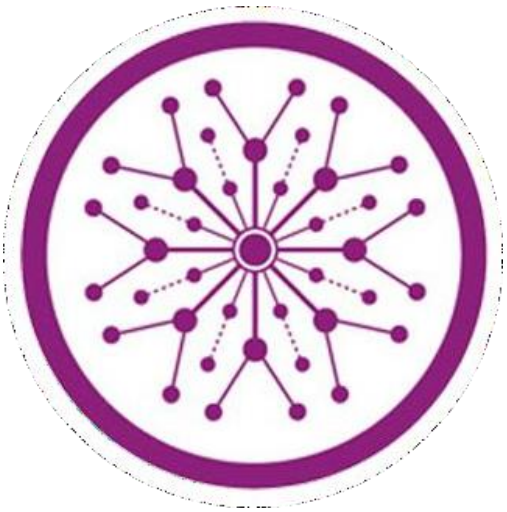
Face Paint

Final Year Project

Session 2019-2023

A project submitted in partial fulfillment of the degree of

BS in Information Technology



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Plagiarism Free Certificate

This is to certify that, I_____S/O_____, group leader of FYP under registration no_____at the information Technology Department, The Superior University, Lahore. I declare that my FYP report is checked by my supervisor.

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Project Report

Face Paint

Change Record

Author(s)	Version	Date	Notes	Supervisor's Signature
Munsif	1.0	Sep	Template 1	
Nadeem Hammad	1.1 1.2	Sep	Template 3	
Munsif	1.3 1.4	Oct	Changes in templates 1 & 3	
Nadeem	1.5	Oct	Prototype	
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Munsif Hammad	2.0	Jan	Prototype	
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Nadeem	2.3	Mar	Prototype	
Munsif	2.4	April	Prototype	
Hammad	2.5	April	Prototype	
Munsif Hammad	2.6	May	Documentation	
Munsif Hammad Nadeem	2.7	May	Documentation & Prototype	

APPROVAL

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Dedication

First of all, we dedicate our project to Allah Almighty

And to whom the world owes its existence

Muhammad (Peace Be upon Him)

This humble effort is dedicated to

Our beloved parents who brought us

To the level of excellence where we

Are studying today looking for most

Promising and gleaming future ahead

For which they scarified most of the

Time of their life

&

To our respected and genius teachers

Who guided us throughout academic career!

And all those people

Who have remembered us in their prayers!

A lot of thanks for all my teachers!

Acknowledgments

Above all, I owe much tribute to the Almighty God who gave us a life worth living and i thank Him for giving us the strength to accomplish this project. The success and accomplishment of this project stems from efforts and dedication offered by many individuals whose support was either direct or indirect. I thank all of them for their devotion.

The author would like to express the sincere gratitude to their project advisor **Sir Nadeem Jabbar** for his vigilant supervision, intellectual guidance, constructive advice and very kind attitude throughout the course of project. Appreciate to the efforts of all our teachers whose teachings have brought us to this stage of academic zenith.

In the last but not the least, special gratitude with the deepest sense of respects to our parents whose love and affections kept us steep fast and enabled us to attain targets and goals of academic life. The authors are extremely indebted to their brothers and sisters whose constant encouragement provides us with the impetus that was necessary for attaining academic initiatives.

Executive Summary

Face paint is a mobile application that allows users to transform their photos by applying a variety of filters. The app will gain widespread popularity in future due to its unique filters and ease of use. Face paint uses artificial intelligence and neural networks to apply the transformations to the photos, resulting in realistic and natural-looking edits. The app has a wide range of potential use cases, including personal use, social media, marketing, entertainment, and research and development.

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Chapter 1

Introduction

Chapter 1: Introduction

It has been observed that people frequently use face paint to decorate themselves during sporting events like cricket or the World Cup of football. They display his or her affiliation by posting pictures of them on social media. Our goal is to develop a smartphone application that allows a user to paint their favorite image a country flag, a player's face, or any other national symbol on their faces while someone takes their own picture like a selfie.

1.1. Background

This paper covers the entire project report for our final year project, which was created by the projects three team members, Nadeem, Hammad Ali, and Munsif Qumais. This document aims to explain each step of the execution of our final year project. It gives a thorough background analysis of deep learning and Python, as well as the justifications for not taking into account any other options for making this App. We provide a thorough explanation of "Collab," the primary tool utilized in the development of our App.

1.2. Motivations and Challenges

There can be several motivations for creating a face paint application. Some possible reasons include:

- **Entertainment:**

  Face paint applications can be used to create fun and engaging experiences for users, such as by allowing them to apply virtual makeup or to add stickers and filters to their selfies.

- **Artistic Expression:**

  Face paint applications can be used as a tool for artists to create digital artworks and animations using facial features as the canvas.

- **Advertising and Marketing:**

  Companies can use face paint application to create virtual try-on experiences for their products, such as makeup or hair color. This can be a valuable tool for promoting products and allowing customers to see how the products would look on them before making a purchase.

- **Virtual reality:**

  Face paint applications can be used in virtual reality contexts to create more realistic and immersive experiences.

- **Augmented Reality:**

  The same as virtual reality but they are grounded in reality.

Challenges:

- **High Computational Requirements:**

  Face paint application often require significant processing power and storage to handle large image and video files, as well as to perform complex image processing and recognition tasks.

- **Privacy Concerns:**

  Face paint applications that collect and process user data, such as facial images, can raise concerns about privacy and data security. It's important to consider these concerns and put appropriate measures in place to protect users' data.

- **Complexity of the Algorithm:**

  Developing an algorithm that can accurately detect and recognize facial features can be a complex task, and requires a deep understanding of computer vision and machine learning techniques.

- **User Interface Design:**

  Creating a user-friendly interface that is easy to navigate and understand can be a challenge, especially when dealing with complex tools and options.

- **Keeping up with Technology Advancements:**

  With time and advances in technology, new tools, libraries, and frameworks are emerging. Keeping up with these advancements and integrating them into the application can be challenging.

1.3. Goals and Objectives

Face paint is actually a real art form, and the makeup artists who use faces as their canvas and transform them into players or flags characters are truly talented. Face painting is a great creative outlet for people of all ages. It's an inexpensive, fun way to explore the worlds of art and imagination. Unlike tattoos which are permanent, face paint is a temporary work that lasts several hours or even days as with the case of henna painted decoration. Today, artists and face painting artisans use cosmetic-like paints to decorate faces.

1.4. Literature Review/Existing Solutions

Face paint is actually a real art form, and the makeup artists who use faces as their canvas and transform them into players or flags characters are truly talented. Face painting is a great creative outlet for people of all ages. It's an inexpensive, fun way to explore the worlds of art and imagination. Unlike tattoos which are permanent, face paint is a temporary work that lasts several hours or even days as with the case of henna painted decoration. Today, artists and face painting artisans use cosmetic-like paints to decorate faces.

1.5. Gap Analysis

There is no filter like this, in the current selfie camera the filters are available like face colors, eye glasses, cartoon face, eye color, Zana lens, heart mood Lenz. Favorite player face

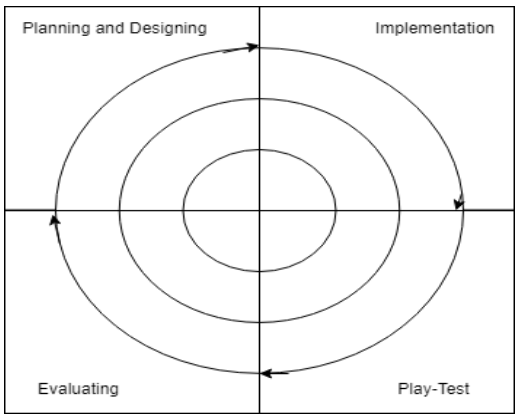
filter is totally new filter that is introduced by our team members. A gap analysis process allows organizations to determine how to best achieve their business goals. It compares the current state with an ideal state or goals, which highlights shortcomings and opportunities for improvement. How do you know what to trim, fix, expand, or change to get your business to the next level.

1.6. Proposed Solution

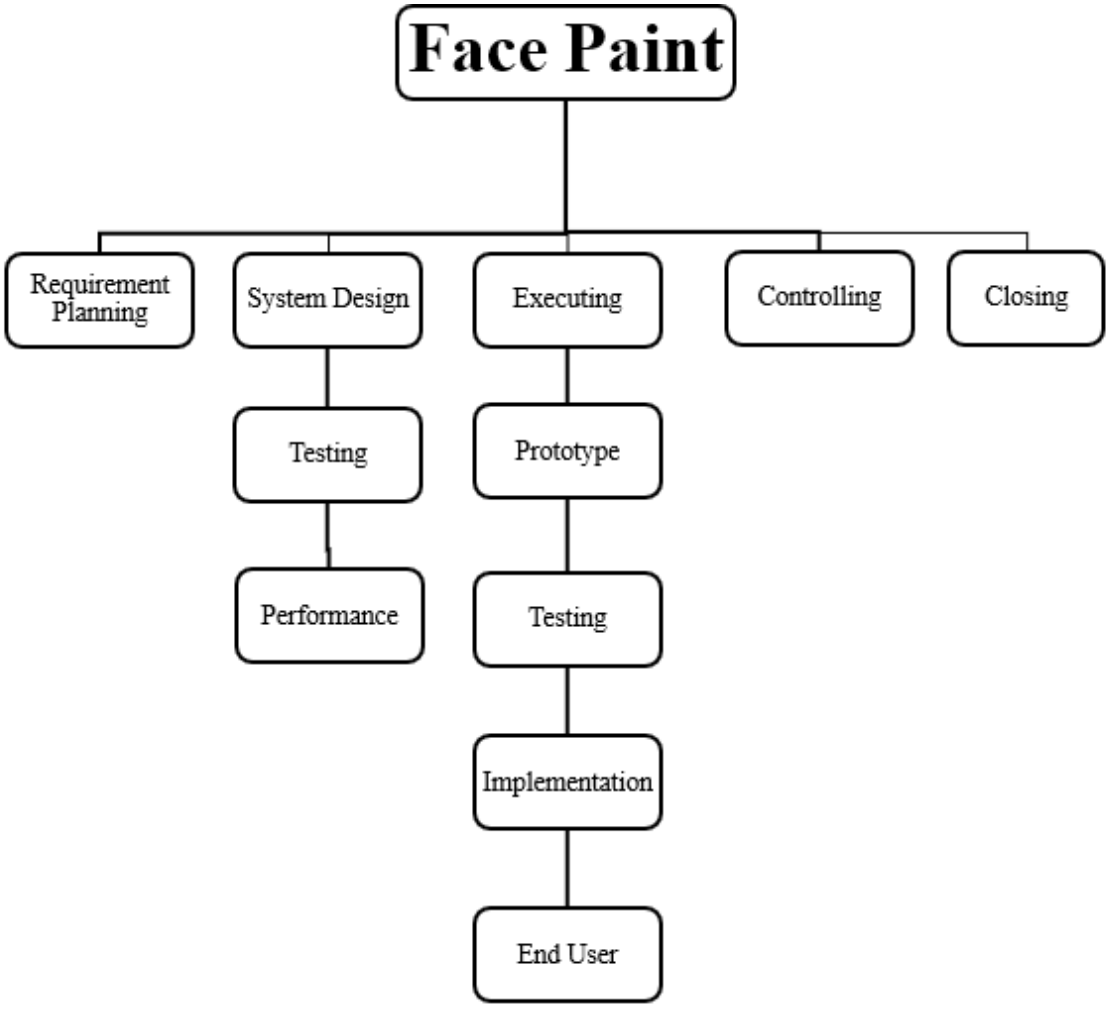
With the use of artificial intelligence, we will provide a platform through mobile application that is not only simple to use but also fixes the user's above said issues.

1.7. Project Plan

This project's major goal is to deliver superior outcomes in every circumstance. We employ a spiral approach because there is substantial risk involved in every stage of this project. The processes of spiral modeling that were used to create our final year are illustrated in the section below. This will give us the adaptability, iterations, and interactivity that a good detector must have. Rough sketch of the processes employed in the project plan.



1.7.1. Work Breakdown Structure

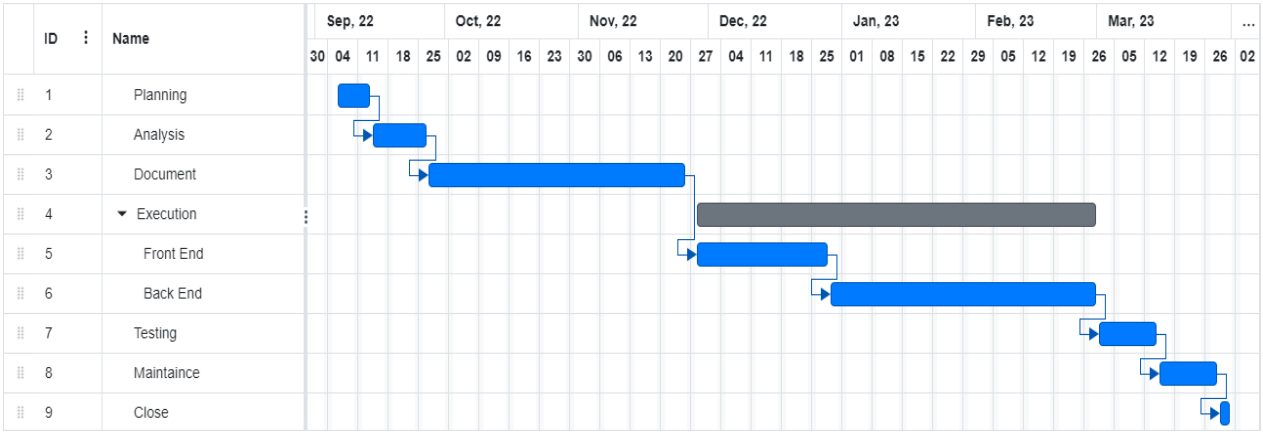


1.7.2. Roles & Responsibility Matrix

WBS #	WBS Deliverable	Activity #	Activity to Complete the Deliverable	Duration (# of Days)	Responsible Team Member(s) & Role(s)
1	**Project Training**	1	Training on the Python programming language's "Colab" development tool	40	Munsif
		2	Learning to use the machine learning tool "Python Language"	30	Nadeem
2	**Project Planning**	1	Create Vision Document	10	Munsif
		2	dividing up the team's work	1	Nadeem
		3	Creating WBS & Gantt Chart to manage time efficiently	3	Hammad
		4	Documenting Project proposal	5	Munsif
3	**Research**	1	Research	7	Nadeem

4	**Designing Datasets**	1	Ideas collection of datasets other AI based projects.	7	Nadeem
5	**Development**	1	Prototyping	65	Hammad
6	**Testing**	1	Component Testing	1	Munsif
		2	Integration Testing	1	Nadeem
		3	Use case Testing	1	Hammad
		4	Compatibility Testing	1	Hammad
		5	Deployment Testing	1	Munsif
7	**Documentation**	1	Completing the Diagrams	5	Nadeem
		2	Formalizing the documentation	7	Munsif

1.7.3. Gantt Chart



1.8. Report Outline

Face paint photo editor is face painting photo editing application which helps you to bring out your creativity in photo editing and face paint players makeup with easy steps. Face paint photo editor is a face paint makeup photo editor application, designed with vibrant, versatile and vast collections of stickers such as popular face paint players and country flags stickers. Face paint photo editor helps to paint your face any country player and flags easily photo with best available tools. A must have for every beauty makeup lovers and face painting lovers.

- Ch#2: Define the features, functional and non-functional requirements, internal and external interface, and other aspects of our project.
- Ch#3: With the help of diagrams, we implement and define actors and utilize case analysis in our project.
- Ch#4: Describe our project through diagrams.
- Ch#5: This chapter allows us to carry out our project and describe the tools and methods employed.

Chapter 2

Software Requirement Specifications

Chapter 2: Software Requirement Specifications

2.1. Introduction

The Software specification and Requirements of face app for the successful deployment are.

- Loading the necessary libraries and configuring settings
- Loading the Data into Memory
- Representing Images
- Defining the Model
- Transfer Learning
- Deploying the Model
- Model Performance
- Deploying the Application
- Sending Data to the Application
- Defining the Application
- Running the Application Locally

2.1.1. Purpose

The Face Paint Application is a software product that allows users to digitally apply virtual face paint and makeup on their photos. The software provides a wide range of creative tools and features to enhance and modify facial appearances for artistic, entertainment, or cosmetic purposes.

The primary purposes of a Face Paint application can include:

- **Creative Expression:**

Face Paint applications enable users to explore their artistic side and express their creativity by designing and applying unique face paint designs.

- **Virtual Makeup Try-On:**

It can serve as virtual makeup try-on tools, allowing users to test different makeup styles and products virtually before making a purchase.

- **Learning and Education:**

Face Paint applications can also be used as educational tools, providing tutorials, tips, and step-by-step guides for applying different types of face paint designs.

The scope of the Face Paint Application, as by this Software Requirements Specification (SRS).

- **User Interface:**

The application should have an intuitive and user-friendly interface for easy navigation and interaction. It should support different screen sizes and orientations to accommodate various devices.

- **Face Detection and Tracking:**

The application should employ computer vision algorithms to detect and track facial features accurately.

- **Virtual Face Paint and Makeup:**

The application should offer a broad range of virtual face paint, makeup, and cosmetic effects. Users should be able to select colors, textures, patterns, and designs for different areas of the face.

- **Editing and Customization:**

Users should have the ability to edit and customize the virtual face paint or makeup, such as adjusting opacity, size, or position. The application may provide features for erasing or undoing modifications.

- **Real-Time Preview:**

The application should provide a real-time preview of the applied face paint or makeup on the user's uploaded photo or live video feed.

- **Sharing and Saving:**

The application should allow users to save the modified photos or videos to their devices. It may provide options to share the creations on social media platforms or through messaging apps.

- **Performance and Compatibility:**

It should be compatible with a wide range of devices, operating systems, and hardware configurations

2.1.2. Document Conventions:

Calibri is the font used throughout this document, and the font size for paragraph content is 12. Sections have been highlighted using bold writing, New Chapter have been Highlighted with Time New Roman with Size 36 Bold and diagrams have been identified and labeled with italic text. And the text is justified throughout.

2.1.3. Intended Audience and Reading Suggestions

The primary purpose of the document is to obtain approval for our information technology final year project. The Superior University clearance panel, which will determine the project's status, is the primary target audience for this document. Additionally, the documentation may assist the team members (Nadeem, Hammad, and Munsif) in keeping track of all aspects (features, processes, model used, risks identified, risks reasons, processes used to remove risks) of the detector application. This will aid in future improvements and updates in the Machine Learning and may also be crucial when the team members create a project that is similar. The user may also benefit from a thorough understanding of the project.

2.1.4. Product Scope

Product scope of a face paint application would involve describing the key features and capabilities that the app will provide to users. These might include:

- **Layers**:

  The ability to work with multiple layers to build up an image or composition.

- **Sharing:**

  Ability to share the finished artworks through social media or cloud services.

- **Drawing and Painting Tools:**

  A variety of brushes, pens, and other tools for creating and editing art.

- **Image Manipulation:**

  The ability to import and edit photos, as well as apply various effects and filters to them.

- **Color Recognition and Detection:**

  The ability to detect colors and make it easy for users to use them in their creation.

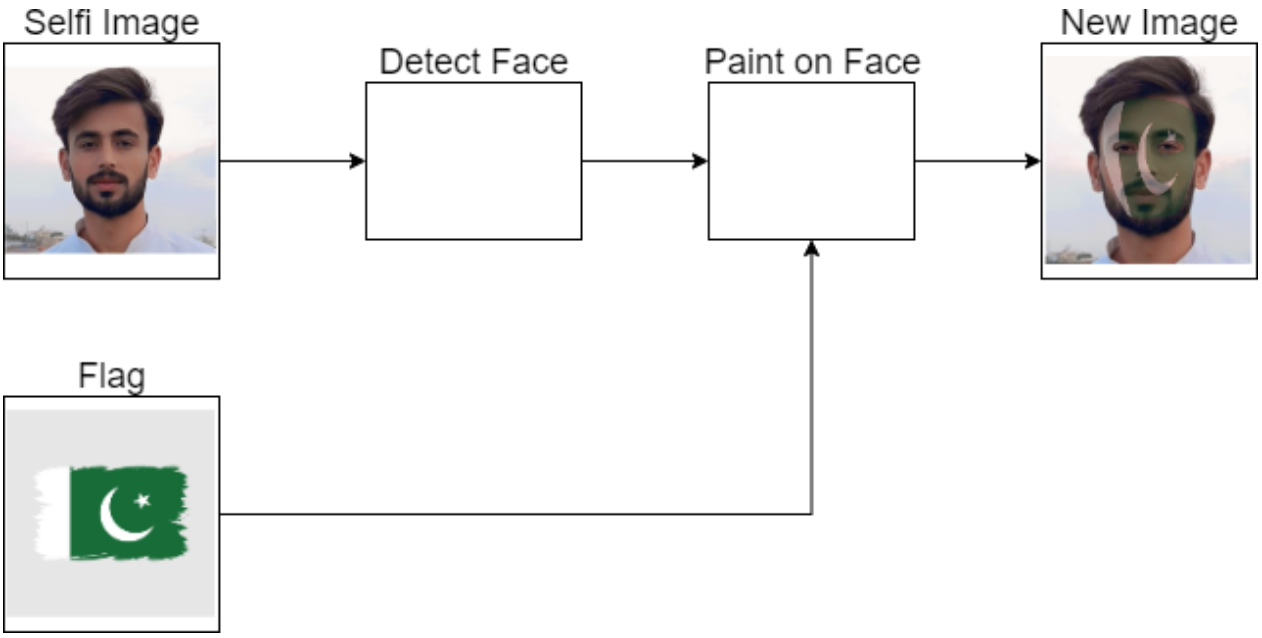
- **Templates and Pre - Designed Elements:**

  The app may include a library of pre-designed elements and templates that users can use in their artwork.

2.2. Overall Description

This project is running on Collab tool use Python Language to creates templates which is running on web browser create a flask app by using python to give predictions by using deep learning train model.

2.2.1. Product Perspective



2.2.2. User Classes and Characteristics

A face paint application caters to a diverse range of users, including regular users seeking creative and self-expression opportunities, makeup enthusiasts looking to experiment with new styles, professional makeup artists incorporating virtual makeup into their work, beauty influencers and content creators producing engaging content, and event and entertainment industry professionals requiring virtual face paint for special events. The application aims to provide intuitive and user-friendly interfaces, support input for modification, utilize face detection and tracking algorithms, offer a variety of virtual face paint and makeup options, allow for editing and customization, provide real-time previews, enable sharing and saving of creations, and ensure performance and compatibility across different devices. By

addressing the needs and characteristics of these user classes, the application aims to deliver an enjoyable and satisfactory user experience.

2.2.3. Operating Environment

The operating environment for a Face Paint application would refer to the specific hardware, software, and network requirements that the app needs in order to function properly. This might include:

- **Hardware:**

  Minimum requirements such as a certain amount of RAM, processor speed and storage, as well as a touch screen display.

- **Network:**

  Any network connectivity requirements, such as a stable internet connection for sharing or downloading content or updates.

- **Permissions:**

  Depending on the features of the app, some permission like access to camera, storage etc might be required for it to work properly.

- **Operating system:**

  The specific version of iOS or Android that the app is compatible with.

It's also worth mentioning that the operating environment can also include information such as security requirements and accessibility standards.

2.2.4. Design and Implementation Constraints

Main constraints for Application:

- Technical
- Usability
- Legal

Technical constraints include device compatibility, performance optimization, connectivity handling, security measures, and efficient memory and storage usage.

Usability constraints involve creating an intuitive user interface, ensuring responsiveness, considering accessibility guidelines, and providing multilingual support if necessary.

Legal constraints encompass respecting intellectual property rights, adhering to privacy regulations, ensuring child safety if targeting children, and providing clear terms of service.

By considering these constraints, we designed and implemented a face paint mobile application that is compatible with different devices, offers a smooth and enjoyable user experience, and complies with legal requirements and guidelines.

2.2.5. Assumptions and Dependencies

Several factors can affect the requirements stated in the Software Requirements Specification (SRS) for a face paint application. These factors include platform and device limitations, technological advancements, user feedback and market trends, regulatory and legal requirements, external system integration, performance and scalability considerations, and stakeholder priorities and business needs. These assumptions highlight the importance of regularly reviewing and updating the SRS to ensure that the requirements remain relevant and aligned with the evolving project environment.

2.3. External Interface Requirements

2.3.1. User Interfaces

The user interface (UI) of Face Paint App is the part of the app that users interact with in order to use its features and functionality. The UI typically includes visual elements such as buttons, menus, and text fields, as well as other interactive elements such as sliders and drop-down lists. The UI is designed to be intuitive and easy to use, so that users can quickly and easily access the app's various features and functions. In the case of Face Paint App, the UI might include elements such as:

- A camera button or icon that allows users to take a new photo or select an existing photo from their device's camera roll.
- A preview area that displays the selected photo and allows users to zoom in or out, rotate, or crop the photo as desired.
- A menu of filters or transformations that users can apply to the photo, such as a change in age or gender.
- A button or icon that allows users to save the edited photo to their device or share it on social media platforms.
- A settings menu that allows users to customize various aspects of the app, such as their account settings or notification preferences.

2.3.2. Hardware Interfaces

Operating System	Android Phone
Tools	Collab For Python Language Java For Application On Android Studio
Language	Python & java
Technique	Machine Learning

As a mobile application, Face Paint App interfaces with the various hardware components of a mobile device, including:

- **Camera:**

  The app allows users to take new photos or select existing photos from the device's camera roll. It interfaces with the camera hardware in order to access these photos.

- **Display:**

  The app displays photos on the device's screen so that users can preview and edit them. It interfaces with the display hardware in order to display these photos.

- **Storage:**

  The app stores photos and other data on the device. It interfaces with the device's storage hardware in order to read and write this data.

- **Processor:**

  The app processes and transforms photos using AI algorithms which would need the device's processor to perform these tasks.

- **Network:**

  The app may also need to connect to the internet and access external resources, such as cloud storage or social media platforms. It interfaces with the device's networking hardware in order to connect to the internet.

Overall, the hardware interface of the Face App would involve the various ways in which the app relies on and utilizes the hardware resources of the device in order to function.

2.3.3. Software Interfaces

Software interface of a Face Paint application would involve the various ways in which the app interacts with and utilizes other software resources. This might include:

- **Operating System:**

  A face paint application would run on various operating systems, such as iOS and Android. It would need to interface with these operating systems in order to access certain features and functionality, such as the camera, touch screen, or storage.

- **Libraries and Frameworks:**

  The application may utilize various libraries and frameworks in order to perform certain tasks, such as image processing or drawing. It would need to interface with these libraries in order to utilize their functionality.

- **External APIs:**

  The application may also make use of external APIs, such as image recognition or color detection, in order to access data or services provided by other companies or organizations. It would need to interface with these APIs in order to exchange data and request resources.

- **Other apps:**

  The application may need to interface with other apps on the user's device in order to share data or functionality. For example, it might allow users to share their edited photos on social media platforms by interfacing with those platforms' apps

2.3.4. Communications Interfaces

Communication interfaces for a face paint mobile application are essential for enhancing user engagement and interaction within the app. Key interfaces include user registration, user profiles, social sharing, a design gallery, design creation tools, real-time collaboration, in-app messaging, and notifications. These interfaces enable users to create accounts, manage profiles, share designs on social media, explore a variety of designs, create their own designs, collaborate with others, communicate within the app, and stay updated with notifications. Prioritizing simplicity and user-friendliness is crucial for a positive user experience. Gathering feedback and conducting user testing can help refine the communication interfaces for optimal effectiveness.

2.4. System Features

The system features of a Face Paint application refer to specific functionality and capabilities that the app provides to users. These features could include:

- **Painting and Drawing Tools:**

  A variety of brushes, pens, and other tools for creating and editing art.

- **Image Manipulation:**

  The ability to import and edit photos, as well as apply various effects and filters to them.

- **Color Recognition and Detection:**

  The ability to detect colors and make it easy for users to use them in their creation.

- **Flag Selection:**

  The ability to select flag for image and make it easy for users to use them in their creation.

- **Layers:**

  The ability to work with multiple layers to build up an image or composition.

- **Undo and Redo:**

  Users should be able to undo and redo the actions they have taken in the application

- **Sharing:**

  Ability to share the finished artworks through social media or cloud services.

- **Templates and Pre - Designed Elements:**

  The app may include a library of pre-designed elements and templates that users can use in their artwork.

- **Color Customization:**

  Users should be able to customize the color settings to suit their needs and preferences.

- **User Account Management:**

  Users should be able to create an account and login to access their saved data and progress.

- **Import and Export:**

  Users should be able to import image, vector, and other files into the app, as well as export their work as a variety of file formats.

- **Brush Customization:**

  Users should be able to customize the brush to suit their needs.

The system features should provide users with the ability to perform the tasks they need to complete with the application.

2.4.1. System Feature 1

2.4.1.1. Description and Priority

It is an innovative and interactive tool that allows users to transform their faces into stunning works of art with just a few taps on their smartphones. With a wide range of vibrant colors, patterns, and designs, the app offers a virtual palette for creative expression and experimentation. Users can choose from a variety of styles, including whimsical fantasy creatures, glamorous masks, and intricate tribal motifs, or even create their own unique designs. The app provides a user-friendly interface, intuitive controls, and advanced features like adjustable brush sizes and layers, enabling users to achieve professional-looking results. Whether you're preparing for a costume party, music festival, or simply want to explore the world of face painting, the Face Paint app is your gateway to endless artistic possibilities right at your fingertips.

2.4.1.2. Stimulus/Response Sequences

The stimulus sequences for a face paint mobile application include scenarios where users can browse popular designs, create their own designs, try designs on their face using the live camera feature, and access tutorial videos for learning new face paint techniques. The app offers a visually appealing interface, options for customization, real-time feedback, and sharing capabilities. Users can save their creations, share them on social media, and engage in a creative and interactive experience with the app.

2.4.1.3. Functional Requirements

Functional requirements are as follow:

- User registration and profile management.
- A catalog of face paint designs with search and filtering options.
- Custom design creation tools and the ability to save and manage designs.
- Augmented reality (AR) for virtual try-on of face paint designs.
- Sharing and social features for users to post and interact with designs.
- Tutorials and tips on face paint techniques and styles.
- Integration with an online store for purchasing face paint products.
- Notifications for updates and reminders.
- Accessibility and localization support.
- Feedback and reporting functionality for user engagement and support.

2.4.2. System Feature 2

2.4.2.1. Description and Priority

The Face Paint mobile application is a user-friendly and interactive tool that brings the art of face painting to your fingertips. With a wide range of vibrant colors, patterns, and designs, users can transform their faces into stunning works of art. Whether you're preparing for a costume party, music festival, or simply want to explore your creativity, the app offers endless artistic possibilities. It features an intuitive interface, adjustable brush sizes, and layers for professional-looking results. From whimsical fantasy creatures to glamorous

masks and intricate tribal motifs, the Face Paint app allows you to unleash your imagination and create unique designs. Embrace the world of face painting with this innovative app and discover a new way to express yourself.

2.4.2.2. Stimulus/Response Sequences

The user expresses an interest in trying out different face paint designs. The app offers a collection of popular designs and allows customization of colors. The user can save their creations, share them on social media, and try the designs on their own face using the live camera feature. The app also provides a drawing tool for creating unique designs and offers tutorials and guides for learning new techniques. The user is informed about the availability of the app on the App Store and Google Play Store. The conversation ends with the user expressing gratitude.

2.4.2.3. Functional Requirements

Functional requirements for a face paint mobile application can include the following:

- User Registration and Profile Management
- Face Paint Catalog
- Custom Design Creation
- Virtual Try-On
- Sharing and Social Features
- Tutorials and Tips
- Shopping and Product Recommendations
- Notifications and Updates
- Accessibility and Localization
- Feedback and Reporting

2.4.3. System Feature 3 (and so on)

- Face paint focus on emotion AI and face filter. All player face filter are save in our camera.
- We select face filter of Asif Ali like we will do my face in front of camera.

- Then camera will overlap Asif Ali face filter on our face.
- This will be possible with deep learning concepts.
- Most facial recognition systems work by comparing the face print to a database of known faces.
- Augmented Reality (AR) filters are computer-generated visual effects that are layered over the real world around you, on your device's camera. Augmented Reality (AR) face filters are simply illustration effects around your face.

2.5. Nonfunctional Requirements

The most common ones are performance, scalability, portability, compatibility, reliability, availability, maintainability, security, localization, and usability. Set of specifications that describe the system's operation capabilities and constraints and attempt to improve its functionality. These are basically the requirements that outline how well it will operate including things like speed, security, reliability, data integrity, etc. Face paint non-functional requirement can be the speed with which a system must perform editing to satisfy user expectations.

2.5.1. Performance Requirements

Performance requirements for Face Paint Mobile Application:

- **Responsiveness:**

  The application should respond quickly to user interactions and provide a smooth and seamless experience. Users should not experience any noticeable delays or lag when using the app.

- **Loading Time:**

  The application should have a fast loading time, especially during the initial launch and when switching between different features or sections within the app. Users should not be kept waiting for extended periods.

- **Image Processing:**

Application involves manipulating and applying virtual face paint on real-time camera or gallery images, the app should have efficient and speedy image processing capabilities. It should be able to apply face paint effects in real-time or near-real-time, ensuring a smooth and immersive user experience.

- **Battery Efficiency:**

Mobile devices have limited battery life, it is essential for the application to be battery-efficient. It should minimize unnecessary resource consumption and optimize power usage, especially during intensive tasks like image processing.

- **Compatibility:**

The application should be compatible with a wide range of mobile devices, including different screen sizes, resolutions, and operating systems. It should adapt well to various device configurations and provide a consistent user experience across different platforms.

- **Network Usage:**

If the application relies on internet connectivity for features like sharing or downloading additional face paint designs, it should be mindful of network usage. The app should use network resources efficiently to minimize data consumption and provide a smooth experience even in low-bandwidth situations.

- **Storage Usage:**

The application should manage its storage usage effectively. It should not occupy excessive device storage or leave behind unnecessary cache files, which impact device performance and user can experience.

- **Security:**

The application should implement appropriate security measures to protect user data, especially if it involves capturing and processing images. It should comply with privacy regulations and ensure that user information is kept secure and confidential.

2.5.2. Safety Requirements

The Application does not violate any safety regulations and is entirely safe for the environment. To avoid overtaxing the eyes, the menu will contain a zoom able, flexible font.

2.5.3. Security Requirements

Security is a crucial aspect of any application Face Paint application would also have certain security requirements to protect user data and maintain the integrity of the application. Some potential security requirements for a Face Paint application could include:

- **Data Encryption:**

  User data, such as account information and saved artworks, should be encrypted both at rest and in transit to protect against unauthorized access or breaches.

- **User Authentication:**

  Users should be required to authenticate themselves, usually through a combination of a password and email, before they can access their account or saved data.

- **Authorization**:

  Users should only be able to access and modify their own data and not the data of other users.

- **Access Control:**

  The app should have a robust access control system in place to restrict unauthorized access to sensitive data or functionality.

- **Network Security:**

  The app should have measures in place to protect against common network-based attacks, such as man-in-the-middle or denial-of-service attacks.

- **Regular Updates:**

  The app should have regular security updates to fix any vulnerabilities that may be discovered.

It's also important to have a plan for incident response and recovery in case of a security breach or other issue. This would include having a way to notify users and take necessary steps to address the issue and prevent future occurrences. Additionally, the app should comply with data protection regulations such as GDPR or HIPAA if applicable to the targeted audience.

2.5.4. Usability Requirements

Face paint Usability requirements are designed to ensure that a product, service, process or environment is easy to use. Requirements can be provided in a broad variety of formats by business units, customers and subject matter experts. In simple terms, app usability refers to the ease with which a user can interact with your app and use its features. An understanding of the characteristics of usability effective, efficient, engaging, error tolerant, easy to learn – helps guide the user-centered design tasks to the goal of usable products.

2.5.5. Reliability Requirements

Face paint reliability requirements for a system describe what the system should do. These requirements depend on the type of software being developed; the general approach taken by the organization when writing requirements. The functional system requirements describe the system function in detail, its inputs and outputs, exceptions and so on. Functional requirements are as follows:

- Time delay is minimized.
- Extracts the eye features efficiently
- Provides faster GUI interaction
- Face Detection
- Face recognition.

2.5.6. Maintainability/Supportability Requirements

Face paint app are considered the most popular and desirable applications due to their friendly interface, various categories and available options, and supporting most of the available hardware in the market. Complexity to understand, design, develop, implement,

and test android applications have been raised. Maintainability is a very important quality attribute that we should consider it seriously. However, it is one of the most difficult and costly attributes that can be achieved. The software metrics are used to predict and estimate the software maintainability value. There are several metrics and formulas that are used to measure and estimate the maintainability value.

2.5.7. Portability Requirements

Portability is the ease with which an app software system can be transferred from its current hardware or software environment to another environment. Portability requirements address the user concern for how easy it is to transport the system. App that requires much environment-related configuration and tuning will cost time and effort as new versions move through the lifecycle. Portability saves time and mental overhead for anyone involved in moving new versions of the software across environments. It leads to increased productivity and better security.

2.5.8. Efficiency Requirements

Face paint is a biometric identification technique that uses unique characteristics of an individual's face to identify them. Most facial recognition systems work by comparing the face print to a database of known faces. If there's a match, the system can identify the individual. Facial paint apps rely on deep learning and java, which requires massive data sets to “learn” to deliver accurate results. Such large data sets require robust data storage. Small and medium-sized companies may not have sufficient resources to store the required data. Python and java languages that are being used to create face paint app solutions.

2.6. Domain Requirements

The application should have an intuitive and user-friendly interface with features like face detection and tracking for accurate painting on the user's face. It should offer a wide range of face paint designs, customizable colors, brushes, and effects, along with options for layering, erasing, and undoing. The application should also have social features such as

sharing on social media platforms and the ability to create a community. Personalization and customization options, compatibility with different devices and operating systems, performance optimization, privacy and security measures, and localization support are also important considerations. These requirements may vary based on specific needs and can be refined through user research and feedback.

Chapter 3
Use Case Analysis

Chapter 3: Use Case Analysis

Use case analysis of face paint would involve identifying the specific actions and goals of the app's users, as well as the various ways in which the app can be used to achieve those goals. This analysis could involve identifying the main actors (users) of the app, the actions they can perform (such as applying filters to photos), and the benefits they can expect to receive (such as creating shareable content or having fun with their photos). The use case analysis could also consider any potential challenges or limitations of the app, as well as any opportunities for future development or expansion.

3.1. Use Case Model

- **Personal Use:**

  Individuals can use the app to have fun with their photos and transform them in creative ways.

- **Social Media:**

  Face Paint can be used to create interesting and shareable content for social media platforms.

- **Marketing:**

  Businesses and organizations can use the app to create promotional materials and ads that stand out.

- **Entertainment:**

  The app can be used by artists, comedians, and others in the entertainment industry to create humorous or attention-grabbing content.

- **Research and Development:**

  Face paint's technology can be used by researchers and developers as a tool to advance the field of artificial intelligence and machine learning.

3.2. Use Cases Description

Imagine that you are a social media influencer who is always looking for new and creative ways to engage your followers. One day, you decide to use Face paint App to transform one of your photos by adding a flag to your face. You post the edited photo to your social media account, along with a caption asking your followers to guess who you are supposed to be. Your followers have a lot of fun with the post, and it becomes one of your most popular posts to date. You continue to use Face paint App to create similar content for your social media account, helping you to grow your audience and engagement.

- **Use Examples:**

A use case defines a task carried out by a system to help a user accomplish a goal. A use case must produce an observable outcome that is useful to the system's user.

- **Actors:**

A user who interacts with the system you are modeling is represented by an actor. The user could be a person, a group, a device, or another external system. The definition of our actor is a patient.

- **Subsystems:**

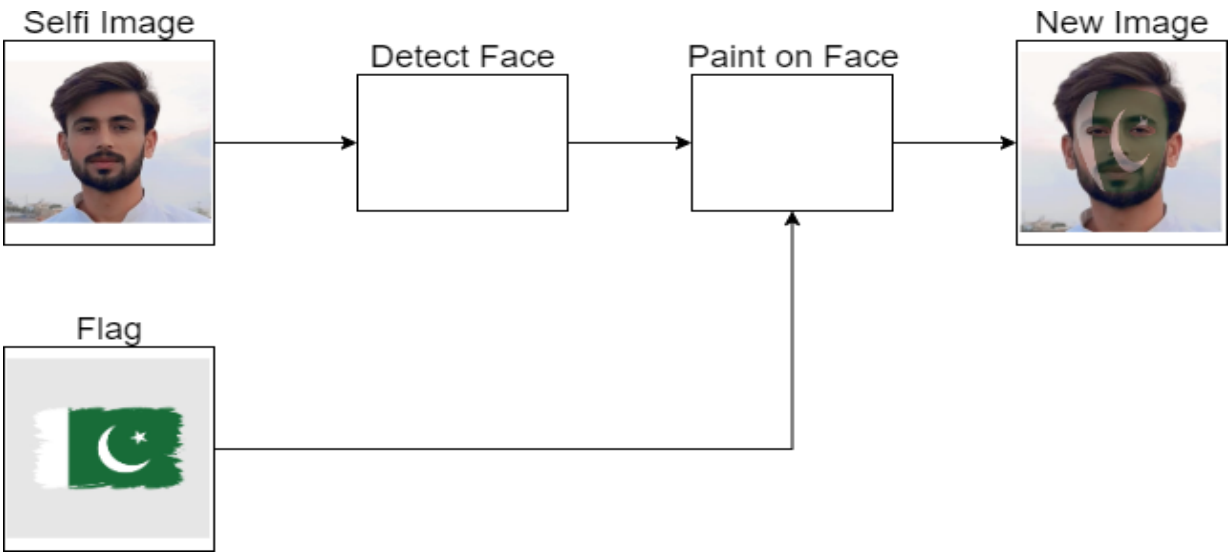
Subsystems are a sort of stereotyped component used in UML models that represent autonomous, behavioral elements within a system. Large-scale components in the system you are modeling are represented as subsystems in class, component, and use-case diagrams.

Chapter 4
System Design

Chapter 4: System Design

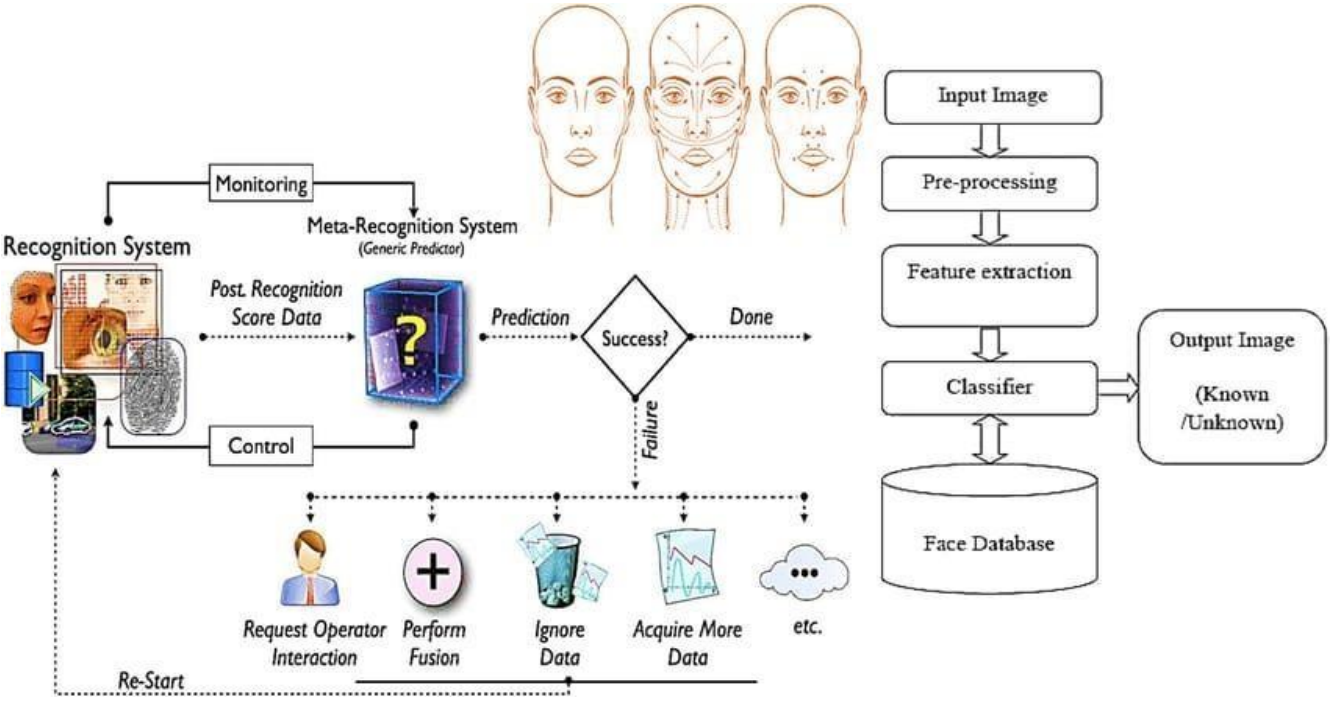
The system design of Face paint App would involve creating a detailed plan for how the app will function and operate. This would include identifying the various components and modules that make up the app, such as the user interface, the image processing algorithms, and the database for storing user data. The system design would also involve determining how these components will interact with one another and with external systems, such as social media platforms or cloud storage services. Other considerations in the system design might include security, scalability, performance, and reliability.

4.1. Architecture Diagram

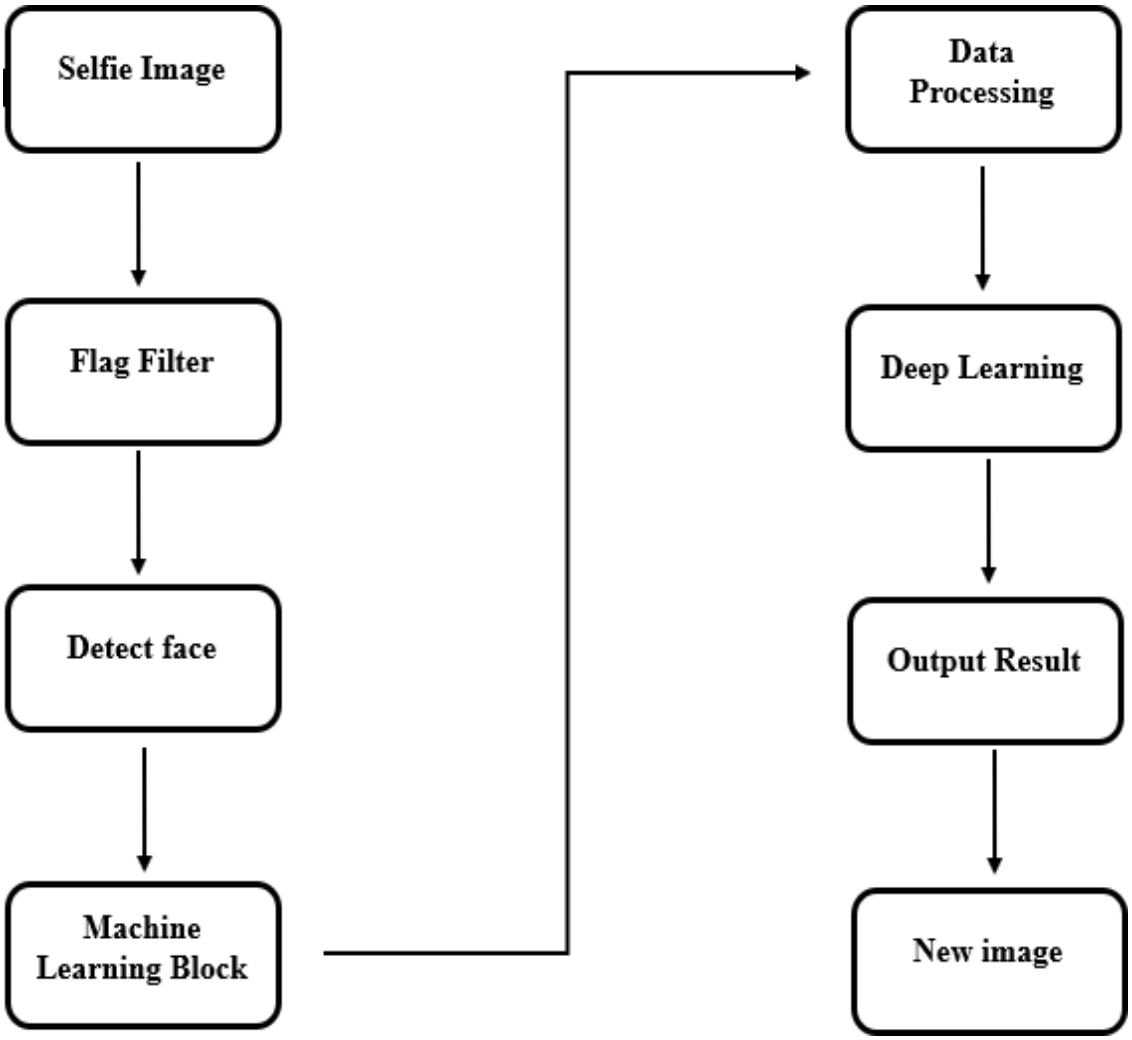


The architecture design of Face App would involve creating a high-level plan for the overall structure and organization of the app. This could include identifying the main components of the app and how they will fit together, as well as the interfaces and APIs that will be used to enable communication between the different components. The architecture design might also consider issues such as scalability, reliability, and performance, and could involve the use of micro services or other design patterns to address these concerns. Other considerations in the architecture design might include the use of cloud infrastructure, the deployment of the app across multiple platforms (such as iOS and Android), and the integration of external services or APIs.

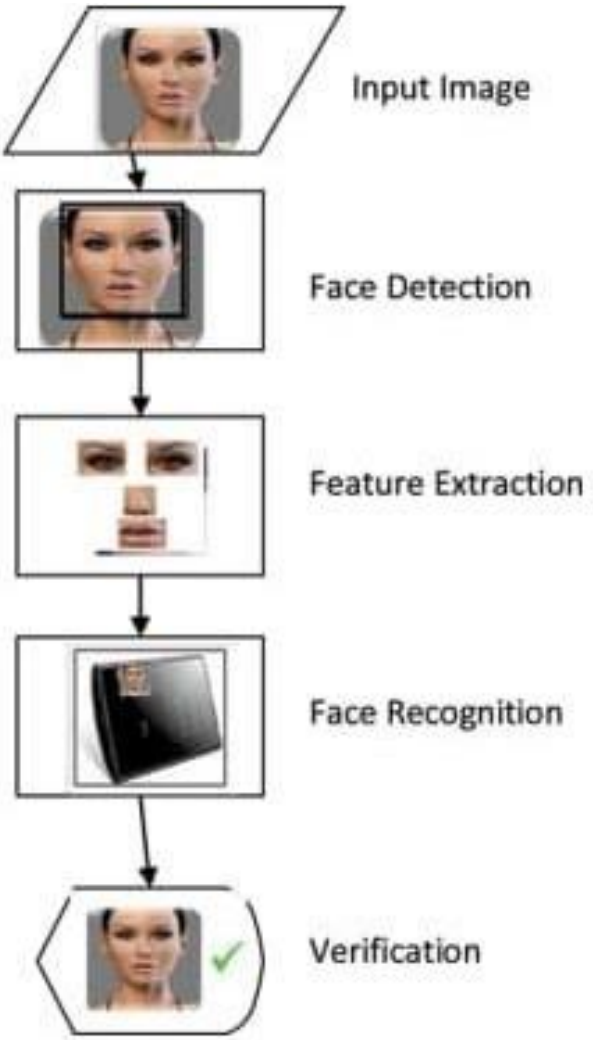
4.2. Domain Model



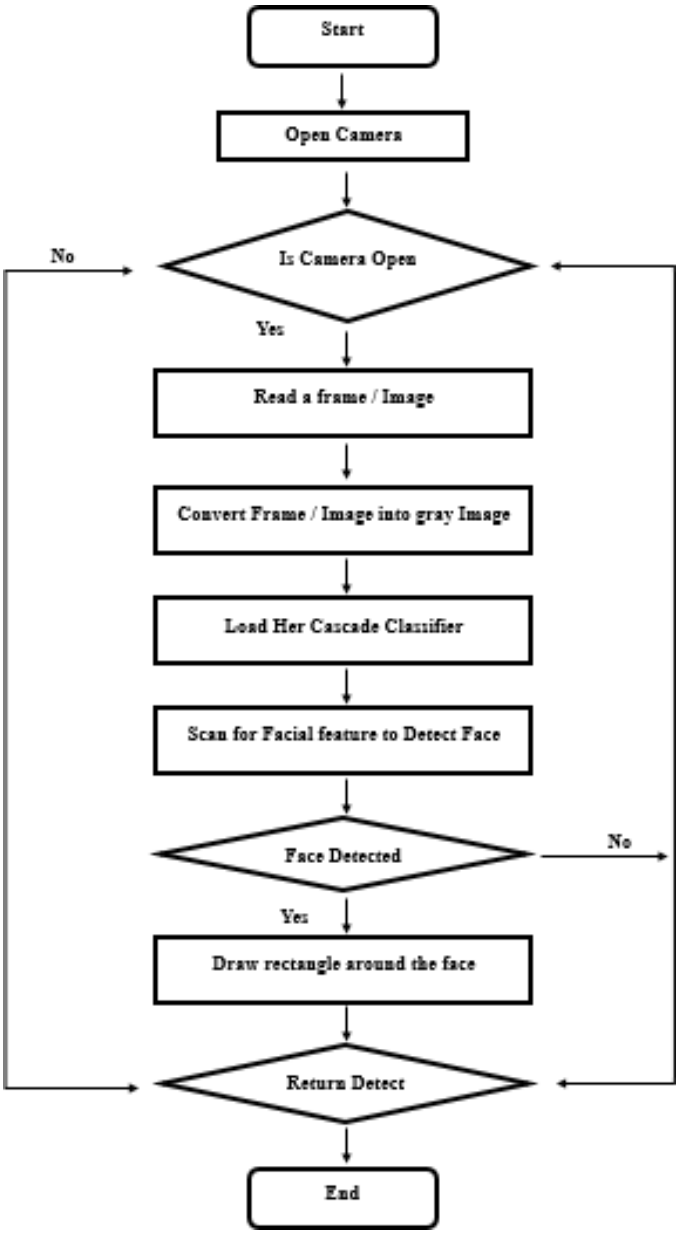
A domain model for Face Paint would involve identifying and modeling the key concepts and entities that are relevant to the app, as well as the relationships between them. This might include entities such as users, photos, filters, and transformations, as well as concepts such as image processing and artificial intelligence. The domain model would aim to provide a clear and concise representation of the core elements and ideas that are central to the app, and how they relate to one another. This model could be used to guide the development of the app, and to help ensure that the app's features and capabilities are aligned with its intended use cases and goals.


Selfie Image
Flag Filter
Detect face
Machine Learning Block
Data Processing
Deep Learning
Output Result
New image

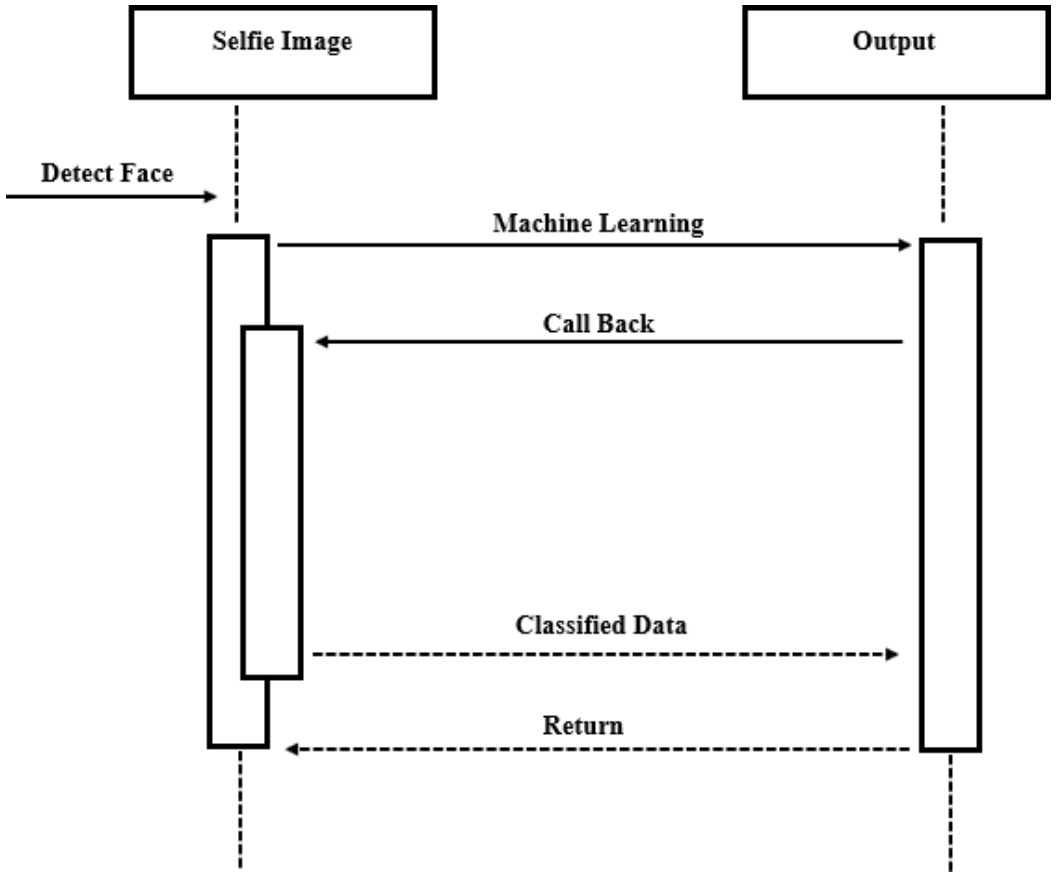
4.3. Entity Relationship Diagram with data dictionary



4.4. Class Diagram



4.5. Sequence / Collaboration Diagram



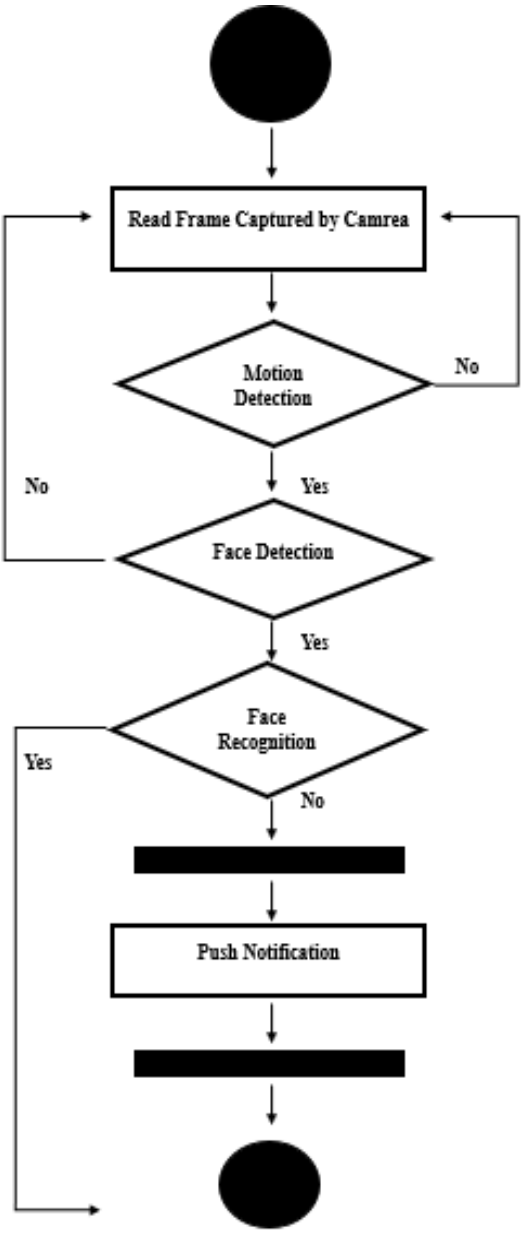
4.6. Operation contracts

We have described

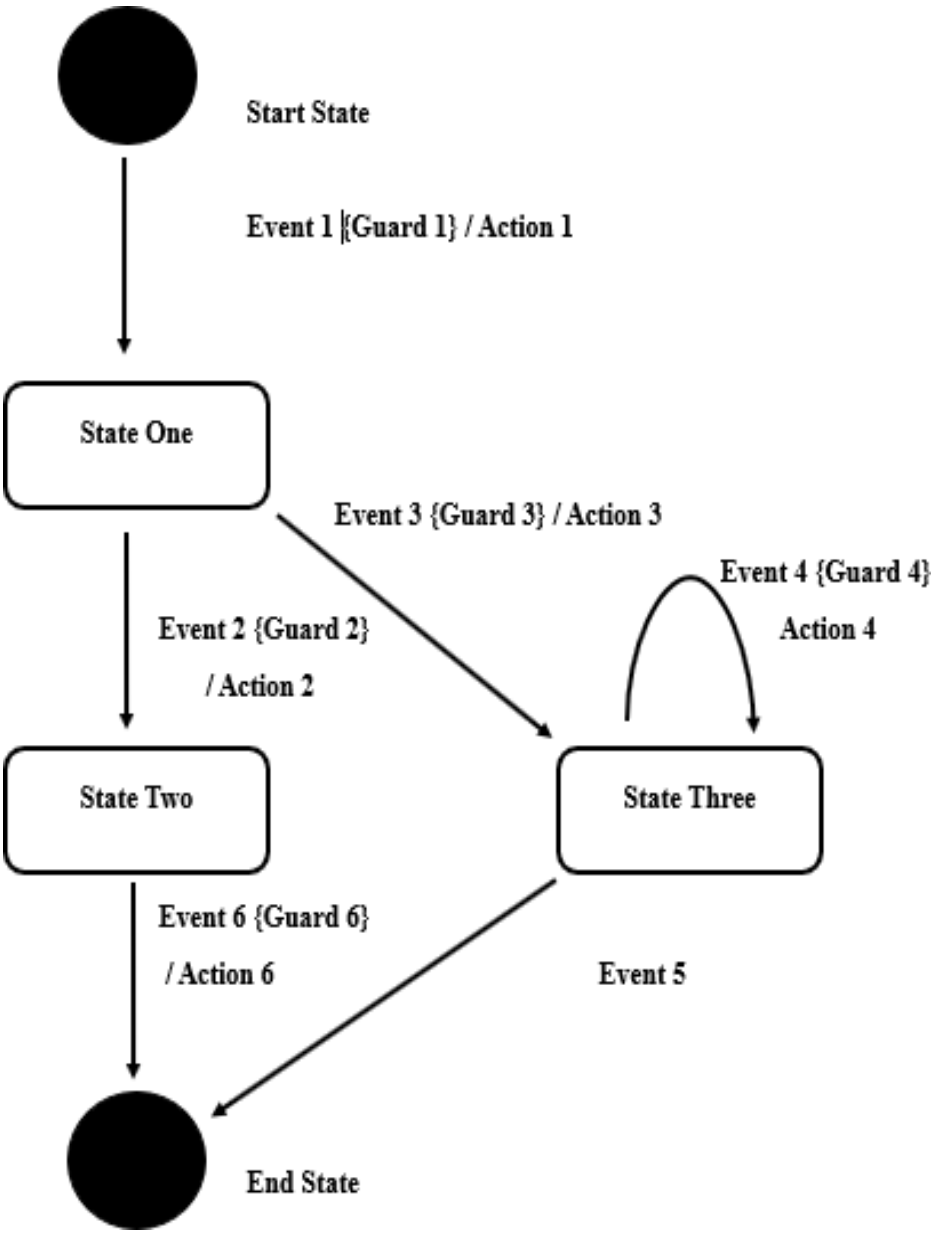
- Use Cases
- Domain Model
- Sequence Diagrams

We talk about the operation contracts. Following that, we enter the Design Model Design. Although use cases typically fully characterize a system's behavior, they might not be enough. Operation Contracts explain how concepts in the domain model's internal state may change. Operation contracts are described using preconditions and post conditions.

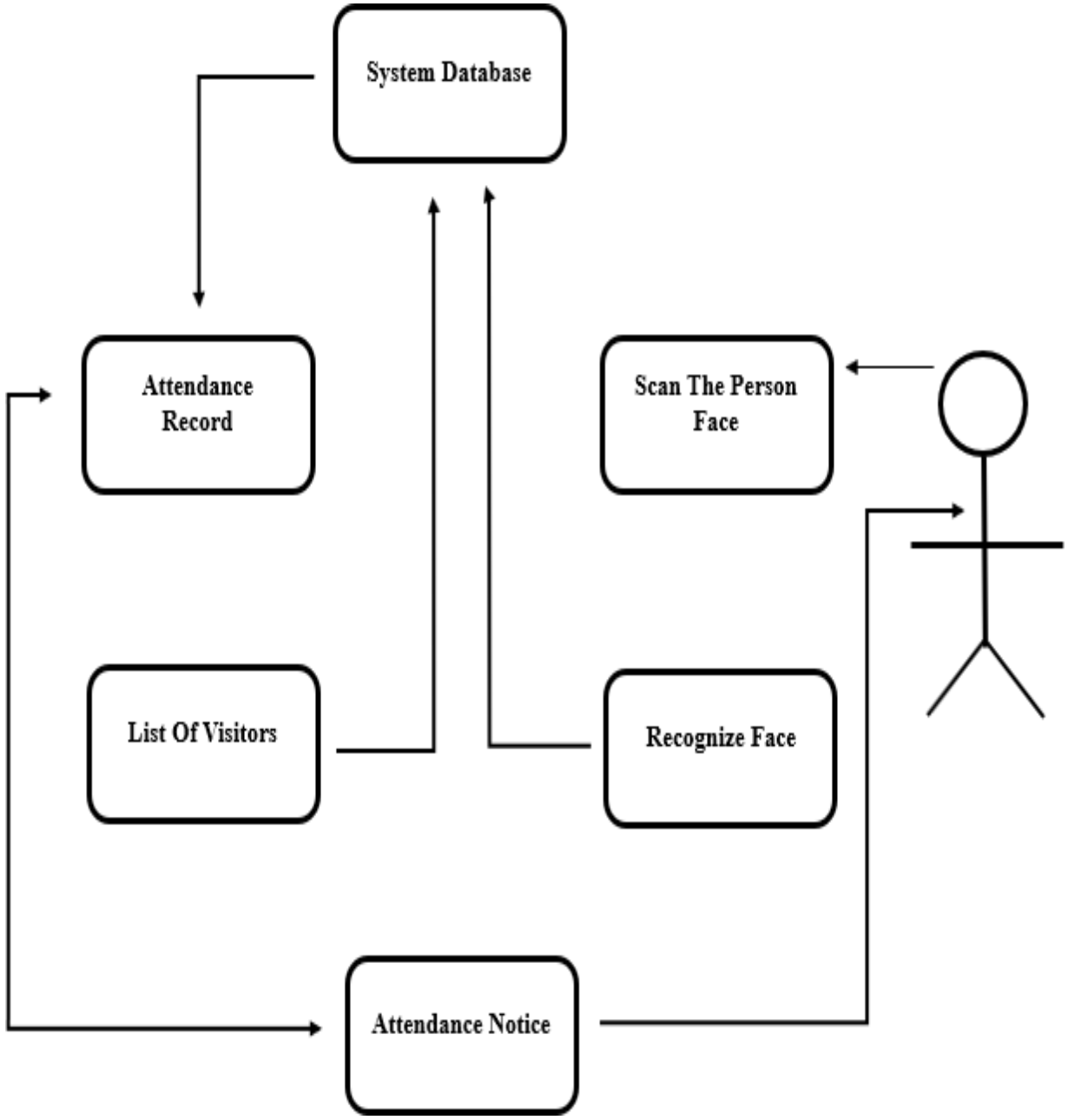
4.7. Activity Diagram



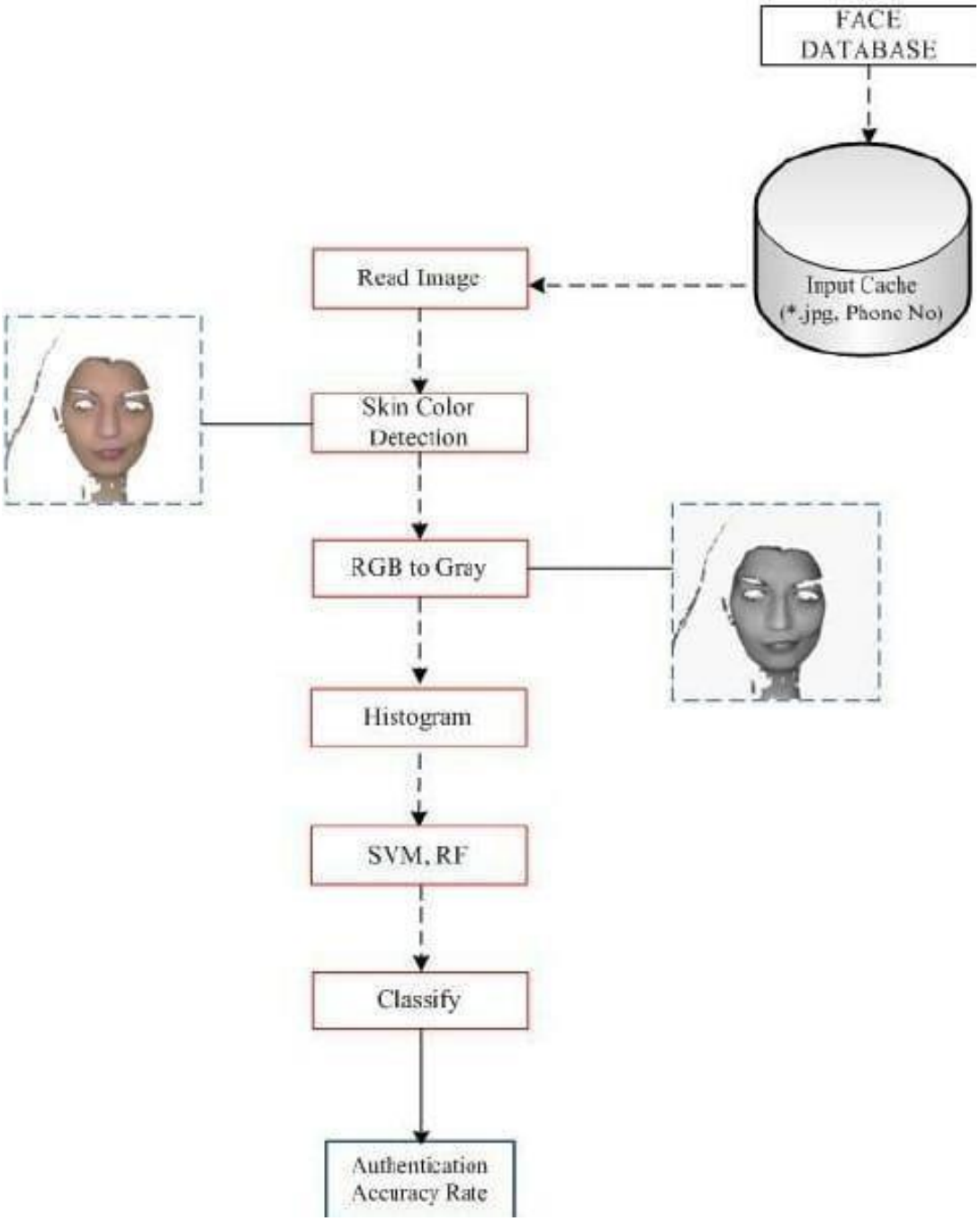
4.8. State Transition Diagram



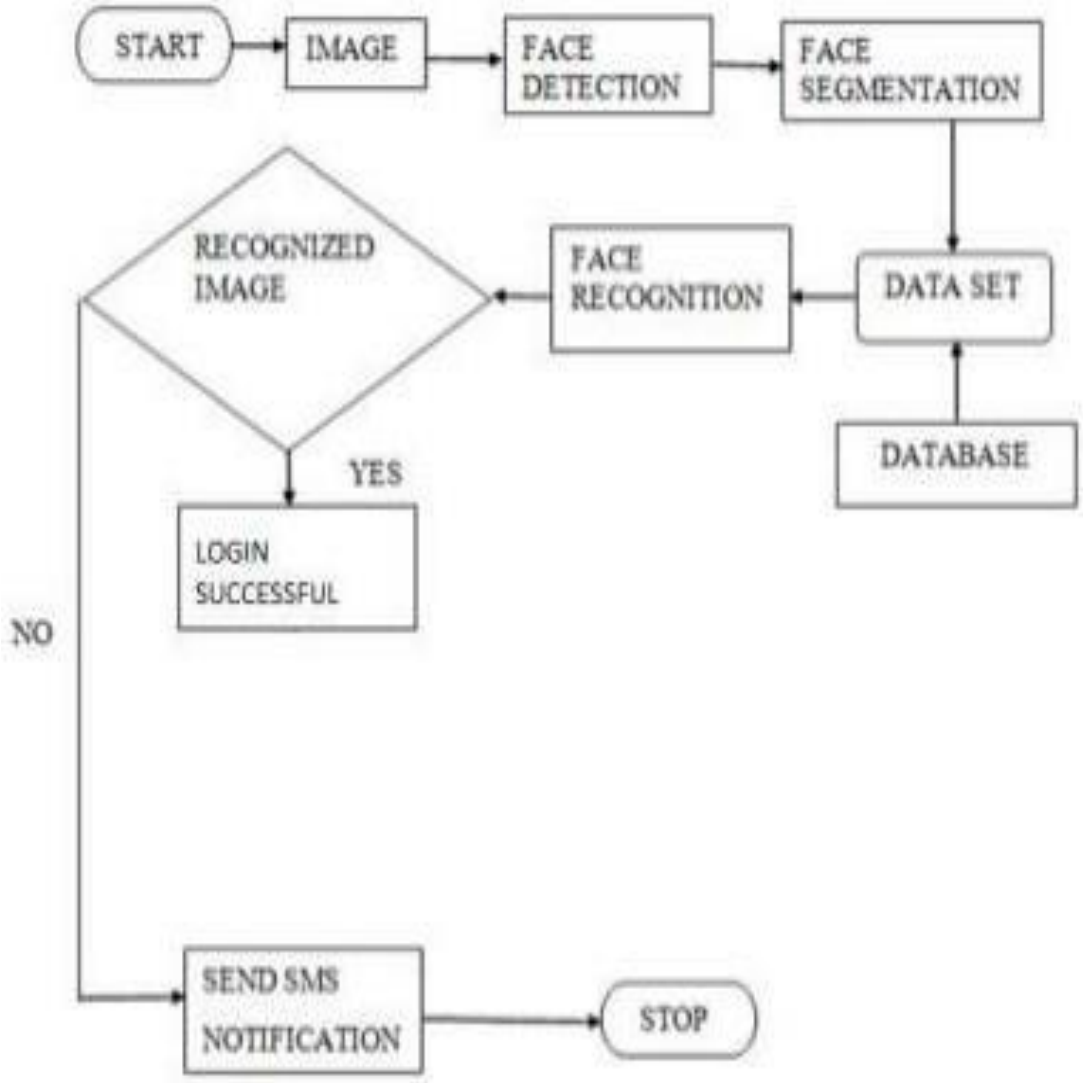
4.9. Component Diagram



4.10. Deployment Diagram



4.11. Data Flow diagram



Chapter 5
Implementation

Chapter 5: Implementation

5.1. Important Flow Control/Pseudo codes

- When we run our application, it starts.
- Show a button to click images and to take from gallery
- User can click the button.
- Chose images from gallery.
- If images are not .png extension there will be show an error message.
- To upload an image with .png extension.
- When user upload an image.
- After processing it shows to choose pic for hover.
- After choosing hover pic it says to edit the picture.
- After that image with hover is ready.

5.2. Components, Libraries, Web Services and stubs

A face paint application typically involves several components, libraries, web services, and stubs that work together to provide the functionality of the app. These can include:

- **Front-end components:**

  These include the user interface, such as buttons, sliders, and canvases, that allow the user to interact with the application. Typically, web technologies such as HTML, CSS, and JavaScript are used to create the front-end components.

- **Image processing libraries:**

  These libraries are used to process and manipulate images, such as to apply effects and filters to the face. Some popular image processing libraries include OpenCV and dlib.

- **Computer vision libraries:**

  These libraries are used to perform tasks such as face detection and facial landmark detection. Some popular computer vision libraries include OpenCV and dlib.

- **Artificial intelligence libraries:**

  These libraries are used to perform tasks such as image recognition and object detection. Some popular AI libraries include Tensor Flow, Keres, and Py-Torch.

- **Face recognition services:**

  These services can be used to perform tasks such as identifying specific individuals in an image. Some popular face recognition services include the Face API from Microsoft and the Recognition API from Amazon.

- **Web services:**

  These are cloud-based services that allow the application to store and retrieve data such as images, user information, and application settings. Some popular web services include Amazon Web Services (AWS) and Google Cloud.

- **Stubs:**

  These are dummy implementations of methods and functions that are used for testing and development purposes. By using stubs, developers can test the application without having to rely on the actual implementation of a service or library.

- **Graphics libraries:**

  Libraries such as Open GL or Metal can be used to handle 2D and 3D graphics rendering, as well as animations.

- **Image Processing libraries:**

  OpenCV or Image-Magic are libraries for image processing and manipulation, like color recognition, image editing, etc.

- **User interface libraries:**

  Libraries such as UI-Kit (for iOS) or Android-X (for Android) provide pre-built UI components that can be used to quickly create a polished and responsive user interface.

- **Networking libraries:**

  Libraries like Retrofit or Volley can be used to handle network communication, including HTTP requests and JSON parsing.

5.3. Deployment Environment

On the technical side, face paint filter are implemented using face tracking algorithms that track the position of face landmarks and a 3D rendering engine that displays the face paint filter the way the user sees it. The face tracking technology determines the accuracy and the quality of the face filter output, while the 3D rendering is responsible for the “beauty” and professional look of your effect. Java SDK is a set of face paint app libraries for desktop and mobile applications that help developers implement face paint app filters, lenses and other Face paint effects in their apps. The difference between filters and lenses is that the latter are augmented reality animations, whereas the former is static image overlays. SDK computer vision to help users create different face tracking applications. It allows developers to build various types of AR effects, including face filters with morphing effects, virtual try-ons, face beautification effects, and much more.

5.4. Tools and Techniques

Operating System	Android Phone
Tools	Collab For Python Language Java for Application on android Studio
Language	Python & java
Technique	Machine Learning Technique is used
Framework & Libraries	Java used to build platform application
Graphics Libraries	Open GL To apply graphics & animations in application
Integrated Deployment Environment	IDE such as Android Studio to write, test & Debug code.

5.5. Best Practices / Coding Standards

- Team members can use your applications with ease if you use clear, solid coding principles that follow industry standards.
- In software engineering, good coding aids in error prevention, complexity management, and application maintainability.
- To make the code easier to read, comprehend, and maintain, give names to all variables, functions, and methods. Anyone who reads the code will understand it. By doing this, maintenance expenses and change-related confusion will be reduced. With these names, it's crucial to be as specific as you can.
- For the names, we use words that are often used. Text that describes something, usually in the native tongue. Even commonly used abbreviations are not used by us.

5.6. Version Control

Version control is a technique for keeping track of changes to documents and files so that you always know which version is the most recent iteration. We can effectively track and control changes to these documents within our software by using project management software with version control.

A system known as version control keeps track of changes made to a file or set of files over time so that you can later recall particular versions. A version management system keeps track of all file modifications so that a specific version can be referred to at a later time.

Chapter 6
Testing and Evaluation

Chapter 6: Testing and Evaluation

Testing and evaluation of the face paint application encompass a range of activities aimed at ensuring its functionality, performance, usability, security, and compatibility. Functional testing verifies that the core features work as intended, while usability testing assesses the user experience and ease of use. Performance testing checks the application's performance under normal and peak loads, and security testing identifies and addresses potential vulnerabilities. Compatibility testing ensures the application works across different devices and platforms, while integration testing ensures seamless interaction with external systems. User acceptance testing gathers feedback from representative users to validate the application's suitability. Continuous evaluation and monitoring help drive ongoing improvement and address user feedback. Overall, testing and evaluation activities contribute to delivering a high-quality and user-friendly face paint application.

6.1. Use Case Testing

Use case testing for the face paint application involves testing the application's behavior and functionality based on specific user interactions and scenarios. By testing various use cases such as user registration, sending and receiving snaps, posting and viewing stories, chatting and messaging, exploring content, managing privacy settings, and account management, the application's behavior can be validated and assessed. Use case testing helps ensure that the face paint application meets user requirements, functions as expected in different scenarios, and provides a satisfactory user experience.

6.2. Equivalence partitioning

Equivalence partitioning is a testing technique applied to the face paint application to divide input data into groups or partitions with similar behavior. This technique helps select representative test cases that cover each partition, reducing redundancy and optimizing test coverage. By categorizing inputs into equivalence classes, such as valid and invalid values, the face paint application can focus testing efforts on a comprehensive set of test cases that efficiently uncover defects or issues within each partition. Equivalence partitioning enables

thorough testing while minimizing time and effort, ultimately ensuring the application's functionality is thoroughly tested and reliable.

6.3. Boundary value analysis

Boundary value analysis is an important testing technique used to assess the behavior of the face paint application at the boundaries of input or output ranges. It focuses on testing inputs that fall precisely at the boundaries, as well as values just below and just above those boundaries. By conducting boundary value analysis, potential issues related to handling limits, off-by-one errors, and boundary-related vulnerabilities can be identified and addressed. This ensures that the application performs accurately and consistently when users provide input at or near the boundaries of acceptable values.

6.4. Data flow testing

Data flow testing is a critical aspect of ensuring the accuracy, integrity, and security of data within the face paint application. It involves tracing the flow of data from its origin through various processes, transformations, and storage within the application. By testing different scenarios and conditions, data flow testing verifies that data is correctly processed, validated, and stored as intended. It also focuses on boundary conditions, error handling, and integration with external systems or APIs. Through comprehensive data flow testing, Snapchat can identify and address any issues related to data accuracy, security, or integrity, ensuring a reliable and secure data handling experience for users.

6.5. Unit testing

Unit testing is an essential aspect of the face paint application development process. It involves testing individual units or components of code to ensure their correctness and functionality in isolation. By verifying the behavior of each unit, unit testing helps identify and fix bugs or issues at an early stage, reducing the likelihood of problems during integration or system testing. It improves code quality, maintainability, and the overall

stability of the application. Through unit testing, face paint can ensure a more robust and reliable mobile application for its users.

6.6. Integration testing

Integration testing for the face paint mobile application is crucial to verify the proper integration and functionality of its various components, systems, and external services. This testing ensures that different parts of the application work together seamlessly, allowing for smooth data flow, accurate information processing, and reliable communication with external APIs and services. By conducting comprehensive integration testing, we can identify and resolve any issues related to component integration, data flow, external service interactions, and error handling. This ensures that the application functions cohesively, providing users with a seamless and reliable experience.

6.7. Performance testing

Performance testing of the Face paint application is essential to evaluate its speed, responsiveness, stability, and resource utilization. Load testing assesses the application's performance under typical user loads, while stress testing evaluates its performance under extreme conditions. Measuring response times for various operations and examining resource utilization helps identify bottlenecks and inefficiencies. By conducting performance testing, face paint can ensure that the application delivers a smooth and satisfactory user experience, responds quickly to user actions, remains stable under varying loads, and optimizes resource usage. Overall, performance testing plays a critical role in maintaining the high-quality performance of the application.

6.8. Stress Testing

Stress testing is a crucial process for evaluating the performance and reliability of the face paint mobile application. It involves subjecting the application to extreme usage scenarios to assess its ability to handle high user loads, heavy data traffic, and various stress-inducing conditions. The goal is to identify potential bottlenecks, vulnerabilities, and performance issues that may arise under stressful conditions. Stress testing focuses on areas such as

concurrent user connections, scalability, data processing capabilities, and response times. By conducting stress testing, face paint can ensure that its application can handle high user demand, maintain stable performance, and provide a reliable and responsive user experience.

Chapter 7

Summary, Conclusion and Future Enhancements

Chapter 7:

Summary, Conclusion & Future Enhancements

7.1. Project Summary

Face paint mobile application is a software application designed for mobile devices that allows users to create and customize artistic designs on images of faces or selfies. It provides a range of tools and features for users to apply virtual paint, makeup, and various effects to transform and enhance their facial appearances. The application's achievements include introducing groundbreaking features like AR filters and disappearing content, revolutionizing the way users engage with social media. It has prioritized user privacy and security, implementing measures such as end-to-end encryption and robust privacy settings. The application's user interface has undergone refinements to improve usability and enhance the overall user experience. The application includes user-friendly interfaces with options for selecting colors, brush sizes, and different artistic tools to create intricate designs. Users can also import existing images or capture photos using the device's camera for editing and painting. The application incorporates image processing algorithms to accurately apply paint colors and effects, ensuring a realistic and visually appealing result. Additionally, it may offer functionalities for undo/redo actions, saving and sharing the edited images on social media platforms or with friends, and exploring inspiration through a gallery of pre-designed face paint creations. Through its intuitive and interactive interface, the face paint mobile application provides users with a creative outlet to experiment with different looks and express their artistic flair. With its constant evolution, focus on user engagement, and commitment to privacy, Face paint remains a leading platform that sets trends and paves the way for multimedia communication and expression.

7.2. Achievements and Improvements

Application has achieved significant milestones and continuous improvements as a leading social media platform. It has garnered a massive user base and widespread adoption globally. The application's achievements include introducing innovative features like AR

filters, revolutionizing content discovery with the Discover section, and prioritizing user privacy and security through end-to-end encryption and privacy settings. It has also made strides in enhancing its user interface, optimizing performance, and fostering an engaged community. With its constant evolution and commitment to improving the user experience, Snapchat remains a prominent player in the social media landscape.

7.3. Critical Review

Application has achieved widespread popularity and success as a multimedia platform but has also faced criticism in various areas. Critics have pointed out concerns regarding the user interface's complexity and learning curve, as well as the ephemeral nature of content, limiting its long-term accessibility. Privacy and security issues have been raised, raising doubts about the effectiveness of safeguards. The algorithmic content curation on the Discover section has faced criticism for prioritizing engagement over quality and accuracy. There are ongoing challenges in improving usability, strengthening privacy measures, and balancing monetization with a positive user experience.

7.4. Lessons Learnt

- Continuous innovation and staying ahead of the curve are crucial in a rapidly evolving digital landscape.
- User engagement and community building are vital for fostering a sense of connection and interaction among users.
- Prioritizing user privacy and security builds trust and loyalty among users.
- Adapting and expanding services to cater to evolving user needs and preferences is key to long-term success.

7.5. Future Enhancements/Recommendations

Future enhancements for the Face paint application could focus on refining the user interface, expanding the range of creative tools and filters, strengthening privacy and security measures, incorporating social and collaborative features, and exploring

partnerships with content creators and brands. These enhancements would contribute to a more intuitive and user-friendly experience, allow for greater creative expression, address privacy concerns, foster community engagement, and provide exciting opportunities for collaboration. By implementing these recommendations, we can continue to evolve and meet the evolving needs and expectations of its users.

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Reference

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