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BEYOND THE BOOKING: ENHANCING SPA MANAGEMENT APPLICATION VIA CONTENT-BASED FILTERING RECOMMENDATIONS AND AUTOMATED REMINDERS

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Abstract: *The growing demand for digital services in the spa and wellness industry has become very important for improving operational efficiency and customer experience. Nowadays, many spa businesses use manual appointment scheduling, which can lead to scheduling inefficiencies, missed appointments, and difficulty for customers to book the right treatment. This study was developed for spa management mobile application that utilizes content-based filtering to generate highly personalized service recommendations based on individual user preferences and historical data. Furthermore, the system integrates registration and login, account management, booking, reminder and report modules as core functions. This study adopted a prototype methodology for analysis, development, and evaluation of the mobile application. Moreover, functionality testing was conducted to verify that all major system functions work as required through seven core functional user requirement (UR1- UR7). In conclusion, the developed mobile application proved its potential to boost the operational efficiency, customer experience, and digital transformation of spa management services.*

Keywords: *Automated Reminder, Content-Based Filtering Recommendation, Spa Management*

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Introduction

Integrating smart technologies into system design represents a shift from traditional development models toward modern frameworks that drive data-driven operational efficiency. Utilizing mobile technologies enables users to submit real-time reports, thereby supporting teams to respond faster (Febrianda & Maiyana, 2024). In this big data era, it is hard for the current generation to find the right data from the huge amount of data contained within online platforms (Hossain et al., 2022). In such a situation, there is a need for an information filtering system that might help them find the information they are looking for. Moreover, by leveraging content-based filtering recommendations and automated reminders in a spa management system, issues such as repeat booking rates and missed appointments can be effectively managed with informative recommendations. With the increasing amount of information on the internet, recommendation systems have been utilized in a variety of fields as an efficient tool to overcome information overload (Yue et al., 2021).

The spa and wellness sector has grown rapidly in recent years as increasing numbers of people have become aware of self-care, skin care, and well-being in general. Nowadays, spa services are not considered a luxury but have become part of people's routine activities. The demand for spas has increased due to the modern lifestyle that leads to increased stress levels and raised beauty concerns. Spas offer therapies that were intended to ease tension and encourage relaxation (Dimitrova, 2024). Today, customers not only focus on the quality of treatment but also demand convenient, reliable, and suitable services for skincare requirements. Due to the increasing customer expectations, spa businesses must adjust their service delivery to be competitive and relevant in the digital world.

Furthermore, treatment recommendations have become increasingly important in assisting customers to select treatments that are suitable based on users' preferences. In spa services, customers often experience uncertainty when choosing treatments because different treatments are designed for different skin types, skin concerns, body conditions, and nail conditions. Hence, the Content-Based Filtering (CBF) approach is suitable because it compares customers' preferences with predefined treatment attributes to generate personalized treatment recommendations that better correspond to individual customer needs.

Automated reminders have become one of the essential features in appointment-based mobile applications because customers frequently forget or overlook their scheduled appointments, resulting in missed appointments and inefficient schedule management. According to Opon et al. (2020), electronic reminder systems are effective at increasing appointment attendance and decreasing missed appointments. This reminder also helps to utilize resources and optimize the operations within appointment services. As demonstrated by Arinawati et al. (2023), Android-based agenda applications can integrate push notification technology to automatically dispatch timely reminder alerts to user devices. This study proved that automated reminders are effective in improving the user's schedule by giving timely information regarding appointments, which leads to better schedule management.

The purpose of the research is to study the framework and design the Spa Management Application via Content-Based Filtering Recommendations and Automated Reminders, then create and test the mobile application functionality. This research is divided into five sections. The first section is an introduction that describes the research's context. Next is the second section that analyses the related work of the study. The third section describes the methodology. In the fourth section, the results and discussion associated with the requirement analysis, design

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and development of the mobile application, including interface and testing. In the final section, the project's conclusion is presented.

Literature Review

This section describes the literature review for the development of the Spa Management Application via Content-Based Filtering Recommendations and Automated Reminders. The literature review provided an understanding of the existing research on the development of Spa Management. It also helps identify theories, concepts, and findings from previous research that are relevant to the spa management of mobile applications. Throughout this review, the materials related to (1) Spa management system, (2) Content-based filtering, and (3) an automated reminder mechanism were gathered to assist in the development of a mobile application for spa management.

Spa Management System

Spa management refers to managing daily activities such as booking appointments, preparing treatments, and handling customer information. According to Husain et. al (2024), the core of the management system is an integrated platform that oversees the entire spectrum of activities. Research by Hamid and Nawi (2025) introduced an online spa booking system using a web-based solution to meet rising demand for cosmetology treatment services, demonstrating the early benefits of digitalization in improving appointment booking and service management.

In spa environments, traditional manual approaches are still commonly utilized in daily operations. These involve appointment booking, customer records, and communication, which depend heavily on human involvement. As noted by Samudra and Anggara (2024), legacy manual workflows in beauty service management contribute to excessive wait times, scheduling overlaps, and errors in client data administration. Manual data entry requires significant administrative effort, thereby elevating the risk of human error, scheduling overlaps, and inaccurate customer records. Similarly, Sabile and Marinas (2025) state that manual documents lead to considerable delays, resource loss, and decreased productivity. Without having a centralized database to store data on a single site, staff need to search for the customer's record individually, which leads to time-consuming processes and customer dissatisfaction. As a result, manual record-keeping slows down operations and affects the quality of an organization's services. In a spa environment, efficiency and timely appointments are crucial. Thus, relying on manual methods contributes to inefficiencies that need a digital solution for better performance.

Although web-based applications are convenient, mobile applications are a more suitable platform for designing a spa management system. According to Permatasari and Purwanto (2024), mobile applications integrated with payment and customer administration systems enable salons and spas to monitor and evaluate client information, provide targeted promotions, and enhance services in response to customers' preferences. Therefore, to better understand the operational aspects that present challenges in spa management, the next sections describe key components related to treatment recommendations more specifically using content-based filtering and automated reminders. These components provide the framework for digitizing spa management in a mobile application.

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Content-based Filtering

Content-Based Filtering (CBF) is a recommendation technique that suggests items based on attribute similarity and a user's past preferences or history. This approach examines features such as category, type, or characteristics of items that the user has selected earlier to generate personalized recommendations. According to Shinagam (2025), content-based filtering recommends items by analyzing their intrinsic features and matching them to a user profile constructed from previous interactions.

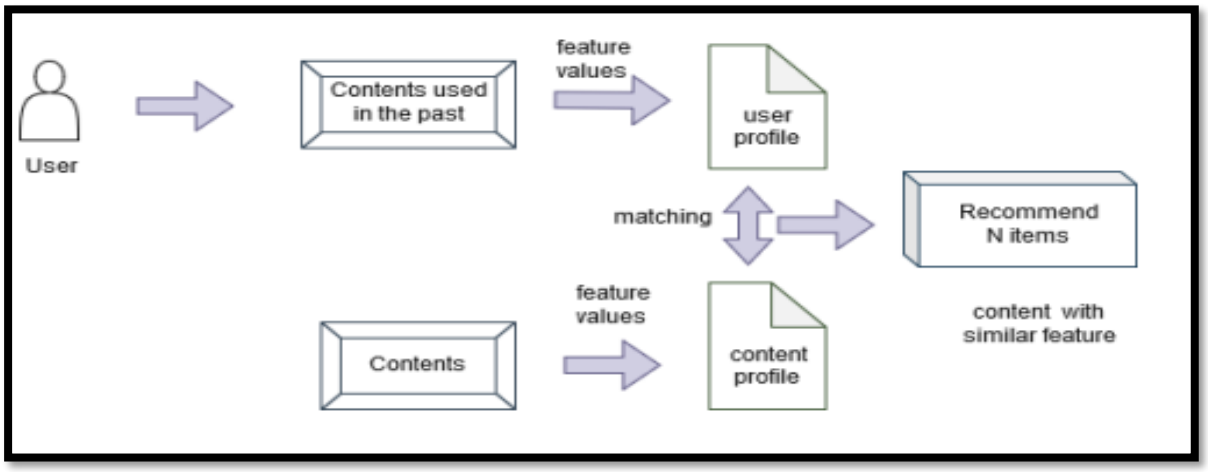

Figure 1: Content-Based Filtering Process (Hossain et al., 2022)

According to Figure 1, content-based recommendations treat recommendations as a user-specific classification issue and train a classifier based on product characteristics for the user's likes and dislikes. Each item is represented by an item profile containing descriptive attributes, while the user profile consists of the user's preferences. The recommendation process involves assessing how well the user profile matches the item profile and ranking the items according to their level of interest, where items with greater correspondence are considered more relevant and are prioritized during the recommendation process (Papadakis et al., 2023). The similarity-based approach allows recommender systems to offer tailored recommendations to meet user's preferences and aid their decision-making process (Hossain et al., 2022).

The treatment attribute should be structured before the matching process is conducted to ensure consistency in matching with customer preferences. The treatment recommendation provides suggestions by matching the treatment features and user preferences across skin, massage, and manicure services. In skin-related treatments, dermatologists study several types of skin, which are normal, dry, oily, and sensitive, that are usually used to determine appropriate facial treatments according to the customer's skin composition and problem (Ning et al., 2024). According to Field (2016), there are several massage treatments exist, including Swedish massage and aromatherapy massage, which contain specific therapeutic effects that can give relaxation, reduce stress, and provide pain relief. Lastly the manicures treatment which also known as nail treatments, are selected depending on the state of the nails and customer preferences to enhance nail health as well as overall hand appearance. Nail polish, acrylics, silks, gels, and nail polish are examples of nail treatments that are consumed by consumers globally (Reinecke & Hinshaw, 2020).

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Automated Reminder Mechanism

In mobile applications, automated reminders are usually used to deliver messages to users. An automated reminder is crucial to implement, as it informs customers about their appointment. Automating this process ensures customers receive timely appointment reminders, which helps prevent last-minute schedule modifications and mitigates administrative staff workload. A study by Mekonnen et al. (2019) stated that the system is developed using front-end (such as Java) and back-end technologies (such as Oracle Database). Meanwhile, Juniawan et al. (2019) indicate that Firebase Cloud Messaging (FCM) enables sending notifications automatically to users' devices even if the application is not actively open. Push notification services, including FCM, are often used to implement automated reminders in mobile applications. This enables cloud servers to deliver real-time messages to users' devices. Push notifications are sent automatically to the user on their mobile device via FCM when criteria are met, such as a set of dates before the appointments. According to Younis and Alwan (2023), Firebase is capable of real-time data synchronization and stable performance across multiple device connections, making it suitable for this feature. Moreover, FCM enables notifications to be sent even when the mobile application is not active, which allows reminders to be delivered reliably without having to interact with the user manually (Mokar et al., 2019). Furthermore, previous studies have highlighted consumer acceptance of push notification notes; although they can be an effective way to motivate users to engage with the application, many notifications as reminders lead to a negative impact on user experience. Therefore, Wohllebe (2020) states that the automated reminder system must use controls and meaningful time notifications to sustain user acceptance and reduce missed appointments.

Comparison Between the System Purpose and the Existing System

To find out the available features and to find out the research gap addressed by this study, the comparison between the proposed system and existing spa management applications was made. The comparison was made with RE Spa Massage and Skincare, Urban Spa Group, Fresha and Kapas Beauty Spa, as these services are offered along with appointment booking spa. The comparison is made based on features user login, user account, registration, treatment catalog, booking appointment, in-app reminder, online payment and treatment recommendation in Malaysia. These features enable the strengths and weaknesses of the current systems to be identified, and they justify the development of Spa management application via content-based filtering recommendations and automated reminders. The comparison results are shown in Table 1.

Table 1: Comparison of the existing system

Features of system	RE SPA Massage and Skincare	Urban Spa Group	Fresha	Kapas Beauty Spa	E-SpaCare (proposed system)
User login	✓	✓	✓	✖	✓
User Account	✓	✓	✓	✖	✓
Registration	✓	✓	✓	✖	✓
Treatment Catalog	✓	✓	✓	✓	✓
Book Appointment	✓	✓	✓	✓	✓
In App Reminder	✖	✖	✓	✖	✓
Online Payment	✓	✓	✓	✖	✓
Treatment Recommendation	✖	✖	✖	✖	✓

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Research Method

The prototyping method is a development technique that focuses on creating an initial version of a product with the aim of testing a concept or process and making improvements before developing the final product (Kunicina et al., 2020). The prototyping method was selected in this study due to its ability to enable developers to evaluate and enhance features depending on user feedback right from the outset of the design process. This methodology includes five phases as illustrated by Figure 2, starting with requirement analysis, design and develop, testing and evaluation, refining the prototype, and implementation and maintenance.

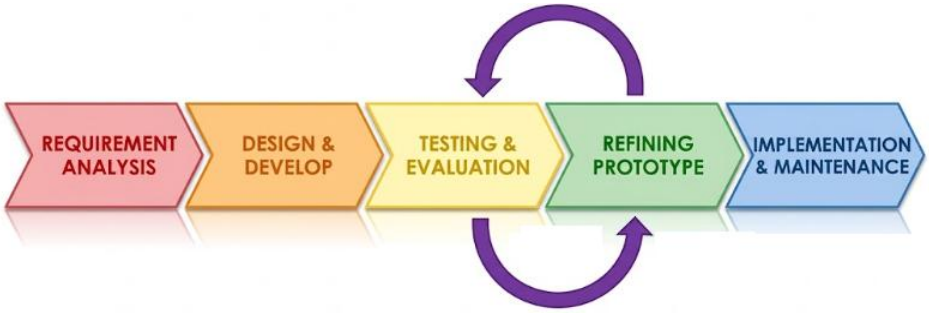

Figure 2: Prototype Methodology (Khoo & Aziz, 2023)

The methodology in Table 2 below outlines a structured five-phase development lifecycle for the Smart Spa Management mobile application. This project begins with the requirement analysis phase, which focuses on identifying core operational needs for spa management, content-based filtering recommendations, and the automated reminder module. During this phase, research is conducted using academic articles, spa catalogues, and existing systems to isolate limitations in traditional spa processes. Through literature reviews and requirement analysis techniques, the primary deliverable produced is a comprehensive specification of functional system requirements.

In the second phase, the foundational architecture of the system is established. The core functionalities for spa management, reminders, and treatment recommendations were drafted and developed. This phase yields key design artifacts including a use case diagram and an interactive system prototype with content-based filtering algorithm.

Table 2: Research Methodology Prototype for Spa Management Mobile Application

Phases	Activities	Deliverables
Phase 1: Requirement Analysis	•Identify the needs for spa management, content-based filtering recommendations (treatment attributes-skintype, massage focus, manicure type), and a reminder module. •Analyze problems related to traditional spa management and content- based filtering treatment recommendations and reminder module from research articles.	•System requirements of functional requirements.
Phase 2: Design and Development	•Design functionality and interaction. •Design prototype features for appointments, reminders, and treatment recommendations. •Formulate the multi-criteria content-based filtering algorithm $Si = \|U \cap Ti$.	•Use Case •Content-based filtering algorithm

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Phase 3: Testing and Evaluation	•Conduct functionality testing for the prototype.	•Prototype evaluation.
Phase 4: Refining Prototype	•Refine the prototype. •Update the UI and system functionality.	•Improved prototype. •Updated prototype design.
Phase 5: Implementation and Maintenance	•Writing code using Java. •Coding the system. •Evaluate reminder and content-based filtering treatment recommendation output. •Fix bugs and optimize performance. •Deploy the system.	•Validated the final mobile application. •Final documentation.

Moving into the third phase, the testing and evaluation phase, the project transitions to verifying the initial design through prototype walkthroughs and systematic functionality testing. The primary deliverable from this phase is a formal prototype evaluation report that assesses user interactions and validates system behaviors prior to further refinement.

Based on testing insights in the fourth phase, focuses on enhancing the user interface and optimizing system functionality. Applying iterative refinement and user interface (UI) enhancement techniques, this phase yields an improved prototype and updated UI design layouts tailored to user feedback.

Finally, the fifth phase translates the refined design into an operational mobile application using Java. Key development activities include system coding, evaluating output from the content-based filtering and reminder modules, addressing bugs, optimizing overall performance, and deploying the application via Android Studio. This concluding phase results in a fully validated mobile application alongside comprehensive final project documentation.

Results and Discussion

The results are therefore discussed in relation to four areas: (1) requirement analysis, (2) system design, (3) system development, and (4) functionality testing.

Requirement Analysis

This section details the system requirements analysis, outlining the primary functional specifications of the application. Based on the needs analysis, the functional requirements of the system were summarized in Table 3.

Table 3: Functional Requirements

Functional Requirement	Requirements Description
Registration and Login Module	• The system shall allow new customers to register a new account before logging in. • The system shall redirect valid users to the homepage upon successful login.
Manage Account Module	• The system shall allow admin, staff, and customers to change passwords and edit profiles.

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Catalog Module	• The system shall allow the admin to manage spa treatments. • The system shall allow customers to choose the treatments that are available in the spa.
Content-Based Filtering Recommendations Module	• The system shall recommend suitable spa treatments based on the customer's preferences
Booking Module	• The system shall allow the customer to request a spa Appointment by selecting the treatment, date, and time.
Reminder Module	• The system shall allow sending automated reminders to The customer.
Report Module	• The system shall allow the admin to view the monthly report, appointments, and services (revenue, completed payments, refunds, billing, refund).

Moreover, in designing the spa management, the recommendations for treatment attributes were detailed in studies such as category skin treatment attributes, massage treatment attributes, and manicure attributes. Table 4 shows the sample of treatment attributes in the spa management mobile application design.

Table 4: Sample of Treatment Attributes

SKIN TREATMENT	
Treatment Name	**Attribute**
Detox	Normal, Oily, Dry, Sensitive, Combination, Dullness, Acne, Aging.
Whitening Peel	Normal, Oily, Sensitive, Combination, Dullness, Dark spots, High pigmentation, Uneven tone.
Vitamin C Booster	Normal, Freckles, Dullness, Dark scars, Dark spot, Uneven tone, Fine lines.
MASSAGE TREATMENT	
Treatment Name	**Attribute**
Face Massage	Stress, Poor blood circulation, Facial tension.
Full Body Massage	Stress, Back pain, Muscle soreness, Body fatigue, Poor blood circulation, Muscle relaxation.
MANICURE TREATMENT	
Treatment Name	**Attribute**
Silks	Nail strengthening, Repair nail
Acrylics	Nail extension, Broken nail, Short nail.

System Design

In this study, the system design incorporates use case diagrams to simplify the development process by clearly identifying the system actors. The use case diagram for this study is illustrated in Figure 3.

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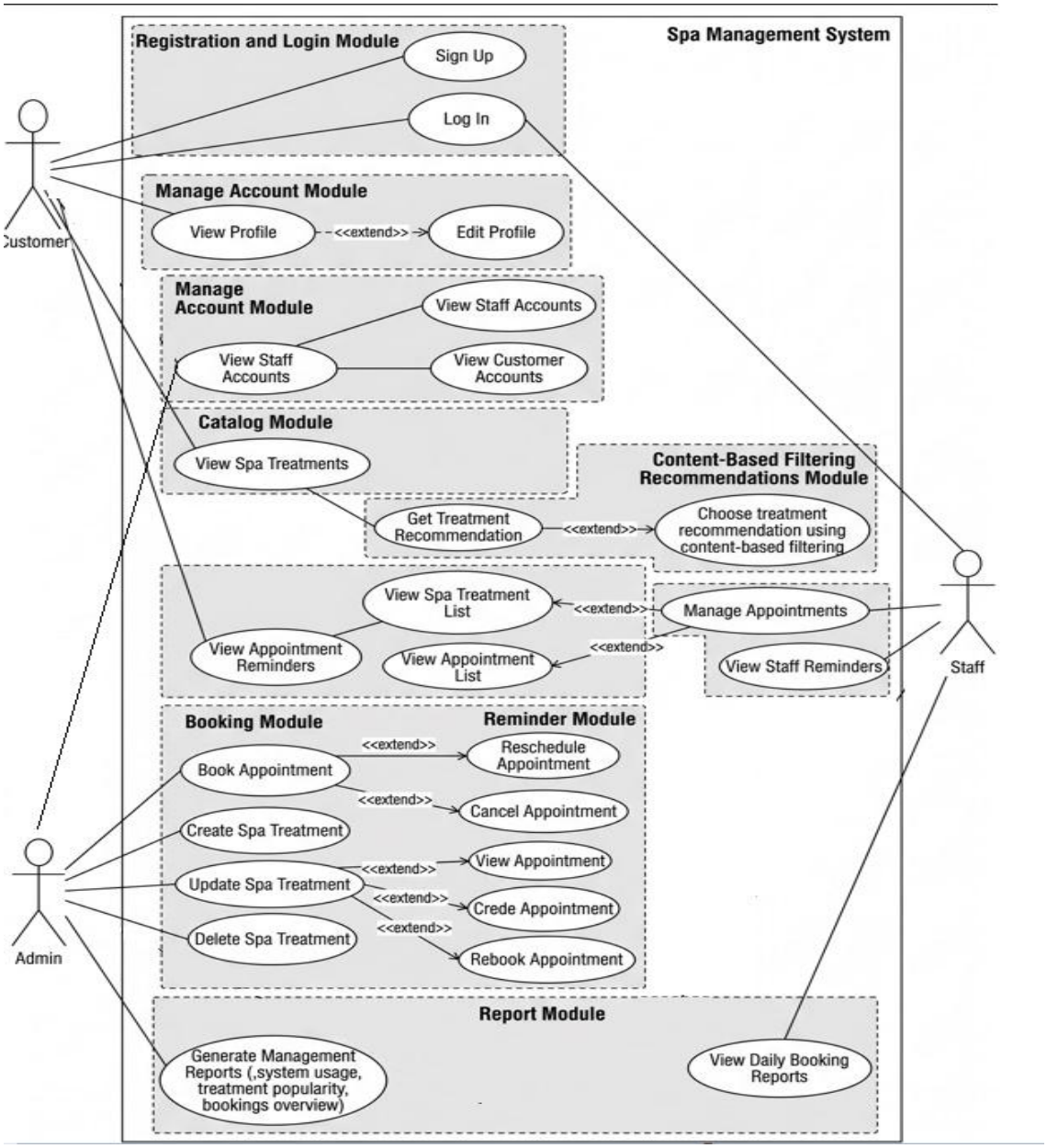

Figure 3: Use Case Diagram for Spa Management System

Overall, the use case diagram for spa management mobile application was organized into seven core modules: Registration and Login, Manage Account, Catalog, Content-Based Filtering Recommendations, Booking, Reminder, and Report.

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The proposed Spa Management Mobile Application framework is shown in Figure 4. On the left, it handles primary user interactions and core operational functionalities, structured sequentially through User Registration & Login, Account Management, the Catalog Module, the Booking Module, and the Report Module. User profile data, including skin conditions and service preferences, is captured and transferred from the Account Management module to the

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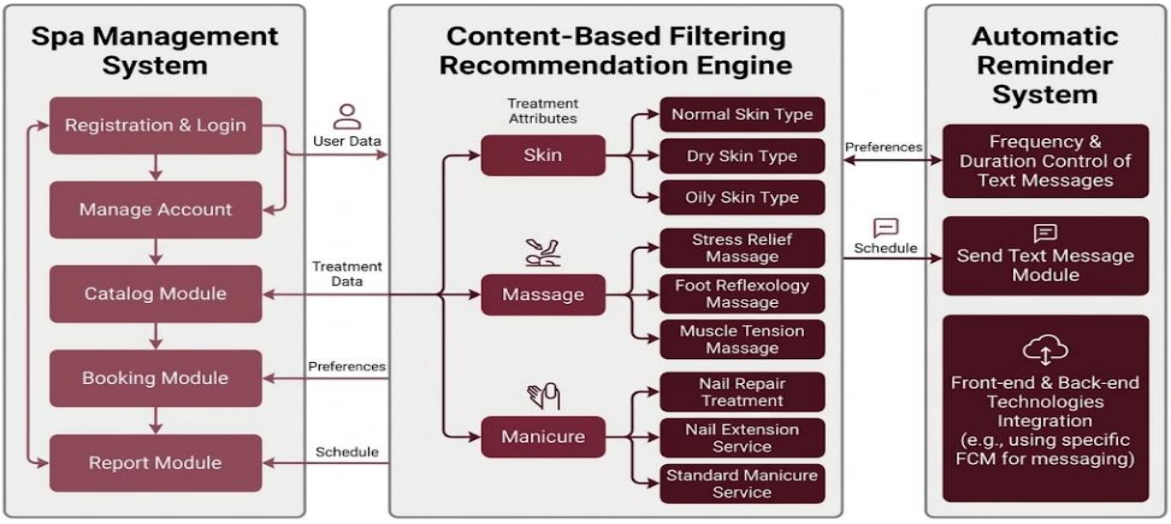

Figure 4: Proposed Framework Design for Spa Management Application via Content-Based Filtering Recommendations and Automated Reminders

Content-Based Filtering Recommendation Engine in the center container. This recommendation engine categorizes treatment attributes into distinct service domains such as Skin (for example, subdivided into Normal, Dry, and Oily skin types), Massage (for example, subdivided into Stress Relief, Foot Reflexology, and Muscle Tension), and Manicure (for example, subdivided into Nail Repair, Extensions, and Standard services). The matched treatment recommendations generated by this attribute are fed directly back into the Catalog and Booking Modules to assist customers in making informed treatment selections.

Concurrently, scheduling and preference parameters flow between the central recommendation engine and the Automatic Reminder System on the right. Externalized preferences and schedule data channels coordinate with the frequency & duration control and send text message modules to manage notification delivery logic. Utilizing Firebase Cloud Messaging (FCM) within its front-end and back-end integration layer, the automatic reminder system dispatches automated, timely push notifications and booking alerts back to the main management system's report and booking modules, ensuring seamless user engagement and optimized appointment management.

Three primary actors interact with the system based on their roles and authorization levels:

(1) Customer - Within the Spa Management System, customers can manage their personal profiles, browse available treatments in the catalog, receive tailored recommendations generated by the content-based filtering engine, book appointments, and access automated reminders.
(2) Staff - In the system, the staff actor interacts with operational modules to view real-time schedules, manage client appointments, and monitor daily booking reports for efficient service delivery.
(3) Admin - As the administrator, this actor manages user access (customer and staff), keeps the treatment catalog up to date, and generates comprehensive system analytical reports through the dashboard.

System Development

This section will exhibit and illustrate the user interface and source code that have been implemented for each module.

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Registration and Login Module

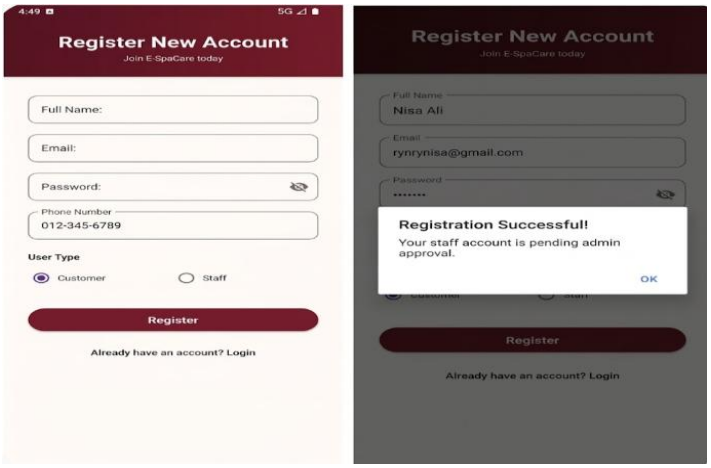

Figure 5: Registration Interface

Figure 5 presents the registration interface that is used for registering new users as customers or staff members in the Spa Management Mobile Application via Content-Based Filtering Recommendations and Automated Reminders. Four fields need to be filled in, which are full name, email, password, phone number, and selecting their role type, either customer or staff. Accounts will be created after the complete data has been submitted.

After successful validation, Firebase authentication creates a new user account with the given email address and password, while the other information is stored in Cloud Firestore. Through the application, customers can immediately log in after registering. By contrast, staff accounts are set to a pending status and require an administrator to approve before login access is granted. This is to ensure staff. This ensures that only authorized staff can log in to the staff dashboard and prevents customer data from leaking to unauthorized staff.

Manage Account Module

The profile interface in Figure 6 displays the details option for customers to look for, such as personal information, Terms and Conditions, About Us, and a Log out button. Customers can view and update their personal information by clicking on the edit icon. Only the full name cannot be updated, while other information such as email, phone number, and password can be changed if needed. This profile feature enables customers to easily access and edit their own details, ensuring the details are current and secure.

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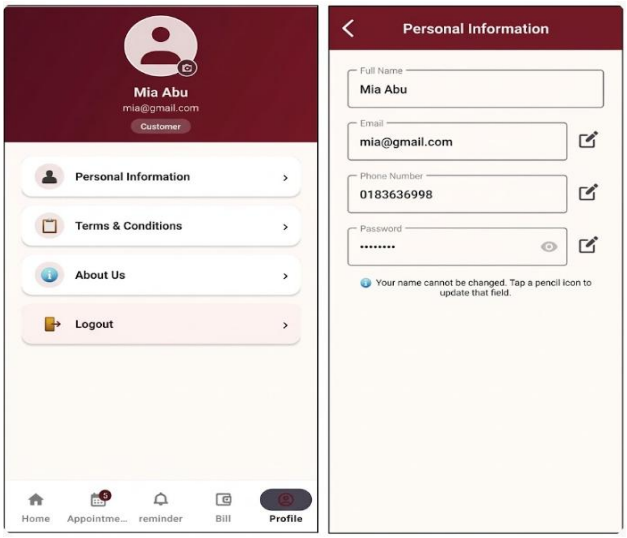

Figure 6: Profile Interface

Catalog Module

Figure 7 shows the dashboard interface, which is the primary page for customers upon successfully logging into Spa Management mobile application. The interface makes it easy for customers to access the main features of the application, such as treatment recommendation catalog, treatment browsing, appointment, reminder, bill, and profile. The dashboard design is a user-friendly way that enables customers to move around efficiently in the application, but at the same time can get the relevant information in one place.

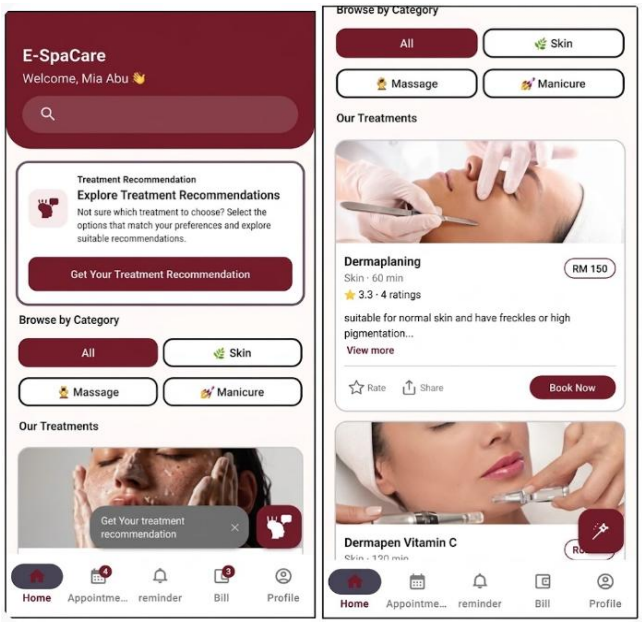

Figure 7: Customer dashboard with scrollable treatments

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Content-Based Filtering Recommendations Module

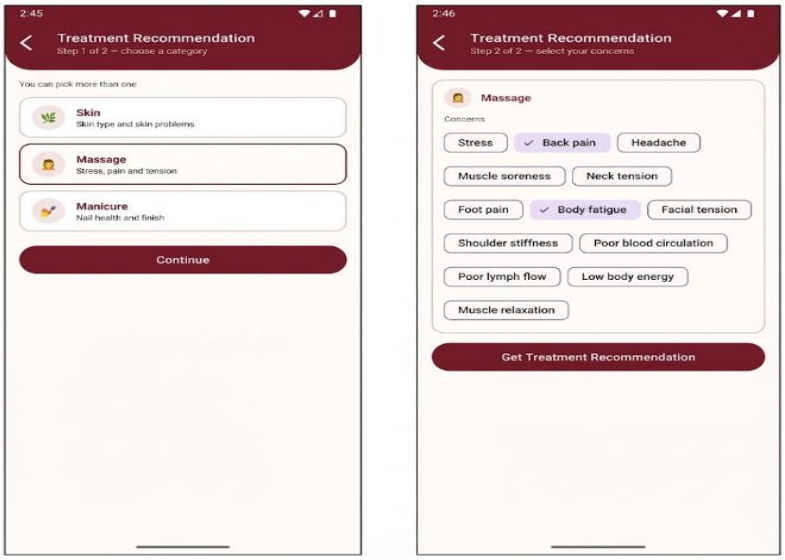

Figure 8: Treatment Recommendation Interface Based on Attribute Preferences by Customer

As seen in Figure 8, the treatment recommendation interface shows the category of treatment that customer have to choose according to their concern, either Skin, Massage, or Manicure. Then, the treatment attribute will be filtered according to the category choose like show in Figure 8. The customer can select one or more of the following attributes to most relevant to the issue they are facing before clicking "Get Treatment Recommendation".

```
private int countMatchesIgnoreCase(
        List<String> treatmentValues,
        List<String> selectedValues) {

    if (selectedValues == null || selectedValues.isEmpty()
            || treatmentValues == null || treatmentValues.isEmpty()) {
        return 0;
    }

    int count = 0;

    for (String selectedValue : selectedValues) {
        for (String treatmentValue : treatmentValues) {
            if (normalizeValue(treatmentValue).equals(
                    normalizeValue(selectedValue))) {
                count++;
                break;
            }
        }
    }

    return count;
}
```

Figure 9: Sample of Coding for Content-Based Filtering Recommendations

The Figure 9 shows the calculation of the matching score which is determined by the size of the set of user concerns and the size of the set of treatment attributes. This is the implementation of $Si = |U \cap Ti|$. The score increases by one for every successful match, and treatments scoring zero are removed.

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Figure 10: Treatment Recommendation Result Interface

Figure 10 presents the result of the treatment recommendation after the treatment attribute or concern has been chosen. The application then processes the selected attributes, compares them with the treatments that are stored in the database, and returns a list of treatments that match the customer's preferences. The information for each recommendation is shown along with its description, price, match score, and recommended based on the score and price, so that customers can choose the treatment that they think is the best. Customers can adjust the selected result of treatment recommendation before moving to the next process. Furthermore, the application automatically saves the recommendation results in Firestore with the customer ID, treatment ID, treatment name, and recommendation date, which can be utilized in the Smart Spa Management with Automated Reminder and Treatment Recommendation mobile application for tracking and further analysis.

Booking Module

The Book Appointment interface lets customers book appointments based on the selected date and time, as shown in Figure 11. This interface aims to make booking easier, while keeping schedules tidy. To view the available time slots for that day, customers must click on the date that they would like to explore. Once the date is selected, the system dynamically loads only the available appointment slots. This keeps staff from double-booking and makes sure that they do not book appointments where they do not have time. Customers can also send extra notes or special requests for their appointments, including their preferred treatments. After all booking information is entered and confirmed, it will be taken up in the system.

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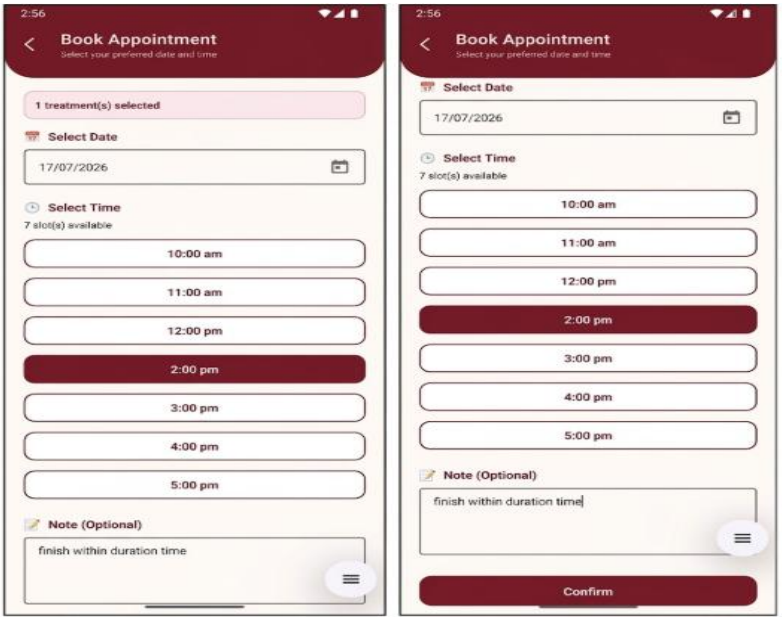

Figure 11: Scrollable Book Appointment Interface

Reminder Module

The reminder interface is shown in Figure 12 and provides reminders regarding refunds, staff changes, appointment rescheduling, and also sends reminders automatically to customers two days before the appointment date and four hours before the appointment time. Customers will always be updated and aware of any updates or upcoming appointments through these features. A badge count on the bottom navigation bar also helps improve visibility when there is an unread or upcoming reminder, ensuring customers easily see and access important reminders without missing out on vital appointment details.

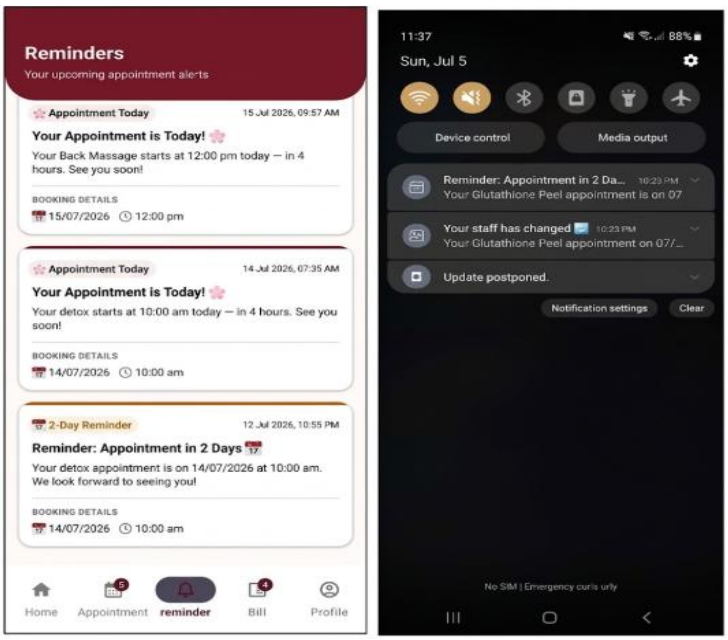

Figure 12: Reminder Interface

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```
Calendar onDay = Calendar.getInstance();
onDay.setTime(apptDate);
onDay.set(Calendar.HOUR_OF_DAY, apptHour);
onDay.set(Calendar.MINUTE, apptMinute);
onDay.add(Calendar.HOUR_OF_DAY,  amount: -4);

long onDayDelay = onDay.getTimeInMillis() - System.currentTimeMillis();
if (onDayDelay > 0) {
    scheduleAndSave(context, appointmentId, customerId,
            treatmentName, appointmentDate, appointmentTime,
            reminderType: "on_day",
            title: "Your Appointment is Today! 🌸",
            message: "Your " + treatmentName + " starts at "
                    + appointmentTime + " today — in 4 hours. See you soon!",
            onDayDelay, TimeUnit.MILLISECONDS);
}
```

Figure 13: Coding Reminder 4 Hours before Appointment Time

This function in Figure 13 is for scheduling a second reminder to alert the customer 4 hours before the actual appointment time. Other than 4 hours reminder, also in this apps consist of 2-day reminder. The calculation of four hours reminder is subtracted from that time using the calendar, HOUR_OF_DAY. Like the other reminders in this mobile apps, the calculated delay (onDayDelay) is checked to ensure it is still positive before scheduling, preventing the reminder from being triggered for appointments that have already passed. This reminder is a final reminder due to it final message in a time-sensitive manner.

Report Module

The admin dashboard interface is displayed in Figure 14. Once loaded, the dashboard pulls real-time data from several collections within Firebase Firestore to feed its components, which are appointments, customers, and treatments. At the top, the admin can see the total revenue generated by completed payments, as well as click on the notification card, which shows the number of staff waiting for approvals and the number of refunds, which will then

Figure 14: Scrollable Admin Dashboard Interface

take the admin to the "Approval" interface or the "Refunds" interface. Below, there are three clickable KPI cards, which are total appointments, customers, and treatments. Tapping each of these takes the admin to the list view of the appointments list, the customers list, and the treatments list. A separate monthly revenue chart that can be filtered by year to display total revenue collected for each month. Lastly, two pie charts summarize the distribution of

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appointments by treatment category and appointment status, done, upcoming, and canceled, providing the admin a quick overview of overall business performance.

Functionality Testing

Functionality testing is used for this mobile application testing. This method tests application functionality without understanding its structure or code. In other words, functionality testing checks application input and output without knowing its core operations.

Table 5: Functionality Testing

UR ID	Requirement Description	Action	Expected Result	Test Cases Executed	Status
UR1	• The system shall allow new customers to register a new account before logging in. • The system shall redirect valid users to the homepage upon successful login.	• Sign up and Log in to Spa Management Application via Content-Based Filtering Recommendations and Automated Reminders	• Account is created and log in successfully	15	Pass
UR2	• The system shall allow admin, staff, and customers to change passwords and edit profiles.	• The admin shall be able to view customer accounts • The staff, and customers shall be able to change passwords and edit profiles.	• List of registered customer accounts • Change password and edit profiles	10	Pass
UR3	• The system shall allow the admin to manage spa treatments. • The system shall allow customers to choose the treatments that are available in the spa.	• Admin clicks add, edit, or delete • Choose treatment category	• Treatment is added, updated, or deleted successfully • Treatment Recommendations are shown	12	Pass
UR4	• The system shall recommend suitable	• Choose treatment attribute more	• Treatment	20	Pass

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	spa treatments based on the customer's preferences	details based on the customer's preferences and get recommendations	Recommendations are shown based on attributes selected		
UR5	• The system shall allow the customer to request a spa appointment by selecting the treatment, date, and time.	• Choose a date and time slot	•Appointment successfully books	18	Pass
UR6	• The system shall allow sending automated reminders to the customer.	• Access to the reminder interface	• Reminders are displayed.	15	Pass
UR7	• The system shall allow the admin to view the monthly report, appointments, and services.	• View report from dashboard	• Total Revenue and the monthly sales report are displayed	20	Pass
UR- User Requirement			**Total Cases Executed = 110**		

The testing results demonstrate that all evaluated functional requirements from UR1 to UR7 achieved a "Pass" status, confirming that the Smart Spa Management application meets its primary technical and operational specifications. A total of 110 test case scenarios were executed across administrative, staff, and customer modules, achieving a 100% functional correctness. The core authentication and account management modules, which were UR1 and UR2, successfully enabled secure user login, profile updates, and role-based account access for administrators, staff, and customers. Furthermore, service administration and booking capabilities stated as UR3 and UR5 has operated as intended, allowing administrators to manage treatment catalogs while enabling customers to select time slots and finalize appointment bookings smoothly. Crucially, the system's key research pillars, specifically the content-based recommendation engine UR4 and the automated reminder module UR6, performed reliably by successfully matching treatment attributes to customer preferences and displaying targeted notification alerts. Finally, administrative oversight functions (UR7) effectively aggregated operational data to display total revenue and monthly sales metrics, validating the system's overall functional readiness and technical viability for deployment.

Conclusion

Spa Management System via Content-Based Filtering Recommendations and Automated Reminder is the proposed system that extends the normal booking process in traditional spa management. This system concludes with the requirement analysis, which identifies the

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organization's needs, and the system design, which outlines the development process and specifies the terms and criteria necessary to meet those needs. In addition, the functionality testing results confirm that all defined use cases across the seven operational modules perform in full alignment with the spa management system specifications. Key functional pathways, including customer account management, content-based filtering recommendation extraction, automated reminders, and administrative functions, achieved a 100% test pass rate. Future research in spa management mobile applications should explore integrating multimodal data such as image-based inputs from a customer perspective. Given that clients frequently possess limited domain knowledge regarding dermatological conditions and spa therapies, incorporating visual diagnostic data refines customer profiling and fosters more accurate, data-driven treatment selection. In terms of practical use, future evaluations should therefore assess recommendation accuracy and user satisfaction in using the system. Overall, by combining a content-based filtering recommendation engine with automated push reminders, the proposed system optimizes appointment scheduling, confirming the functional correctness and operational stability of the application.

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