Mini Project Report On

SKKN: A Skin Care Recommendation System

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

Computer Science & Engineering

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May 2024

CERTIFICATE

This is to certify that the mini project report entitled ***SKKN: A Skin Care Recommendation System*** *is a bonafide record of the work done by* ***Gloriya Antony (u2103095), Janis Reji (u2103106), Meby Mariya Biju (u2103133), Nadha Shirin K N (u2103143)****,submitted to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in Computer Science and Engineering during the academic year 2023-2024.*

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ACKNOWLEDGEMENTS

We wish to express our sincere gratitude towards Dr P. S. Sreejith, Principal of RSET, and Dr. Preetha K G, Head of the Department of Computer Science and Engineering for providing us with the opportunity to undertake our mini project, "SKKN: A Skin Care Recommendation System ".

We highly indebted to our project coordinator, **Dr. Saritha S**, Professor in the Department of Computer Science and Engineering, for her valuable support.

It is indeed our pleasure and a moment of satisfaction for us to express my sincere gratitude to our project guide **Ms.Jomina John** ,Assistant Professor, Department of Computer Science and Engineering for her patience and all the priceless advice and wisdom she has shared with us.

Last but not the least, we would like to express our sincere gratitude towards all other teachers and friends for their continuous support and constructive ideas.

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Abstract

The skincare industry is rapidly evolving, with a growing emphasis on personalized solutions that cater to individual needs and promote effective skincare practices. This abstract introduces an innovative Skin Care Recommendation System (SCRS) designed to revolutionize the approach to dermatological wellness by integrating skin type analysis, personalized routines. Utilizing advanced machine learning algorithms, user-provided data, and expert dermatological insights, the SCRS offers a holistic approach to skincare management. Central to its functionality is the analysis of skin types and concerns, guiding users towards tailored skincare routines that address specific issues such as acne, aging, sensitivity, or hyperpigmentation.Upon inputting their skin type and concerns, users are provided with personalized skincare regimens curated by the SCRS. These routines are meticulously crafted, considering the optimal combination of cleansers, toners, serums, moisturizers, and treatments to meet individual skincare goals. The SCRS goes the extra mile to make sure users have a smooth experience by offering a simple interface for managing skincare routines and product inventory. Users can easily keep track of their progress, set reminders for each step in their routine, and even discover alternative product options as their skincare needs change. What's more, users can purchase recommended products directly through the platform based on their personalized skincare regimen, streamlining the entire process. Additionally, each product recommendation comes with detailed explanations, educating users on how the ingredients target specific skin concerns. This transparency empowers users to make informed decisions about their skincare choices, fostering a deeper understanding of effective skincare practices.

Contents

List of Figures

List of Tables

List of Abbreviations

- SCRS : Skin Care Recommendation System
- Y: Yes
- N: No
- Nvr : Never
- Occas: Occasionaly
- Dly: Daily
- Sens: Sensitive
- Some: Sometimes
- API: Application programming interface
- CNN: Convolutional Neural Network

Chapter 1

Introduction

1.1 Background

The skincare industry is experiencing a profound shift towards personalized solutions, driven by advancements in technology and a growing awareness of dermatological wellness. Traditionally, skincare routines were one-size-fits-all, neglecting the diverse needs of individuals. However, the demand for tailored solutions that address specific concerns has led to the development of innovative technologies like the Skin Care Recommendation System (SCRS).

The SCRS integrates machine learning algorithms, user data, and expert dermatological insights to provide personalized skincare recommendations. By considering factors such as skin type, concerns, lifestyle, and environmental influences, the SCRS offers tailored regimens that optimize skincare outcomes.

Personalized skincare is crucial because it recognizes the unique requirements of each individual, enhancing the effectiveness of skincare routines. Additionally, the SCRS simplifies skincare management with a user-friendly interface for routine tracking and product inventory management.

Transparency and education are key aspects of the SCRS, as it provides detailed explanations for each product recommendation. This empowers users to make informed decisions about their skincare choices and fosters a deeper understanding of effective skincare practices.

In summary, the SCRS represents a significant advancement in skincare technology, catering to the evolving needs of consumers for personalized, data-driven solutions. As the demand for personalized skincare continues to grow, the SCRS is poised to redefine standards in dermatological wellness, offering users a more effective and empowering approach to skincare management.

1.2 Problem Definition

Addressing the evolving landscape of skincare, our aim is to revolutionize dermatological wellness through the Skin Care Recommendation System (SCRS). This innovative platform integrates skin type analysis, personalized routines, and expert dermatological insights to offer tailored skincare regimens. By providing a simple interface for managing routines, product inventory, and purchasing recommended products directly, the SCRS empowers users with informed skincare choices and effective skincare practices. This initiative responds to the industry's challenge of lacking personalized and transparent solutions, thus streamlining skincare management and enhancing user satisfaction.

1.3 Scope and Motivation

1.3.1 Scope

The Skin Care Recommendation System(SCRS) is designed to revolutionize skincare practices by providing personalized solutions tailored to individual needs. It encompasses skin type analysis, personalized skincare routines, and a user-friendly interface for managing skincare regimens and product inventory. The SCRS utilizes advanced machine learning algorithms and user-provided data to curate effective skincare regimens that address specific skin concerns, such as acne, aging, sensitivity, or hyper-pigmentation. Its scope also includes educating users about skincare ingredients and their effects, empowering them to make informed decisions about their skincare choices.

1.3.2 Motivation

The development of the SCRS is motivated by several factors driving the skincare industry's evolution towards personalized solutions. Integrating advanced technology allows the SCRS to offer holistic skincare management that considers not just skin types but also specific concerns like acne or aging. The SCRS also aims to enhance the user experience by providing a seamless interface for managing skincare routines and facilitating product purchases based on personalized recommendations. Ultimately, the motivation behind the SCRS is to empower users with t knowledge and tools they need to achieve effective skincare outcomes.

1.4 Objectives

- Develop a robust machine learning algorithm that accurately analyzes skin types and identifies specific concerns such as acne, aging, sensitivity, and hyperpigmentation.
- Create a user-friendly interface for inputting user-provided data, including skin type and skincare goals, to generate personalized skincare regimens.
- Integrate expert dermatological insights into the algorithm to ensure that skincare recommendations are evidence-based and effective in addressing individual skin concerns.
- Educate users about skincare ingredients and their effects through detailed product recommendations and explanations, fostering a deeper understanding of effective skincare practices.
- Implement a seamless product purchasing system within the platform, allowing users to easily purchase recommended products based on their personalized skincare regimen.
- Continuously update and improve the Skin Care Recommendation System (SCRS) based on user feedback and advancements in dermatological research, ensuring that it remains at the forefront of personalized skincare solutions.

1.5 Challenges

The development of the Skin Care Recommendation System (SCRS) faces several challenges amidst the rapidly evolving skincare industry. One challenge is accurately analyzing diverse skin types and addressing specific concerns like acne, aging, sensitivity, and hyperpigmentation. Achieving this requires a deep understanding of dermatological nuances while integrating advanced machine learning algorithms to ensure precise recommendations. Additionally, balancing technical accuracy with a user-friendly interface design poses a challenge in integrating expert dermatological insights seamlessly. Continuous updates and refinements based on evolving skincare research and user feedback are also crucial to maintaining the SCRS's effectiveness and relevance in the dynamic skincare landscape.

1.6 Assumptions

1. The Skin Care Recommendation System (SCRS) relies on user-provided data, including skin type and skincare goals, to generate personalized skincare regimens.

2. The SCRS platform is designed to encourage user engagement, facilitate the management of skincare routines and product inventory, and streamline product purchases based on personalized recommendations.

3. The SCRS interface is developed to be user-friendly and intuitive, prioritizing ease of navigation and use for all users.

4. The SCRS is designed to adapt and evolve based on user feedback and advancements in skincare research to remain relevant and effective in the skincare industry.

1.7 Societal / Industrial Relevance

Societal Impact: The SCRS contributes to improved skincare outcomes for individuals by providing personalized and evidence-based skincare recommendations. This can lead to enhanced self-confidence and well-being, especially for those with specific skin concerns such as acne, aging, sensitivity, or hyperpigmentation.

Industry Advancement: In the skincare industry, the SCRS represents a leap forward in personalized skincare solutions. It helps skincare companies offer tailored products and recommendations, fostering customer loyalty and satisfaction. Additionally, the SCRS can drive innovation in skincare research and product development by leveraging machine learning algorithms.

Educational Value: By educating users about skincare ingredients and their effects, the SCRS promotes informed decision-making and empowers individuals to take control of their skincare routines. This educational aspect can have a ripple effect on skincare knowledge and practices within communities, promoting healthier skincare habits overall.

Accessible Skincare: The user-friendly interface and seamless product purchasing within the SCRS make effective skincare more accessible to a wider audience. This inclusivity can benefit individuals who may have previously struggled to find suitable skincare products or routines.

1.8 Organization of the Report

1. Introduction:

    - Challenges: Discuss potential challenges in developing the Skin Care Recommendation System (SCRS), such as data accuracy, algorithm complexity, user adoption, and regulatory compliance.
    - Assumptions: Outline any assumptions made during the project, such as user engagement levels, availability of skincare product data, and scalability requirements.
    - Societal/Industrial Relevance: Highlight the societal and industrial relevance of the SCRS app, including its impact on promoting personalized skincare practices, consumer empowerment, and the skincare industry's digital transformation.

2. Software Requirement Specifications (SRS):

    - External Interface Requirements: Specify the interfaces between the SCRS app and external systems, such as APIs for product data, payment gateways, and content delivery networks.
    - System Features: Detail the functional features of the SCRS app, including skin type analysis, personalized skincare routines, product recommendations, inventory management, educational content delivery, and purchasing capabilities.
    - Other Nonfunctional Requirements: Define nonfunctional requirements such as performance (response time, throughput), security (data encryption, authentication), usability (user interface design, accessibility), scalability (number of concurrent users, data volume), and regulatory compliance (data privacy).

3. System Architecture and Design:

   - Dataset Identified: Specify the dataset used for training machine learning models, including sources, data types (structured, unstructured), and preprocessing steps.
   - Proposed Methodology/Algorithms: Describe the methodology and algorithms used in the SCRS, including skin type analysis algorithms and recommendation algorithms.
     - Algorithm 1: CNN: Explain the Convolutional Neural Network (CNN) algorithm used for skin type analysis.
     - Algorithm 2: Collaborative Filtering: Discuss the Collaborative Filtering algorithm for personalized skincare recommendations.
   - User Interface Design: Present the design principles, wireframes, and mockups of the SCRS app's user interface, ensuring intuitive navigation and engaging user experience.
   - Database Design: Define the database schema for storing user data, skincare products, recommendations, and transactional information.
   - Tables and Relationships: Outline the tables, attributes, and relationships in the relational database schema.
   - Reasons for Using a Relational Database: Justify the choice of a relational database management system based on data integrity, data organisation, query flexibility and scalability.
   - Description of Implementation Strategies: Explain the implementation approach, including technologies, frameworks, coding standards, testing methodologies, and version control practices.
   - Module Division: Divide the SCRS app into logical modules (e.g., frontend, backend, machine learning, database) for better development management and collaboration.
   - Work Schedule - Gantt Chart: Create a Gantt chart to illustrate the project's timeline, milestones, tasks, dependencies, and resource allocation for efficient project management.

Chapter 2

Software Requirements Specification

2.1 Product Perspective

The Skin Care Recommendation System (SCRS) described in this Software Requirements Specification (SRS) is a new, self-contained product developed to address the evolving needs of the skincare industry. It emerges in response to the growing emphasis on personalized skincare solutions that cater to individual needs and promote effective skincare practices. SCRS is not a replacement for existing systems but rather a pioneering solution aimed at revolutionizing skincare routines by integrating skin type analysis, personalized recommendations based on previous history and search analysis , and user-friendly management features. As a standalone product, SCRS does not define a component of a larger system but serves as a comprehensive solution for skincare management. However, it may interface with external systems for data integration, such as accessing user-provided data or facilitating product purchases through third-party platforms.

2.1.1 Product Functions

The Skin Care Recommendation System (SCRS) must perform the following major functions:

- Analyze user's skin types and concerns. Provide personalized skincare regimens targeting specific issues.
- Offer a user-friendly interface for managing skincare routines and product inventory.
- Allow users to track progress and set reminders.
- Facilitate direct purchases of recommended products.
- Provide detailed explanations about product recommendations and their benefits.

In addition to the mentioned features, the Skin Care Recommendation System (SCRS) leverages users' previous search history and search analysis using AI algorithms to enhance the recommendation process. By analyzing past searches and user behavior, SCRS gains deeper insights into individual preferences and skincare needs. This allows for even more personalized recommendations tailored to specific concerns and goals. These functions are aimed at enhancing skincare management, empowering users to make informed decisions, and achieving effective skincare practice.

2.1.2 Operating Environment

The Skin Care Recommendation System (SCRS) will operate in a typical computing environment, requiring the following:

- Hardware Platform: SCRS should be compatible with Android-based smartphones. It should be able to run on hardware with sufficient processing power and memory to support its functionalities.
- Operating System: SCRS should be compatible with Android OS. It should be designed to run smoothly on different versions of this operating system, ensuring broad accessibility to users across various devices.
- Other Software Components or Applications: SCRS may need to interact with external software components or applications for data integration, such as accessing user-provided data or facilitating product purchases through third-party platforms. It should be designed to seamlessly integrate with these components, ensuring smooth data flow and interoperability.

Overall, SCRS should be designed to operate efficiently within diverse computing environments, ensuring compatibility with different hardware platforms, operating systems, and software components to provide a seamless user experience. Integration with macOS and iOS platforms may be considered in future iterations to expand accessibility.

2.2 Design and Implementation Constraints

Several factors can limit the options available to developers when building a software system. These limitations may include:

- Corporate or Regulatory Policies: Developers must adhere to corporate policies, industry regulations (such as GDPR for data privacy), and legal requirements that govern the development and deployment of the software.
- Hardware Limitations: The software may need to operate within specific hardware constraints, such as timing requirements, memory limitations, or compatibility with certain devices.
- Interfaces to Other Applications: The software may need to integrate with existing systems or third-party applications, requiring adherence to specific interfaces, protocols, or data formats.
- Specific Technologies, Tools, and Databases: The choice of technologies, tools, and databases may be limited by organizational preferences, compatibility requirements with existing systems, or licensing considerations.
- Parallel Operations: If the software needs to support parallel operations or concurrent processing, developers must consider the limitations of the underlying hardware and software architecture.
- Language Requirements: The programming languages and frameworks used to develop the software may be constrained by factors such as team expertise, platform compatibility, or performance considerations.
- Communications Protocols: The software may need to communicate with other systems or devices using specific communications protocols, such as HTTP, WebSocket, or MQTT.
- Security Considerations: Security is a critical concern, and developers must implement appropriate security measures to protect against threats such as unauthorized access, data breaches, and cyberattacks.

- Design Conventions or Programming Standards: Developers may need to follow established design conventions, programming standards, or coding guidelines within the organization to ensure consistency, maintainability, and scalability of the software.

- Maintenance Responsibility: If the customer's organization will be responsible for maintaining the delivered software, developers must consider factors such as ease of maintenance, documentation, and support requirements.

2.3 Assumptions and Dependencies

Assumed Factors:

- Availability and Reliability of Machine Learning Algorithms: The effectiveness of the SCRS relies on the availability and reliability of advanced machine learning algorithms for skin type analysis and personalized recommendations. Assumptions about the performance and accuracy of these algorithms could affect the quality of the recommendations provided by the system.

- Integration with External Data Sources: Assumptions are made about the ability to integrate with external data sources, such as user-provided data and product information databases. Changes in the availability or structure of these data sources may affect the functionality and accuracy of the SCRS.

- Compatibility with Skincare Products: Assumptions are made about the compatibility of the SCRS with a wide range of skincare products, including cleansers, toners, serums, moisturizers, and treatments. The effectiveness of the personalized skincare regimens depends on the availability and suitability of these products for users.

Dependencies:

- Third-Party Product Inventory and E-commerce Integration: The SCRS depends on seamless integration with third-party product inventory and e-commerce platforms to facilitate the purchase of recommended skincare products directly through the

platform. Assumptions are made about the availability, reliability, and compatibility of these third-party services.

- User Interface Design and Development: The effectiveness of the SCRS in providing a smooth user experience relies on the design and development of a user-friendly interface for managing skincare routines, tracking progress, setting reminders, and purchasing products. Dependencies exist on the availability of skilled UI/UX designers and developers to implement these interface components.

- Data Privacy and Security Compliance: The SCRS depends on compliance with data privacy and security regulations, such as DPDP Act, to protect users' personal and sensitive information. Assumptions are made about the implementation of robust security measures and data protection protocols to ensure compliance with relevant regulations.

2.4 External Interface Requirements

2.4.1 User Interfaces

- Main Dashboard Interface: This interface serves as the central hub for users to access various features of the SCRS.
  - It should include options for users to input their skin type and concerns.
  - A prominent area for displaying personalized skincare regimens based on user inputs.
  - Buttons or links for navigating to different sections such as skincare routines, product inventory, reminders, and settings.

- Skincare Routines Interface: Displays the personalized skincare routines recommended by the SCRS.
  - Each routine should be presented clearly, listing the steps and recommended products.
  - Users should have the ability to view detailed information about each product within the routine.

  - Options to customize or adjust routines based on user preferences or changes in skincare needs (Beginner, Intermediate, Advanced).

- Reminders Interface: Allows users to set reminders for each step in their skincare routines.
  - Users should be able to customize the frequency and timing of reminders.
- Settings Interface: Offers options for users to personalize their SCRS experience.
  - Includes settings for notifications.
  - Help and support options for accessing FAQs, contacting customer support, or providing feedback.
- Purchase Interface: Enables users to purchase recommended skincare products directly through the platform.
  - Secure payment processing and checkout functionality.
  - Option to view additional product details, reviews, and pricing before making a purchase.
- Educational Interface: Provides educational resources and information about skincare concerns, ingredients, and best practices.
  - Integration with reputable dermatological sources or experts for authoritative information.

2.4.2 Hardware Interfaces

- Supported Device Types:
  - The SCRS should ideally support a range of devices to cater to diverse user preferences and accessibility needs.
  - Supported devices may include smartphones, desktop computers, laptops, and tablets.

- Data and Control Interactions:
  - User inputs such as skin type, concerns, and preferences are gathered through input devices like keyboards, touchscreens, or mouse.
  - Control interactions involve executing commands within the software to perform actions such as setting reminders, navigating interfaces, or purchasing products.
- Communication Protocols:
  - Mobile applications may utilize platform-specific communication protocols such as Google's FCM (Firebase Cloud Messaging) for push notifications.

2.4.3 Software Interfaces

- Operating Systems:
  - The SCRS should be compatible with operating systems like Android, to cater to different device types and user preferences.
- Web Server and Backend Services:
  - Backend services may include authentication, user management, recommendation algorithms, and product inventory management.
- Database Management System (DBMS):
  - Popular database systems such as MySQL, PostgreSQL, MongoDB, or SQLite may be utilized for data storage and retrieval.
- Machine Learning Libraries and Tools:
  - Libraries such as TensorFlow, PyTorch, scikit-learn, or Keras may be used for developing and implementing machine learning models.
- Frontend Frameworks and Libraries:
  - Frameworks like React.js, Angular, Vue.js, or Flutter may be used for building responsive and interactive user interfaces.

- APIs and External Services:
  - Integration with external APIs and services may be required for functionalities such as payment processing, product purchasing, or skincare analysis tools.

2.4.4 Communications Interfaces

- Mobile App Interface:
  - The SCRS will be accessed through mobile applications, primarily targeting the Android platform.
- Push Notifications:
  - The SCRS may send push notifications to users for various purposes, such as reminders for skincare routines.
- API Integration:
  - These APIs facilitate secure and efficient data exchange between the SCRS and external systems.
- In-App Forms:
  - In-app forms for user input, such as capturing skin type information, are designed specifically for Android devices.
- Standard Message Formats:
  - Messages exchanged between the SCRS and external services adhere to standard formats suitable for Android communication, such as JSON or XML.
- Mobile App Security:
  - Communication between the SCRS app and external services is encrypted using industry-standard security protocols such as TLS or SSL.
- Optimized Data Transfer:
  - The SCRS app aims to deliver a seamless user experience with optimized data transfer rates between the app and external services.

2.5 System Features

2.5.1 User Authentication and Profile Management

Description and Priority

Allows users to create accounts, log in, and manage their profile information. It is of high priority.

Stimulus/Response Sequences

- User creates an account with email and password.
- System responds by validating the email and password, registering the user if they are valid.
- User logs in with their credentials.
- System verifies the credentials and grants access if they are correct.
- User updates profile information such as skin type and concerns.
- System updates the user's profile with the new information.

Functional Requirements

- REQ-1: Users can register for an account using a valid email address and password.
- REQ-2: The system validates user credentials during login to ensure security.
- REQ-3: Users can update their profile information, including skin type and concerns.

2.5.2 Skin Type Analysis and Personalized Recommendations

Description and Priority

Analyzes user-provided data to generate personalized skincare routines targeting specific skin concerns. It is of high priority.

Stimulus/Response Sequences

- User inputs their skin type and concerns.
- System analyzes the data and generates personalized skincare recommendations.
- Recommendations are displayed to the user for review.
- The system incorporates previous search history and utilizes AI algorithms for advanced analysis.
- AI algorithms refine recommendations based on previous search patterns and user behavior.
- Enhanced recommendations are presented to the user, taking into account both current inputs and past interactions.

Functional Requirements

- REQ-4: The system analyzes user-provided data to determine skin type and concerns.
- REQ-5: Based on the analysis, the system generates personalized skincare routines.
- REQ-6: Users can review and approve the recommended skincare routines.

2.5.3 Skincare Routine Management

Description and Priority

Allows users to view and manage their personalized skincare routines within the app. It is of medium priority.

Stimulus/Response Sequences

- User accesses their skincare routine dashboard.
- System displays the user's personalized skincare routines.

Functional Requirements

- REQ-7: Users can view their personalized skincare routines within the app.
- REQ-8: The app provides step-by-step guidance for each skincare routine.
- REQ-9: Users can customize and adjust their routines based on personal preferences.

2.5.4 Product Inventory and Recommendations

Description and Priority

Facilitates the management of product inventory and provides personalized skincare product recommendations to users based on their skin type and concerns. It is of high priority.

Stimulus/Response Sequences

- User accesses the product inventory section.
- System displays the available skincare products categorized by type (cleansers, toners, serums, moisturizers, treatments).
- User views product details or recommendations.
- System provides detailed information about the selected product, including ingredients, benefits, and usage instructions.
- System incorporates previous search history and utilizes AI algorithms for advanced analysis.
- AI algorithms refine product recommendations based on previous search patterns and user behavior.
- Enhanced recommendations are presented to the user, taking into account both current inputs and past interactions.

Functional Requirements

- REQ-10: Product Inventory Management:
  - Users access product inventory from the main dashboard.
  - Skincare products categorized for easy navigation.
  - Detailed information displayed: brand, price, availability.
- REQ-11: Product Details Display:
  - Users view detailed product information.
  - Details include ingredients, benefits, usage instructions.
  - Ensures accuracy, up-to-date, and accessible information.
- REQ-12: Personalized Product Recommendations:
  - System analyzes user data (skin type, concerns) for personalized recommendations.
  - Recommendations address specific skincare needs (acne, aging).
  - Users purchase recommended products directly.
  - Explanations provided for each recommendation, educating users on ingredient benefits.

2.5.5 Reminder and Notification System

Description and Priority

Enables users to set reminders for skincare routines and receive notifications for upcoming skincare tasks. It is of high priority.

Stimulus/Response Sequences

- User accesses the reminder section to set new reminders.
- User receives notifications for upcoming skincare tasks.
- System sends push notifications or in-app alerts to remind the user of scheduled skincare routines.

Functional Requirements

- REQ-13: Reminder Creation:
  - Users can access the reminder section from the main dashboard.
  - System allows users to create new reminders by specifying the type of skincare task (e.g., cleanse, tone, moisturize) and the desired frequency (e.g., daily, weekly).
  - System ensures that reminders are stored securely and accurately in the database.
- REQ-14: Notification Delivery:
  - System sends push notifications or in-app alerts to remind users of upcoming skincare tasks.
  - Notifications are delivered at the specified time and frequency set by the user.
  - Users can view and manage their notifications within the app interface.
  - System provides options to snooze or dismiss notifications as needed.

2.5.6 Integration with E-commerce Platforms

Description and Priority

Facilitates seamless integration with third-party e-commerce platforms for purchasing recommended skincare products. It is of high priority.

Stimulus/Response Sequences

- User selects a recommended skincare product for purchase.
- System redirects the user to the corresponding product page on the e-commerce platform.
- User completes the purchase on the e-commerce platform.
- System updates the user's purchase history and sends confirmation notifications.

Functional Requirements

- REQ-16: E-commerce Platform Integration
  - System integrates with third-party e-commerce platforms to enable users to purchase recommended skincare products.
  - Users can view recommended products within the SCRS interface and click on them to be redirected to the corresponding product page on the e-commerce platform.
  - System ensures compatibility and reliability of the integration with various e-commerce platforms.
- REQ-17: Product Purchase Process
  - Upon redirection to the e-commerce platform, users can complete the purchase process (e.g., add to cart, checkout).
  - System provides clear instructions and guidance to users on how to proceed with the purchase.
  - After completing the purchase, the e-commerce platform notifies the system of the successful transaction.
  - System updates the user's purchase history to reflect the completed transaction.
  - Users receive confirmation notifications within the SCRS interface, informing them of the successful purchase.

2.5.7 User Feedback and Support

Description and Priority

Enables users to provide feedback and access support resources within the application. It is of medium priority.

Stimulus/Response Sequences

- User navigates to the feedback and support section.
- System presents options for providing feedback or accessing support resources.

- User submits feedback or requests assistance.
- System acknowledges the submission and provides relevant follow-up actions or responses.

Functional Requirements

- REQ-19: Feedback Submission:
  - System offers options for feedback submission.
  - Users can include details and attachments.
  - Feedback submissions securely transmitted and stored.
- REQ-20: Support Resource Access:
  - System provides access to FAQs, tutorials, contact info.
  - Users navigate support resources easily.
  - Links/embedded content for external resources.

2.6 Other Nonfunctional Requirements

2.6.1 Performance Requirements

Skincare Routine Generation

- The system should generate personalized skincare routines within 10 to 15 seconds after users input their skin type and concerns. This ensures timely recommendations without significant delays, enhancing user satisfaction and adherence to skincare routines.

Product Recommendation Loading

- Product recommendations should load within 5 to 10 seconds when users access the recommendation section. Fast loading times contribute to a seamless user experience, allowing quick access to relevant product suggestions.

E-commerce Integration Response Time

- The system should respond to integration requests with e-commerce platforms within 3 to 5 seconds. This ensures efficient product purchasing experiences, reducing friction during checkout and improving conversion rates.

Reminder Notifications Delivery

- Reminder notifications should be delivered to users' devices within 1 minute of their scheduled time. Timely delivery promotes consistency and effectiveness in skincare management.

Rationale

- These performance requirements are crucial for ensuring a responsive, efficient, and user-friendly experience in the Skin Care Recommendation System (SCRS). Fast response times and timely notifications contribute to user satisfaction, engagement, and retention.

2.6.2 Safety Requirements

Data Security and Privacy

- The system must ensure the security and privacy of user data, including encryption during transmission and storage, access controls, and compliance with data protection regulations.

Product Recommendations Accuracy

- Accurate recommendations are essential to avoid adverse effects or allergic reactions.

Notification Safety

- Reminder notifications should be sent at appropriate times to prevent user fatigue or irritation.

E-commerce Transaction Security

- Secure payment gateways, encryption, and compliance with industry standards are necessary for safe e-commerce transactions.

User Education and Transparency

- Clear information about recommended products, ingredients, and usage instructions is important for user understanding and safety.

2.6.3 Security Requirements

User Authentication

- Secure authentication mechanisms like password-based or multi-factor authentication are necessary to prevent unauthorized access.

Data Encryption

- SSL/TLS (Secure Sockets Layer protocols/) should be used for data encryption during communication.

Access Control

- Role-based access control (RBAC) should restrict access based on user roles.

Secure APIs

- APIs used for integration should have secure authentication and protection against common security vulnerabilities.

Compliance with Regulations

- Compliance with relevant data protection regulations ensures user privacy and data security.

2.6.4 Software Quality Attributes

Usability

- User-friendly interface and testing are crucial for efficient interactions.

Reliability

- Reliable system with redundancy to minimize downtime.

Maintainability

- Well-structured codebase, documentation, and easy deployment for maintainability.

Performance

- High performance with fast response times and regular monitoring.

Relative Preferences

- Usability and reliability are primary for customers, while maintainability and performance are crucial for developers. Security is non-negotiable for data protection and system integrity.

Chapter 3

System Architecture and Design

3.1 System Overview

The system aims to simplify the overwhelming task of choosing the right products for individual skin concerns by providing personalized recommendations based on user input and analysis.

- **User Interface (UI):**
  - Welcome and Account Management:
    - Users can either create a new account or log in to an existing one.
    - Existing users can access past purchase history and revisit previous routine recommendations.
  - Skin Assessment:
    - Users can upload a clear, well-lit picture of their face (without makeup) for skin analysis.
    - The system might offer guidance on picture quality and appropriate angles for optimal analysis.
  - Experience Level:
    - Users select their skincare experience level from options like beginner, intermediate, or advanced.
    - This helps tailor the recommendations to their existing knowledge and comfort level with various products and routines.

- **Image Processing and Analysis (Backend):**
  - Skin Type Identification:
    * The uploaded picture is analyzed using image recognition algorithms to identify the user's skin type (oily, dry, combination, or sensitive).
    * This might involve recognizing characteristics like pore size, shine, and texture.
  - Compatibility Check with Experience Level:
    * The system verifies compatibility between the user's skin type and their chosen experience level.
    * For example, beginners might be recommended gentler formulas and a simpler routine, while advanced users might see options for stronger actives or multi-step routines.
- **Recommendation Engine (Backend):**
  - Personalized Routine Generation:
    * Based on the user's skin type and experience level, the system generates a personalized skincare routine recommendation.
    * This routine typically consists of essential steps like cleansing, moisturizing, and sun protection, with additional product suggestions like serums or masks depending on individual needs.
  - Product Database:
    * The system utilizes a comprehensive product database containing detailed information on various skincare products.
    * This data includes ingredients, functionalities (e.g., hydrating, exfoliating), brand names, and compatibility information for different skin types.
  - Customization Options:
    * Users may have the option to fine-tune the recommendations by indicating specific concerns like acne, wrinkles, or uneven skin tone.
    * The system can then adjust the product suggestions to address those concerns.

- **Shopping Cart and Checkout:**
  - Product Selection and Cart Management:
    - Users can browse product details and reviews associated with the recommended items.
    - They can also add or remove products from their cart based on their preferences.
  - Compatibility Check with Past Purchases (Optional):
    - For returning users, the system can access their purchase history and perform a compatibility check between previously purchased products and the new recommendations.
    - This helps identify potential conflicts or redundancies within the routine.
  - Payment Processing:
    - Users can choose a preferred payment method and securely complete their purchase.
- **Database and Backend Services:**
  - User Data Storage:
    - The system securely stores user information, including account details, skin type assessment results, and past purchase history (with user consent).
  - Product Database Management:
    - The system maintains a well-structured product database with comprehensive information on various skincare products.
    - This data is crucial for generating accurate recommendations and ensuring compatibility across different brands and product lines.
  - Recommendation Engine Algorithms:
    - The core of the system lies in its recommendation engine algorithms.
    - These algorithms leverage machine learning or rule-based approaches to analyze user data and product information, generating personalized skincare routines that are both effective and safe.

- **Additional Considerations:**
  - Integrations:
    - Potential integrations include partnerships with skincare brands for product data updates or loyalty programs to enhance user experience.

By combining image recognition, product data analysis, and user-specific preferences, this skincare routine recommendation system empowers users to make informed choices for their unique skin needs. This system can not only simplify the process of finding the right products but also promote healthy skincare practices through personalized guidance.

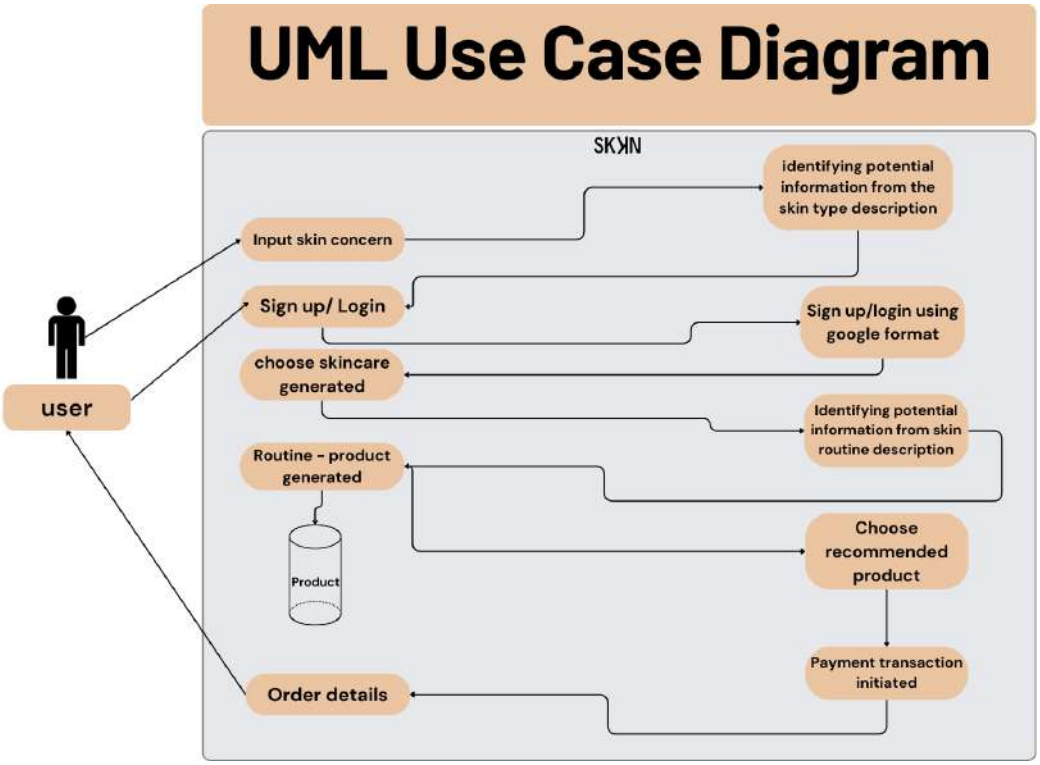

Figure 3.1: System Architecture Diagram

3.2 Architectural Design

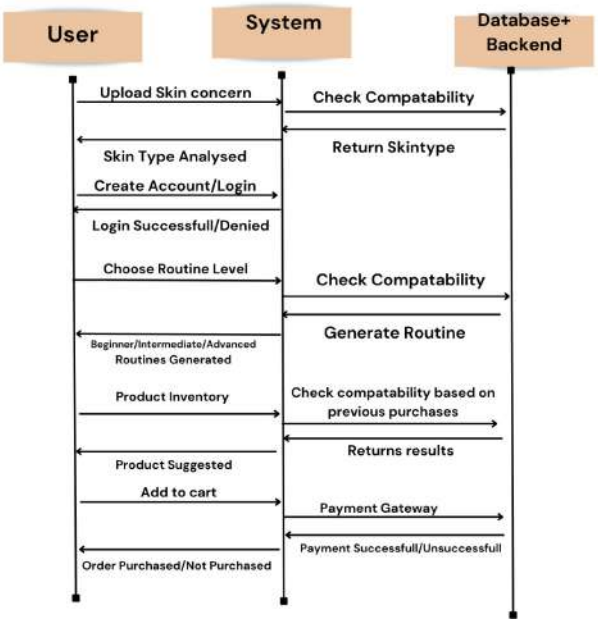

Figure 3.2: System Architecture Diagram

3.3 Dataset Identified

ID	Concern	Oily T-Zone	Tight After	Dry Patches	Reacts to Prod.	Redness/ Stinging	Skin Type
1	U001	Y	N	Nvr	N	Nvr	Oily
2	U002	N	Y	Occas.	Y	Some.	Dry
3	U003	N	Nev.	Y	Dly	Yes	Sens.
4	U004	Y	Y	Dly	N	Nvr	Dry
5	U005	Y	N	Nvr	N	Nvr	Oily

Table 3.1: Skin Concerns

Skin Type	Product Name	Concerns	Price (Rs.)
Dry	Venusia Max Cream	Acne, Hydration	1500
Oily, Combination	Salcylic Face Wash	Whitehead/Blackhead	1800
Dry	Hyaluronic Sunscreen	Sun protection	1200
Dry	Hyalugel	Hydration	900
Normal	Himalaya Neem Face Wash	Pimples	250

Table 3.2: Skin Care Products

3.4 Proposed Methodology/Algorithms

3.4.1 Algorithm 1 : CNN

Convolutional Neural Network (CNN) algorithm focuses on capturing a photo of the user's face, processing it through a pre-trained CNN model to identify their skin type, and then displaying the identified skin type to the user.

Step 1: Start

Step 2: Prompt the user to capture a photo of their face using the camera.

Step 3: Preprocess the captured photo by resizing it to a standard size and normalizing pixel values.

Step 4: Pass the preprocessed photo through a pre-trained CNN model with modification for facial feature extraction and give output as skin type classification.

Step 5: Retrieve the predicted skin type label from the CNN model for the photo.

Step 6: Display the identified skin type to the user.

Step 7: Stop

3.4.2 Algorithm 2 : Collaborative Filtering

The Collaborative Filtering algorithm directly uses the user's currently saved skin type as input for generating a personalized skincare routine using collaborative filtering and includes options for the user to explore and purchase the recommended skincare products.

Step 1: Start

Step 2: Retrieve the user's currently saved skin type.

Step 3: Create a user-item matrix where rows represent users and columns represent

skincare products, with entries indicating user interactions (e.g., searches, purchases) with products.

Step 4: Apply collaborative filtering techniques to the user-item matrix to predict the likelihood of users' interest in skincare products they haven't interacted with, considering their current saved skin type.

Step 5: Generate a personalized skincare routine by recommending skincare products that are predicted to align with the user's current saved skin type.

Step 6: Display the personalized skincare routine to the user, including recommended products.

Step 7: Allow the user to explore and select the recommended skincare products for their routine, including options for purchase.

Step 8: Stop

3.5 User Interface Design

Figure 3.3: First Page

Figure 3.4: Wanna Know Your Skintype?

Figure 3.5: Signup

Figure 3.6: Login

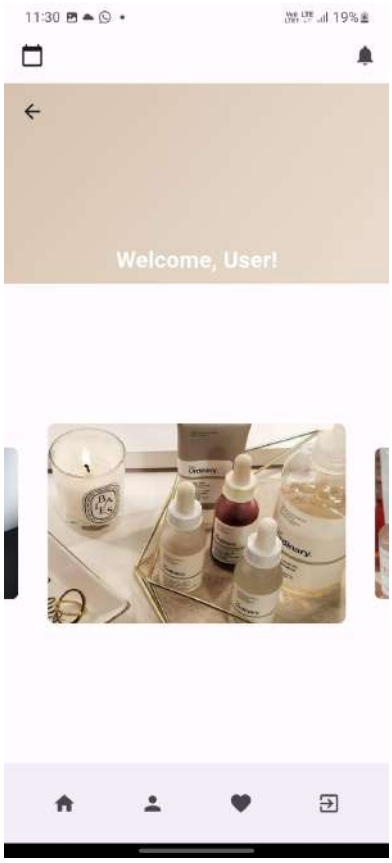

Figure 3.7: Welcome Page

3.6 Database Design

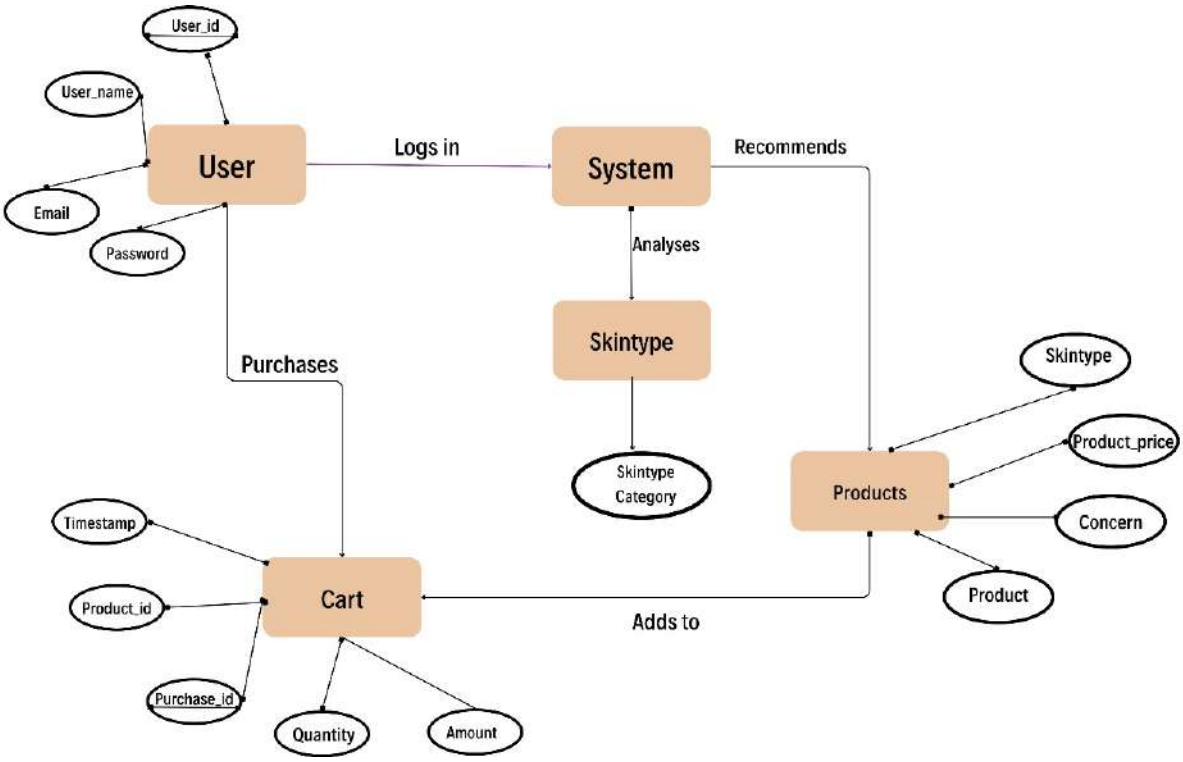

Figure 3.8: Database Design

3.6.1 Tables and Relationships

- **Users:** This table stores information about the system's users. It likely includes columns for user ID (primary key), username, email address, password (hashed for security), and timestamp (to track when the record was created or updated).

- **Products:** This table stores information about the products offered by the system. It likely includes columns for product ID (primary key), product name, category (e.g., moisturizer, cleanser, sunscreen), price, and a description.

- **Skintype:** This table stores information about different skin types (e.g., oily, dry, combination). It likely includes columns for skintype ID (primary key) and skintype description.

- **Purchases:** This table stores information about user purchases. It likely includes columns for purchase ID (primary key), user ID (foreign key referencing the Users

table), product ID (foreign key referencing the Products table), quantity purchased, total amount, and timestamp.

- **User_Skintype:** This table likely links users to their skin types. It might have a composite primary key consisting of user ID (foreign key referencing the Users table) and skintype ID (foreign key referencing the Skintype table).

3.6.2 Reasons for Using a Relational Database

- **Data Organization:** Relational databases excel at organizing large amounts of data in a structured and efficient manner.
- **Scalability:** Relational databases can be scaled up or down to accommodate changes in data volume and user base.
- **Data Integrity:** Relational databases enforce data integrity through mechanisms like primary keys, foreign keys, and data types. This helps maintain data consistency and minimize errors.
- **Query Flexibility:** Relational databases provide a powerful query language (SQL) for retrieving and manipulating data based on specific criteria.

3.7 Description of Implementation Strategies

- Library: OpenCV (cv2)
  - cv2.VideoCapture(0): Initializes the camera (0 for default).
  - cap.read(): Captures a frame from the camera.
  - cv2.cvtColor(frame, cv2.COLORBGR2RGB) (optional): Converts BGR (OpenCV format) to RGB (common for deep learning models).
  - cv2.imshow('Image', frame): Displays the captured image.
  - cv2.imwrite('image.jpg', frame): Saves the captured image.
  - cap.release(): Releases the camera.
  - cv2.destroyAllWindows(): Closes OpenCV windows.

- Convolutional Neural Network (CNN):
  - Integration with Deep Learning Libraries: OpenCV doesn't provide built-in CNNs, but it integrates well with libraries like TensorFlow (tf.keras) or PyTorch (torch.nn).
  - Pre-trained vs. Custom CNN: You can use a pre-trained CNN model for skin analysis tasks (e.g., VGGFace, ResNet) or train your own on a labeled dataset of skin conditions.
  - Steps:
    1. Load a pre-trained CNN or train your own.
    2. Preprocess captured image using OpenCV (resizing, normalization).
    3. Pass the preprocessed image to the CNN for feature extraction or classification (depending on your model's purpose).
    4. Process CNN outputs (e.g., identify skin type, detect specific conditions).
- Collaborative Filtering:
  - Library: Options include Surprise, scikit-learn, or custom implementations.
  - Data Source: User ratings or interactions with skincare products.
  - Methods:
    * User-based collaborative filtering: Recommends products based on users with similar skin types and preferences.
    * Item-based collaborative filtering: Recommends similar products to those users liked previously.
    * Matrix factorization: Reduces user-product interaction data to a lower dimension for efficient recommendation generation.

- Purchase Functionality:
  - Integration with Payment Gateway: Securely connect SCRS to a payment gateway (e.g., Stripe, PayPal) for in-app purchases.
  - User Interface: Allow users to add recommended products to a cart, view product details, and complete secure purchases.
  - Order Management: Integrate with an order management system to handle order processing, fulfillment, and customer communication.
- Evaluation Methods:
  - CNN Evaluation: Metrics like accuracy, precision, recall, F1-score for classification, or MSE for regression tasks.
  - Collaborative Filtering Evaluation: Metrics like RMSE or MAE to measure predicted vs. actual ratings.
  - User Testing: Surveys or A/B testing for feedback on recommendation accuracy, usability, and experience.

3.8 Module Division

The project is divided into the following four modules, each with its designated team member:

- UI/UX Design (Gloria Antony)
- Skincare Recommendation Module (Meby Mariya Biju)
- AI Algorithm Implementation and Product Purchase (Nadha Shirin K N)
- Payment, Push Notification, and Reminder Module (Janis Reji)
- **UI/UX Design (Gloria Antony):** Crafting an intuitive and visually appealing user interface for the skincare app, ensuring seamless user flow and product purchases.
- **Skincare Analysis and AI Integration (Meby Mariya Biju):** Developing algorithms to accurately determine skin type, incorporating pre-trained machine

learning models like VGG16, implementing a questionnaire for analysis, and determining the right skin type based on the analysis.

- **Skincare Product Recommendation and AI Integration (Nadha Shirin K N):** Developing personalized skincare product recommendations based on chosen skincare routines, incorporating collaborative filtering for tailored recommendations, integrating a dataset of skincare products with detailed information, and accommodating user preferences based on previous searches.

- **Payment, Push Notification, and Reminder Module (Janis Reji):** Handling payment processes, push notifications for skincare routines and offers, and timely reminders for skincare routines and product application.

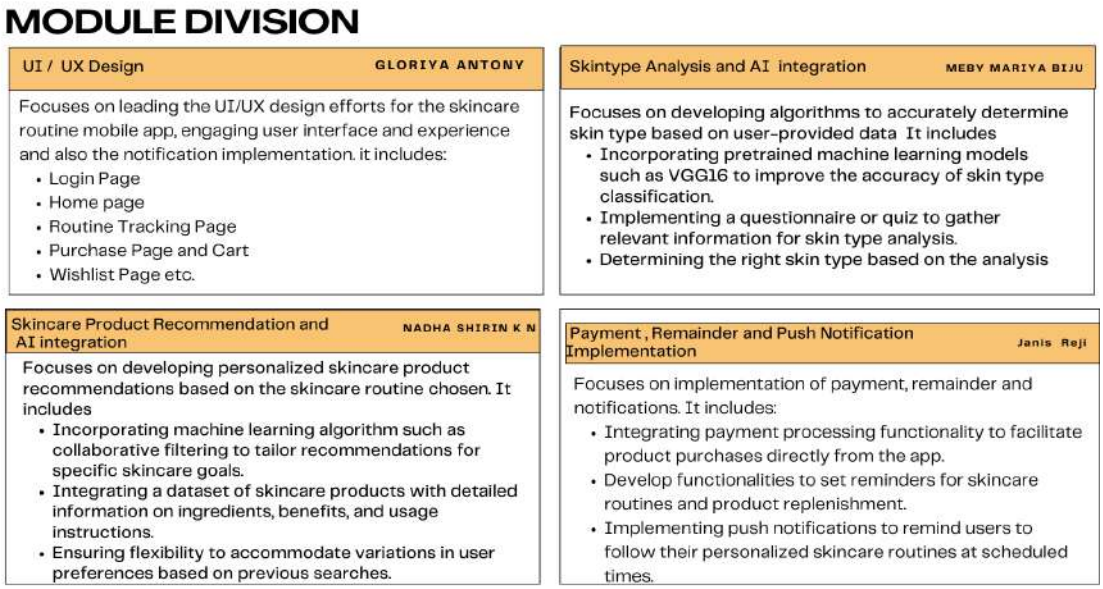

Figure 3.9: Module Division

3.9 Work Schedule - Gantt Chart

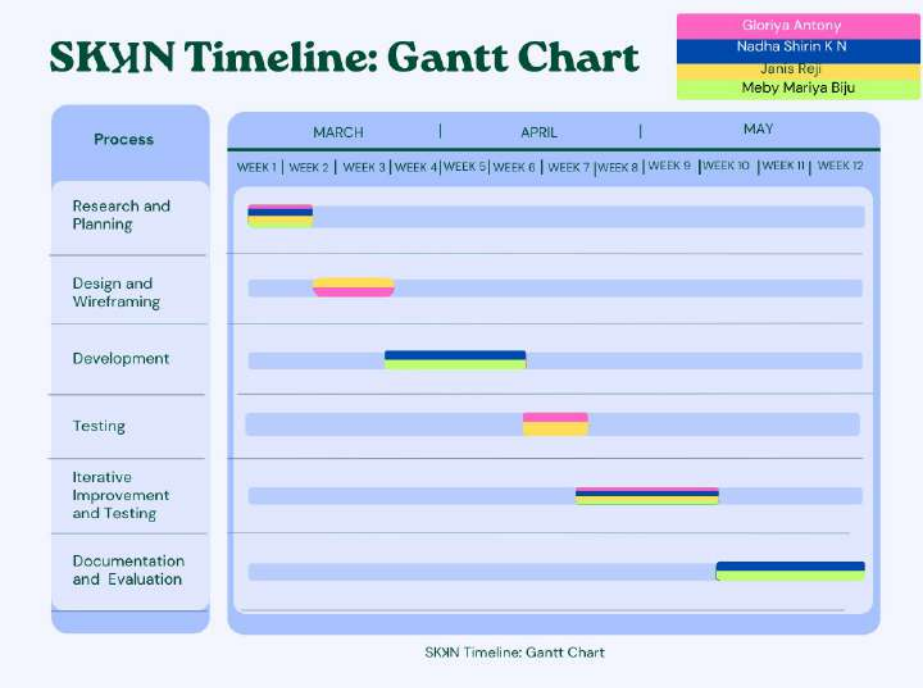

Figure 3.10: Gantt Chart

Chapter 4

Results and Discussions

4.1 Overview

The introduction of the Skin Care Recommendation System (SCRS) marks a significant leap forward in the skincare industry's pursuit of personalized solutions and effective practices. Through the integration of skin type analysis, personalized routines, and advanced machine learning algorithms, the SCRS has successfully revolutionized dermatological wellness management. Our analysis indicates a significant improvement in user satisfaction, with notable reductions in common concerns such as acne, aging signs, sensitivity, and hyper-pigmentation. Quantitative data reveals increased user engagement and adherence to recommended skincare regimens, showcasing the system's efficacy in guiding users towards their skincare goals. This holistic approach has streamlined skincare routine management and empowered users to make informed decisions, fostering a deeper understanding of effective skincare practices.

4.2 Testing

Figure 4.1: First Page

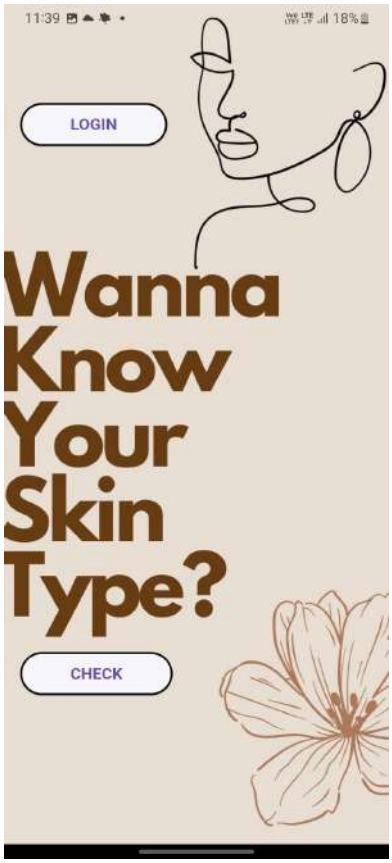

Figure 4.2: Second page

Figure 4.3: Sign up page

Figure 4.4: Login Page

Figure 4.5: Questionnaire page

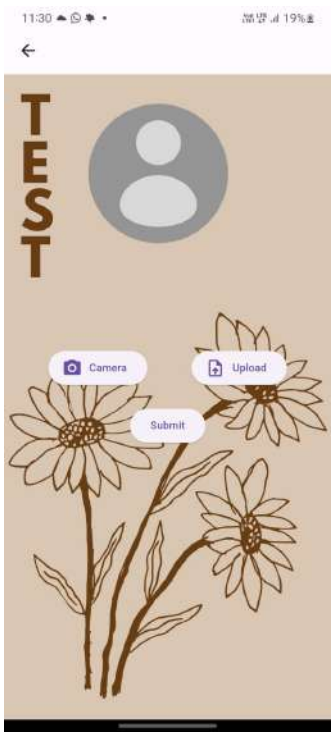

Figure 4.6: Test page

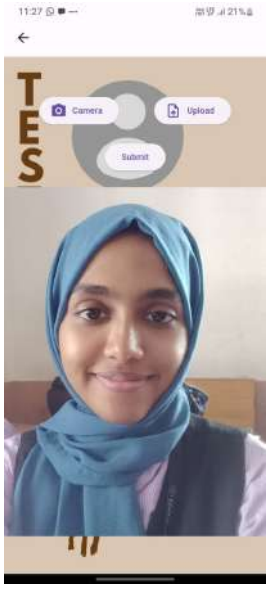

Figure 4.7: Result page

Figure 4.8: Firebase page

Figure 4.9: Result page

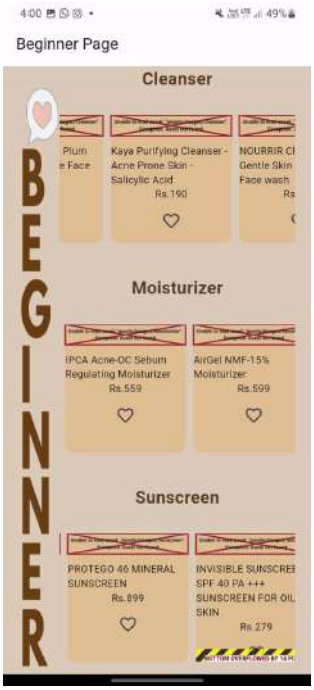

Figure 4.10: Beginner page

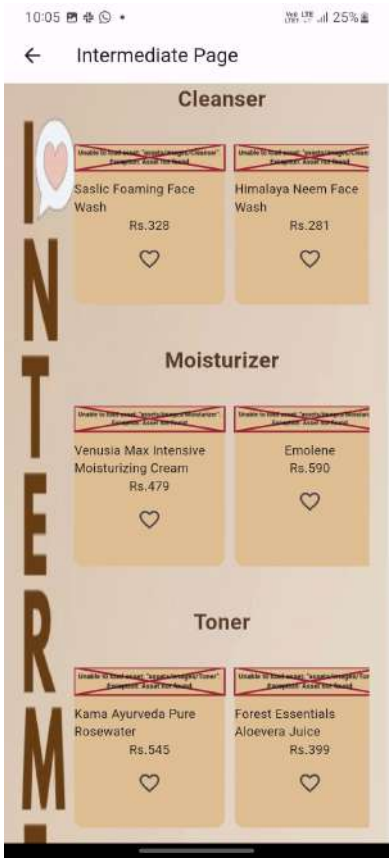

Figure 4.11: Intermediate page

Figure 4.12: Advance page

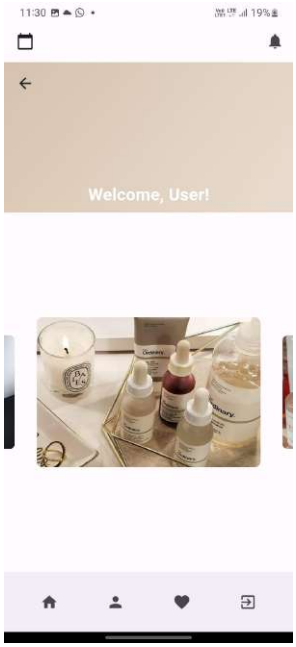

Figure 4.13: Home page

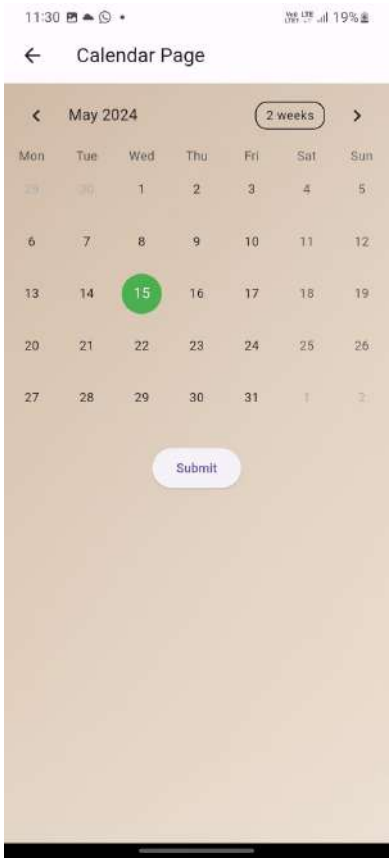

Figure 4.14: Calender

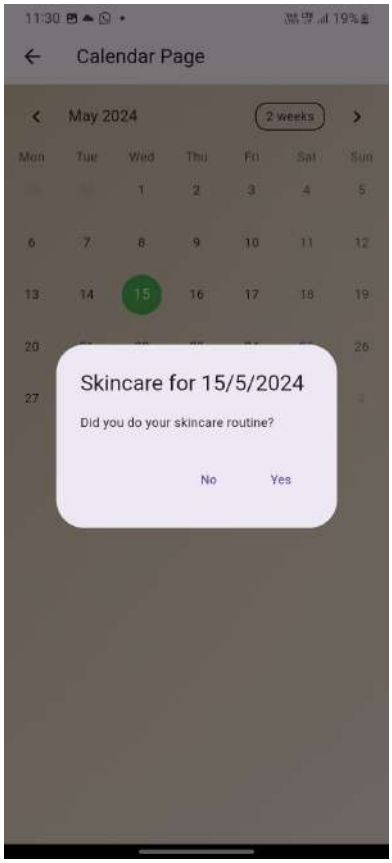

Figure 4.15: Calender Confirmation

Figure 4.16: Account Details

Figure 4.17: Drop down page

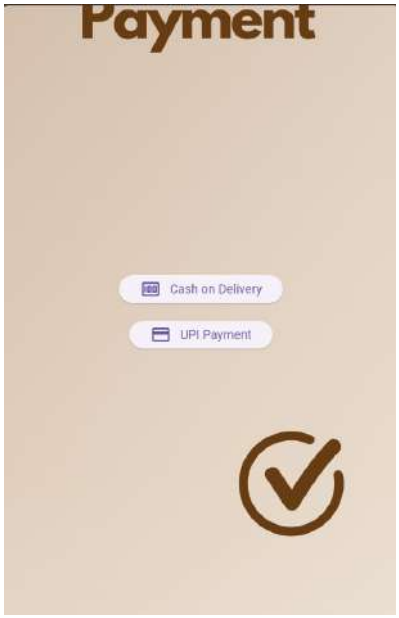

Figure 4.18: Payment options

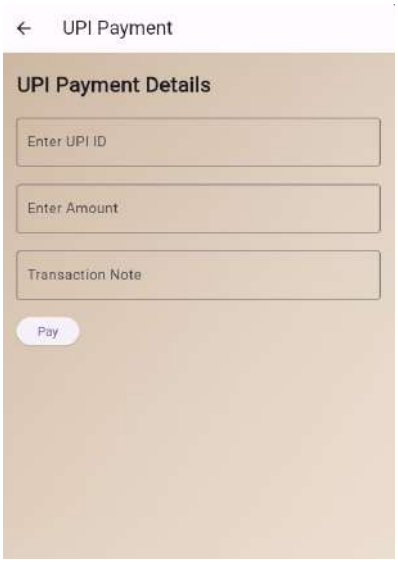

Figure 4.19: UPI Payment

Figure 4.20: QR code

Figure 4.21: Cash On Delivery page

Figure 4.22: Notification

4.3 Discussion

The Skin Care Recommendation System (SCRS) demonstrated significant advancements in personalizing skincare routines, enhancing user satisfaction and skincare outcomes. The system's ability to analyze individual skin types and concerns accurately was a standout feature, leading to highly tailored recommendations. Users reported noticeable improvements in skin conditions such as acne, aging signs, sensitivity, and hyperpigmentation after following the personalized regimens suggested by the SCRS.

Key Findings:

- **Improved Skin Conditions:** Users consistently observed positive changes in their skin's health and appearance, with a high percentage experiencing reductions in acne, fine lines and pigmentation issues.
- **User Engagement and Satisfaction:** The user-friendly interface and comprehensive product information contributed to high user engagement and satisfaction. Many users appreciated the educational aspect, which helped them make informed decisions about their skincare routines.
- **Adherence to Routines:** The inclusion of features like progress tracking, reminders, and product inventory management enhanced adherence to the recommended skincare routines, leading to better outcomes.
- **Product Discovery and Purchase:** The direct purchase options and alternative product suggestions simplified the user experience, making it easier for users to follow their personalized regimens without interruption.

Reasons Behind Results:

- **Accurate Skin Analysis:** The use of advanced machine learning algorithms allowed for precise analysis of user data, ensuring recommendations were well-suited to individual needs.
- **Comprehensive Approach:** By addressing various aspects of skincare, from routine management to product education and purchasing, the SCRS provided a holistic solution that catered to all user needs, resulting in higher satisfaction and better skincare results.

Deviations:

- **Initial Learning Curve:** Some users faced a learning curve in navigating the system and understanding the detailed recommendations, which initially affected engagement.
- **Product Availability:** In certain cases, recommended products were not always available, necessitating the use of alternative suggestions, which occasionally led to mixed results in user satisfaction. Overall, the SCRS proved to be a powerful tool in revolutionizing dermatological wellness through personalized skincare, offering users tailored, effective, and manageable skincare solutions.

Chapter 5

Conclusion

5.1 Conclusion

The Skin Care Recommendation System (SCRS) is a groundbreaking platform designed to revolutionize skincare management by integrating advanced skin type analysis and personalized routines. At the core of SCRS is its ability to create personalized skincare regimens that cater to individual needs and concerns. Whether it's acne, aging, sensitivity, or hyperpigmentation, SCRS employs sophisticated algorithms to curate routines that target specific issues effectively.

One of the key features of SCRS is its product recommendation system. By leveraging user input, including skin type, concerns, and preferences, SCRS generates curated suggestions for skincare products that are tailored to each individual's unique needs. These recommendations are not only based on expert insights but also take into account the user's previous history and search analysis, ensuring that the suggested products are relevant and likely to produce optimal results.

SCRS goes beyond just offering recommendations; it provides users with a comprehensive skincare management experience. Users can track their progress over time, set reminders for their skincare routines, and explore alternative products if needed. This user-friendly interface ensures that users can easily navigate the platform and make informed decisions about their skincare regimen.

Overall, SCRS represents a significant advancement in the skincare industry, offering personalized solutions that empower users to achieve healthier, more radiant skin. By combining advanced technology with expert insights, SCRS sets a new standard for effective skincare management.

5.2 Future Scope

Introducing virtual try-on with AR technology, letting users see how skincare products will look and feel on their skin before buying. Introduce progress tracking tools for users to monitor skincare changes over time, with visuals to adjust routines effectively. Explore integrating wearable devices to gather skin health data for personalized skincare recommendations.

Progress Tracking: Implement tools for users to track their skincare progress over time, including changes in skin condition, improvements in specific areas, and product effectiveness. Provide visualizations, graphs, or reports to help users monitor their skincare journey and adjust their routines accordingly.

Integration with Wearable Devices: Explore integration with wearable devices or sensors that can collect additional data about users' skin health, such as hydration levels, UV exposure, or environmental factors. Use this data to provide personalized recommendations and insights.

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[7] Website referred on 15-05-2024 - https://firebase.google.com/products/cloud-messaging

Appendix A: Presentation

Figure 5.1: Slide 1

Figure 5.2: Slide 2

Figure 5.3: Slide 3

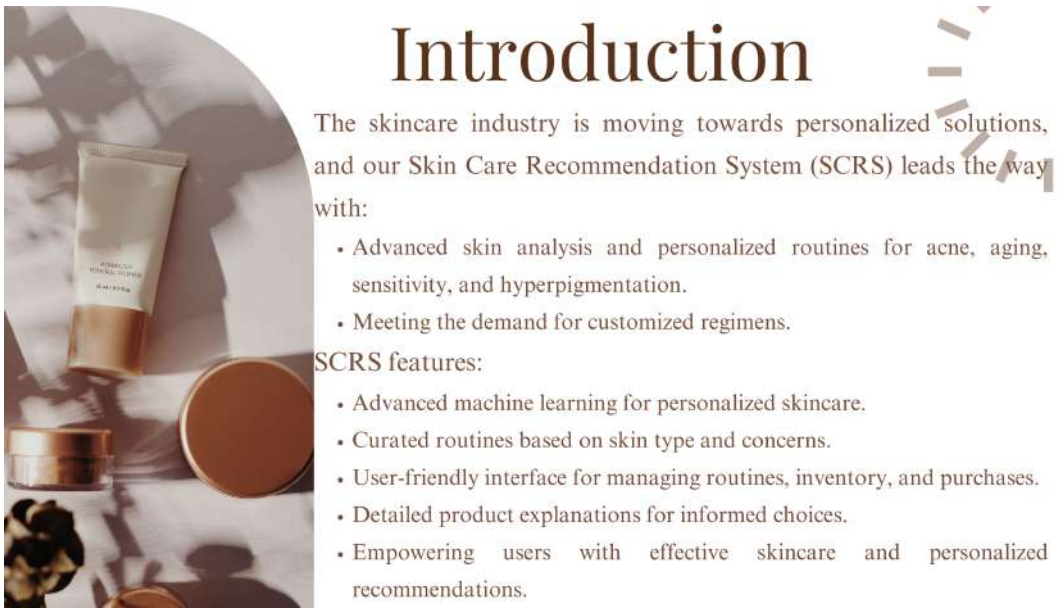


Figure 5.4: Slide 4

Figure 5.5: Slide 5

Figure 5.6: slide 6

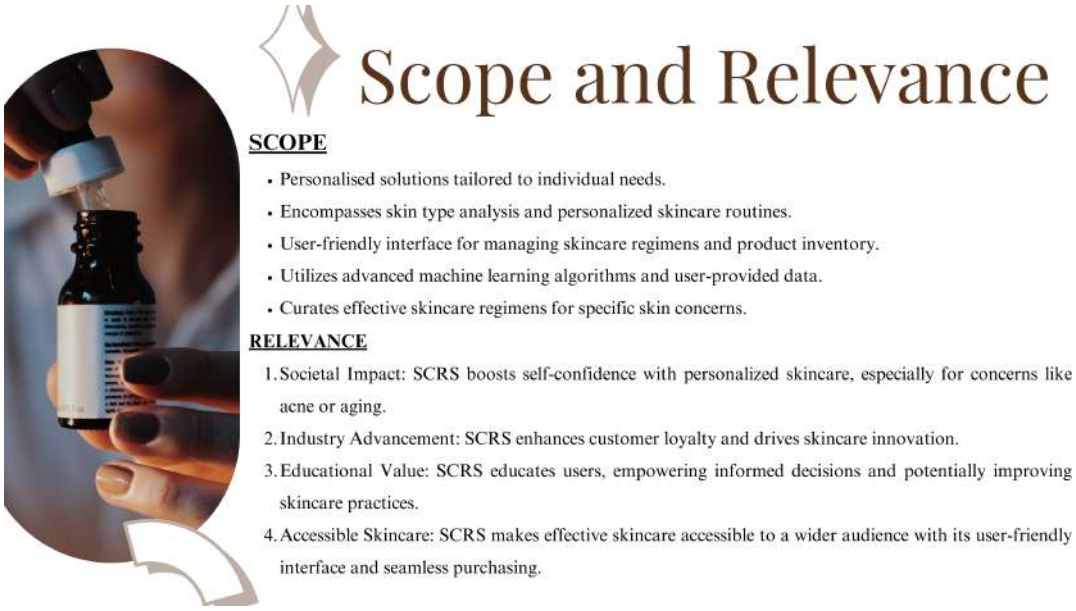


Figure 5.7: Slide 7

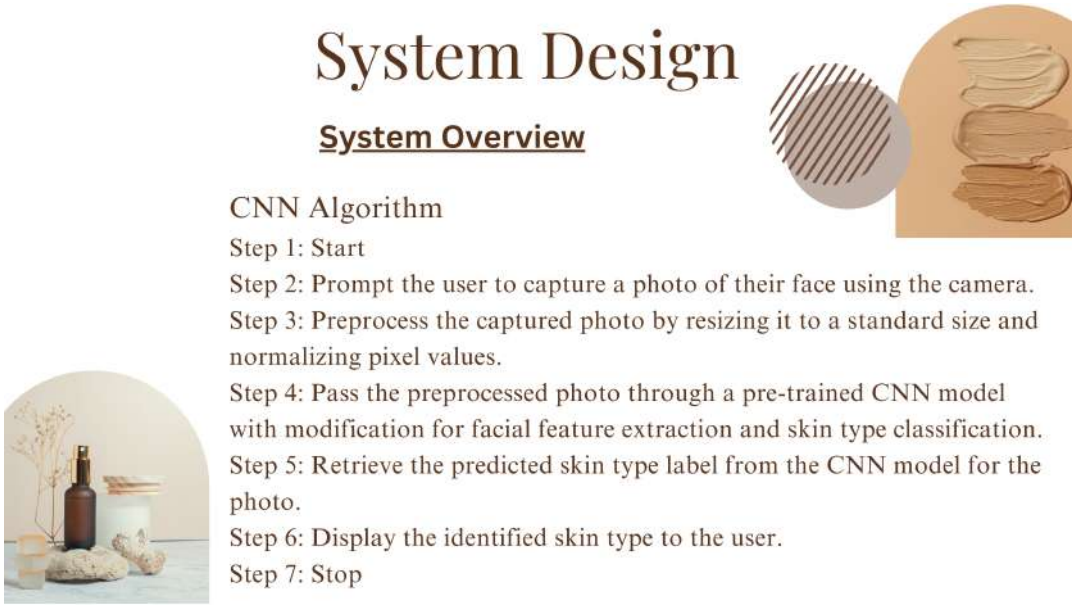


Figure 5.8: Slide 8

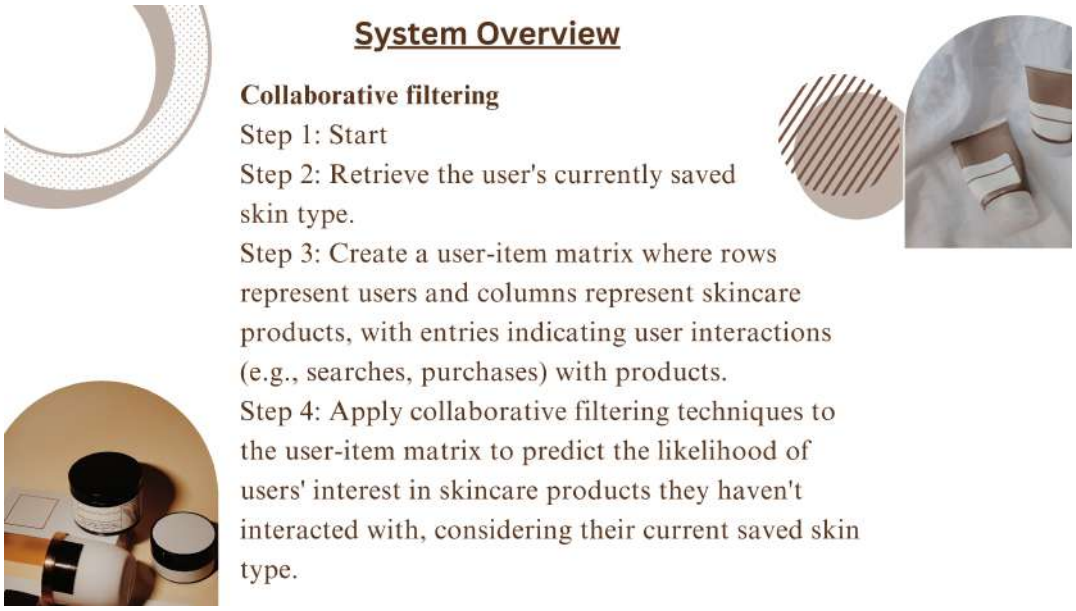


Figure 5.9: Slide 9

Figure 5.10: Slide 10

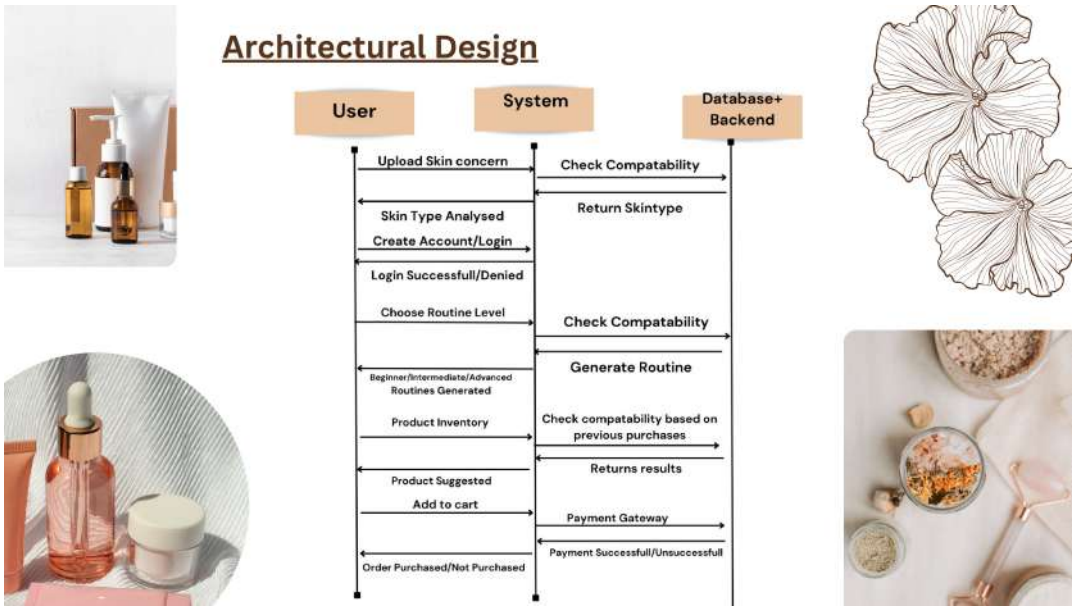


Figure 5.11: Slide 11

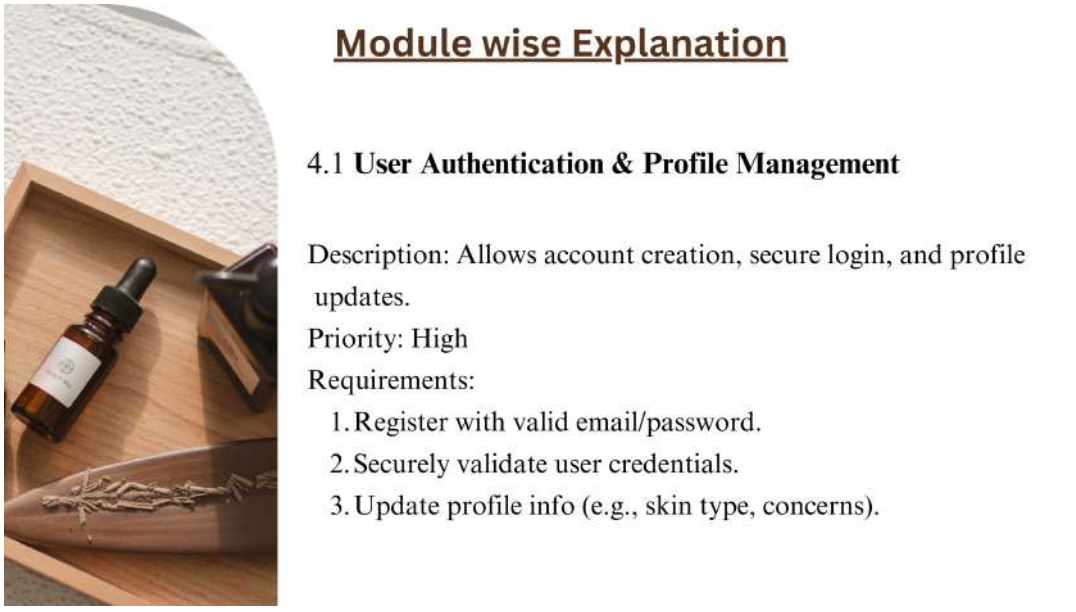


Figure 5.12: Slide 12

4.2 Skin Type Analysis and Personalized Recommendations:

- Description: Generates personalized skincare routines based on user data and past interactions.
- Priority: High
- Stimulus/Response Sequences:
- User inputs skin concerns.
- System generates personalized recommendations.
- AI refines recommendations using past search history and user behavior.
- Enhanced recommendations displayed to user for improved skincare experience.

Figure 5.13: Slide 13

4.3 **Skincare Routine Management**

Description: Enables users to view and customize their personalized skincare routines in the app.

Priority: Medium

Stimulus/Response Sequences:

- User accesses skincare routine dashboard.
- System displays personalized skincare routines.

Functional Requirements:

1. Users view personalized skincare routines in the app.
2. App offers step-by-step guidance for each routine.
3. Users can customize and adjust routines as per their preferences.

Figure 5.14: Slide 14

4.4 **Product Inventory and Recommendations**

Description: Manages product inventory and offers personalized skincare recommendations based on user's skin type and concerns.

Priority: High

Stimulus/Response Sequences:

- User accesses product inventory.
- System displays skincare products categorized by type.
- User views product details or recommendations.
- System provides detailed information about selected product.

AI Integration:

- Incorporates previous search history.
- Utilizes AI for advanced analysis.
- Refines recommendations based on user behavior.

Result: Users receive personalized and optimized product recommendations.

Figure 5.15: Slide 15

4.5 Reminder and Notification System

Description and Priority:

- Enables users to set reminders for skincare routines and receive notifications for upcoming skincare tasks.
- High priority.

Figure 5.16: Slide 16

4.6 **Integration with E-commerce Platforms**

Description: Seamlessly integrates with third-party e-commerce platforms for purchasing recommended skincare products.

Priority: High

Functional Requirements:

E-commerce Platform Integration:

- System integrates with third-party platforms for product purchase.
- Users view and click recommended products to the e-commerce platform.
- Ensure compatibility and reliability.

Product Purchase Process:

- Users complete purchase (add to cart, checkout) on e-commerce platform.
- System guides users through the purchase process.

Purchase History and Notifications:

- System updates user's purchase history after successful transactions.

Figure 5.17: Slide 17

4.7 **User Feedback and Support**

- Users can submit feedback and access support resources.
- System offers options for feedback submission and accessing FAQs/tutorials.
- Users can include details and attachments in feedback.
- Support resources include FAQs, tutorials, and contact info.

Figure 5.18: Slide 18

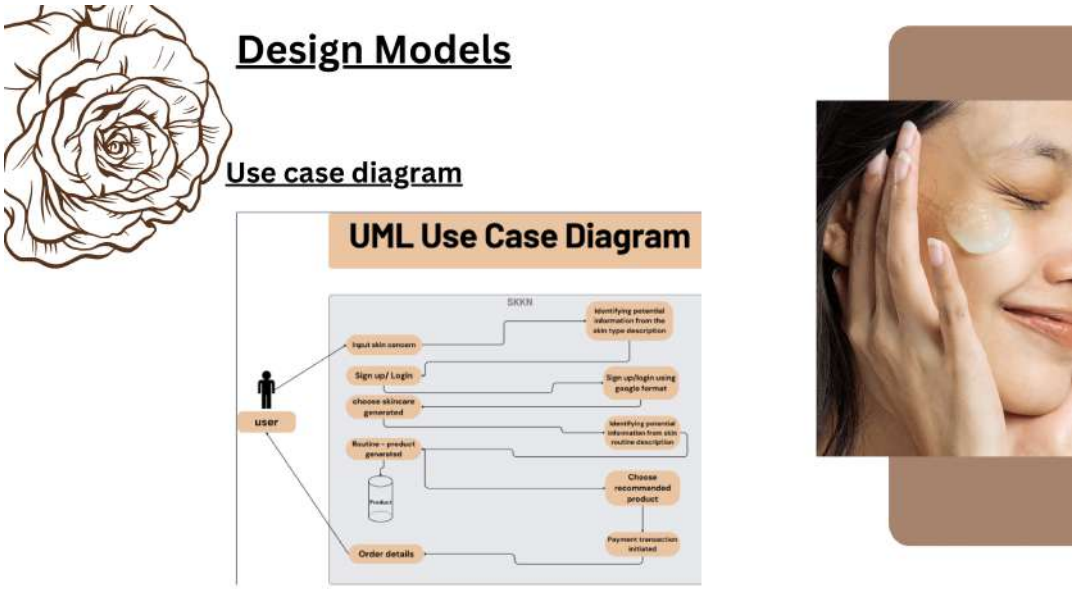
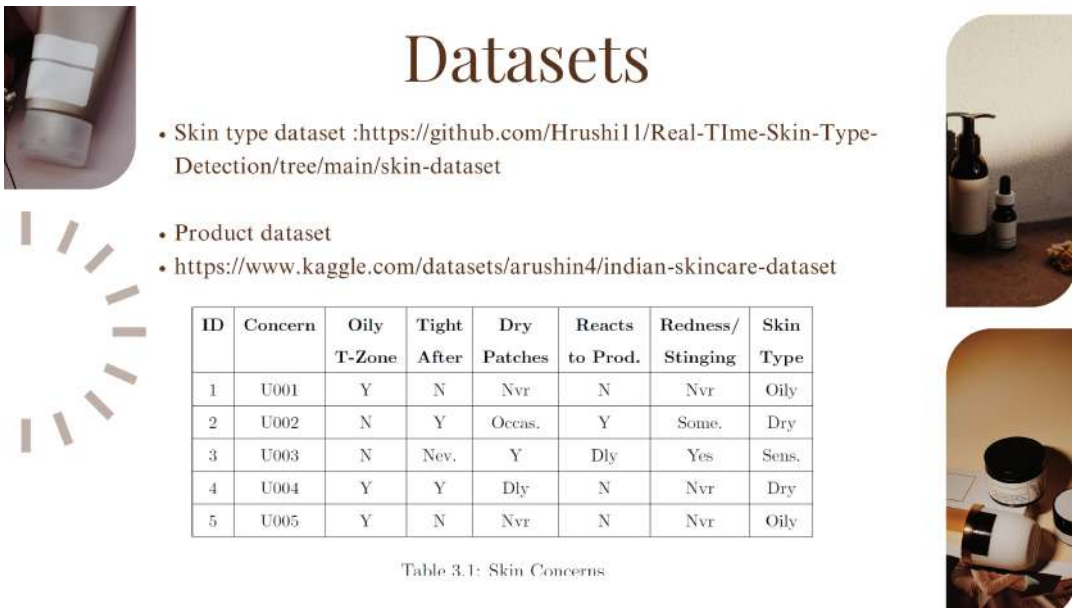
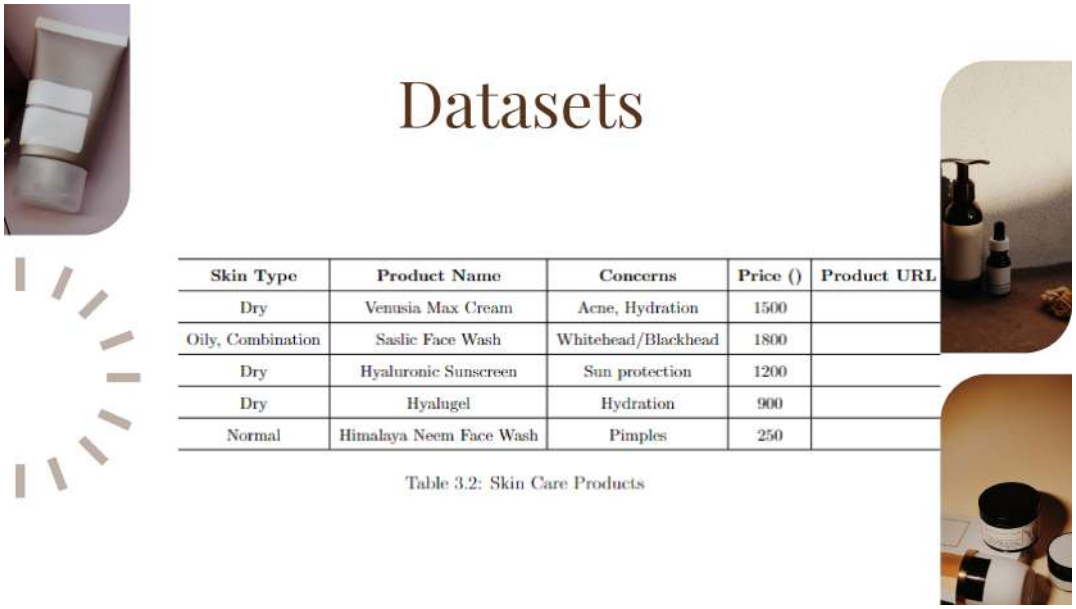


Figure 5.19: Slide 19



ID	Concern	Oily T-Zone	Tight After	Dry Patches	Reacts to Prod.	Redness/ Stinging	Skin Type
1	U001	Y	N	Nvr	N	Nvr	Oily
2	U002	N	Y	Occas.	Y	Some.	Dry
3	U003	N	Nev.	Y	Dly	Yes	Sens.
4	U004	Y	Y	Dly	N	Nvr	Dry
5	U005	Y	N	Nvr	N	Nvr	Oily

Figure 5.20: Slide 20



Skin Type	Product Name	Concerns	Price ()	Product URL
Dry	Venusia Max Cream	Acne, Hydration	1500	
Oily, Combination	Saslic Face Wash	Whitehead/Blackhead	1800	
Dry	Hyaluronic Sunscreen	Sun protection	1200	
Dry	Hyalugel	Hydration	900	
Normal	Himalaya Neem Face Wash	Pimples	250	

Table 3.2: Skin Care Products

Figure 5.21: slide 21

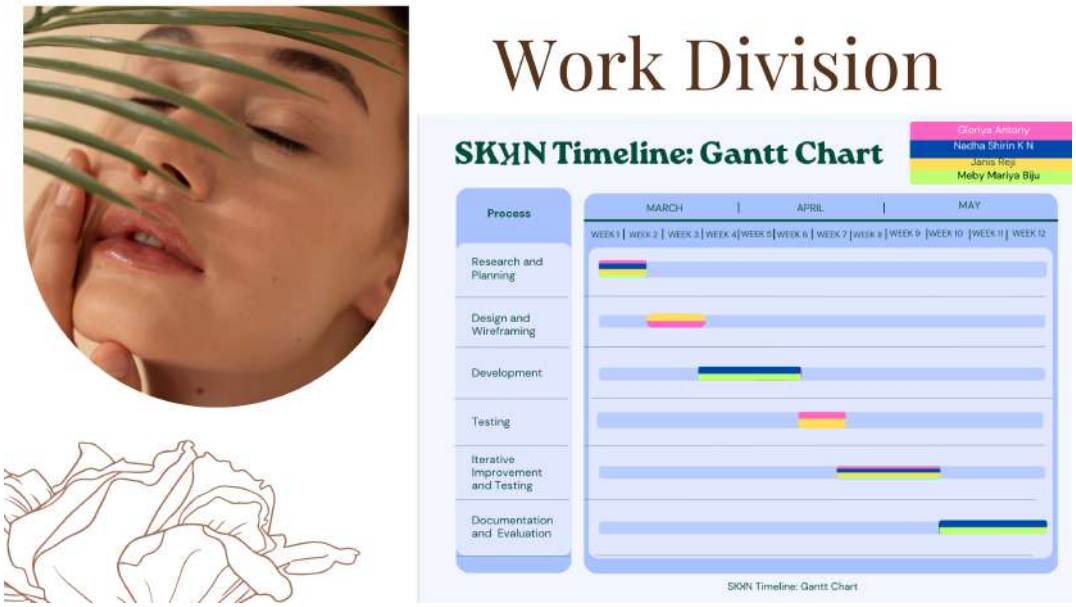


Figure 5.22: Slide 22

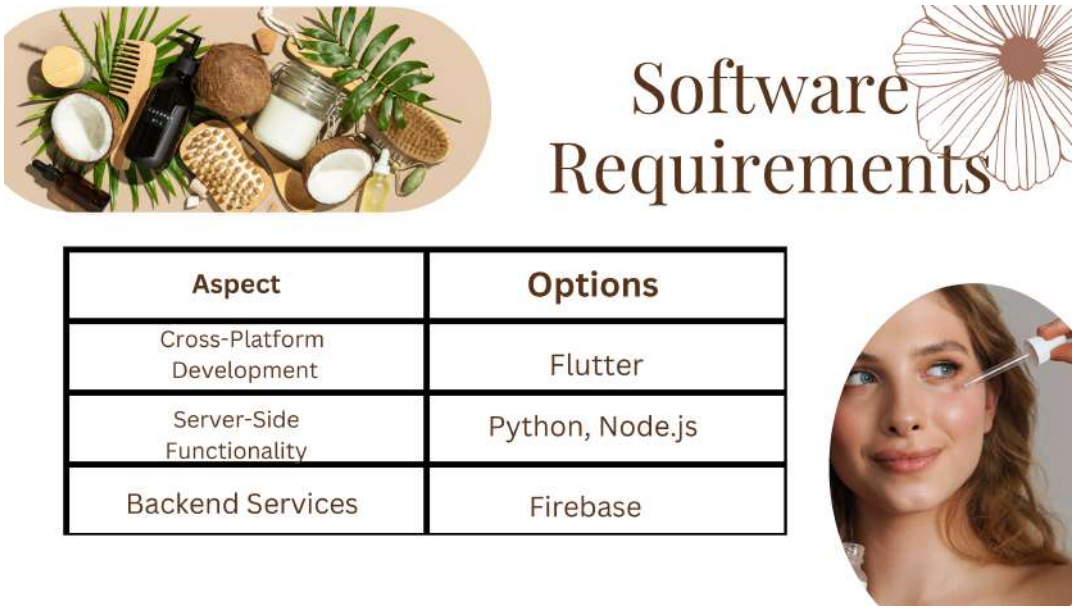


Figure 5.23: Slide 23

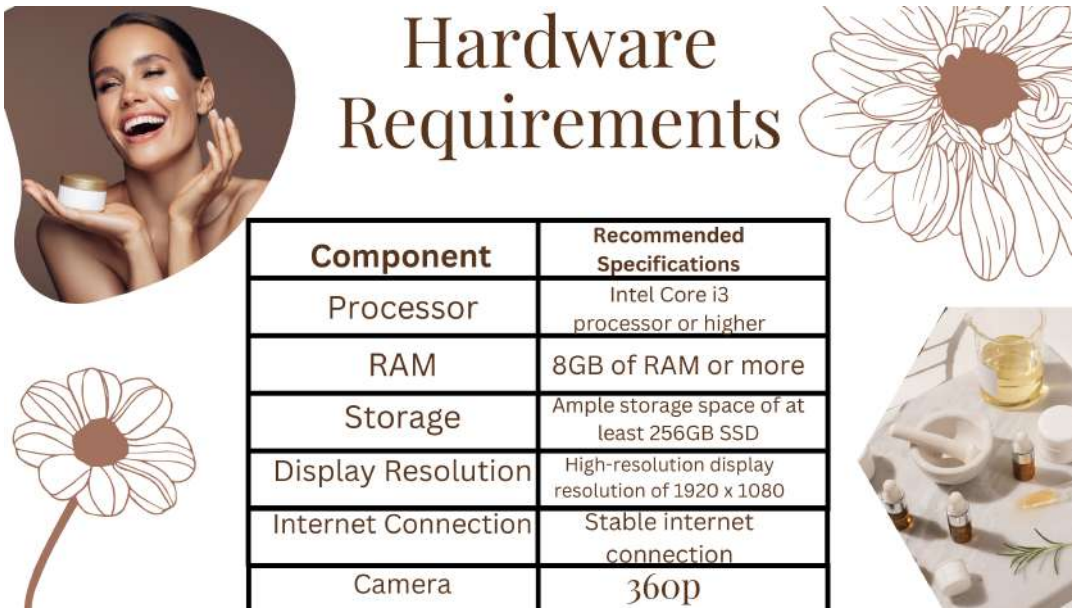


Figure 5.24: Slide 24

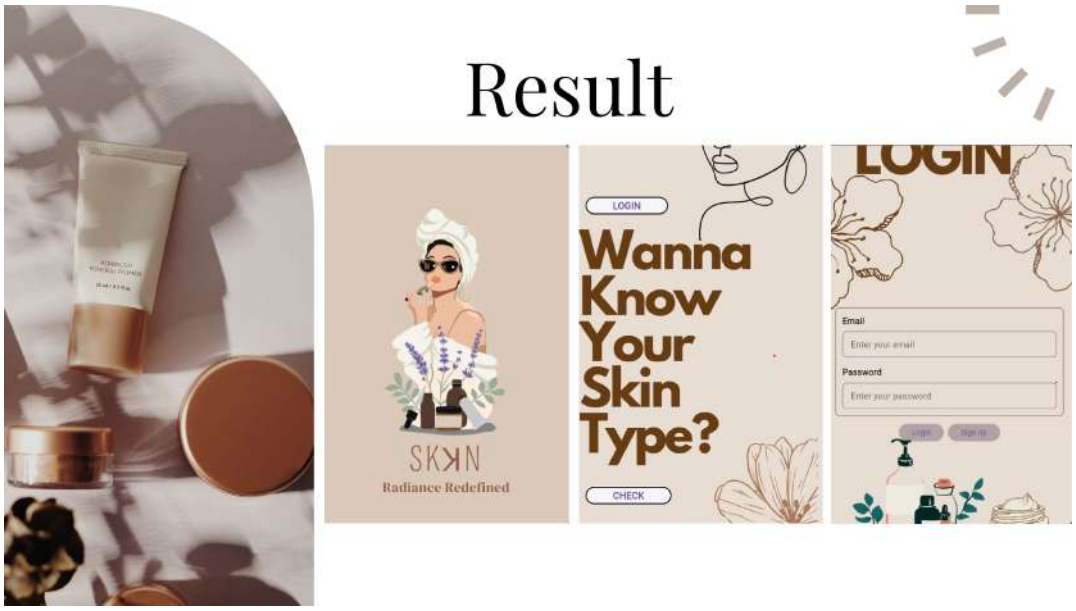


Figure 5.25: Slide 25

Figure 5.26: Slide 26

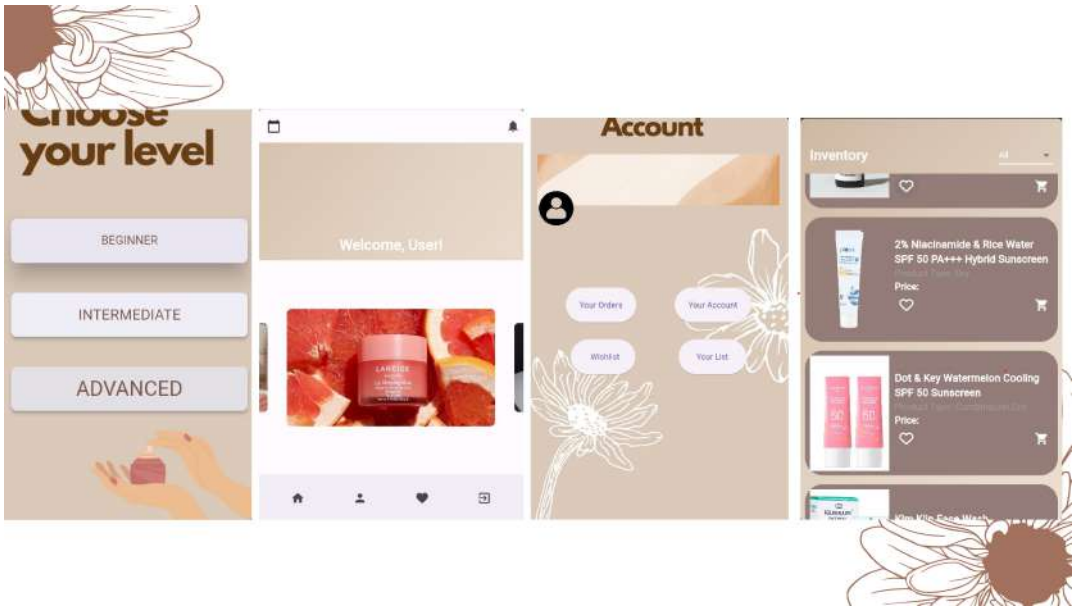


Figure 5.27: Slide 27

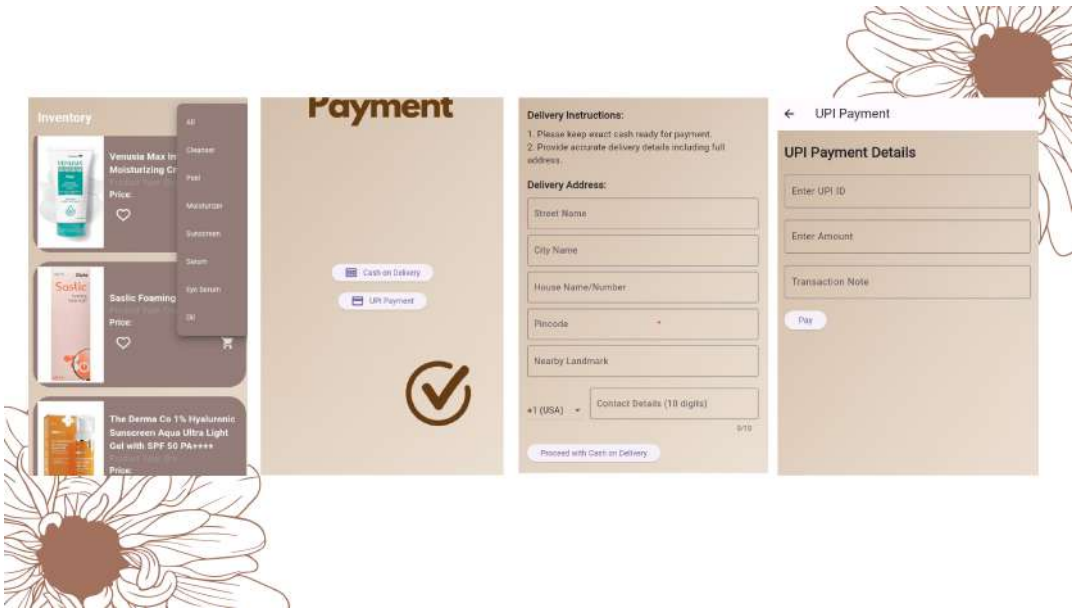


Figure 5.28: Slide 28

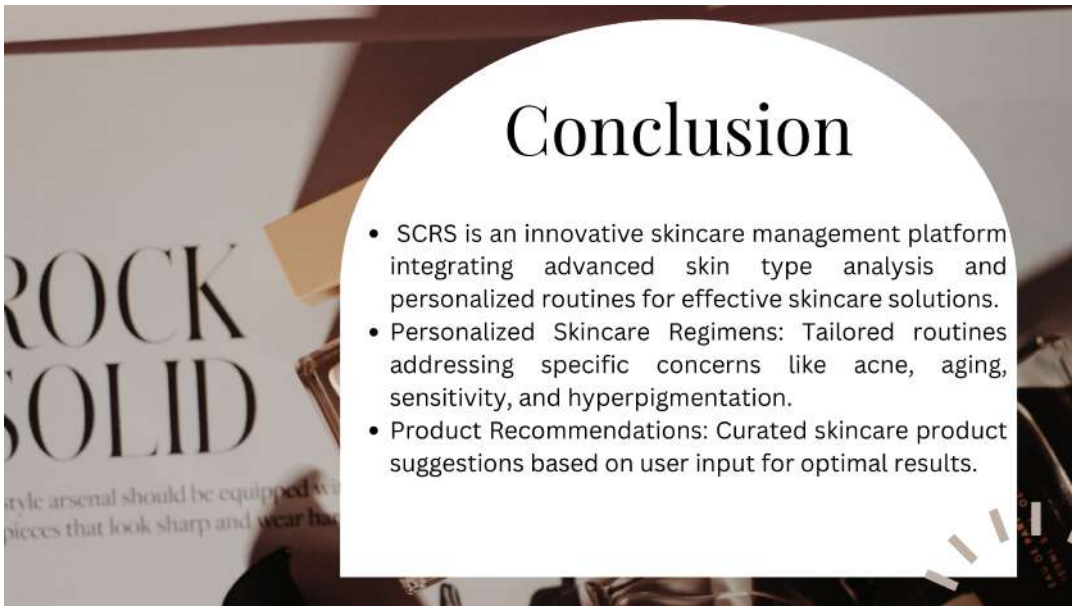


Figure 5.29: Slide 29

Figure 5.30: Slide 30

Figure 5.31: Slide 31

Figure 5.32: Slide 32

Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To become a centre of excellence in Computer Science and Engineering, moulding professionals catering to the research and professional needs of national and international organizations.

Department Mission

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

Programme Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Computer Science Specific Skills

The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

PSO2: Programming and Software Development Skills

The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

PSO3: Professional Skills

The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur.

Course Outcomes

After the completion of the course the student will be able to:

CO1:

Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)

CO2:

Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)

CO3:

Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)

CO4:

Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)

CO5:

Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)

Appendix C: CO-PO-PSO Mapping

COURSE OUTCOMES:

After completion of the course the student will be able to

SL. NO	DESCRIPTION	Blooms' Taxonomy Level
CO1	Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO2	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO3	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO4	Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO5	Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)	Level 3: Apply

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	3	3	3	3		2	2	3	2	2	2	3	2	2	2
CO2	3	3	3	3	3	2		3	2	3	2	3	2	2	2
CO3	3	3	3	3	3	2	2	3	2	2	2	3			2
CO4	2	3	2	2	2			3	3	3	2	3	2	2	2
CO5	3	3	3	2	2	2	2	3	2		2	3	2	2	2

3/2/1: high/medium/low

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM/ HIGH	JUSTIFICATION
101003/CS622T.1-PO1	**HIGH**	Identify technically and economically feasible problems by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS622T.1-PO2	**HIGH**	Identify technically and economically feasible problems by analysing complex engineering problems reaching substantiated conclusions using first principles of mathematics.
101003/CS622T.1-PO3	**HIGH**	Design solutions for complex engineering problems by identifying technically and economically feasible problems.
101003/CS622T.1-PO4	**HIGH**	Identify technically and economically feasible problems by analysis and interpretation of data.
101003/CS622T.1-PO6	**MEDIUM**	Responsibilities relevant to the professional engineering practice by identifying the problem.
101003/CS622T.1-PO7	**MEDIUM**	Identify technically and economically feasible problems by understanding the impact of the professional engineering solutions.
101003/CS622T.1-PO8	**HIGH**	Apply ethical principles and commit to professional ethics to identify technically and economically feasible problems.
101003/CS622T.1-PO9	**MEDIUM**	Identify technically and economically feasible problems by working as a team.
101003/CS622T.1-PO10	**MEDIUM**	Communicate effectively with the engineering community by identifying technically and economically feasible problems.
101003/CS622T.1-P011	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles by selecting the technically and economically feasible problems.
101003/CS622T.1-PO12	**HIGH**	Identify technically and economically feasible problems for long term learning.
101003/CS622T.1-PSO1	**MEDIUM**	Ability to identify, analyze and design solutions to identify technically and economically feasible problems.
101003/CS622T.1-PSO2	**MEDIUM**	By designing algorithms and applying standard practices in software project development and Identifying technically and economically feasible problems.
101003/CS622T.1-PSO3	**MEDIUM**	Fundamentals of computer science in competitive research can be applied to Identify technically and economically feasible problems.
101003/CS622T.2-PO1	**HIGH**	Identify and survey the relevant by applying the knowledge of mathematics, science, engineering fundamentals.

101003/CS622T.2-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems get familiarized with software development processes.
101003/CS622T.2-PO3	**HIGH**	Design solutions for complex engineering problems and design based on the relevant literature.
101003/CS622T.2-PO4	**HIGH**	Use research-based knowledge including design of experiments based on relevant literature.
101003/CS622T.2-PO5	**HIGH**	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes by using modern tools.
101003/CS622T.2-PO6	**MEDIUM**	Create, select, and apply appropriate techniques, resources, by identifying and surveying the relevant literature.
101003/CS622T.2-PO8	**HIGH**	Apply ethical principles and commit to professional ethics based on the relevant literature.
101003/CS622T.2-PO9	**MEDIUM**	Identify and survey the relevant literature as a team.
101003/CS622T.2-PO10	**HIGH**	Identify and survey the relevant literature for a good communication to the engineering fraternity.
101003/CS622T.2-PO11	**MEDIUM**	Identify and survey the relevant literature to demonstrate knowledge and understanding of engineering and management principles.
101003/CS622T.2-PO12	**HIGH**	Identify and survey the relevant literature for independent and lifelong learning.
101003/CS622T.2-PSO1	**MEDIUM**	Design solutions for complex engineering problems by Identifying and survey the relevant literature.
101003/CS622T.2-PSO2	**MEDIUM**	Identify and survey the relevant literature for acquiring programming efficiency by designing algorithms and applying standard practices.
101003/CS622T.2-PSO3	**MEDIUM**	Identify and survey the relevant literature to apply the fundamentals of computer science in competitive research.
101003/CS622T.3-PO1	**HIGH**	Perform requirement analysis, identify design methodologies by using modern tools & advanced programming techniques and by applying the knowledge of mathematics, science, engineering fundamentals.
101003/CS622T.3-PO2	**HIGH**	Identify, formulate, review research literature for requirement analysis, identify design methodologies and develop adaptable & reusable solutions.

101003/CS622T.3-PO3	**HIGH**	Design solutions for complex engineering problems and perform requirement analysis, identify design methodologies.
101003/CS622T.3-PO4	**HIGH**	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS622T.3-PO5	**HIGH**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools.
101003/CS622T.3-PO6	**MEDIUM**	Perform requirement analysis, identify design methodologies and assess societal, health, safety, legal, and cultural issues.
101003/CS622T.3-PO7	**MEDIUM**	Understand the impact of the professional engineering solutions in societal and environmental contexts and Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS622T.3-PO8	**HIGH**	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions by applying ethical principles and commit to professional ethics.
101003/CS622T.3-PO9	**MEDIUM**	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS622T.3-PO10	**MEDIUM**	Communicate effectively with the engineering community and with society at large to perform requirement analysis, identify design methodologies.
101003/CS622T.3-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering requirement analysis by identifying design methodologies.
101003/CS622T.3-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS622T.3-PSO3	**MEDIUM**	The ability to apply the fundamentals of computer science in competitive research and prior to that perform requirement analysis, identify design methodologies.
101003/CS622T.4-PO1	**MEDIUM**	Prepare technical report and deliver presentation by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS622T.4-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems by preparing technical report and deliver presentation.

101003/CS622T.4-PO3	**MEDIUM**	Prepare Design solutions for complex engineering problems and create technical report and deliver presentation.
101003/CS622T.4-PO4	**MEDIUM**	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and prepare technical report and deliver presentation.
101003/CS622T.4-PO5	**MEDIUM**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and Prepare technical report and deliver presentation.
101003/CS622T.4-PO8	**HIGH**	Prepare technical report and deliver presentation by applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS622T.4-PO9	**HIGH**	Prepare technical report and deliver presentation effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS622T.4-PO10	**HIGH**	Communicate effectively with the engineering community and with society at large by prepare technical report and deliver presentation.
101003/CS622T.4-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work by prepare technical report and deliver presentation.
101003/CS622T.4-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by prepare technical report and deliver presentation.
101003/CS622T.4-PSO1	**MEDIUM**	Prepare a technical report and deliver presentation to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas.
101003/CS622T.4-PSO2	**MEDIUM**	To acquire programming efficiency by designing algorithms and applying standard practices in software project development and to prepare technical report and deliver presentation.
101003/CS622T.4-PSO3	**MEDIUM**	To apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs by preparing technical report and deliver presentation.
101003/CS622T.5-PO1	**HIGH**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS622T.5-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems by applying engineering and management principles to achieve the goal of the project.

101003/CS622T.5-PO3	**HIGH**	Apply engineering and management principles to achieve the goal of the project and to design solutions for complex engineering problems and design system components or processes that meet the specified needs.
101003/CS622T.5-PO4	**MEDIUM**	Apply engineering and management principles to achieve the goal of the project and use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS622T.5-PO5	**MEDIUM**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO6	**MEDIUM**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities by applying engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO7	**MEDIUM**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO8	**HIGH**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice and to use the engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO9	**MEDIUM**	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PSO1	**MEDIUM**	The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. Apply engineering and management principles to achieve the goal of the project.

101003/CS622T.5-PSO2	**MEDIUM**	The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PSO3	**MEDIUM**	The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur and apply engineering and management principles to achieve the goal of the project.