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User Interface Design for E-Appointment Systems in SME Service Businesses using Shneiderman's Eight Golden Rules

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ABSTRACT

The advancement of information and communication technology (ICT) has enabled small and medium enterprises (SMEs) to operate more efficiently through internet-based application systems. However, many SMEs still overlook the importance of user interface (UI) design in their digital solutions, resulting in poor usability, inefficient processes, and user dissatisfaction. This study addresses the usability challenges faced by SMEs that do not prioritize UI in their systems, using Jajja Chinta Hair Salon as a case study. The salon is experiencing numerous appointment conflicts and operational disruptions due to its manual booking system, which relies on WhatsApp and phone calls. To resolve these issues, we propose an E-Appointment System developed with a user interface designed using Shneiderman's Eight Golden Rules. These principles were applied to ensure consistency, universal usability, informative feedback, simple error handling, and support for user control and memory reduction. A functional hierarchy diagram was developed to define user roles and application flow, followed by the application of each rule in designing the interface for different user types (customer, staff, and administrator). The findings show that the implementation of Shneiderman's rules significantly improves the usability, efficiency, and user satisfaction of the appointment booking system. As a result, the system can reduce booking conflicts, enhance service quality, and strengthen customer engagement. Future work will involve developing a full prototype and conducting usability testing among real users to further validate the effectiveness of this user-centered interface approach.

1. Introduction

Information communication technology (ICT) has become part of human life. Nowadays, every field uses ICT to operate. Many small and medium enterprises (SMEs) also use it to assist in running their business operations. Furthermore, SMEs play an essential role in a country's economic development. So, ICT, primarily internet-based applications systems, has emerged as a pivotal

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enabler for SME operational efficiency, competitiveness, and growth [1]. ICT empowers SMEs to promptly engage locally and in global markets, which can considerably improve their outreach and competitive standing [2].

ICT applications help SMEs connect with their potential customers. Various ICT applications, especially Internet-based ones, accommodate SMEs and customers. Moreover, users can easily access Internet-based applications anywhere at any time as long as they have internet access and a gadget. Changes in internet technology and its role cause the user-centered system to mature, and users become familiar with this approach. A user-centered system is envisioned as a design framework that prioritizes the needs, preferences, and behavior of end-users throughout the entire development process. In the realm of SMEs, employing a user-centered strategy can produce impressive benefits [3].

However, the neglect of user usability in the user interface of a user-centered system affects both the effectiveness of the system and the satisfaction of its users. When systems ignore usability, they risk creating frustrating user experiences [4], which can lead to decreased engagement [5] and increased errors [6]. Therefore, enhanced usability and increased efficiency are key to providing a positive user experience in a user-centered system. However, to earn these benefits, a quality, user-friendly user interface must be designed. The user interface is a medium that end users use to interact with the system. Therefore, the user interface usability design must be considered during application system development to ensure that users feel the system is easy to learn, intuitive to use, and meets their expectations. In this paper, we will show the design of the user interface for E-Appointment Systems in SME service businesses, which focuses on enhancing usability based on Shneiderman's eight golden rules. This paper will also include a review of related work, a brief explanation of the case study, a functional hierarchy diagram of the system, and a user interface design that adheres to Shneiderman's eight golden rules. Finally, the conclusion and future works of the study will be discussed.

2. Related Works

2.1 Key Benefits of ICT Application Systems in Operating SME Business

ICT application systems help a lot in running SME business operations. The advantages of using ICT application systems help SMEs grow rapidly by improving efficiency, communication, customer reach, and decision-making. Integrating the ICT application system, particularly Customer Relationship Management (CRM), has significantly enhanced operational efficiency in SMEs servicing businesses. According to Nethanani *et al*., [7] CRM systems improve the operational efficiency of SME, primarily through process automation and enhanced data management capabilities [7].

Besides that, by having ICT application systems, especially to improve the relationship with customers, it can indirectly enhance customer retention and increase sales, driven by improved customer interaction and personalized services [7]. Moreover, the use of AI-driven ICT application systems for SMEs allows for automated tasks such as responding to customer inquiries and segmenting audiences, leading to more efficient marketing strategies and improved customer retention [8].

ICT application systems can also provide SMEs with real-time data analytics that can help the SME owner make decisions and plan strategically. For example, the integration of social media analytics into CRM systems offers insight into customer behaviors and preferences that can enhance SMEs' marketing strategies [8].

Technological developments in ICT applications are driving rapid digital development. These developments are also influencing digital transformation and the use of emerging technologies such

as artificial intelligence (AI) and the internet of things (IoT), stimulating innovation and enhancing the ability of SMEs to compete in a dynamic market [9].

2.2 User Interface Usability

User interface usability is a critical aspect of designing system applications. It refers to the quality of the user's experience when interacting with a system application. A well-designed UI can enhance user experience (UX), streamline operations, and improve customer engagement, which are vital for the competitive edge of SMEs. It encompasses effectiveness, efficiency, and satisfaction in achieving specific goals in a particular context of use [10].

For the SME sector, a well-designed user interface can enhance operational efficiency and decision-making processes [11]. Besides that, by having an efficient UI design, the time users spend on tasks can be reduced and minimize errors. For example, one of the Indonesian pharmaceutical mobile commerce applications proves its efficient user interface improves usability, reducing both time-based efficiency and error rates, which are critical for user retention and satisfaction [12].

2.3 Shneiderman's Eight Golden Rules

Shneiderman's Eight Golden Rules are a set of principles aimed at augmenting user interface (UI) and user experience (UX) by enforcing the development of intuitive and user-centric interfaces [13]. The rules are (1) Strive for Consistency, (2) Seek Universal Usability, (3) Offer Informative Feedback, (4) Design Dialogs to Yield Closure, (5) Offer Simple Error Handling, (6) Permit Easy Reversal of Actions, (7) Support Internal Locus of Control, and (8) Reduce Short-Term Memory Load [14,15].

Implementing Shneiderman's Eight Golden Rules in interface design offers numerous advantages, enhancing user experience and usability. With these principles, it encourages consistency in design that helps users predict the behavior of the interface, reducing the learning curve and increasing efficiency [14]. Shneiderman's rules also encourage interface designers to provide shortcuts for frequent users, which can significantly enhance productivity by allowing them to perform tasks more quickly [16]. These principles also offer informative feedback that helps users understand the results of their actions, which is crucial in maintaining user engagement and satisfaction [17].

3. Case Study

In this study, we use one SME, Jajja Chinta Hair Salon, a servicing business, specifically hair salon services. Jajja Chinta Hair Salon offers a range of services, including hair wash, haircut, hair relaxing, hair colour, and scalp treatment.

Jajja Chinta Hair Salon uses a manual approach to handling customer appointments. Customers can make service appointment bookings with the salon through messaging applications, called WhatsApp, and phone calls. Then, the staff will check the requested appointment bookings, time, and date availability. The customer will be informed if the requested time and date are available. For record purposes, all the appointment booking information will be recorded in a spreadsheet application.

With this approach, Jajja Chinra Hair Salon consistently encounters numerous challenges. This method often results in problems like data duplication and scheduling problems. For example, there are situations where customers get scheduled at the same time, which leads to overbooking at the salon. This scenario causes customers to wait for an extended period, negatively impacting customer service. On the other hand, unscheduled or late customers can disrupt the salon's operation,

resulting in overtime or increased workload and stress for staff. An additional challenge is the management of customer details and their appointment booking records. Since appointment bookings are only captured through phone calls and WhatsApp, extracting these details may be elusive for some.

The problem faced by Jajja Chinta Hair Salon can be solved using an efficient appointment booking application system, also known as an E-Appointment System. To develop an efficient appointment booking application system, it is essential to study the current flow of the appointment booking process to prevent similar issues from arising in the system. Besides that, the design of the user interface in this application must also be prioritized because users will communicate with the application using the user interface. Having a high user interface usability can increase sales and the total customers. There are various user interface usability models that we can adapt. In this study, we will use Shneiderman's Eight Golden Rules to design the user interface to enhance the usability of the proposed booking application system.

4. A Functional Hierarchy Diagram of the System

In this study, we developed a functional hierarchy diagram to understand the structure of the E-Appointment system better. The functional hierarchy diagram also plays a crucial role in designing user interfaces, as it supports a systematic structure and navigation, and facilitates a human-centered design approach. It can also enhance the range of functions, ensuring the user interface design meets the diverse needs of users [18-21].

Fig. 1 shows a functional hierarchy diagram of the E-Appointment system. There are three types of users in this system: (1) customer, (2) staff, and (3) administrator. Customers must register to schedule an appointment through this system. Under the booking module, customers can choose services, prices, dates, and times, and confirm their booking. The customer can also cancel a booking through this module. The account setting module allows the customer to edit the profile. They can also view the booking they made and messages from the admin. The customer can also view the services offered by Jajja Chinta Hair Salon and view the list of stylists. The customer can easily obtain the contact information through the 'Contact Us' module.

The second type of use is staff. Through the dashboard, staff can view today's schedule, view upcoming slots, and view appointment details. They are also able to accept or reject bookings through the booking module. The monthly completed appointment booking report can also be accessed through the report module. Through the user profile module, they are allowed to update their profile.

The third type of user is an administrator. Through the dashboard, the administrator can view the total staff, today's bookings, and total revenues. The administrator can also manage services and staff, such as adding, editing, and deleting them. Like the customer and staff, administrators can also update their profiles. The administrator can also easily view reports, manage messages, and review ratings and customer feedback through this system.

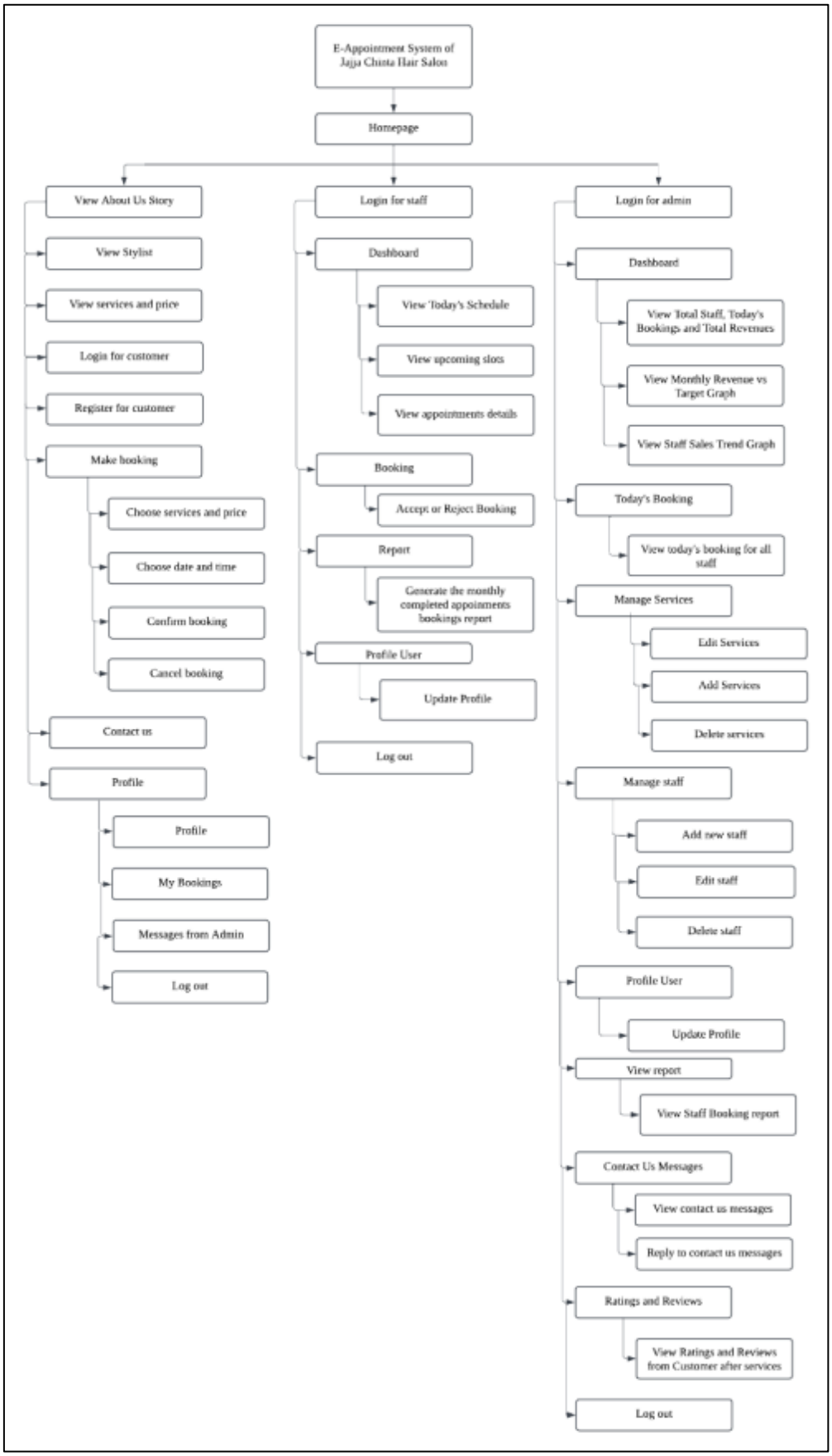


Fig. 1. A functional hierarchy diagram of the system

5. Designing User Interface using Shneiderman's Eight Golden Rules

In this section, we will demonstrate how we implement Shneiderman's Eight Golden Rules in this system to enhance the user interface and improve the user experience.

i. Strive for Consistency

In Shneiderman's Eight Golden Rules of Interface Design, the first rule is "Strive for Consistency." This rule emphasizes the importance of maintaining uniformity in the design of user interfaces, enabling users to learn and interact with systems more efficiently. Here, similar operations and elements are designed to behave consistently across the entire system interface. In this, the E-Appointment system, we standardize the background design, font, and colour of the buttons as stated in Table 1. Fig. 2 illustrates an example of user interfaces that achieve design consistency based on the information provided in Table 1.

Table 1
Background, font, and colour of button information

Element	Information
Background	• Blurred salon interior image with a semi-transparent charcoal overlay.
Font Type for Heading	• Segoe UI Semibold
Font Size for Heading	• H1 = 32 px • H2 = 24 px
Font Type for Text	• Segoe UI Regular
Font Size for Text	• 16 px
Colour for Button	• Blush pink background with the white text • Pale blush background with the charcoal text • Berry pink background with the white text

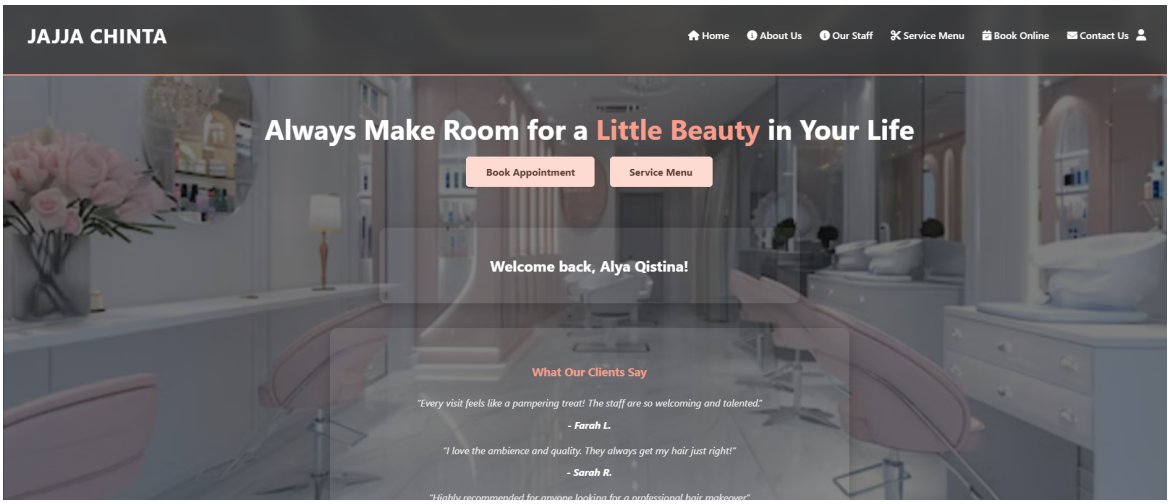


Fig. 2. An example of user interfaces that achieve design consistency

ii. Seek Universal Usability

The second rule of Shneiderman's Eight Golden Rules is "Seek Universal Usability". This rule emphasizes designing interfaces that are accessible and usable by the broadest range of users. To ensure the interface of the E-Appointment System at Jajja Chinta Hair Salon is easy to understand for a wide range of users, we provide clear explanations of the information. For example, we explain the services offered by the Jajja Chinta Hair Salon, so that it can assist the users to choose the correct services, as shown in Fig. 3.

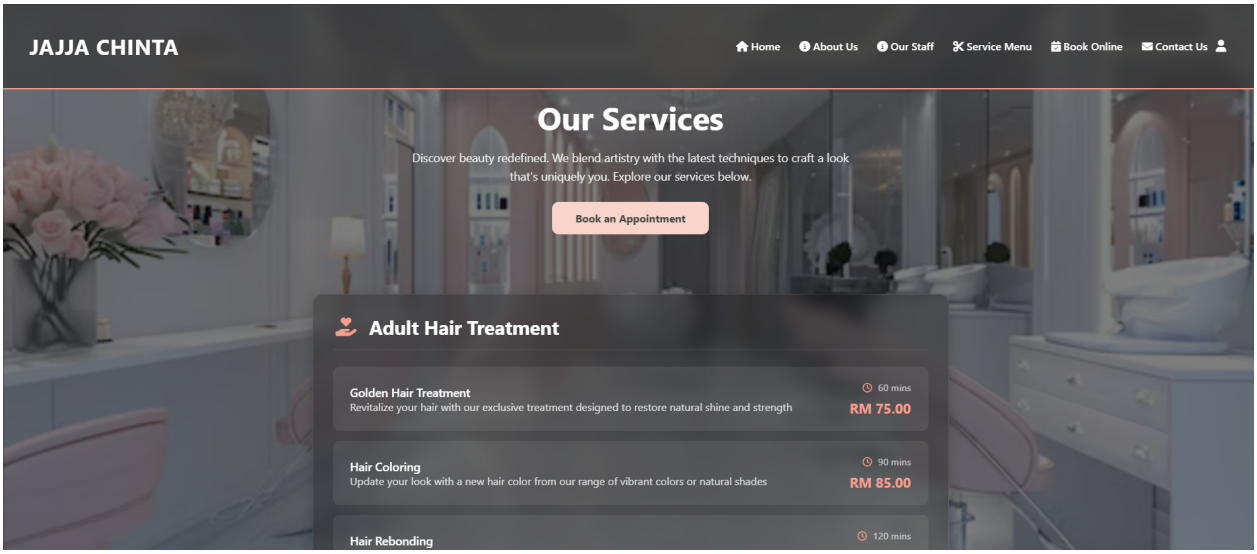


Fig. 3. An example of user interfaces that implement the second rule of Shneiderman's Eight Golden Rules

To enhance the user experience with this system, we also utilize familiar graphical icons within the system. For example, we display an icon of a phone to show the phone contact number and a calendar icon for the date and time, as shown in Fig. 4. We also implement links to assist users in browsing from one page to another. The examples are illustrated in Fig. 5.

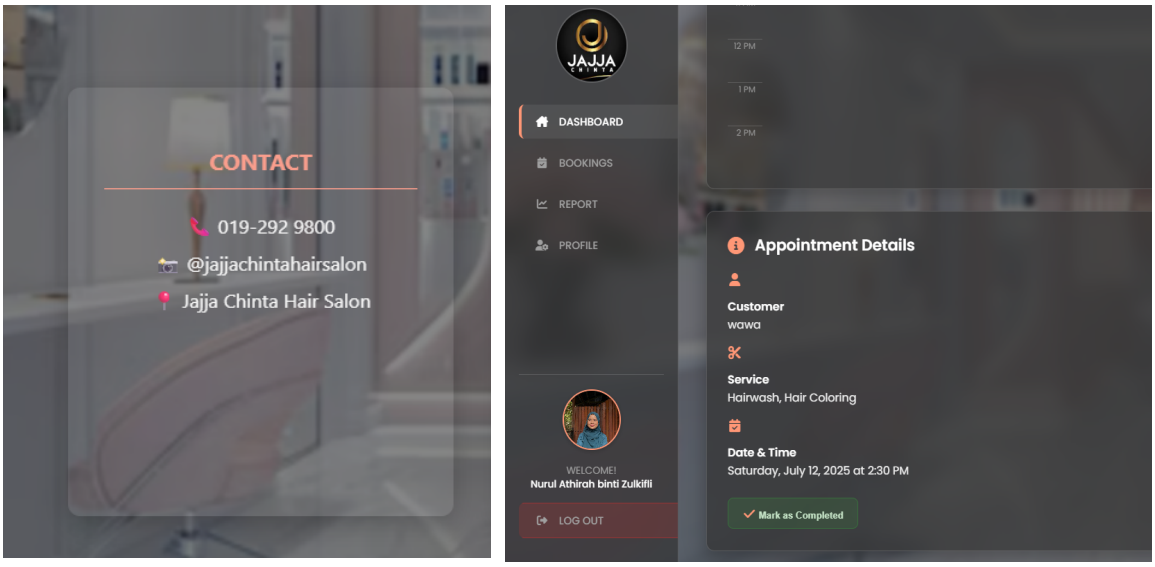
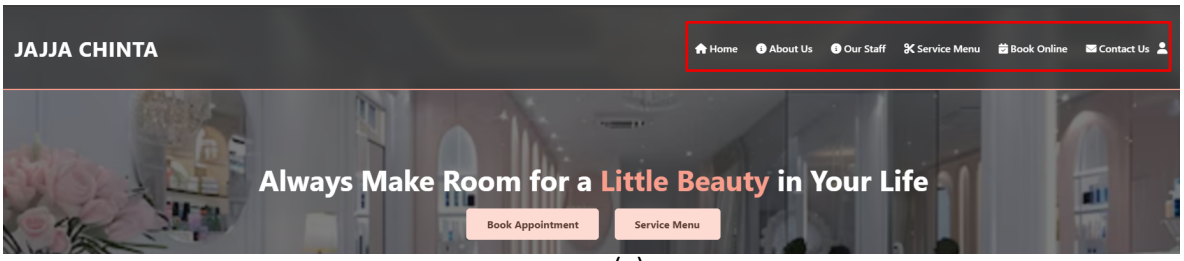
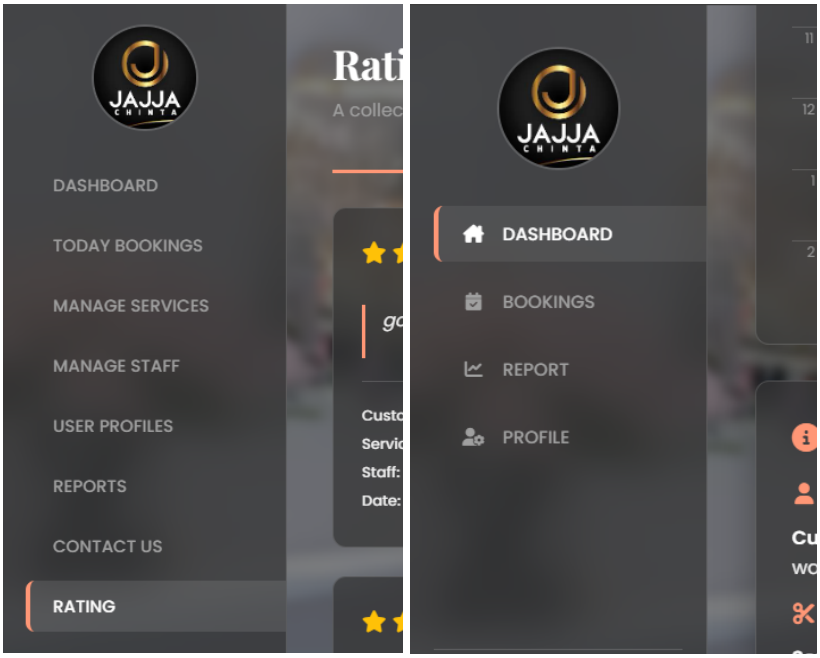


Fig. 4. Examples of user interfaces that implement familiar icons



(a)



(b)

Fig. 5. (a) Example of customer page that has links to another page (b)The dashboard for Admin and Staff that also has links to another page

iii. Offer Informative Feedback

In the third rule of Shneiderman's Eight Golden Rules, "Offer Informative Feedback," the importance of keeping users informed about what the system is doing, especially in response to their actions, is highlighted. In the E-Appointment System of Jajja Chinta Hair Salon, we ensure that users receive feedback when they take specific actions. For example, the system will inform them that their appointment approval is pending or that the booking they made has been cancelled successfully. Fig. 6 shows examples of interfaces that implement this rule.

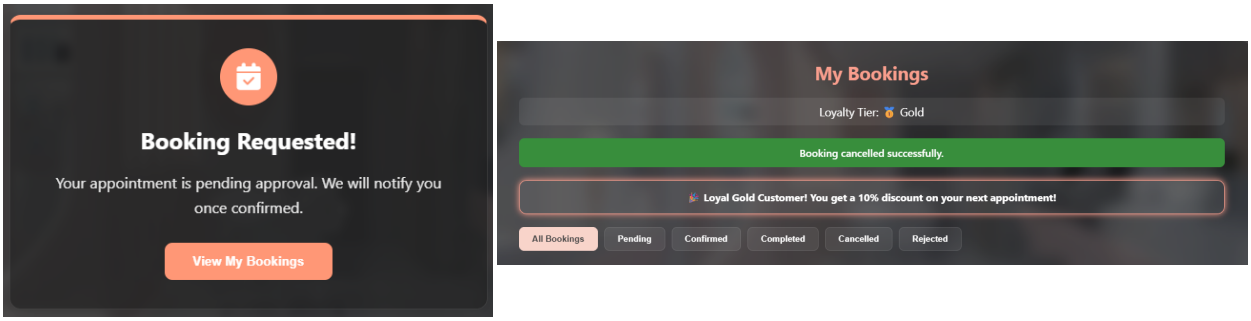


Fig. 6. Examples of interfaces that implement the third rule of Shneiderman's Eight Golden Rules

iv. Design Dialogs to Yield Closure

"Design Dialogs to Yield Closure" emphasizes the imperative of user engagement, or a task a user completes should end with a clear and informative signal. In other words, this rule helps users feel confident, avoid confusion, and keep moving forward in the interface. In this E-Appointment System, we guide users by providing feedback using meaningful messages. For example, to let them know they logged in successfully, a "welcoming back" message appears and guides them by providing simple instructions when they want to change their password. Examples of interfaces that implement the fourth of Shneiderman's Eight Golden Rules are illustrated in Fig. 7.

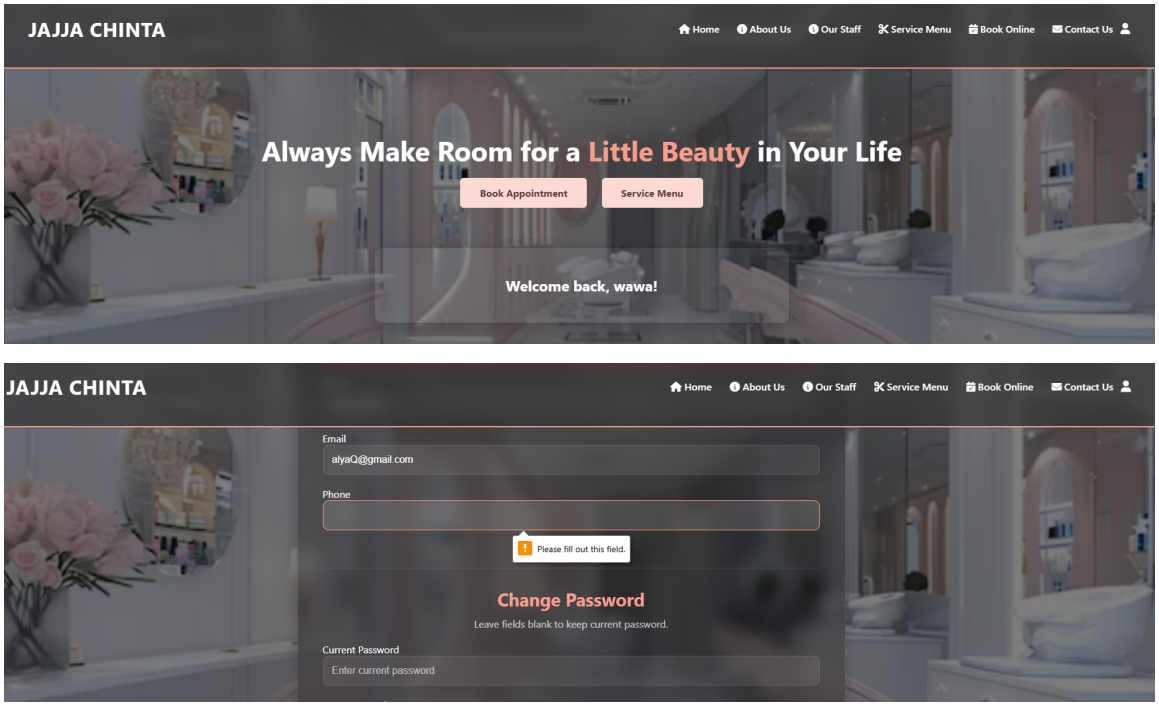


Fig. 7. Examples of interfaces that implement the fourth rule of Shneiderman's Eight Golden Rules

v. Offer Simple Error Handling

The fifth of Shneiderman's Eight Golden Rules prevents errors when possible, and when errors do occur, the system should help users recognize, understand, and recover from them easily. In the E-Appointment System of Jajja Chinta Hair Salon, we enable users to identify errors by providing clear messages. For example, the message "Time Unavailable" will appear if the user chooses a time that the chosen stylist is not available. This example is illustrated in Fig. 8.

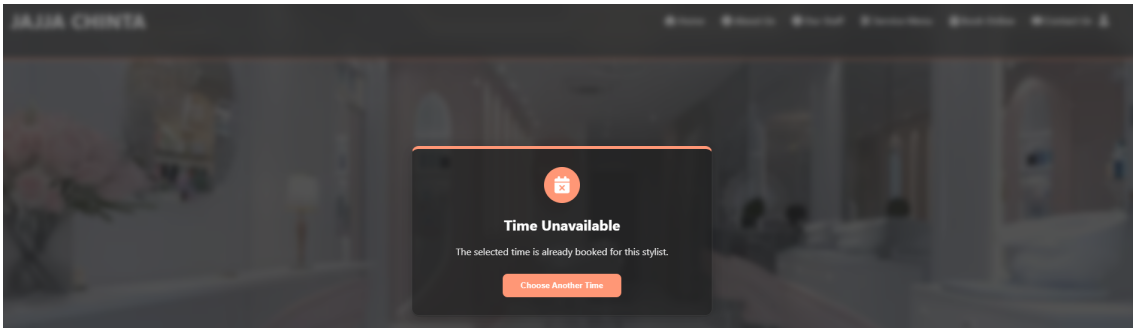


Fig. 8. Examples of interfaces that implement the fifth rule of Shneiderman's Eight Golden Rules

vi. Permit Easy Reversal of Action

"Permit Easy Reversal of Action" is the sixth rule of Shneiderman's Eight Golden Rules. This rule ensures that the interface design allows users to undo or redo actions easily. In other words, this rule lets users feel at ease and have a sense of control over their actions. In this E-Appointment System, we provide navigation buttons and links, including Back, Next, Cancel, Continue, and Close. Fig.9 shows examples of how we implement this rule in the E-Appointment System.

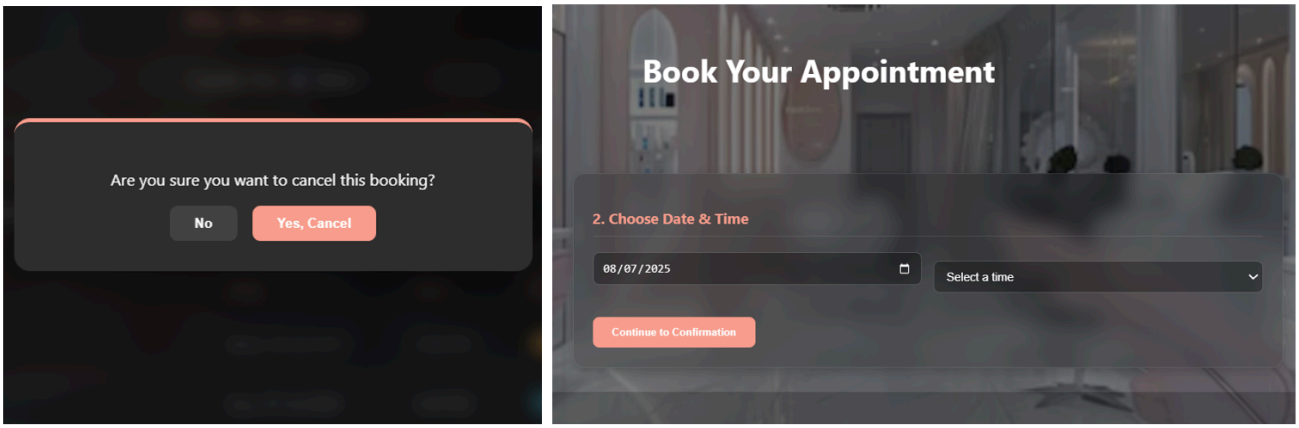


Fig. 9. Examples of interfaces that implement the sixth rule of Shneiderman's Eight Golden Rule

vii. Support Internal Lokus of Control

This seventh rule of Shneiderman's Eight Golden Rules emphasizes that the interface design of the system allows users to feel they are in control of the interface and their actions, rather than the system controlling them. In the E-Appointment System of Jajja Chinta Hair Salon, we not only allow users to navigate freely through the system but also implement a rule that enables them to choose their desired stylist and update their profile. The system also allows users to schedule appointments that are convenient for their time, date, and desired services. Fig. 10 shows the examples of interfaces that implement this rule in the E-Appointment System.

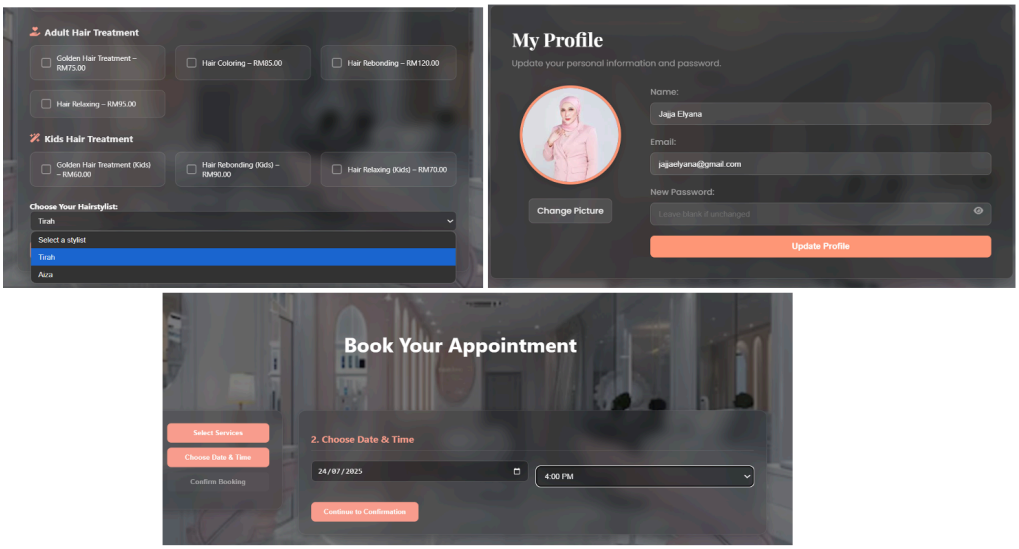


Fig. 10. Examples of interfaces that implement the seventh rule of Shneiderman's Eight Golden Rules

viii. Reduce Short-Term Memory Load

This last rule of Shneiderman's Eight Golden Rules emphasizes minimizing the amount of information users must remember when interacting with a system. In the E-Appointment System, we assist users by providing navigation buttons or links from one step of booking to another. Additionally, we ensure that all the information you provide to the system is saved, so you never lose your information when navigating forward and backward. To ensure users insert essential information about booking an appointment, the system sets the Next step button to remain greyed-out if users haven't chosen or ticked at least one option in the booking appointment section. This action prevents users from advancing with an empty selection. Fig. 11 illustrates an example of this action.

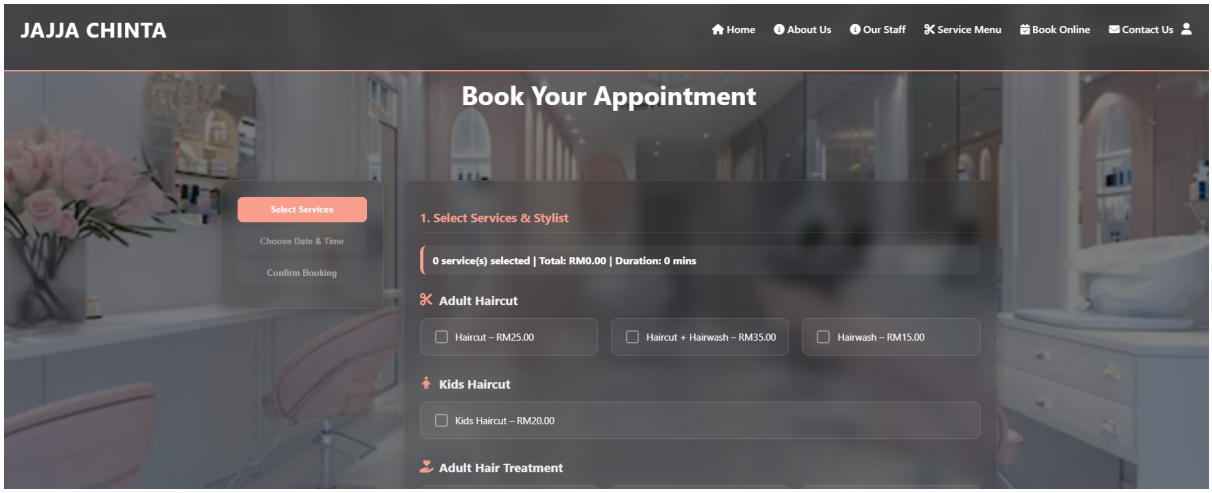


Fig. 11. The Next step button remains greyed out because users haven't chosen or ticked at least one option in the booking appointment section

6. Conclusions and Future Works

In conclusion, this study successfully designed a user interface for the E-Appointment System that is tailored for SME service businesses by implementing Shneiderman's Eight Golden Rules. The output of this study demonstrates that each rule implemented significantly contributes to enhancing interface usability, user satisfaction, and operational efficiency. This system provides a user-friendly experience that empowers both customers and staff by striving for consistency, seeking universal usability, offering informative feedback, and supporting an internal locus of control. Furthermore, simple error handling, easy reversal of actions, clear dialog closure, and reduced memory load minimize user frustration and help users interact with the system more intuitively. The E-Appointment System gains many benefits from the implementation of Shneiderman's Eight Golden Rules, including reduced appointment conflicts, enhanced customer engagement, streamlined scheduling processes, and improved customer information management. Shneiderman's principles not only resolve existing issues in manual booking but also foster a more professional, trustworthy image for SMEs.

The future work of this study will focus on developing the full prototype of the E-Appointment System and conducting usability testing involving users from the SME service sector. The result of testing will help refine the interface further and validate the effectiveness of Shneiderman's Eight Golden Rules in real-world deployment.

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