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Salon Appointment System with Real-Time Skill-Based Employee Allocation and Intelligent Workload Balancing using Cross-Platform: FLORA LUXE

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***Abstract*— This paper presents a novel cross-platform salon appointment management system that boosts operative performance through real-time, skill-based staff scheduling as well as smart workload balance. As a constantly changing beauty and wellness industry, booking appointments and making optimal use of employee abilities is a major hurdle. Such challenges are overcome by this system by exploiting real-time data and intelligent matching algorithms that can dynamically calibrate appointments to staff based on individual client service needs and individual staff expertise. In doing so, it makes sure every individual customer gets to receive service from the most competently skilled professional, this works to improve service quality and customer satisfaction.**

Besides, the system employs workload balancing mechanisms that monitor and share out tasks equitably among employees to avoid burn-out brought by over use as well as dis-engagement triggered by under use. The intelligent scheduling algorithm is dynamic in nature and takes into account such parameters as appointment length, availability of employees with matching skill set. It maintains a healthy balanced working environment leading to better employee morale and retention. The solution is built on a cross-platform basis, providing availability and functionality for salon personnel and clients on various devices. With reduction of idle time, better resource allocation and better user experience, the system offers a scalable model for modern salons. It ultimately leads up to building a more sustainable, more efficient, more client-centred salon management ecosystem.

***Index Terms*— Workload Balancing, Real-Time Scheduling, Cross-Platform Application, Employee Optimization, Intelligent Scheduling, Resource Management, Service Automation.**

I. INTRODUCTION

The salon industry has seen rapid digital transformation with the advent of mobile applications that enhance user experience and operational efficiency. Proper management of appointments and employees is needed nowadays to uphold quality in the beauty and wellness industry and make customers happy. The use of manual scheduling and assigning staff in the traditional ways can result in more waiting for clients, employees getting too tired, and incorrect services being given. As customer needs change and competition rises, there is now a strong need for systems that automatically reallocate resources based on up-to-date data.

The research sets up a system for salons that uses intelligent algorithms to handle appointment scheduling and ensure employees are properly assigned with equal duties. The system aims to achieve a better service standard, less idleness, and fair employment of staff by using data in real time. Since it can be accessed on multiple devices, the system is easy to use for all involved.

The development of mobile applications has brought about quick digitization in the salon business. Appointments are often scheduled ineffectively, people have to wait for a long time, and the use of versatile workers is neglected in traditional methods. Because of the switch to digital solutions, it is now much easier to schedule and run the business smoothly. Still, the majority of these services ask users to sign up first, which could make the platform less attractive for new users. Without the need for login, guests use the system to explore before logging in using OTPs when they are ready to book.

What's more, Firebase helps with real-time updates, which leads to a better customer experience. More people have started to ask for user-friendly and efficient ways to schedule salon appointments. The use of mobile technology can boost how employees are available, improve how customers feel, and help businesses generate more revenue. Online payments in FLORA LUXE are securely handled by integrating the Razorpay gateway. With this, customers have the choice to pay through UPI, cards, or wallets hassle-free. A confirmation screen that shows details of the transaction

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helps both parties trust the process more.

The research looks at how FLORA LUXE simplifies managing a salon, increases operation efficiency, and helps keep customers engaged by offering real-time insights and user-friendly technology.

II. PROBLEM STATEMENT

Despite the fact that more beauty and wellness businesses are moving online, most salon management systems have some basic problems. Traditional methods of scheduling appointments usually require people to do things by hand or use basic booking tools that miss things like what each employee is best at, when they have free time, or how busy they are. This leads to a few challenges when running the organization, like making sure the different departments work together well and staying up to date with new technology.

The efficiency of traditional salon management and satisfaction of customers are often hampered by some significant problems. Sometimes, employees who are not suited for the work are given services, and this leads to wrong service delivery. In addition, managing the workload can be uneven, making some people too busy while leaving others with nothing to do. Their existence leads to extra time spent by customers and a drop in how much they are pleased with the company's service. When there are no live updates and staff do not communicate well, it becomes hard to satisfy and solve customers' issues promptly. In addition, various platforms depend on specific applications or need users to sign up, which makes it harder for new users to use the service.

Existing apps generally make you go through different layers of verification before you can use anything, which can put off new users. Additionally, most systems don't have features like automatically spreading tasks out between agents, matching workers to tasks by skill level, or keeping things up to date right when changes happen. These gaps show how it's important to have a salon management system that is smart, easy to use, and can help make quick, personalized, and up-to-date decisions.

III. OBJECTIVES OF THE STUDY

The key objectives of this research are to build FLORA LUXE, a system that uses both iOS and Android apps to make it easier for people to book and manage salon appointments while making work and customer service better. The system tries to quickly match clients' needs with what each employee is good at. To make sure staff are working in a fair and balanced way, the work is divided between them using smart algorithms so nobody feels too busy or is left with nothing to do. The platform also has easy-to-use design by letting guests just look around and get started without signing up, and then asks for an OTP, or one-time password, only when they want to book something. Real-time updates on things like appointments, staff availability, and changes in the system are made possible with Firebase, which helps everyone stay coordinated and respond quickly. Furthermore, the system lets customers pay online using Razorpay and gives them a few choices for payment, like UPI, credit or debit cards, or digital wallets, and makes sure the payments are clear and secure. Lastly, cross-platform compatibility is taken care of to make sure people can use the app easily on different devices, which makes things much simpler for both the staff and customers.

IV. LITERATURE REVIEW

Eidward Williams et al. analyze the impact of simulation on service efficiency and resource allocation in a salon. Their research highlights how optimized scheduling, strategic staff distribution, and efficient resource management can significantly reduce customer wait times and enhance service quality. Using simulation models, they identify bottlenecks and propose data-driven solutions to improve workflow efficiency. The study underscores the importance of digital tools in streamlining salon operations for better customer satisfaction and operational effectiveness. [1] Z. Sabir et al. explore human resource allocation management, focusing on optimizing workforce distribution for improved efficiency and productivity. The study highlights key challenges in resource allocation, such as workload balancing and real-time decision-making. Using advanced algorithms and strategic planning models, the authors propose a framework to enhance workforce utilization while minimizing operational bottlenecks. Their findings emphasize the role of data-driven approaches in achieving cost-effective and well-optimized human resource management." [2]

Marta Rocha et al. The research paper explores the challenges of staff scheduling and rostering in the hospitality sector, an area often overlooked in quantitative research. The authors highlight the complexities of hospitality management, including unpredictable customer demand, a multiskilled workforce, and diverse labor contracts. Drawing parallels with scheduling approaches used in hospitals and transportation, they examine adaptable models like tour scheduling. A survey by the Center for Hospitality Research at Cornell University identifies human resource management as the primary concern for hotel managers worldwide. The study underscores the need for efficient workforce planning in hospitality to enhance flexibility, profitability, and service quality. [3] Luise Pufahl et al. conduct a systematic literature survey on automatic resource allocation in business processes, highlighting its critical role in optimizing efficiency and effectiveness. Their research categorizes existing approaches based on allocation goals, data usage, algorithmic techniques, and maturity levels. They identify rule-based methods as dominant while also recognizing the relevance of heuristics and machine learning. The study addresses challenges such as balancing workload,

minimizing process costs, and resolving resource conflicts across multiple concurrent processes. By providing a structured overview, the research aims to guide stakeholders in selecting suitable algorithms and identifying gaps for future research in business process optimization. [4]

Gautami G. Shingan et al. proposes an Automated Supervision System to streamline examination management in educational institutions. The system automates critical tasks such as faculty supervision allocation, student seating arrangements, and block assignments, reducing manual effort, errors, and time consumption. It features centralized data storage for exam schedules and faculty assignments, ensuring easy access and efficiency. Additionally, the system facilitates faculty leave management by enabling substitute allocations via automated email notifications. By digitizing the traditionally manual process, this research aims to enhance examination coordination, minimize workload, and improve institutional efficiency. [5] Khoo Zi Xuan et al. present a digital solution for managing salon appointments, aiming to streamline customer interactions and salon operations. The study addresses traditional scheduling inefficiencies by introducing an online system that automates bookings, service selection, and time slot management. By integrating user-friendly interfaces and real-time data tracking, the system enhances customer convenience and operational accuracy. Their proposed model highlights the growing importance of digital transformation in service industries, particularly in improving customer satisfaction and business efficiency.[6]

Alise Yeap Rou Xin et al. introduce a secure and efficient appointment management system for Elvira True Beauty Salon. The system integrates two-factor authentication to enhance client data protection and appointment verification. Key functionalities include gender-based service display, home or in-salon service selection, and OTP confirmation before booking finalization. The authors address real-time appointment handling and system responsiveness, offering a Flutter-based mobile solution. Their work highlights the growing importance of cybersecurity and user-centered design in salon management applications.[7] Md. Aftab Alam et al.presents an Android-based salon appointment booking system tailored to modernize salon operations and improve user experience. The mobile app facilitates user registration, service selection, and time slot booking, offering personalized service through stylist selection and real-time scheduling. The paper discusses the challenges of traditional manual booking, such as inefficiency, delays, and lack of personalization. The proposed system overcomes these by providing features like GPS-based salon search, interactive UI, appointment reminders, and customer history management. It also enhances salon-side operations by streamlining schedules and reducing no-shows. The study demonstrates how digital solutions can increase efficiency, convenience, and customer satisfaction in service-based industries like beauty and wellness. [8]

Priti Warungse et al. present SalonSync, an innovative mobile-based appointment booking system aimed at improving operational efficiency and customer experience in salons. The system allows users to register using phone number-based OTP verification, view nearby salons, and book appointments in real time using a First Come First Serve (FCFS) mechanism. Built using Flutter and Firebase, it supports modules for login, appointment scheduling, notification management, and salon info administration. By integrating all features into a single Android platform, the system reduces manual errors, enhances convenience, and supports digital transformation in the beauty industry. The authors emphasize the benefits of real-time interaction, centralized management, and mobile accessibility for both customers and salon owners.[9] Jayesh Karankal et al. propose a mobile-based Salon Appointment Booking App designed to modernize salon operations and improve the user experience for both customers and salon managers. Developed using Flutter and Firebase, the app allows users to browse available salons, services, and time slots, while offering features such as stylist selection, appointment scheduling, real-time availability, and secure payment integration. For salon owners, the app includes staff scheduling, inventory management, analytics, and notification modules. It also incorporates QR code verification and push notifications for efficient workflow and communication. The system enhances operational efficiency, reduces manual errors, and offers a streamlined, user-friendly experience for the beauty industry.[10]

Nazia Bibi et al. introduce an expertise-based skills management system aimed at enhancing resource allocation in software organizations. The study identifies key limitations in traditional skill assessment—such as inaccurate evaluations and lack of tool support—and proposes a mathematical framework to automatically calculate employees' soft and hard skills over time. Central to their solution is the Skills Calculation Engine (SCE), implemented as a Windows-based application, which assists managers in aligning tasks with employee capabilities. Their approach incorporates educational background, experience, training, and emotional intelligence to ensure accurate skill evaluation. Tool validation through surveys and workshops highlights the system’s practical relevance and user satisfaction, demonstrating its potential to boost organizational efficiency and project success. [11] Shreya A. Bhagat et al. propose a Flutter-based mobile application titled “Appoint Me” for scheduling doctor appointments, aiming to reduce hospital crowding and wait times, especially during the COVID-19 pandemic. The app enables patients to register, browse doctor profiles, view specializations, and book appointments conveniently. Doctors can also manage their schedules and patient data through a dedicated interface. Features like OTP login, Firebase integration, patient history, and appointment tracking enhance the user experience. The

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application promotes a streamlined, paperless healthcare system and reflects the growing trend toward digitized health services in India. [12] Parth Jindal et al. present a productivity-enhancing mobile application designed using Flutter and Firebase to track users' daily progress. The app addresses modern challenges such as digital distractions and lack of task prioritization by offering features like Pomodoro timers, task analytics, and focus-enhancing tools. Through interviews and surveys, they identified a gap in existing productivity apps—either being too simplistic or overly complex. Their solution focuses on intuitive UI/UX, minimalism, and real-time progress tracking. The app supports cross-platform deployment (Android, iOS, Web) and aims to help users make conscious use of their time, ultimately improving personal efficiency and task management. [13]

D. Mourtzis et al. present an intelligent workforce allocation model that optimizes the assignment of jobs to operators based on skill compatibility and workforce cost. The model addresses challenges in dynamic industrial environments with distributed workstations, emphasizing multi-skilled operator scheduling. Using a hybrid decision-making algorithm— combining Intelligent Search Algorithm (ISA) and Exhaustive Search Algorithm (ESA)—the framework ensures efficient task-to-operator matching while minimizing computational time. Implemented in a cross-platform tool, the model was validated in a real-world assembly plant, achieving high utility and operational efficiency. This research contributes to Industry 4.0 by integrating human skills into smart manufacturing systems. [14] H.A. Eiselt et al. propose a multi-objective optimization model for employee positioning and workload allocation that emphasizes job satisfaction, workload equity, and cost-efficiency. The model maps employees and tasks into a multidimensional skill space and uses a distance metric to quantify the mismatch between employee skills and task requirements. It aims to minimize overtime costs, subcontracting, employee-task skill mismatch (to reduce boredom), and workload inequity. Tested in a real-world engineering lab in Chile, the model allows flexible adjustment of parameters to meet organizational goals while considering both individual and collective job satisfaction factors. The approach highlights the importance of tactical workforce planning in improving organizational productivity [15]

V. PROPOSED SYSTEM

Flora Luxe is a mobile application that works on multiple platforms and helps both customers and salon workers schedule appointments easily. By using the app, users can decide on services according to gender, read about them, and put their preferred treatments in a virtual cart. Authentication is done using phones and a verification code sent by Firebase Authentication, so accounts remain protected and no password is required. Clients are allowed to change their profile and log in, select what services they require, and arrange appointments for either salon visits or home services. In real time, the app prevents anyone from scheduling a service lasting more than seven hours, and fees and the needed time are automatically adjusted.

Customer can pick a suitable time, either in the day or for the following month, and the system will prevent them from choosing past times. An OTP verification at the customer's home adds more safety for home services. Based on their particular skills and what they are available to work on at any one time, employees are booked for projects using an advanced work scheduling system. In the event the assigned employee has to cancel, the system automatically assigns the booking to another qualified employee while also preventing the original one from being able to get the same booking. Updates to appointments automatically send an email to the customer, guaranteeing they are informed at all times.

Employees who have authenticated themselves are allowed to view their appointments, either accept or reject services, and control their daily activities. Personnel working in home service can use OTPs to confirm the visit and submit photos and the reason for cancelling if the customer is not present. After the services are finished and the payment is cleared by the boss, employees should click "Done" on the booking.

Users can access the admin page using credentials and will find weekly and monthly analytics for the income brought in from both salon and in-home appointments. Through charts, admins have a clear picture of employee engagement based on the amount of service time per employee grouping.

It runs on Firebase Firestore for smooth database activities and Razorpay for payment security, so customers are able to use various methods of transacting. Flora Luxe, through modular parts, real-time notices, smart booking, and secure data procedures, ensures the salon's operations are efficient and can grow with the business.

VI. USER INTERFACE

A. User Side

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Figure 1. Login Screen

This screen in Figure-1, allows users to enter a One – Time Password (OTP) sent to their registered phone number for authentication. The OTP received on this screen comes from Firebase.

In Figure-2 shows services from Firebase. Clicking the 'Add' button adds the service to bookings. If the user is not logged in, it redirects to the login page.

Screenshot available in Figure-3 is the booking summary page that displays the services you have added. The 'Home Service' and 'Salon Service' buttons at the bottom become enabled only when a service is selected. After selecting the services, the bottom buttons get enabled. Selecting the 'Home Service' option will add an extra charge of ₹200. Based on the selected services, the estimated time will also be displayed.

In Figure-4 The Order Page lets users easily view their booked services, with each service shown in a card displaying the booking date, assigned employee, and a status icon. A green tick means the employee accepted the service, a yellow clock indicates pending acceptance, a pink double tick indicates the service is done and a red tick shows if the service is cancelled. If payment is due, a "Pay" button appears, which users can tap to pay via Razorpay. After successful payment, the button changes to "Paid." This page provides a quick overview of the service status, employee assignment, and payment progress.

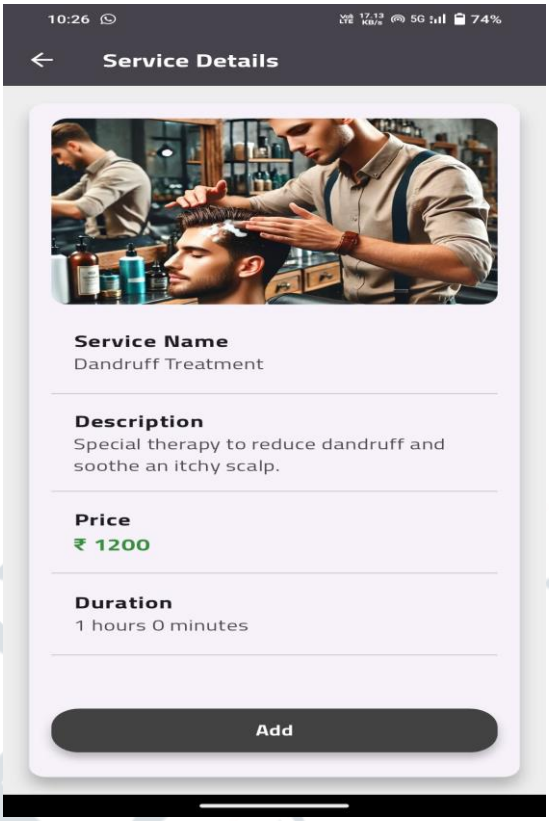

Figure 2. Service Description

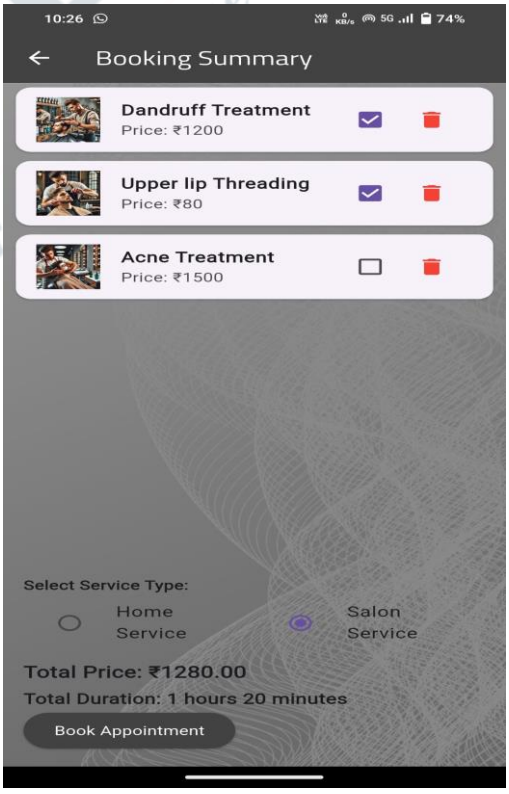

Figure 3. AddToCart Service

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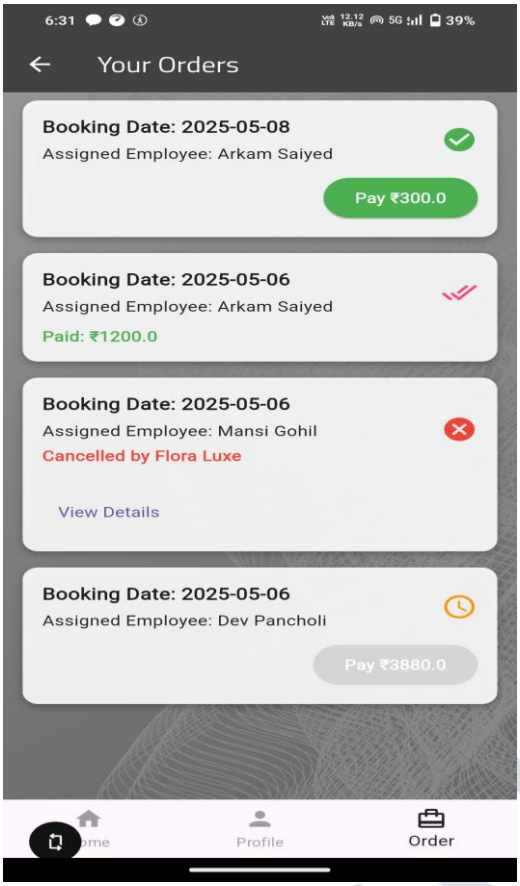

Figure 4. Customer Orders

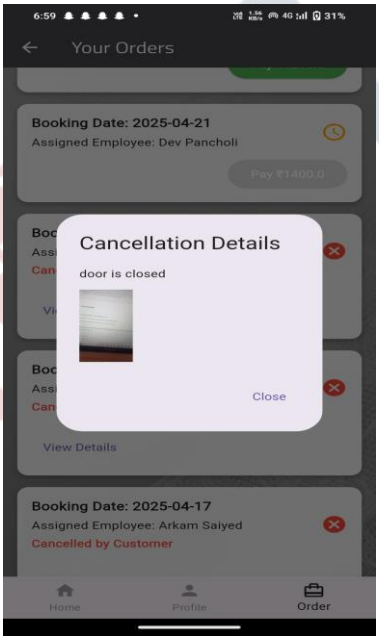

Figure 5. Cancellation Message

The Cancellation Detail screen in Figure-5 shows why a service was cancelled. For home services, if the employee goes to the customer's place but the customer isn't available (like the door is closed), the employee can cancel the booking. In that case, a reason is shown along with a photo as proof that they were there.

The photo helps avoid any confusion and confirms that the employee actually visited. For salon services or when the customer cancels the booking, only the message is shown—no photo is needed since no visit happened.

B. Employee Side

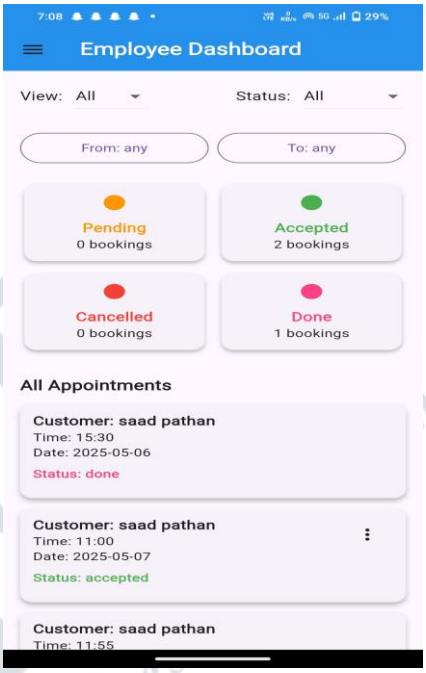

Figure 6. Employee Dashboard

This is the Employee Dashboard screen given in Figure-6 On this screen, staff members get a clear view of their daily service orders. At the top, they can easily switch between different statuses—like Pending, Accepted, Done, or Cancelled—to stay organized. With just a tap on the View option, they can also filter bookings by date, making it simple to manage their appointments efficiently. This data is fetched from the employees_orders collection in Firebase. Each appointment card clearly shows the customer's name, appointment time and date, and the status (such as accepted, pending, etc.). This layout allows the employee to quickly review all their scheduled visits and manage them efficiently.

Figure-7 shows the screen for Home Service appointments, it is important that the employee verifies the customer's presence before starting the service. When the employee reaches the customer's home, they must request an OTP from the customer to confirm the visit. This can be done by clicking the "Send OTP" button, which will prompt the customer to provide their verification code. We are using Firebase Authentication to handle the OTP process securely. Once the OTP is entered and verified, it confirms that the employee has reached the customer and can proceed with the service. If the customer is not available at the scheduled time, the employee should click the "Not Available" button. This will allow them to enter a reason and take a photo as a proof for the missed appointment — for example, "Customer was

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not available" or "The door was not opened." This ensures proper tracking and accountability for each appointment.

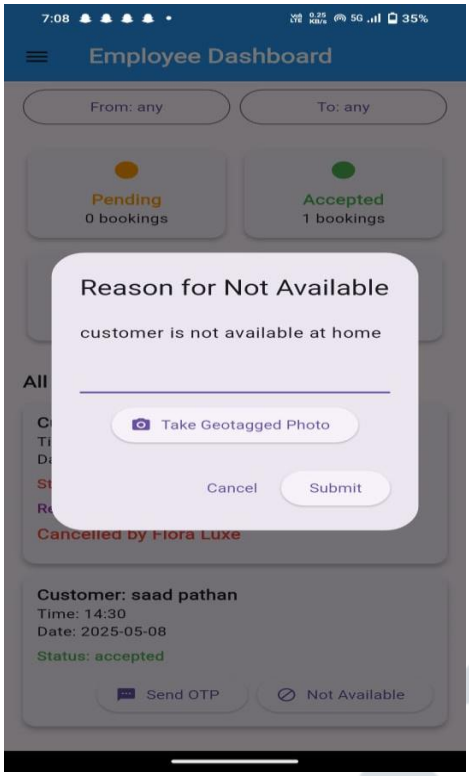
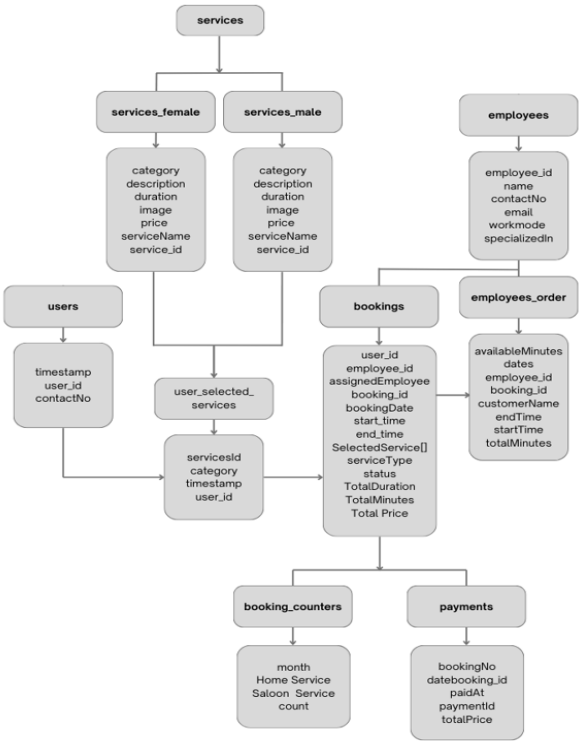


Figure 7. Employee Cancel Reason

VII. DATABASE



This database design not only supports employee assignments but also ensures customers get top-notch service from the right specialists. Here, every employee has their own document, which contains a sub-collection called dates. Each date document tracks how many minutes are still available for bookings that day and includes a list of all appointments with details. This smart design allows salon managers and staff to easily manage daily schedules and avoid overbooking. Each user has a document that holds a subcollection called services, where each service they've added is stored.

VIII. METHODOLOGY

This study explains how a system was created and built that can schedule salon appointments for different platforms and helps the staff figure out who is best for each job and makes sure the work is evenly spread out. The system architecture connects a simple and easy-to-use user interface to a strong under-the-hood computer program that can handle quickly changing information like employee abilities, hours, and what customers want. By using real-time communication, the system helps make sure that customers and salon workers always stay up to date and can work together smoothly. The core of the methodology is coming up with a system that pairs appointments with staff according to their skills and tries to share out the work evenly so that the work can be done better and everyone in the team works in a productive way. Cross-platform compatibility is achieved by using the latest software tools, which let the app work the same way on different phones and computers.

The algorithm for auto-assigning employees to salon appointments operates through a series of logical steps to ensure optimal skill matching, availability, and balanced workload. The steps are as follows:

1. Filter Employees by Skill

- Retrieve the list of employees from the database.
- Check which employees have the required skill for the requested service.
- Only employees with a matching skill set proceed to the next step.

2. Check Availability for the Given Date & Time Slot

- For each employee with the required skill, check their schedule for the requested date.
- Ensure the requested time slot does not overlap with any existing bookings.
- If an employee is available, they move to the next step.

3. Calculate Workload for the Given Date

- Fetch the total hours already assigned to the employee for that specific date.
- Employees should not exceed 9 working hours per day.
- If the employee's total workload remains within the limit, they remain eligible.

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4. Select the Most Suitable Employee

- Among all the available employees, select the one with the least workload for the given day.
- This ensures fair distribution of bookings and avoids overburdening any employee.

5. Return the Assigned Employee

- If a suitable employee is found, assign them to the booking.
- If no employee is available, return a message indicating that no suitable employee is found.

Algorithm works like, suppose there are 4 employees in the system. A customer books a Haircut on April 28, 2025, from 12:00 to 13:30. The system follows these steps, first finds employees skilled in Haircut then checks which employees are free during 12:00 - 13:30. Among those available, picks the one with the lowest total working hours for the day and assigns the booking and updates the employee's schedule. This algorithm ensures efficient workload distribution, prevents employee burnout, and maximizes availability for customer.

IX. MATHEMATICAL MODEL REPRESENTATION

For Employee Set and Attributes,

Let E = {e_1e_1, e_2e_2, …, e_ne_n} be the set of employees. For each employee $e_ie_i \in$ E

s_is_i is the set of skills possessed by e_ie_i.

$m_im_i \geq 0$ is the total workload in minutes assigned to e_ie_i on the given day.

$a_i(T)\ a_i(T) \in \{0, 1\}$ is an indicator function for availability during time slot T, where:

$$a_i(T) = \begin{cases} 1, if\ e_i\ is\ available\ at\ time\ slot\ T, \\ 0, otherwise \end{cases}$$

For Job Requirements where,

s_rs_r is the skill required for the task.

$t_{job}\ t_{job} > 0$ is the duration of the task in minutes.

The maximum allowed daily workload per employee is 540 minutes.

Candidate Selection Criteria An employee *ei* is eligible for assignment if and only if all the following conditions are met:

Matching skills $s_r\ s_r \in s_is_i$, availability $a_i(T)\ a_i(T) = 1$, and workload Capacity $m_im_i + t_{job}\ \ t_{job} \leq 540$

Let the candidate set CC be defined as:

$CC = \{\ e_i\ e_i \in EE \mid s_rs_r \in s_is_i,\ a_i(T)\ a_i(T) = 1,\ m_i\ m_i + t_{job}\ \ t_{job} \leq 540\}$

From the candidate set C, select the employee with the minimal current workload $e^*e^* = arg\ \min_{e_i \in C} m_i\ arg\ \min_{e_i \in C} m_i$

The selection e^*e^* is assumed to be unique. In cases where multiple employees share the same minimum workload, a secondary criterion is defined by the application logic is used to break ties.

If the candidate set is empty, means $C = \emptyset$, then no valid assignment exists.

Although the above criteria consider a single time slot T, when assigning multiple tasks to an employee, the application logic ensures that no overlapping assignments occur. This is represented mathematically as:

∀tasks kk, ll assigned to e_ie_i, $T_kT_k \cap T_l\ T_l = \emptyset$ for k ≠ ll

X. CONCLUSION

The Flora Luxe salon appointment system is an excellent and modern way to oversee and manage a salon business. The use of real-time assignment following skill levels, equilibrating the staff workload, and an application framework that crosses several platforms greatly boosts customers' satisfaction and company efficiency. The platform uses Flutter and Firebase, allowing for smooth experiences for users in choosing a service, OTP verification for appointments, and payment processing. The algorithm works to divide work evenly among employees, cutting down the chances of either having too much work or too little. There are several things about Flora Luxe that give it an advantage, including skill-based bookings, home service opportunities, and adjustable workloads, making it a leader in automated salons. These findings show that real-time digital products and data-driven solutions can move the beauty and wellness industry closer to serving its customers better with more efficiency.

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