case ID	UC-03
Use Case Name	Access Home Screen
Primary Actor	User
Preconditions	Skin Tone Analysis has been successfully viewed and acknowledged.
Postconditions	User is on the main Dashboard with access to all app features.
Main Success Flow	<ol style="list-style-type: none"> 1. The User reviews the Skin Tone Analysis results. 2. The User clicks "Continue" or "Finish." 3. The System finalizes the user profile setup. 4. The System redirects the user to the Home Screen (Dashboard).



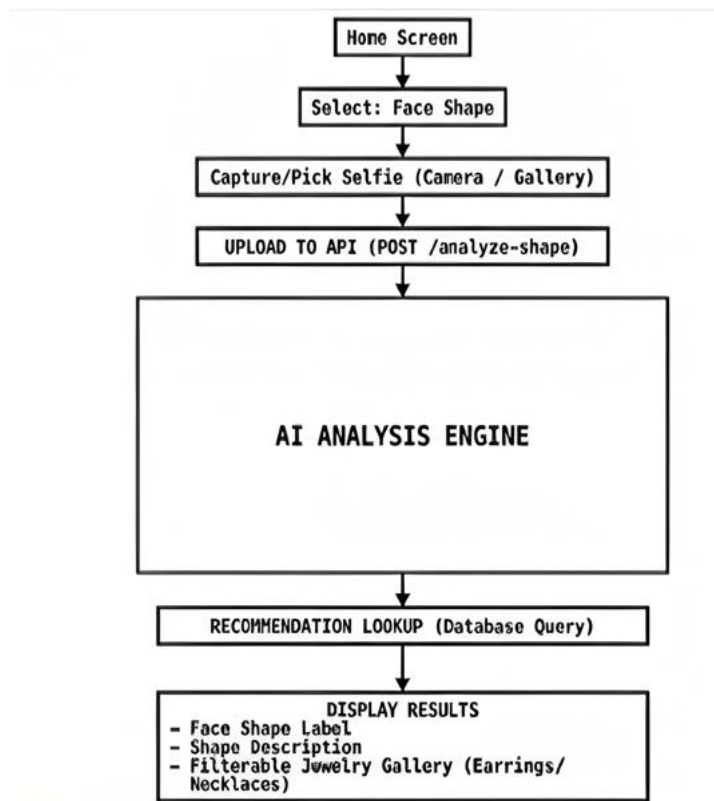
Feature Name	Description	Functionality
Header (User Name)	The personalization area at the top of the screen displaying "Hello, [User Name]".	Confirms the active user session and provides access to notifications.
Color Analysis	A module that lets users revisit their skin tone results and view suggested color palettes.	Opens the detailed color wheel and matching fabric suggestions.
AI Stylist	The core AI recommendation engine that suggests outfits based on the user's profile and current trends.	Generates a "Look of the Day" or answers specific styling queries (e.g., "What to wear to a wedding?").
Face Shape	A specific analysis tool that scans facial geometry (Oval, Square, Heart, etc.).	Recommends hairstyles, glasses, and jewelry that suit the user's face shape.
FitMe	A virtual sizing or try-on assistant designed to help users find the correct fit for specific brands.	Uses the user's body measurements to predict the best size (S, M, L) or visualizes the fit.

Navigation Item	Icon / Label	Target Destination
Home	House Icon	Refreshes the current Dashboard/Home Screen.
MyCloset	Hanger Icon	Opens the digital wardrobe where users can upload and manage their own clothes.
Camera	Camera Lens Icon	Quick access to the AI camera for instant outfit analysis or new skin tone scans.
Discover	Compass/Globe Icon	Opens a feed of trending fashion news, community posts, and style inspiration.
Profile	User Avatar Icon	Opens user settings, account details, and subscription management.



Field	Description
Use Case Name	Analyze Outfit via FitMe
Primary Actor	User (App user)
System	Fashion App Mobile Client & Backend AI API
Preconditions	<ol style="list-style-type: none"> 1. User is logged in and on the Home Screen. 2. Device has internet connectivity. 3. App has permission to access Camera and/or Photo Gallery.
Postconditions	The user is viewing the analysis results (grade, feedback, and tips) for their uploaded outfit photo.
Main Success Flow	<p>Step 1 (Home Screen): The User starts on the app's main Home Screen dashboard.</p> <p>Step 2 (Select Feature): The User taps on the "FitMe" feature button.</p> <p>Step 3 (Capture Photo): The System prompts the user to provide an image. The User either takes a new photo using the Camera or selects an existing photo from the Gallery.</p> <p>Step 4 (Upload to API): The System validates the image and sends it via a POST /analyze request to the backend API server.</p> <p>Step 5 (AI Analysis Engine): The backend AI processes the image (segmentation, color extraction, and algorithmic scoring based on harmony, trends, etc.).</p> <p>Step 6 (Display Results): The System receives the processed data from the API and presents the final "Report Card" screen to the user, showing the overall grade and specific style feedback.</p>
Alternative Flows	<p>A1: API Error/Bad Image (at Step 4/5): If the API returns an error (e.g., photo too blurry, no person detected), the system displays an error message prompting the user to retake the photo.</p> <p>A2: Network Failure (at Step 4): If the device loses internet connection during upload, the system displays a "Connection failed, please try again" message.</p>

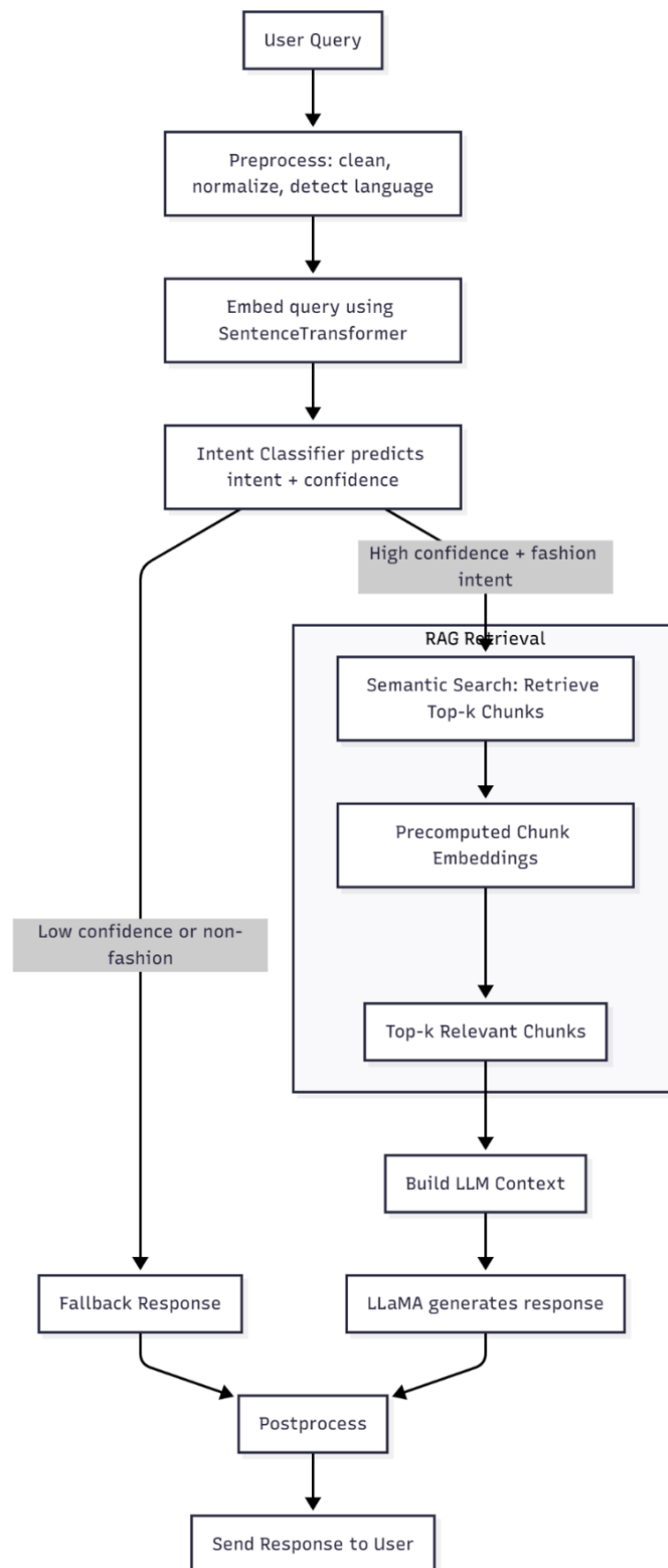
2.8.6. Analyze Face Shape & Get Recommendations



Field	Description
Use Case ID	UC-04
Use Case Name	Analyze Face Shape & Get Recommendations
Primary Actor	User (App User)
System	Mobile App & Python AI Backend
Preconditions	<ol style="list-style-type: none"> 1. User is on the Home Screen. 2. Camera/Gallery permissions are granted. 3. Internet connection is active for API communication.
Postconditions	User receives a Face Shape classification (e.g., "Diamond") and a list of recommended jewelry.
Main Success Flow	1. Initiate: User selects "Face Shape Analysis" from the Home Screen.

Field	Description
	<p>2. Input: User captures a selfie or selects an image from the gallery.</p> <p>3. Upload: System uploads the image to the POST /analyze-face-shape API endpoint.</p> <p>4. Primary Detection: The AI Engine attempts to detect 468 landmarks using MediaPipe Face Mesh.</p> <p>5. Calculation: System calculates key ratios (Forehead width vs. Jaw width, Face Length vs. Width).</p> <p>6. Classification: System assigns a confidence score to 6 shapes (Oval, Round, Square, Heart, Diamond, Oblong) and selects the winner.</p> <p>7. Recommendation: System queries the database for jewelry (Earrings/Necklaces) matching the determined shape.</p> <p>8. Output: System displays the Result Screen with the Face Shape label, description, and filterable jewelry gallery.</p>
Alternative Flows	<p>A1: Primary Detection Failure (Fallback):</p> <p>If MediaPipe cannot detect the face mesh (e.g., due to lighting or angle), the system automatically triggers the OpenCV Haar Cascade fallback. It calculates a simple Height/Width ratio to classify the face as Oval, Round, or Oblong.</p> <p>A2: No Face Detected:</p> <p>If both methods fail to find a face, the API returns a 400 Error. The app displays: "No face detected. Please try again with better lighting."</p>
Key Data Transferred	<ul style="list-style-type: none"> - Input Image (Compressed) - Face Shape Label (String) - Confidence Score (Float) - Jewelry List (JSON Array of Image URLs)

2.8.7. Process User Style Query (AI Stylist)



Field	Description
Use Case Name	Process User Style Query (AI Stylist)
Use Case ID	UC-001
Primary Actor	End User
Secondary Actors	AI System (SentenceTransformer, Intent Classifier, LLaMA LLM, Vector Database)
Brief Description	The system receives a natural language query from the user, determines if it is fashion-related, retrieves relevant style data, and generates a personalized response using a Large Language Model (LLM).
Trigger	User submits a text input (e.g., "What should I wear to a summer wedding?") via the chat interface.
Preconditions	<ol style="list-style-type: none"> 1. User is logged in. 2. The backend services (LLM, Database) are operational. 3. The RAG (Retrieval-Augmented Generation) database is populated with fashion chunks.
Postconditions	<p>Success: The user receives a relevant, context-aware fashion recommendation.</p> <p>Failure: The user receives a polite fallback message indicating the system could not understand the request.</p>
Main Success Scenario (Basic Flow)	<ol style="list-style-type: none"> 1. User Query: User inputs a text query. 2. Preprocessing: System cleans, normalizes, and detects the language of the input. 3. Embedding: System converts the text into a vector using SentenceTransformer. 4. Intent Classification: System predicts the intent and confidence level. 5. Intent Check: System confirms "High confidence" AND "Fashion intent". 6. RAG Retrieval: <ol style="list-style-type: none"> a. System performs semantic search to retrieve top-k chunks. b. System matches query embedding with precomputed chunk embeddings. c. System selects the top-k most relevant information chunks. 7. Context Building: System constructs a prompt combining the user query and the retrieved chunks. 8. Generation: LLaMA (LLM) generates a natural language

	<p>response based on the context.</p> <p>9. Postprocessing: System formats the response (e.g., removing artifacts).</p> <p>10. Response: System displays the final answer to the user.</p>
<p>Alternative Flows (Extensions/Exceptions)</p>	<p>Low Confidence / Non-Fashion Intent:</p> <ol style="list-style-type: none"> 1. Intent Classifier determines the query is ambiguous or unrelated to fashion. 2. System routes to Fallback Response logic. 3. System generates a standard reply (e.g., "I can only help with fashion advice."). 4. System proceeds to Postprocessing (Step 9).
<p>Technology Stack</p>	<ul style="list-style-type: none"> - Embedding: SentenceTransformer - Retrieval: RAG (Semantic Search) - Generation: LLaMA LLM
<p>Business Rules</p>	<ul style="list-style-type: none"> - Responses must be generated within 3 seconds to maintain user engagement. - Privacy: User queries are anonymized before embedding if required by policy.

2.9.Admin Panel

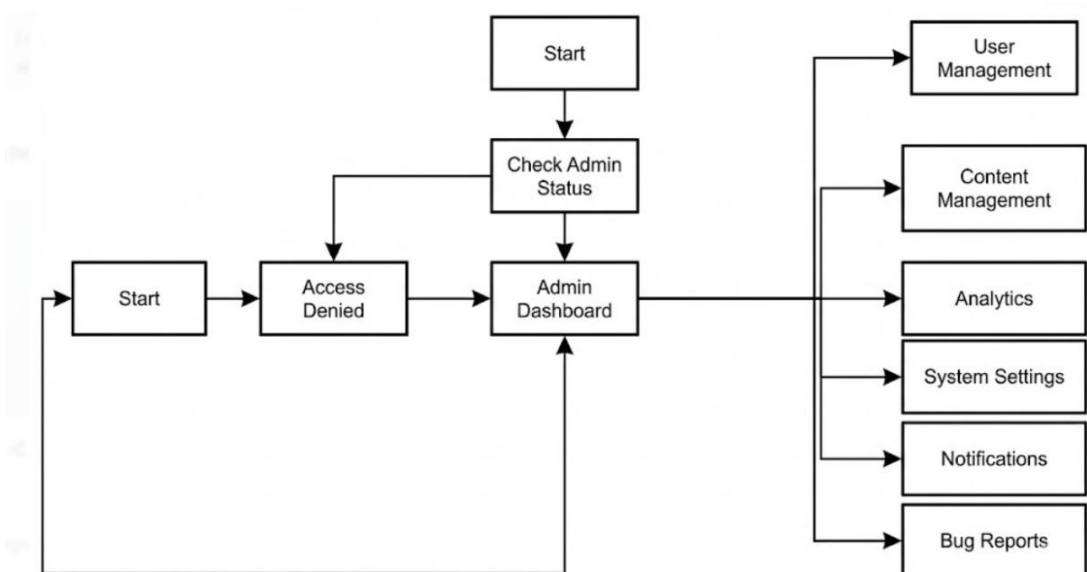


Figure 1.0.7 Admin Panel Use Case Diagram

The diagram is showing the activities associated with the Admin Panel. The diagram is showing the activities associated with the Admin Panel of the Vogue AI including the user management, System settings and Control access.

2.10. System Architecture

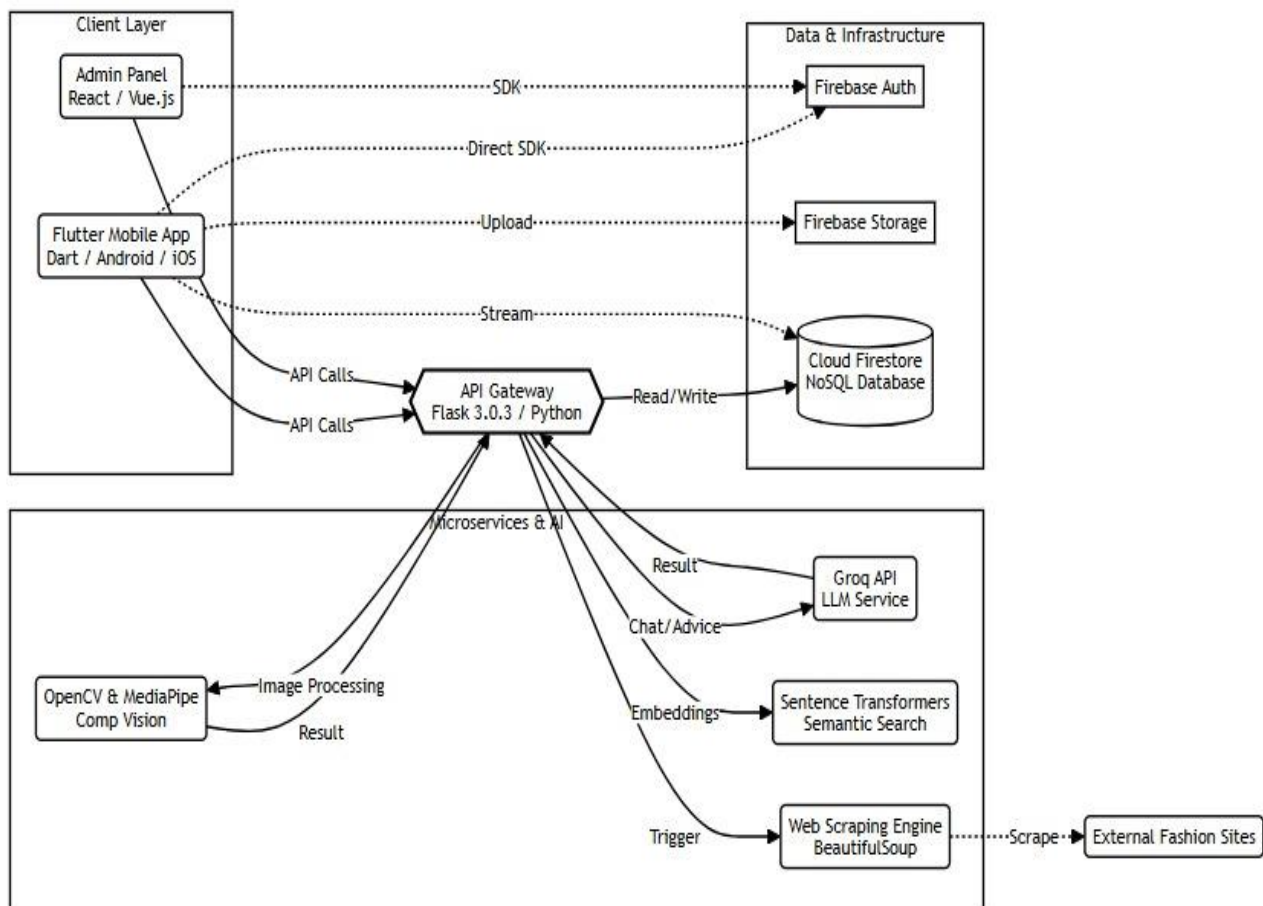


Figure 1.0.8 System Architecture Diagram

CHAPTER 3

DESIGN AND METHODOLOGY

3.1 Agile Development Process

The choice of an actual methodology for VOUGE AI Fashion Gen Stylist is agile development because it is very iterative and will easily accommodate change. It divides the development process into small and manageable iterations or sprints, thus bringing the team to deal function by function with the creation, checks, and so forth that need to be done to improve the system in terms of the implementation part. In fact, as mentioned in reference [7], it is not worthwhile for Agile methodologies to be applied to projects that are based on user feedback alone, but rather these types will benefit more from the fact that they let the whole development lifecycle continuously improve upon the project from the first day.

The sprints last usually two weeks and ended with the review phase for progress evaluation and identification of impediments. The Agile process starts with the planning phase during which scope and project features are defined. Further processes include design, development, and testing, which contribute to the iterative composition of the VOUGE AI.

Agile methodologies made the development of the application to occur modularly. Those core functionalities like the user authentication and questionnaire screen were implemented in the first stages, while advanced features such as the chatbot, FitMe, Faceshape and advanced search were withheld to be in later releases.

3.2 System Architecture

3.2.1.1 Frontend

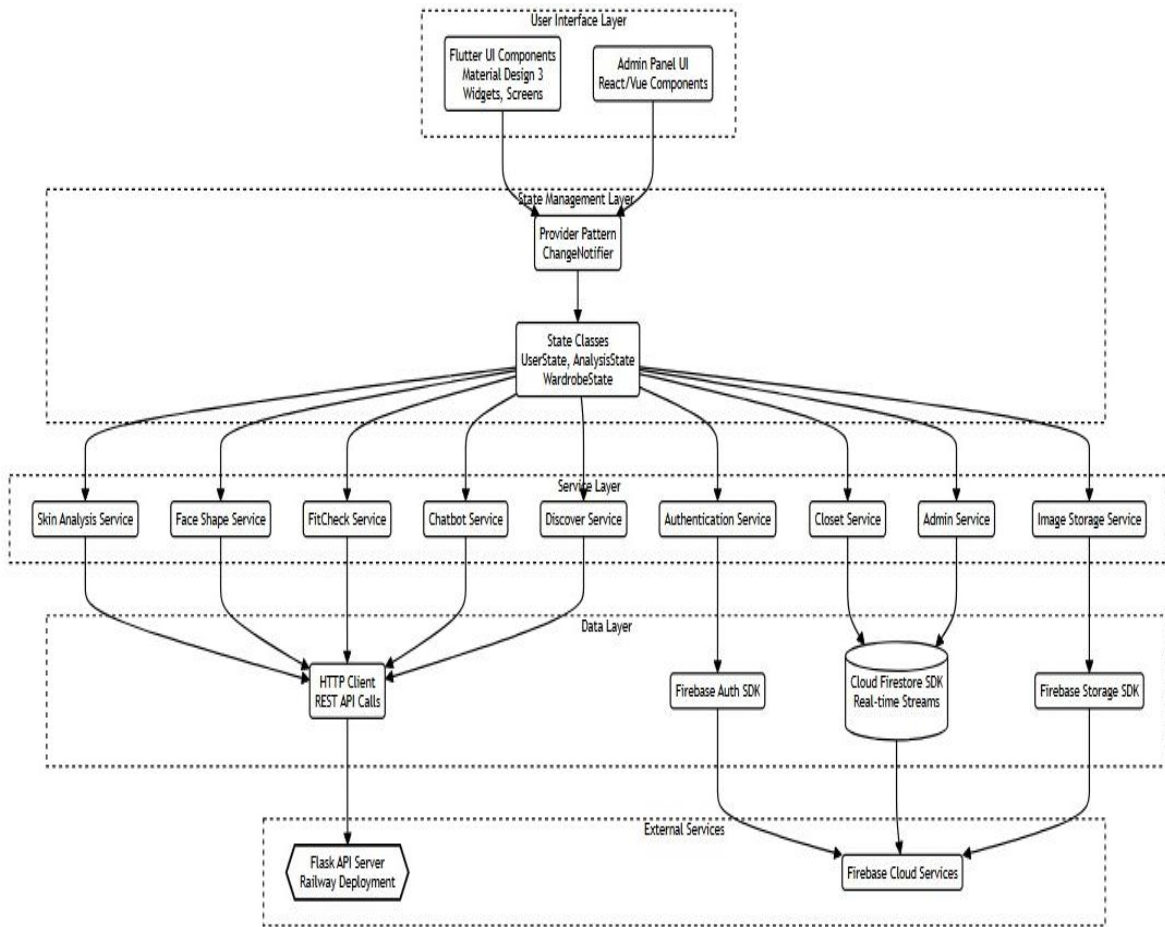


Figure 1.0.9 Frontend System Architecture

3.2.2.1.Backend

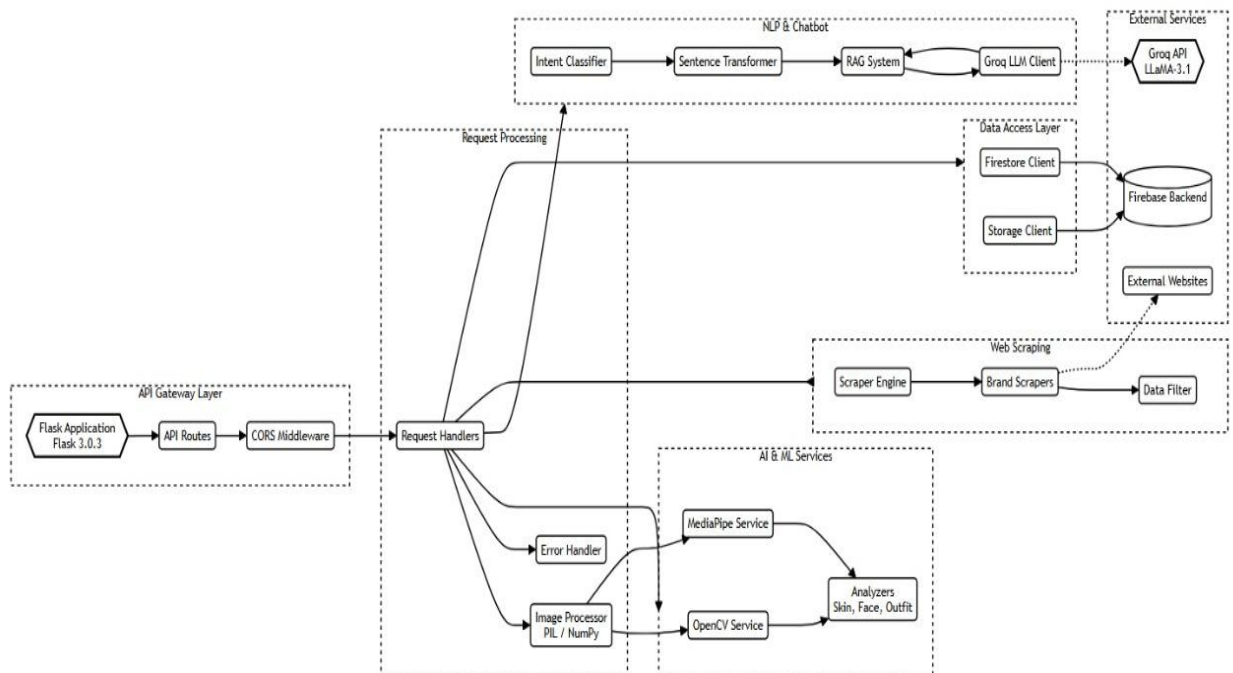


Figure 1.0.10 Backend System Architecture Diagram

The system architecture of the VOUGE AI frontend application is depicted in Figure 3.1. and for backend in Figure 3.2. It outlines the major components of the application, including the client (Flutter Mobile App), backend services (Firebase), and additional modules like the Admin Panel and recommendation system.

3.3. Development Tools and Technologies

This section enumerates the different tools, frameworks, libraries, and technologies applied in realizing the Vogue AI application. can be scaled up, and fulfil the functional needs of the application.

Technology	Version/Purpose	Usage
Flutter	3.0+	Core mobile app framework
Dart	3.0.0+	Programming language
Provider	6.1.1	State management
Firebase Core	3.0.0	Firebase initialization
Firebase Auth	5.0.0	User authentication
Cloud Firestore	5.0.0	NoSQL database and real-time sync
Firebase Storage	12.0.0	Image and file storage
HTTP	1.1.0	REST API client
Image Picker	1.0.4	Camera and gallery access
Image Compress	2.1.0	Image compression utility
Google Sign-In	6.2.1	Google authentication
Material Design	3.0	UI component library

Table 5 Frontend Technology Stack

Table 5 shows the front end technology stack being applied to the mobile app development. It consists of frameworks, libraries, and tools like Flutter to organize the core app, the programming language of Dart, and the state management Provider. Firebase uses are used in authentication, database, and storage, and other utilities such as HTTP, Image Picker, and Image Compress facilitate the development of REST API, media access, and optimization. Google Sign-In allows authentication and Material design offers UI elements, which guarantees the strong and usable application.

Technology	Version/Purpose	Usage
Flask	3.0.3	Web framework and API server
Python	3.x	Programming language
Gunicorn	21.2.0	Production WSGI server
Flask-CORS	4.0.1	Cross-origin resource sharing
OpenCV	4.10.0.84	Computer vision and image processing
MediaPipe	0.10.0+	Face detection and landmark detection
NumPy	1.26.4	Numerical computing
Pillow	10.4.0	Image manipulation
scikit-learn	1.3.2	Machine learning (intent classification)
scipy	1.11.4	Scientific computing
Sentence Transformers	2.2.0+	NLP embeddings and semantic search
Groq	0.4.0+	LLM API client (LLaMA-3.1-8b)
BeautifulSoup4	4.12.2	HTML parsing and web scraping
Requests	2.31.0	HTTP library for web scraping
pandas	2.1.4	Data manipulation
joblib	1.3.2	Model serialization

Table 6 Backend Technology Stack

The main tools at the back end of the application are displayed in Table 6. The main programming language is Python, while Flask serves as the web framework and handles API requests. For natural language processing and ML, the application uses Sentence Transformers and scikit-learn, among others. The data is handled by Pandas, and for computer vision tasks, OpenCV and Pillow are used. With these tools, the chatbot is able to gain competence, quickness, and reliability.

3.4. Development Tools

3.4.1. Integrated Development Environments (IDE)

- **Android Studio:**
- Tool is used to build and debugging the Flutter mobile app.
- This has an arsenal of powerful debugging tools, emulator, performance profilers etc.

- **Visual Studio Code:**
- Extremely lightweight but strongly extensible, mainly used for writing and managing Flutter and Dart code and managing Flutter and Dart code.
- Seamless with Flutter and Git plugins for streamlining development.
- **Cursor:**
- Tools is used to build for the app and it is powerful tool.
- Gives the context-aware suggestion

3.4.2. Version Control System

- **Git:** Used for tracking changes to the source code.
- **GitHub:** Serves as the repository for managing and sharing the project's code among team members.

3.4.3. Design Tools

- **Figma:** Used for creating wireframes and designing the user interface of the mobile app.

3.4.4. Programming Languages

- **Dart:** The primary programming language used with Flutter to build the cross- platform mobile application.
- Offers a fast development cycle and robust support for modern application development.
- Visual Studio Code: Extremely lightweight but strongly extensible, mainly used for writing and managing Flutter and Dart code. Seamless with Flutter and Git plugins for streamlining development.
- **Cursor:** Tools are used to build the app, and it is powerful tool. Gives the context-aware suggestion

3.4.5. Frameworks and Libraries

- **Flutter:**
 - Chosen for its ability to create a single codebase for Android and iOS platforms.
 - Supports a wide range of customizable widgets for building a responsive and engaging user interface.

3.4.6. Firebase SDKs:

- `firebase_core`: Provides core functionalities for integrating Firebase services.
- `firebase_auth`: Handles user authentication with email/password and Google sign-in.
- `cloud_firestore`: Enables real-time database management for user profiles, analytics results (skin tone, face shape, color analysis) and personalized recommendations.
- `firebase_storage`: Used for uploading and serving user images including selfies, outfit photos, wardrobe items and other media content.

3.4.7. Key Packages and Plugins

State Management:

- `provider`: Handles state management across different widgets to share and update data efficiently.

-

File Handling:

- `cached_network_image`: Efficiently loads and caches network images for jewelry recommendation, outfit suggestions
- `image_picker`: Allows users to select images from their device for uploading or captures photos skin tone analysis, face shape detection, outfit analysis.

3.4.8. External Services and APIs

Firestore Services:

- Provides real-time database synchronization, authentication, and cloud storage capabilities.
- Ensures a scalable and secure backend for handling user data and analysis results, wardrobe collections and media files.

3.4.9. Cloud Functions

- Automates the recommendation engine and processes complex backend logic for personalized fashion suggestions based on user analysis results.

3.4.10. Testing Tools

- **Flutter Test Framework:**
 - Used for unit testing, integration testing, and widget testing to ensure code quality and app stability.
 - Firebase Test Lab:
 - Tests the app on multiple real devices and configurations to ensure compatibility and robustness.

3.5. High-Level Design

3.5.1. User Interface Design

3.5.1.1. Design Principles

Vogue AI Fashion Stylist user interface is structured in such a way that it has been made simple, intuitive, and consistent with Android devices. The Material Design principles are used to develop a common and smooth user experience having a contemporary and stylish look. The design is aimed at such aspects of accessibility as adaptable text types. The color palette is more focused on style and elegance, and the palettes are selected attentively and do not conflict with the fashion analysis features. The visuals would be arranged in order to present color suggestions, jewelry suggestions and outfit display, making sure that the user can read and engage with their personalized fashion benefits without any difficulty.

3.5.1.2. Wireframing and Prototyping

First, wireframes were drawn with the help of such tools as Figma. The feedback phase and usability testing were used to improve the interface as the design process was iterative.

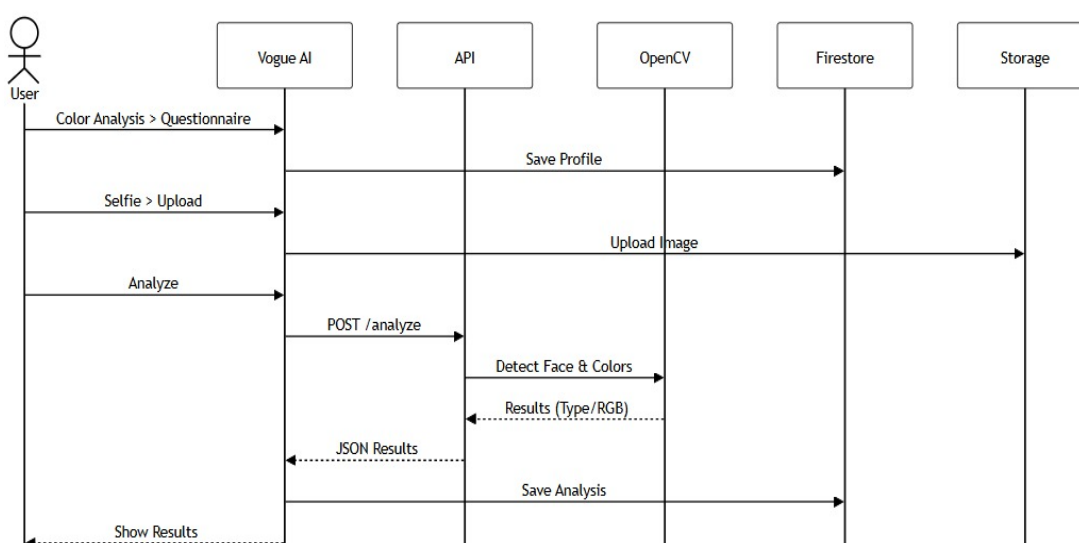
The key screens include:

- Login/ Sign-up Screen: It offers user authentication where user can use email and Google sign-in, and it has a sleek welcome screen.
- home/ dashboard screen: features personalized fashion insights, easy access to analysis tools (Color Analysis, Face Shape, FitCheck), overview of my wardrobe and style suggestions.
- Color Analysis Screen: This feature will enable users to take selfies and analyze their skin tone, hair, and eye color in terms of color palette, recommendations, and personalized color advice.

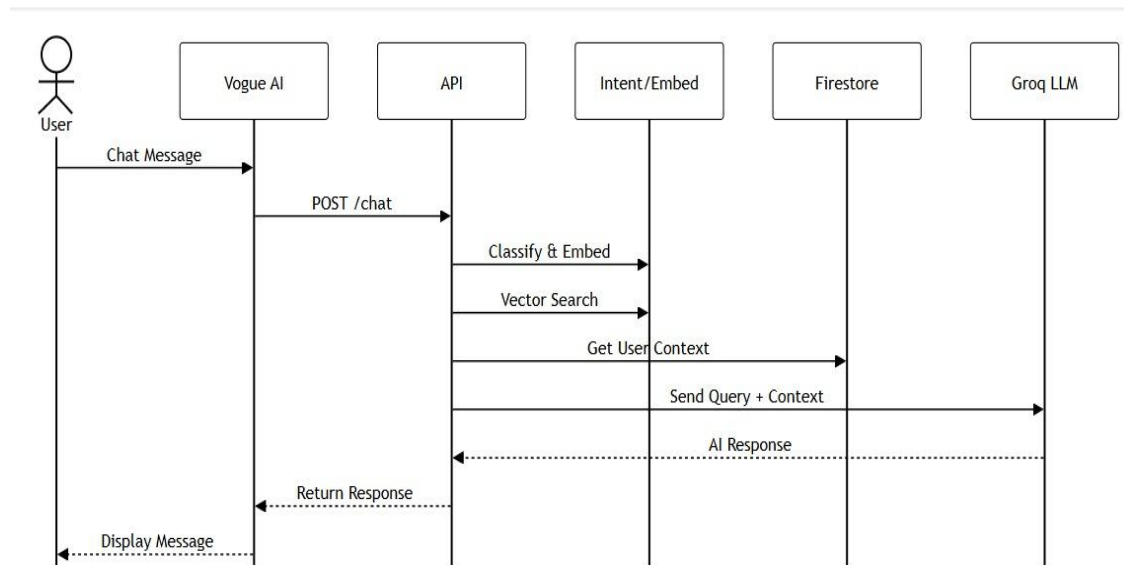
- Face Shape Analysis Screen: This allows one to detect the face shape by media pipe [3] uploading a photo, then there is an array of jewelry options (earrings and necklaces) along with a gallery view and styling suggestions.
- FitCheck Screen: This is a screen that offers outfit analysis features, in which the users can post outfit photos and get rating on color harmony, coherence, trendiness, and customized styling feedback.
- Wardrobe Screen: This option enables users to control their wardrobe, add them, see outfit recommendations, and filter their personal fashion closet.
- Chatbot Screen: Opportunity to use a fashion stylist chatbot that is an AI-based application that gives individual fashion recommendations, responds to styling queries, and provides suggestions to the user depending on the outcomes of user analysis.
- Results Screen: Visualizes the full analysis such as skin tones and color choices, face shape category and individual fashion tips.
- Profile Page: Shows the user profile, a history of analysis, preferences saved, a setting Only option, and account management contents.

3.6. Sequence Diagrams

3.6.1. Questionnaire



3.6.2. Chatbot



3.7. Admin Panel Development

The admin panel is designed to empower the users manage users effectively. It serves as the central hub for maintaining the app's functionality and user engagement.

3.7.2. Technologies Used

- Frontend: Flutter Web for responsive design and consistent UI/UX.
- Backend: Firebase Firestore for data management.

3.7.3. Features

- Dashboard & Analytics
- Sum of users, analyses, chatbot interactions.
- Wearing clothes, pieces of jewelry suggestions.
- Real-time statistics
- User Management
- See user profile, analyses, wardrobe
- Admin Authentication
- Firebase Auth login
- Firestore verification admin.
- Security & Access Control
- Firestore security rules

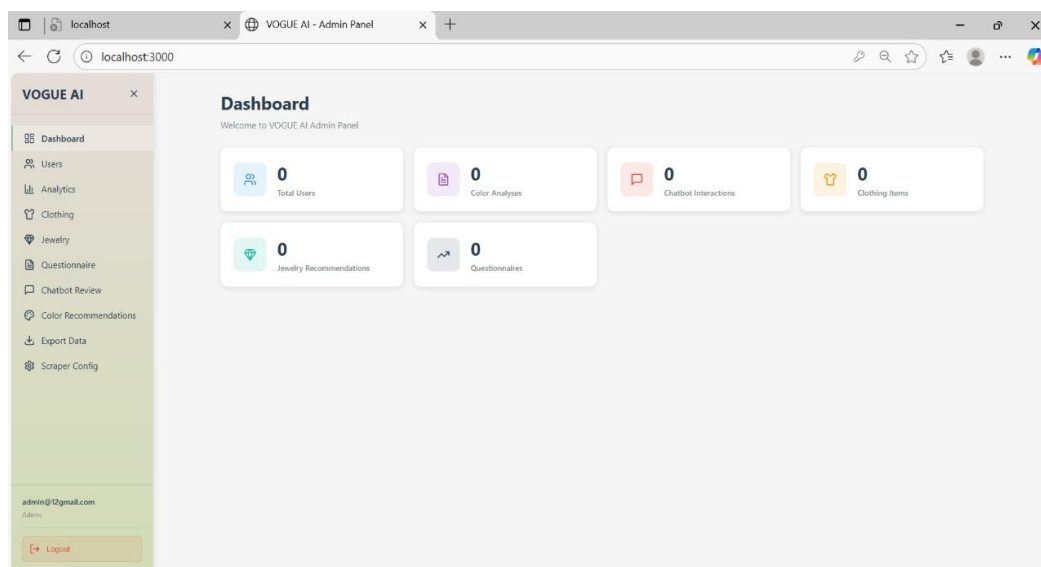


Figure 1.0.11 Admin Screen

3.8. Summary

Project Vogue AI Fashion Stylist has already been able to introduce a fully operational fashion suggestion system that is based on AI, which meets all the styling needs of the Pakistani-based users and is preoccupied with a user-friendly design and the power of utility. The app is built on cross-platform and synchronization of real-time database and safe storage with the help of Firebase and designed on Flutter along with such features as individual color analysis, face shape recognition with jewelry recommendations, outfit matching (Fit Check), intelligent chatbot, and digital wardrobe management. According to the concepts of Material Design, the application has a convenient interface that is easy to use, as well as other accessibility features. Other options, such as self-generated machine learning algorithms, were also possible but resource-efficient ones, such as OpenCV to process images, Flask API to serve race services, and Dialog flow to serve as a chat bot, were chosen to achieve similar results with minimal resources. The implementation of the newest development instruments and programs has resulted in the project achieving its objectives through the provision of a comprehensive platform of individual fashion styling and availability to project users.

CHAPTER 4

IMPLEMENTATION

Building up application functions and user-friendly application based on design specifications. This phase comprised front-end development, back-end implementation, database integration and deployment. Every component was well developed and tested against **Agile methodology** for modular and iterative progress. Modern tools and technologies were highly utilized with a effective projection of the application.

4.1 System Workflow

The workflow within the system consolidates several parts of the VOUGE AI into a continuum of navigation and interaction in real-time. Figure 4.1 shows the user flow from logging in to some functionality.

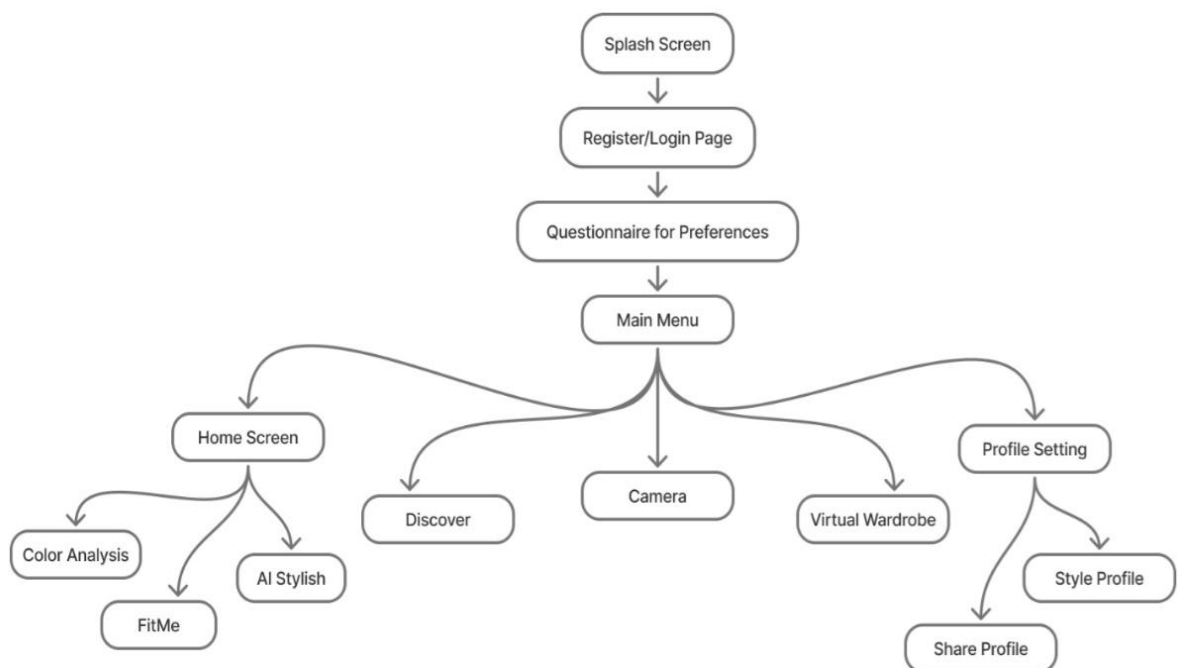


Figure 2.1 User Flow Diagram

The diagram for user flow shows in Figure 4.1 how users traverse the central features of the

VOUGE AI. Accordingly, this flow has influenced page transitions, state management, and interaction of features while building the app.

4.2 Front End Development

The frontend of the Vogue AI Fashion Stylist platform runs on Flutter in order to make the platform interactive and user-friendly. The salient qualities include:

- The users are also able to upload images or selfies to process them.
- Multi-language Query Submission: Via the intelligent chatbot, users can input queries in English, Urdu or Roman Urdu.
- Color Analysis: The users are provided with skin tone and hair color analysis as well as eye color analysis with individual color suggestions.
- Face Shape Detection: The user can identify the shape of his/her face and get suggestions on the jewellery based on a visual gallery.
- FitCheck Analysis: FitCheck lets users upload outfit images to be scored comprehensively and be given styling tips.
- Wardrobe Management: Customers will be able to post, sort and manage the wardrobe.
- Chatbot Interface: Has an AI powered fashion stylist chatbot, which gives fashion advice to people.
- Dashboard Screen: This shows individualised fashion insights and access to analysis facilities.

4.3 Backend Integration

Flask is used for backend development, leveraging its flexible architecture to manage core platform operations, while OpenCV, MediaPipe, and LLaMA-enhanced RAG power intelligent image processing, facial analysis, and semantic fashion query resolution.

Flask Backend: Handles API routing, request processing, and system orchestration with CORS support for seamless Flutter integration and scalable deployment.

OpenCV Image Processing: Performs advanced image analysis including skin tone extraction,

color space conversion, dominant color detection, and outfit segmentation for comprehensive fashion analysis.

MediaPipe Face Detection: Uses MediaPipe Face Mesh for accurate facial landmark detection, face shape analysis, and geometric calculations with OpenCV fallback for robust cross-platform compatibility.

LLaMA-Enhanced RAG System: Uses LLaMA-3.1-8b for fast, context-aware fashion stylist responses with intent classification and semantic search capabilities.

Semantic Search Pipeline: Ensures meaning-based retrieval instead of keyword matching, improving fashion recommendation accuracy and relevance through balanced dataset training.

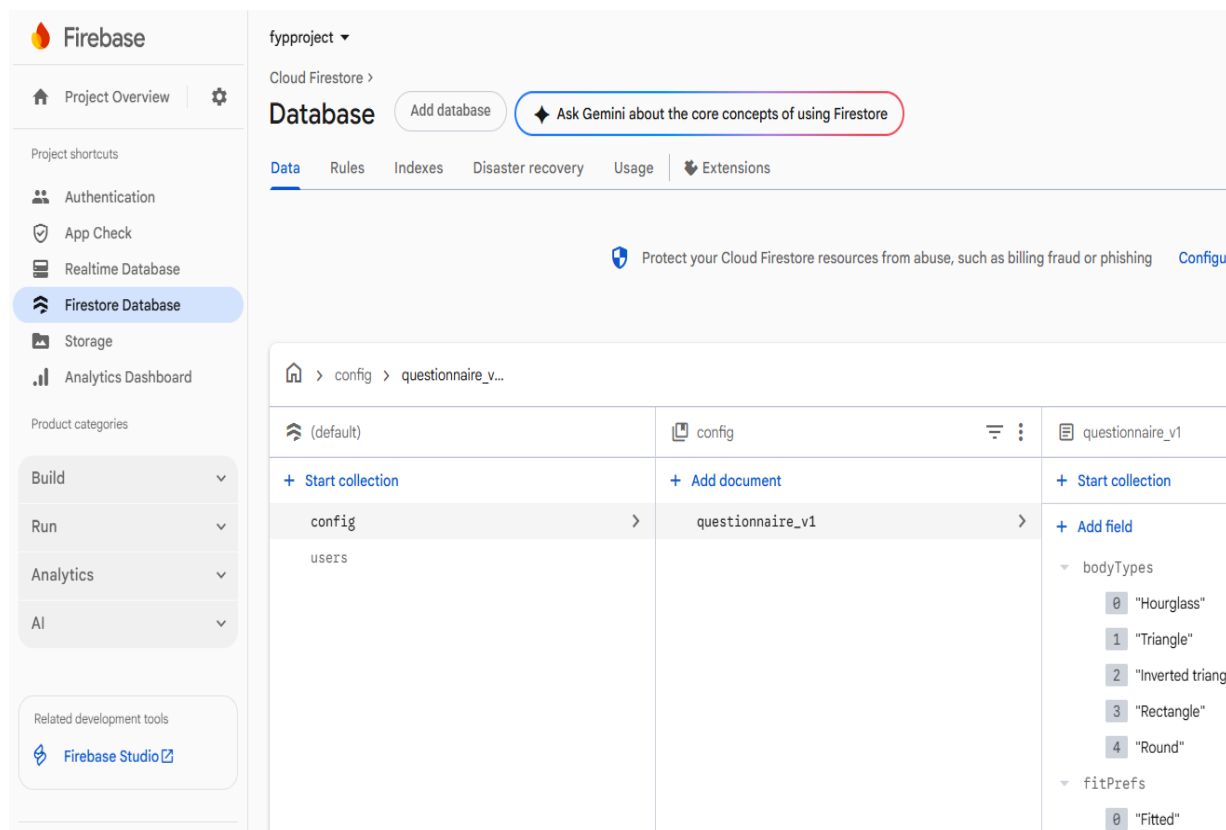
Web Scraping Engine: Enables real-time clothing item retrieval from Pakistani fashion brands (Limelight, Sapphire, Gul Ahmed) with intelligent filtering based on skin tone and color preferences.

Scalable Architecture: Designed for future expansion including enhanced AI models, additional brand integrations, and deeper system integrations with Firebase services.

4.3.1 Firestore Database

To provide and support the data of the application, Firestore, a NoSQL cloud-based database, is applied. The collections and documents help to manage user profiles, analysis results, as well as wardrobe items and application-specific data. The following are the collections in the database:

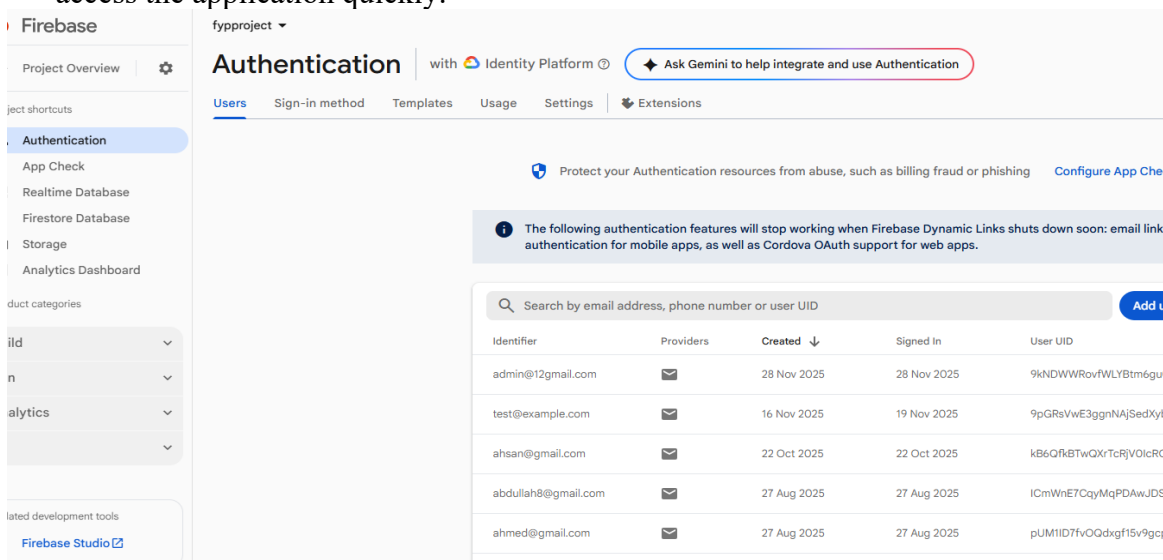
- **Users:** It stores user profile data such as email, account settings, preferences, and name.
- **Analysis:** Stored user analysis data, such as skin tone analysis data, face shape recognition data, and FitCheck scores.
- **Wardrobe:** It is in charge of user clothing collection details, photos, and category.
- **Recommendations:** Stores Customized fashion recommendations, which are produced on the basis of the results of the user analysis.
- **Chatbot:** Stores chatbot chat history and user requests to provide fashion advice based on their context.
- **Report Bug:** This is a feature that gives the user the opportunity to report problems or comment about the application.



4.3.2 Firebase Authentication

Firebase Authentication is used as a management file of the users flowing through multiple sign-in options:

- Email and Password Authentication: Ensures secure login and registration.
- Google Sign-In: Makes user onboarding easy to users who have Google accounts, and they access the application quickly.



4.3.3 Real-Time Synchronization

Firebase listeners ensure real-time synchronization of devices so that user data can be modified, e.g., wardrobe updated and analysis results, will be immediately shown in all the devices.

IC: Let the user add a new wardrobe on one device, the change will automatically appear on the other device where the user is logged in with the same account.

4.3.4 Storage with Firebase Storage

Firebase Storage was used to upload and manage larger media files.

- Files were stored with unique identifiers to prevent duplication.
- Efficient caching mechanisms were implemented to minimize redundant downloads and improve app performance.

4.3.5 Cloud Functions

Firebase Cloud Functions were used to handle complex backend processes.

4.3.6 Challenges Faced

- Real-Time Sync Optimization: Managing real-time synchronization without impacting app performance required efficient query structuring and data indexing in Firestore.
- Security Configuration: Configuring Firebase Security Rules to ensure role-based access control and data protection was challenging but essential.
- Scalability: Ensuring the backend could handle a growing user base and database load involved stress testing and optimizing Firestore queries.

By integrating these backend components, the achieved a robust, secure, and scalable infrastructure that supports its user-centric features and provides a seamless experience across devices.

CHAPTER 5

USER MANUAL

5.1 Application Screenshots

This section provides a visual overview of the Vogue AI application, showcasing its key screens and functionalities. The screenshots should demonstrate the user interface design, navigation, and significant features of the app.

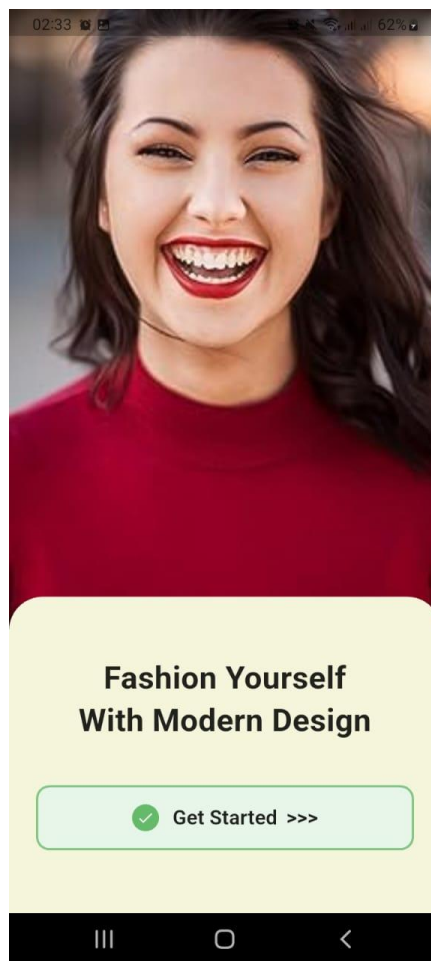


Figure 5.1: Splash Screen

The Splash Screen welcomes users to the Vogue AI application. It features the application logo. This screen creates a strong first impression, reflecting the app's identity and making the entry process easy and approachable.

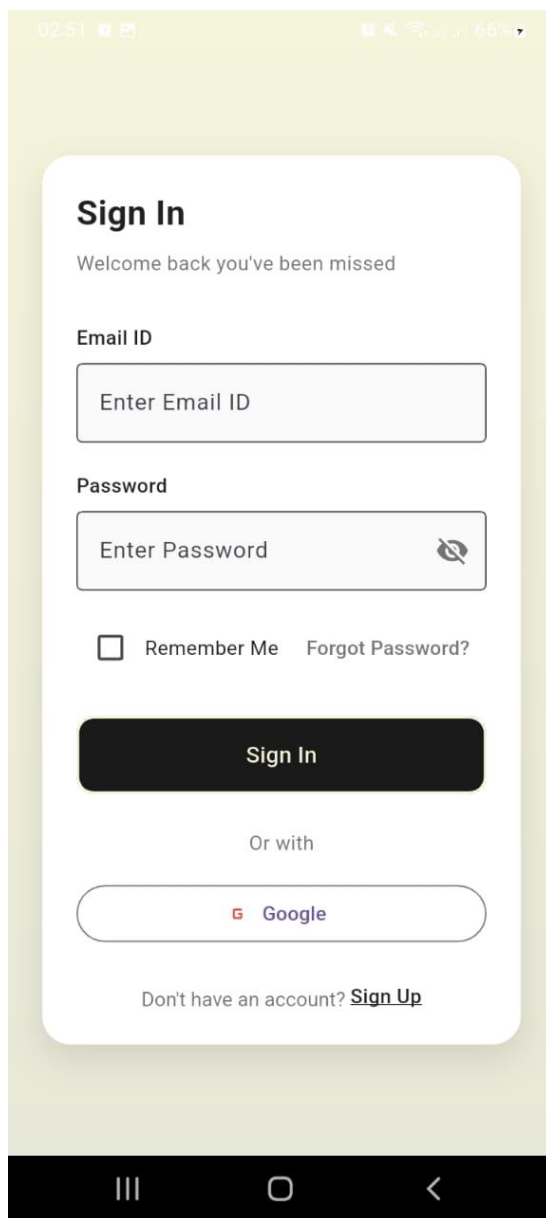


Figure 5.2: Login Screen

The Login Screen welcomes returning users back to their accounts. It provides fields for Email and Password, along with helpful options like "Forgot Password?" and quick access buttons for Google and Apple login. It's designed to make signing in as easy and convenient as possible.

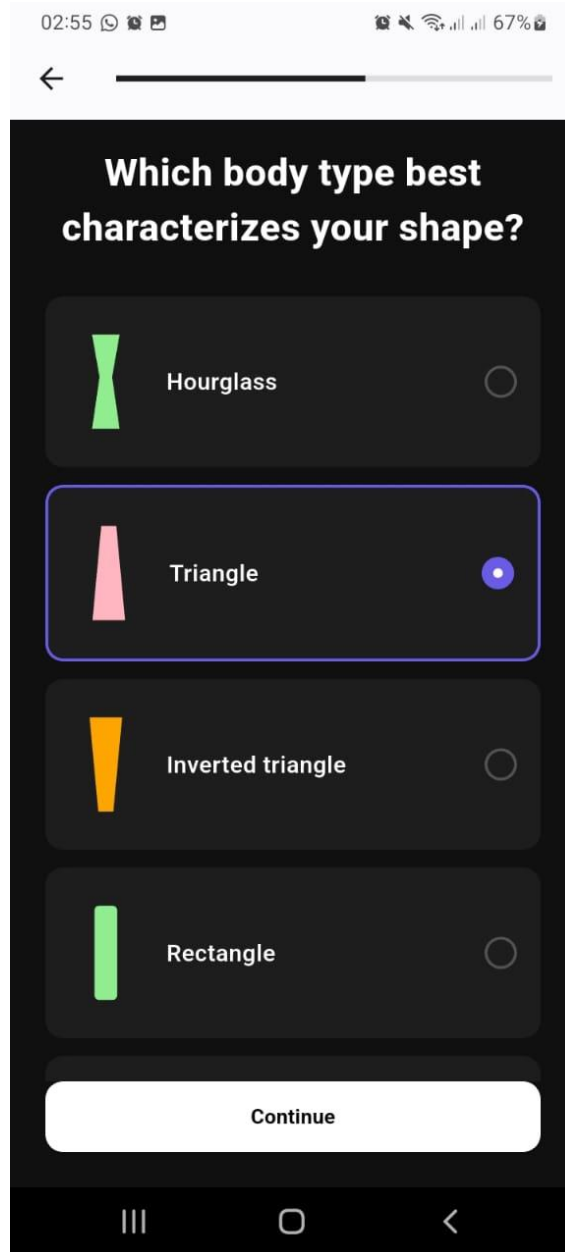


Figure 5.3: Questionnaire Screen

This screen features a multiple-choice question, which requires users to select their body type among four types, namely Hourglass, Triangle, Inverted Triangle, and Rectangle, and each of them has a visual icon and can be selected through the radio buttons. By clicking one of the options, users can move to the next step with the help of the Continue button and the progress is tracked through a horizontal progress bar displayed on the top of the screen.

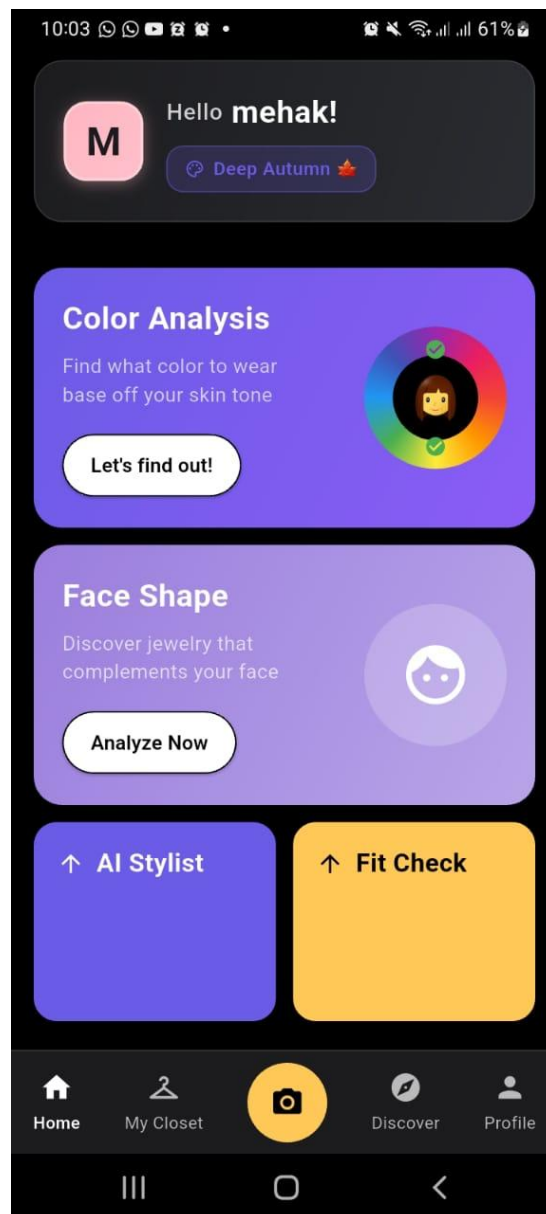


Figure 5.3: Questionnaire Screen

The primary screen shows a customized header where the user is welcomed by his/her name and a color season badge (e.g., Deep Autumn) with which he/she is analyzed. There are two big feature cards below the header: one called Color Analysis where the color recommendations are based on skin tones and one is Face Shape where the jewelry recommendations are provided with descriptive text and the call-to-action button. The lower area has two minor cards of the features of the AI Stylist (purple) and Fit Check (yellow) which are used to provide immediate access to the styling help and outfit images analysis. The bottom section is a navigation bar with five tabs (Home, My Closet, Camera, Discover, Profile) that allow one to readily navigate the app; the Home tab is active now.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Project Achievement

The Vogue AI Fashion Stylist project was able to deliver an innovative, easy-to-use, AI-based fashion suggestion app in the Pakistani market. The platform has all the features including user authentication, custom color analysis on the basis of skin tone, hair color and eye color recognition, face shape analysis with jewelry suggestions, outfit analysis with FitCheck scoring and electronic wardrobe management. It also has a personalized fashion advisor (English-Urdu) to chat with, real time wardrobe sync, and connect with popular Pakistani brands such as Sapphire, Gul Ahmed, Nishat Linen and Akaram to suggest fashion.

Through the application, users can access the app on Android devices with future-proof and supportable and secure back ends through Flutter and Firebase tools. The Flask API back-end is integrated with the state-of-the-art image processing with OpenCV that detects facial features, and Firebase services are used to synchronize the data in real time, authenticate the user and store all the images uploaded by users in the cloud. The modular design philosophy enables smooth updates and the fundamental features such as color analysis, face shape detection, outfit scoring and the chatbot interactions are strictly tested to be stable and reliable. This project has established solid groundwork in terms of improvement, as the Pakistani consumers now have a platform to rely on to complete their personalized fashion styling and this answers the question of the lack of culturally-relevant fashion technology to the South Asian market.

6.2 Recommendations

The VOUGE AI project is designed with scalability in mind, leaving room for future enhancements. Some key areas for future work include:

6.2.1 Advanced Features

- **Add the males features:** Add the males features, males will also use this app
- **Gamification:** Introducing badges or rewards for reading milestones to increase user engagement and motivation.
- **iOS Platform Support:** iOS This will enable the application to be available on iPhones and iPads so that the fashion styling features can be accessed by users of these gadgets too. This expansion will be enabled by the cross-platform nature of the Flutter framework with minimum modifications to the code.
- **Multi-Lingual Support:** Expand the app's accessibility by including support for multiple languages, enabling a diverse user base to benefit from the platform.

6.2.2 Admin Panel Enhancements

- **Custom Notifications:** Allow for targeted notifications based on user preferences, ensuring relevant updates and announcements.

6.2.3 Scalability and Performance

- **Advanced Caching Mechanisms:** Optimize app performance by implementing advanced caching strategies to reduce loading times and improve offline experience.
- **Cloud Storage Optimization:** Use hierarchical storage methods for better organization and retrieval.

These additions will further enhance the usability and appeal of the VOGUE AI.

6.3 Implementation Issues and Challenges

The implementation phase presented several challenges that required creative problem-solving and technical expertise:

- **Data Structuring in Firebase:** Organizing data collections in the Firebase database to ensure optimal performance for queries was challenging. This was resolved by implementing indexing and structuring the database in a scalable manner.
- **Image Processing and Analysis Accuracy:** Achieving accurate skin tone

classification, face shape detection, and outfit analysis required fine-tuning OpenCV and MediaPipe algorithms, especially for diverse Pakistani skin tones, which was resolved by implementing multiple detection methods (MediaPipe with OpenCV fallback) and calibrating color space conversions through extensive testing.

- **Backend API Integration and Network Handling:** Ensuring reliable communication between the Flutter app and Flask backend API for large image uploads and long-running analysis operations posed challenges with timeouts and connection errors, which was addressed by implementing proper error handling, timeout configurations, health check endpoints, and supporting both production (Railway) and local development environments.
- **Chatbot Intent Classification and Bilingual Support:** Developing an accurate intent classification system for the AI fashion stylist chatbot with bilingual support (English/Roman Urdu) required balancing the training dataset and improving semantic search accuracy, which was resolved by creating a balanced dataset.
- **Cross-Platform Testing:** Differences in behavior between Android and iOS devices necessitated thorough testing and adjustments to ensure consistent functionality and appearance across platforms.
- **Recommendation Engine Limitations:** Developing a content-based filtering recommendation engine posed challenges due to the reliance on detailed item attributes and the inability to capture diverse user preferences effectively. This was addressed by enhancing the attribute dataset and leveraging additional metadata during the testing phase to ensure functionality.

Despite these challenges, the project achieved its primary objectives and delivered a functional and scalable application. Lessons learned during the implementation phase will guide future development and improvements.

REFERENCES

- [1] D. Rodrigues and R. Pereira, “How can artificial intelligence help improve fashion sustainability?,” in *Digital Technologies and Transformation in Business, Industry and Organizations*, R. Pereira, I. Bianchi & Á. Rocha, Eds., *Studies in Systems, Decision and Control*, vol. 497, Cham, Switzerland: Springer, 2023, pp. 43–61. doi: 10.1007/978-3-031-40710-9_3
- [2] P. N. Evangelista, “Artificial intelligence in fashion: how consumers and the fashion system are being impacted by AI-powered technologies,” M.S. thesis, Scuola del Design, Politecnico di Milano, Milan, Italy, 2020
- [3] A. K. Singh, V. A. Kumbhare, and K. Arthi, “Real-time human pose detection and recognition using MediaPipe,” *Advances in Intelligent Systems and Computing*, pp. 145–154, 2022. doi:10.1007/978-981-16-7088-6_12
- [4] Q. Zhang, Z. Chen, B. Tian, Y. Guan, and Q. Liu, “The impact of clothing colour on skin tone perception and consumer preference,” *Coloration Technology*, May 2025, doi: 10.1111/cote.12828.
- [5] R. Singh, C. Dutta, and P. K. Singh, “Comparative analysis of human GAIT across different attires using MediaPipe Pose,” in *Lecture notes in electrical engineering*, 2025, pp. 247–261. doi: 10.1007/978-981-96-6034-6_17.
- [6] “AI-skin tone Features on Online Shopping to Women’s Casual Clothing Purchase Intentions,” *IEEE Conference Publication | IEEE Xplore*, Aug. 07, 2024. <https://ieeexplore.ieee.org/abstract/document/10701119>
- [7] M. K. Mishra, R. Pal, and R. Nayak, “Chatbots and AI in fashion industry,” in *Springer series in fashion business*, 2025, pp. 41–66. doi: 10.1007/978-981-97-7528-6_3.
- [8] D. Sukhwal, “Retrieval augmented generation: An evaluation of RAG-based chatbot for customer support,” *UTUPub*, <https://www.utupub.fi/handle/10024/178860> (accessed Dec. 1, 2025).

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