HOT DESKING BOOKING MOBILE APPLICATION DESIGN

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1. Abstract

With the shift from a fixed desk arrangement to a hot desking arrangement in certain parts of Defence Science & Technology Agency (DSTA), users may face challenges that negatively impact their work experience. In this project, the Double Diamond model was adopted to design a hot desking booking mobile app that will address these issues and improve users' hot desking experience in the organisation. It was gathered through research that hot desking was unpopular due to new pain points such as users needing to cable lock laptops and having to walk to their lockers daily, which wastes extra time and effort. With features such as scanning a QR code to book a seat or finding colleagues without needing to text them, this app was designed to be as efficient as possible for users to minimise their time and effort wasted in their hot desking experience.

2. Introduction

As the present-day workplace evolves to accommodate flexible working arrangements, hot desking has gained traction as an approach to optimise office space. To understand the feasibility of hot desking in DSTA, a hot desking pilot is being conducted on Level 20 and 21 for the staff in Human Resource (HR), Corporate Planning & Services (CPS) and Legal. By eliminating the practice of fixed desks, hot desking allows employees to choose their workstations based on their personal preferences, encouraging collaboration and flexibility in the office.

Despite this, effective hot desking management tends to bring about challenges concerning desk availability, resource allocation, and user experience. Hence, this project seeks to understand the needs and wants of the hot deskers in DSTA in order to tackle these challenges and design a functional hot desking booking app prototype with features that will benefit the users of said app.

3. Materials & Methods

To design a functional app that caters to the users' experience, I adopted the Double Diamond model. The Double Diamond model is a design process comprising four stages: Discovery, Define, Develop and Deliver.

Figure 1. *Visual Diagram of the Double Diamond Model [1]*

These four stages alternate between converging and diverging perspectives, where we need to explore and solve the problem with an open mindset before zooming in on the ideal solution and product [1].

3.1 Competitor Analysis

I started off the "Discover" phase by analysing booking apps from other organisations, gathering the key strengths and weaknesses of their interface. From there, the main features of the hot desk booking app can be derived from building on the strengths and minimising the weaknesses of the competitors' apps.

From the apps, I put together several key features that I could consider:

1) Floor plan can be shown when booking a seat
2) Users can choose seats that have desirable features
3) Capacity of each floor can be shown
4) Information of seats can be provided to the user
5) Future bookings can be viewed by the user

3.2 Initial Assumptions & Hypothesis

Subsequently, I came up with several assumptions that users in DSTA are facing without the app:

1) When coworking, users feel that it's troublesome to constantly inform their colleagues of where they are seated
2) Users feel that it is troublesome to manually check if certain seats are available or if the hotdesk area is full
3) Users feel annoyed at vacant seats that are excessively hogged for extended periods of time

Based on these assumptions, I devised multiple hypotheses in which users could benefit from specific features:

1) Having the ability to see where colleagues are seated would help users to find their colleagues without much hassle
2) Showing the capacity of the hot desk area would help users decide whether or not they want to book a seat at a given time
3) Displaying a floor plan would help users to quickly book and find their seat
4) Allowing users to see current and future bookings would help them to better keep track of their bookings

3.3 User Interviews

To validate my assumptions and hypotheses, I conducted user interviews with six employees from HR and Digital Hub (DH) to find out about their current hot desking experience. With this, I can understand their considerations when choosing a seat and what their pain points are when hot desking. This will help me to develop empathy for the users and allow me to shape my user personas around their behaviours and goals, where the app can be designed for them. For the list of interview questions, see Annex A.

From the interviews, I gained several key insights from the employees:

1) Most interviewees would prefer to know where their team is and sit near them
2) Generally, interviewees would like to know the availability of the seats at any given time
3) When hot desking, most interviewees tend to choose seats that suit their ideal working environment
4) Several interviewees are frustrated over the proximity of their seat to their locker
5) All interviewees are neutral or prefer their fixed desks over hot desking

3.4 User Survey

From the survey sent out by CPS to the pilot users at Level 20 and 21 in October 2023, I could extract more key insights about the hot desking situation to have a better grasp on their experiences:

1) Most users are often seated near their team
2) Hogging is not a major issue in the workplace, given that over 75% of users have not witnessed any instance of hogging
3) Among all the seats, the regular workstations and height adjustable desks are the most preferred and used seats
4) Lack of seats is not a major issue; there is a low occupancy of seats and most other workstations are often always available
5) An overwhelming majority of users find their hotdesking experience to only be satisfactory or good

3.5 Observations

To take a closer look at the hot desking spaces, I went to the hot desking area at the front wing of Level 20 over 2 days. On a Wednesday, about 50% of all the seats were occupied, with nearly all of them on the regular or standing desks. Meanwhile on a Friday, only about 10% of seats were occupied, with all of them on the regular or standing desks.

3.6 Visioning with Strategic Plans

For me to further understand the reason behind the hot desking efforts in DSTA, I consulted Strategic Plans, the department in charge of the whole hot desking situation in the company. From them, it was further reaffirmed that hot desking was not very well received in DSTA. They expressed that users want a sense of ownership in DSTA, and that occupancy was lower than expected. However, as DSTA is growing in numbers each year, and it is at the point where new hires do not have their own seat anymore, there is a possibility that hot desking will continue to be rolled out in the organisation.

From my research, it was clear that most of my initial assumptions proved to be invalid – the occupancy of hot desking spaces was low and users faced no issue finding an available seat to work on. Nonetheless, my research and Strategic Plans' inputs gave me an alternative direction to work on. Due to the shift to a hot desking arrangement, users often have pain points such as cable locking their laptop, and needing to walk to their locker to retrieve their cable locks. Furthermore, according to The Business Times, "...hot-desking has taken offices by storm." [2]. With the growing popularity of hot desking and as DSTA grows in numbers, more fixed desk spaces may be converted into hot desking spaces to accommodate the increase in employees. As

hot desking efforts may continue to expand in DSTA, the app should be designed to be scalable with the number of floors that have hot desking areas and more importantly, to minimise their current challenges faced due to hot desking, thus improving their hot desking experience.

3.7 "How Might We" Statement

"How Might We" statements mark the start of the "Define" phase and help us to come up with innovative ideas that solve the needs of the users [3]. In view of my research, I formulated a "How Might We" statement following the Employee Experience Framework by the Employee Experience Chapter in the DI & UX Team.

Thus, my "How Might We" statement was "How might we design an app for employees that encourages collaboration, benefits their health & wellbeing and gives them a sense of belonging & purpose while equipping them with an easy to use app which will improve their hot desking experience, in an environment with social opportunities that will foster a supportive and smart office?"

3.8 User Persona

A user persona is a made up depiction of a model user [4]. The user persona is formed from the user research, so that this app can be developed such that it fits the needs of the intended audience.

To start off, I came up with a primary and a secondary user persona (for the results, see Annex B). The primary user persona is the target audience whom I would design the app around, whereas the secondary user persona is an additional group of users that may improve the app's user experience (UX) through extra features.

The primary user persona, Jacob Koh, is someone who wishes to spend as little time as possible on his hot desking experience. Whereas the secondary user persona, Anna Chua, is a new employee who wishes to find the most suitable seat for her. Therefore, I plan to design this app to be both efficient and user-friendly so that users like Jacob do not find it a hassle to use the app, while also having features for users like Anna to discover seats that will suit her needs.

3.9 User Journey Map

By following my user persona, I charted out the As-Is User Journey Map (UJM) that displays how the user personas would currently go about achieving their objective without the product [5]. This allows me to understand the user's emotions and pain points when hot desking to think of what I can do to enhance their overall experience. The UJM mapped out how Jacob and Anna would go about their day at work while hot desking. For example, finding a suitable seat, cable locking their laptop and clearing their table at the end of the day are some touchpoints that they go through every day. For the full results, see Annex C.

4. Results

4.1 User Stories & Prioritisation

A user story is a concise description of a product's feature from the user's viewpoint. They do not explicitly describe the solutions – rather, they detail the goal the user wants to accomplish [6]. This allows me to understand what the user wants, so that I can concentrate on the user's goals and think of the best possible solution for them.

After coming up with the user stories, I had to prioritise them based on their importance to the app. I used the MoSCoW method, which is an acronym that stands for "Must Have", "Should Have", "Could Have" and "Won't Have" (for the full results, see Annex D).

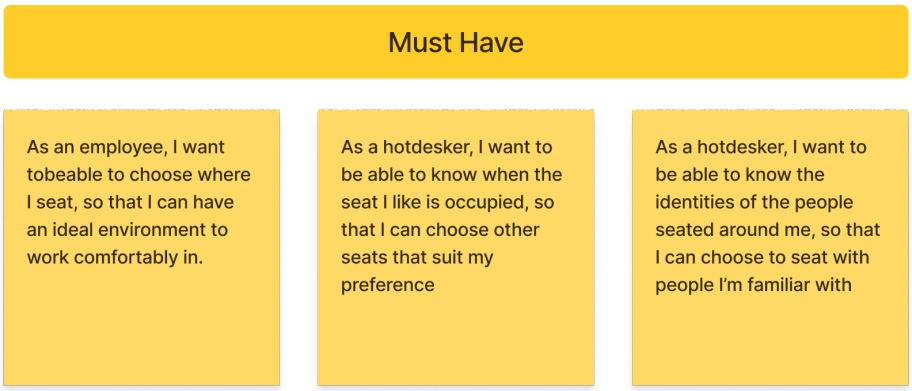


Figure 2. *Diagram of "Must Have" user stories*

4.2 User Flows

A user flow is a diagram that displays the full, detailed course a user would take to complete a specific task [7]. Based on the most relevant features, I visualised how users would navigate the app and proceeded to plan out four main flows which users will take to achieve their goal. To see all four flows, refer to Annex E.

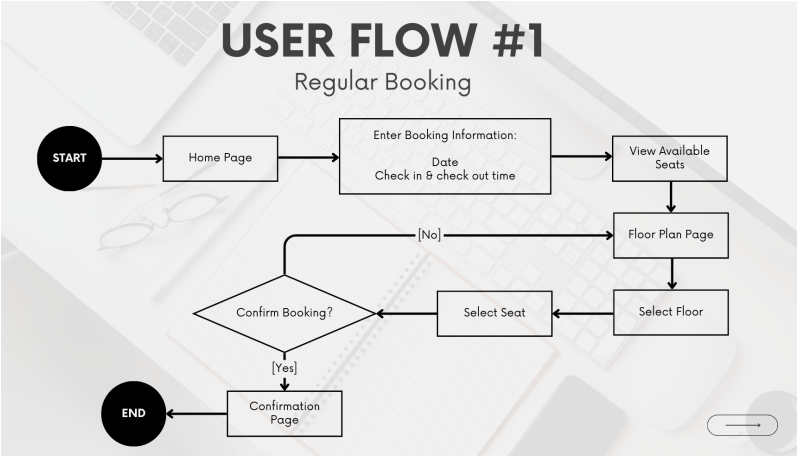


Figure 3. *Regular Booking user flow*

Our first main user flow, “Regular Booking”, is for the user to see the floor plan & reserve their seat in advance. Meanwhile, “Fast Booking” is for the user to book a seat on the spot by scanning a QR code on the desk. The third flow is for users to know who they are going to be sitting beside by viewing their neighbours in their upcoming bookings. Lastly, the fourth flow is so that users can find their colleagues and how long they will be sitting for.

4.3 Low-fidelity Wireframes

The “Develop” phase begins with the low-fidelity wireframes. Following the 4 main user flows, I proceeded to draw low-fidelity wireframes so that I could have the skeleton of the app. Low-fidelity wireframes are rough sketches of the user interface (UI) that provides us an outline of how the product will look like. As they are only a basic outline, a lot of the product’s details can be changed later on when one proceeds to the mid-fidelity and high-fidelity prototypes.

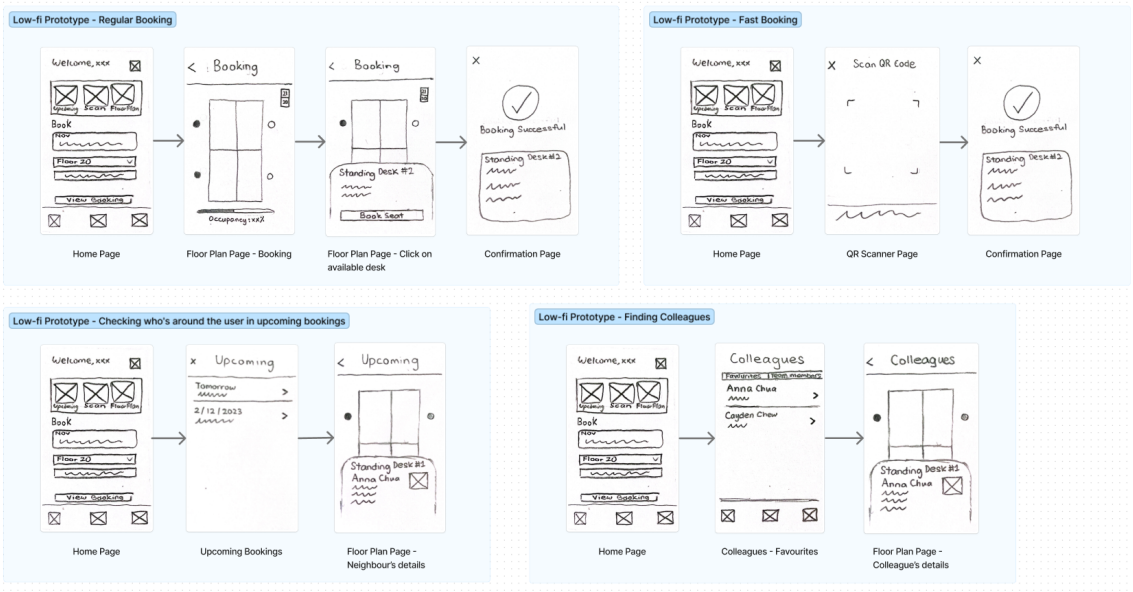


Figure 4. *Screens of low-fidelity wireframes*

4.4 Mid-fidelity Prototype

After designing the low-fidelity wireframes, I headed on to design the mid-fidelity prototypes using Figma (for more pictures, see Annex F). This gave me a clear layout of what the app will look like, especially after I head on to design the high-fidelity prototype in the future.

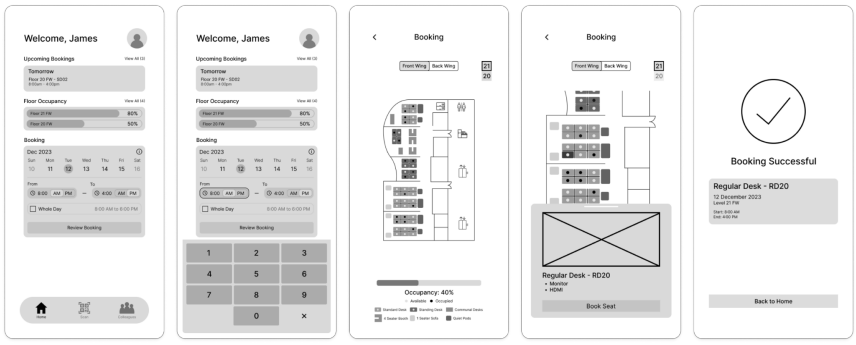


Figure 5. *Samples of mid-fidelity screens*

4.5 Guerrilla Testing

To test out how user-friendly the app was in the mid-fidelity state, I conducted a short guerrilla usability test (UT) with 2 participants from DH to see how users would navigate through the app.

From the guerrilla UT, I discovered many areas for improvement that the app could have. For example, the “Booking” header in the home screen (See Figure 6) may be ambiguous to users, and should be changed to something clearer like “Book a Desk”.

Furthermore, users would generally prefer to make a reservation than to see the floor occupancy, which meant that the “Booking” section should come before the “Floor Occupancy” section. I also realised that I should standardise everything throughout the different screens, as the app had a lot of inconsistent padding and font sizes for headings and body text.

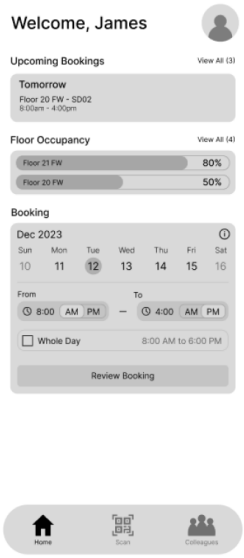


Figure 6. *Mid-fidelity home screen*

4.6 High-fidelity Prototype

After the guerrilla UT, I moved on to the “Deliver” phase, where I designed the high-fidelity prototype by making improvements to the design based on the feedback given.

This stage involves adding detailed elements like colour and images, bringing the prototype closer to the end product.

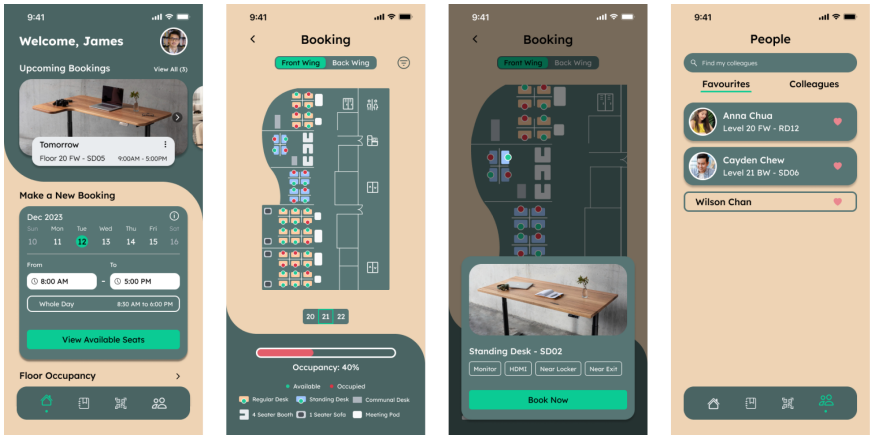


Figure 7. *Samples of four high-fidelity screens*

4.7 Usability Testing

In a UT session, participants are given scenarios and tasks which they would need to complete and give feedback on their experience using the product. I consulted 4 participants from DH and gathered their qualitative (comments) and quantitative (survey metrics) data to understand the areas of the app that need improvement. For the list of scenarios and tasks, see Annex G.

To collect their quantitative data, I would be using the Perceived Efficiency, Single Ease Question (SEQ), System Usability Scale (SUS), and Net Promoter Score (NPS) methods. For me to understand the participants' perceived efficiency, I asked them to rate their satisfaction with the amount of time it took to complete each task from a scale of 1 to 7, with 1 being very unsatisfied and 7 being very satisfied.

Meanwhile, to understand how challenging the tasks were, I asked them the SEQ, where they rated how difficult or easy they found each task on a scale of 1 to 7, with 1 being very difficult and 7 being very easy.

The results, shown on the right in Figure 8, tells us that multiple people rated Task 1.1 and 1.2 with 6 out of 7 for both questions, indicating that there is still room for improvement for those features.

Grade	Fair	Good	Exceptional
Score	5.5	6	6.3

Perceived Efficiency

Scenario 1		
Participant	Task 1.1	Task 1.2
P1	7	6
P2	7	6
P3	6	7
P4	6	7
Efficiency Score	6.5	6.5

Scenario 2		
Participant	Task 2.1	Task 2.2
P1	7	7
P2	7	6
P3	7	7
P4	7	7
Efficiency Score	7	6.75

Single Ease Question

Scenario 1		
Participant	Task 1.1	Task 1.2
P1	7	6
P2	7	6
P3	7	7
P4	6	7
SEQ Score	6.75	6.5

Scenario 2		
Participant	Task 2.1	Task 2.2
P1	7	6
P2	7	7
P3	7	7
P4	7	7
SEQ Score	7	6.75

Figure 8. *Results of Perceived Efficiency and SEQ*

After they were done with the whole UT session, they completed a survey which gathered the SUS and NPS data. As their names suggest, the SUS measures the usability of the app from the users' perspectives, while the NPS is a score ranging from -100 to 100 that measures how satisfied users are with the app and how likely they are to recommend it to their friends. The results are shown below in Figure 9. With a 94.4 SUS Score, this tells us that our app has exceptional usability with a user-friendly UI, whereas a NPS of 75 shows that participants are mostly satisfied with the prototype and would be willing to recommend it to their friends.

System Usability Scale

Scoring	Score	Description
Lowest	1	Strongly disagree
Highest	5	Strongly agree

Grade	Fair	Good	Exceptional
Score	68	74.1	78.9

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Score
P1	4	1	5	2	4	2	5	1	5	1	**90**
P2	4	1	5	1	4	2	5	1	5	1	**92.5**
P3	5	1	5	1	5	1	4	1	5	1	**97.5**
P4	5	2	5	1	5	1	5	1	5	1	**97.5**
										Average	**94.375**

Net Promoter Score

	Q1
P1	9
P2	8
P3	9
P4	9
NPS	**75**

Figure 9. *Results of SUS and NPS*

After synthesising the quantitative and qualitative data from the UT, I understood some flaws in my design. For instance, in Task 1.1, users were tasked to find out who was sitting beside them in their upcoming bookings. However, several participants did not know they could click their neighbour's seat as they thought the other seats were not clickable (see Figure 10 below).

I also had several other findings and suggestions, such as:

1) Most users did not like the background colour, and it should be changed to something whiter
2) Most users found the "Upcoming Bookings" and "People" navigation bar icons confusing
3) Some users found the level selector unclear; some thought it was a page selector, while others simply found it unnoticeable
4) The floor plan should not be entirely darkened as it will lead people to think that the other seats are unclickable
5) The app could indicate where certain people (eg. Favourites) are seated in the floor plan

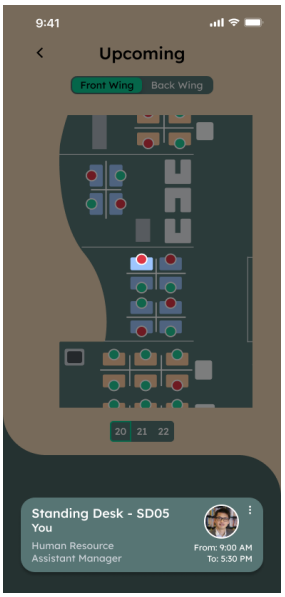
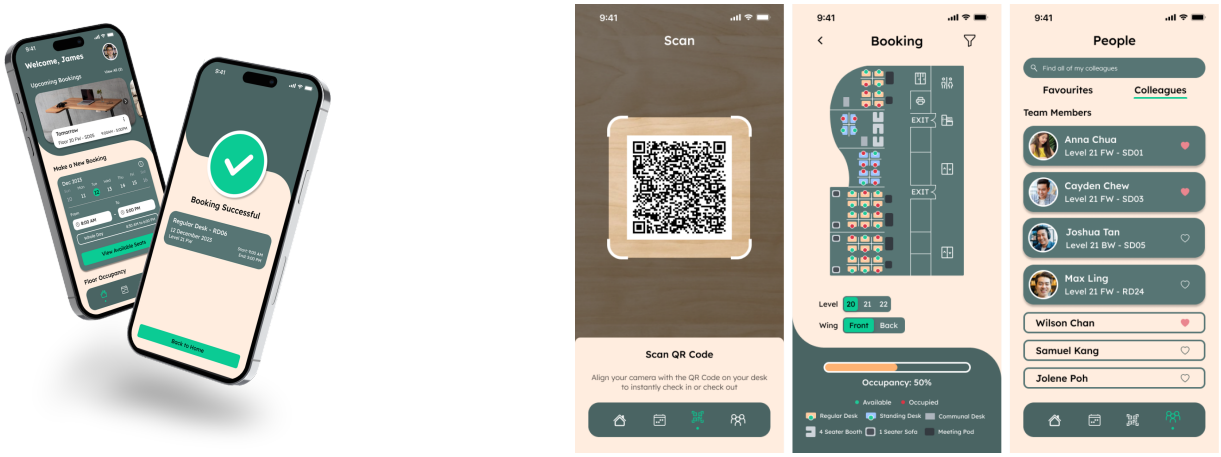


Figure 10. *Upcoming Bookings screen*

4.8 Final High-fidelity Prototype

Based on the synthesised insights from the UT, a list of design improvements was created and prioritised according to impact and effort required. This prioritised list was used in the final iteration of the high-fidelity prototype. For the full results, refer to Annex H.



Figures 11 & 12. *Samples of final iteration of high-fidelity prototype*

At the end of our final high-fidelity prototype, we had several finalised key features for users:

1) The ability to book a seat in advance
2) The option to book a seat by scanning a QR code on the desk
3) The ability to see who is sitting beside the user in future bookings
4) The ability to see where one's colleagues are seated
5) A filter function for users to seats by their attributes (eg. Near Lockers)

6) The ability to see the capacity of the floors in real time
7) A “You Might Like” section where users are recommended seats they might be interested in based on what they previously booked

5. Discussion

5.1 Potential Improvements

As with all products, there are possible improvements for my design that can be made even after the final iteration.

One possible example is how “Upcoming Bookings” could use a carousel design, which will make it easier to navigate through future bookings instead of having to press a button to do so.

Another possible improvement can be to include staff from other programme centres (PC), as multi-PC projects require staff to consult people from other PCs.

5.2 Next Steps

Due to time limitations, there are several features that could not be added but could help users in their hot desking experience. For instance, a feature where users can book by a certain seat (instead of a certain time slot) so that they can come to office when said seat is available, or a pathfinding feature where the app shows the exact way to get to a colleague’s seat, which would mainly benefit new employees like Anna Chua.

6. Conclusion

To summarise, this hot desking booking app addresses specific challenges faced by pilot users identified through our user research. With features like scanning a QR code to book a seat and finding where one's colleagues are seated, the app aims to minimise user efforts and enhance the overall hot desking experience in DSTA.

7. Acknowledgements

I would like to express my gratitude for my mentors Lee Kee An and Goh Jun Rui from the DI & UX team for their guidance in this project. They have provided a lot of helpful feedback throughout this entire internship and taught me a lot in my time here. I could not have completed this project without their support.

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Lastly, I am also grateful to Eileen Leong (DH), Clio Chuang (DH), Cheryl Koh (DH), Tan Zi Ting (DH) and Andy Ng (DH) for taking part in the UT and giving me feedback for this project.

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Annex A: Interview Questions

Interview Questions	
Could you let me know about your role in the organisation?	
Can you walk me through a typical day from when you enter the office to when you get off work?	
[Interviewees who hot desk]	[Interviewees who do not hot desk]
What are your pain points on the current hotdesking process?	Have you ever tried hotdesking? [If yes] Could you share with me your experience? [If no] Could you share with me why?
What do you usually consider when choosing a hotdesk seat?	What are your thoughts on the current hotdesking process?
How often do you use hotdesking spaces?	What are the reasons that you prefer your fixed desk over hotdesking?
Do you tend to use them by yourself or with colleagues?	Are there specific instances where you would prefer hotdesking and what are the considerations?
What is the percentage of occupied seats on a typical day?	Are there features you wish to see in a hotdesk booking app which will be a useful tool for all staff?
Do you usually prefer to hot desk or to sit at your fixed seat, and why?	
Could you tell me some differences in your work process when hot desking as compared to working on a fixed seat?	
What features would you wish to see in a hotdesk booking app which will increase the take up rate of hotdesking?	

Annex B: User Personas

Primary User Persona

Profile

Jacob Koh, 32 years old

Background & Context

HR Talent Acquisition Manager

- Has been in DSTA for around 3 years
- Plans and executes recruitment drives with his team members
- Has to leave his seat for meetings and events from time to time
- Prefers to seat on the new standing desks if they are unoccupied

Quotes

"Time is of the essence, every moment counts. Finishing my work as soon as possible is something I strive to achieve everyday!"

Goals

- To be able to locate an available standing desk without having to go through the hassle of physically searching for one
- To choose a standing desk as close to the lockers as possible
- To know where his team members are without needing to physically look for them

Needs

- To quickly check if the standing desks are vacant before he reaches office in the morning
- To settle on the seat he wants as soon as he reaches office
- To see which standing desks are closer to the lockers
- To find out where his colleagues are seated so that he can have a short discussion with them when needed

Pain Points

- Cable lock - Having recently switched to hotdesking after 3 years in DSTA, Jacob feels that taking out his cable lock at the end of the day is troublesome and time consuming
- Proximity of locker - Along with the cable lock, Jacob is not used to walking to the locker area everyday
- Location of team members - Jacob has to find his team members or ask where they're at through text, which may take awhile

Figure 13. *Diagram of Primary User Persona*

Secondary User Persona

Profile

Anna Chua, 25 years old

Background & Context

HR Executive

- Has only been with DSTA for around a month
- Prefers to seat by herself or with the colleagues she's close to
- Needs to work with her team members on occasion
- Interested in trying out different seats around the office to see which one fits her best

Quotes

"Setting foot in a new environment takes me a while to adapt. Though it's daunting, I count everyday as an opportunity for me to experience something new!"

Goals

- To experience different seats to find those that suit her ideal working environment
- To sit on a desk which has a monitor
- To sit in areas that are emptier or near the colleagues that she's familiar with
- To know where her team members are when she needs to look for them

Needs

- To easily see the amenities located near her desk
- To see which desks have monitors installed at a glance
- To check if the seat she wants to try out is vacant
- To check if there are too many unfamiliar people surrounding her
- Easy identification of Anna's colleagues so that she can have a short discussion with them or have lunch together

Pain Points

- Proximity of locker - Lockers can be far away from some of the seats she tries out
- Location of colleagues - Anna has to walk around to find her colleagues or ask where they're at through text, which may take awhile

Figure 14. *Diagram of Secondary User Persona*

Annex C: User Journey Maps

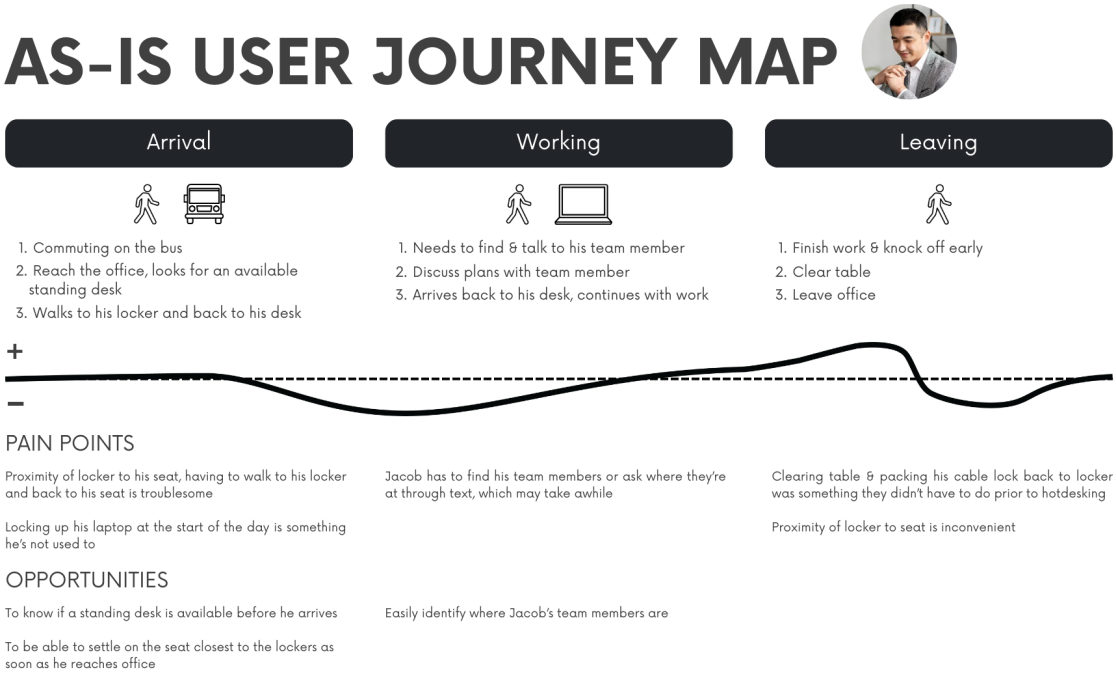

Figure 15. *Diagram of Primary User Journey Map*

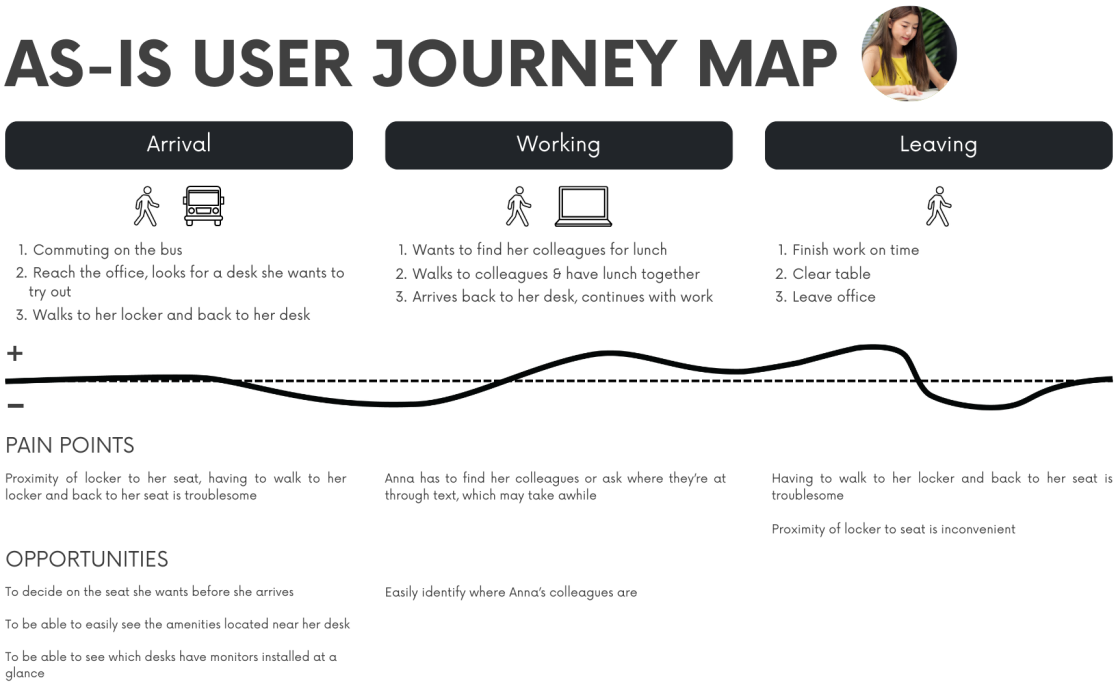

Figure 16. *Diagram of Secondary User Journey Map*

Annex D: User Stories

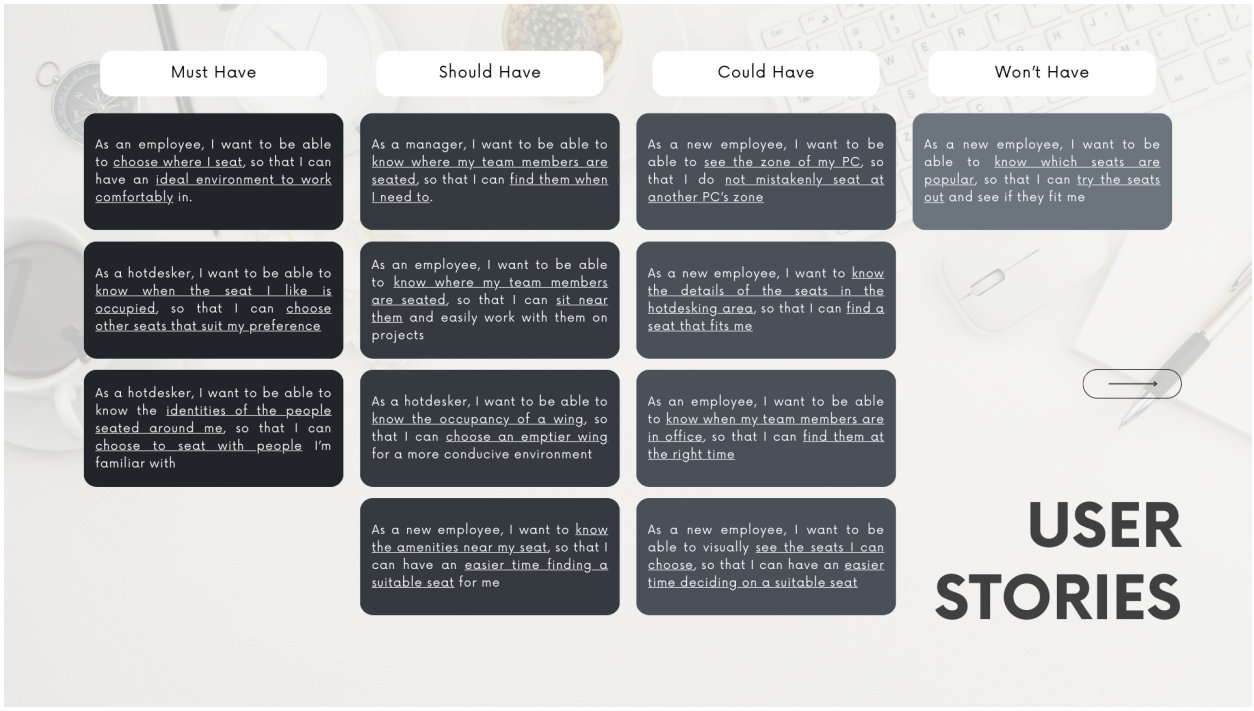

Figure 17. *List of User Stories*

Annex E: User Flows

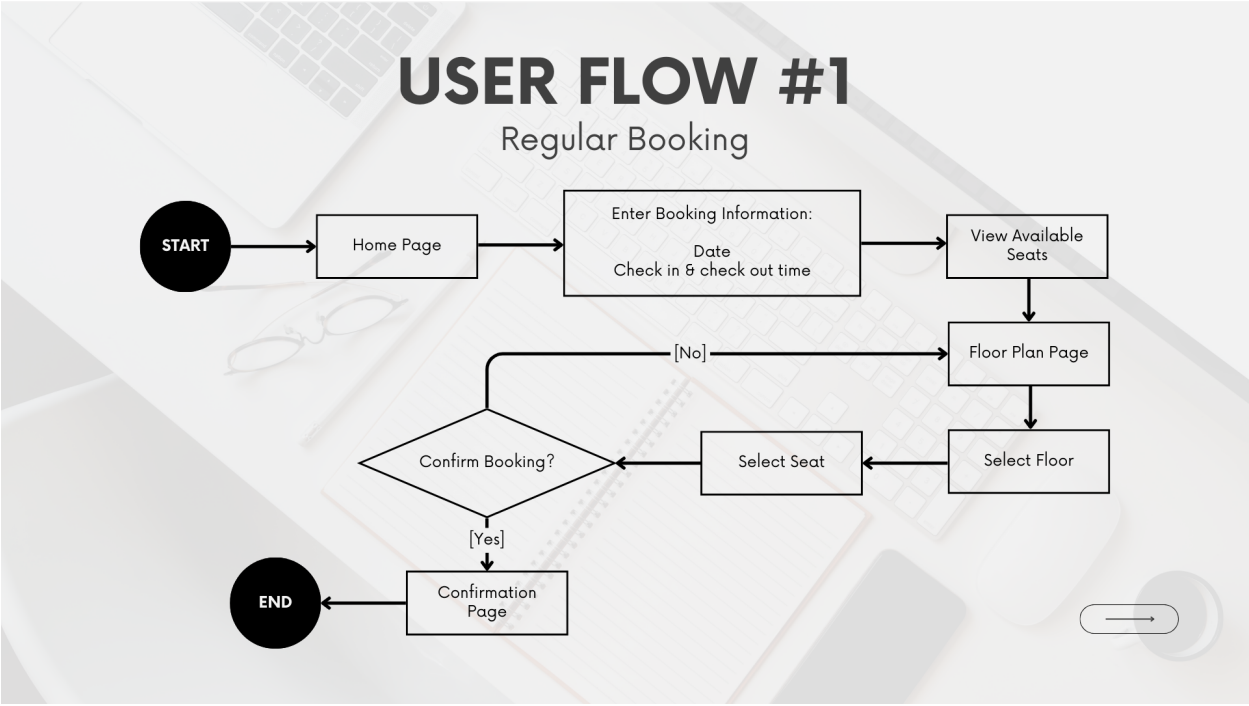

Figure 18. *Diagram of "Regular Booking" User Flow*

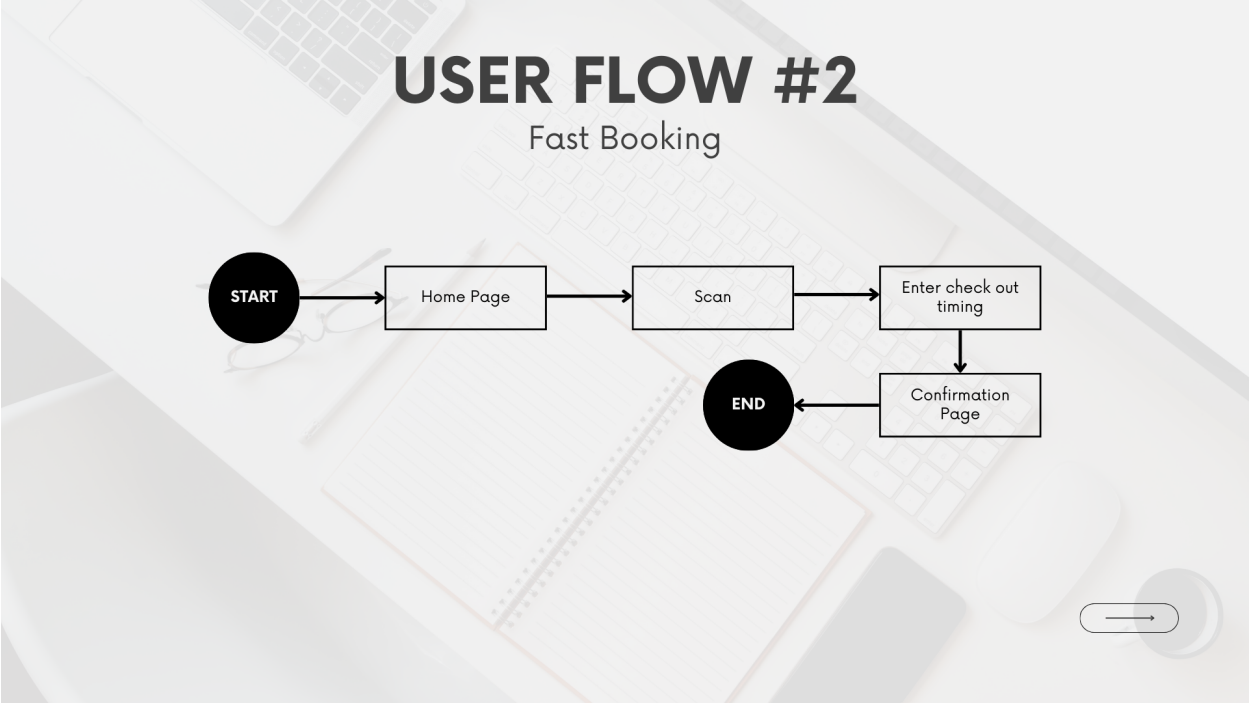

Figure 19. *Diagram of "Fast Booking" User Flow*

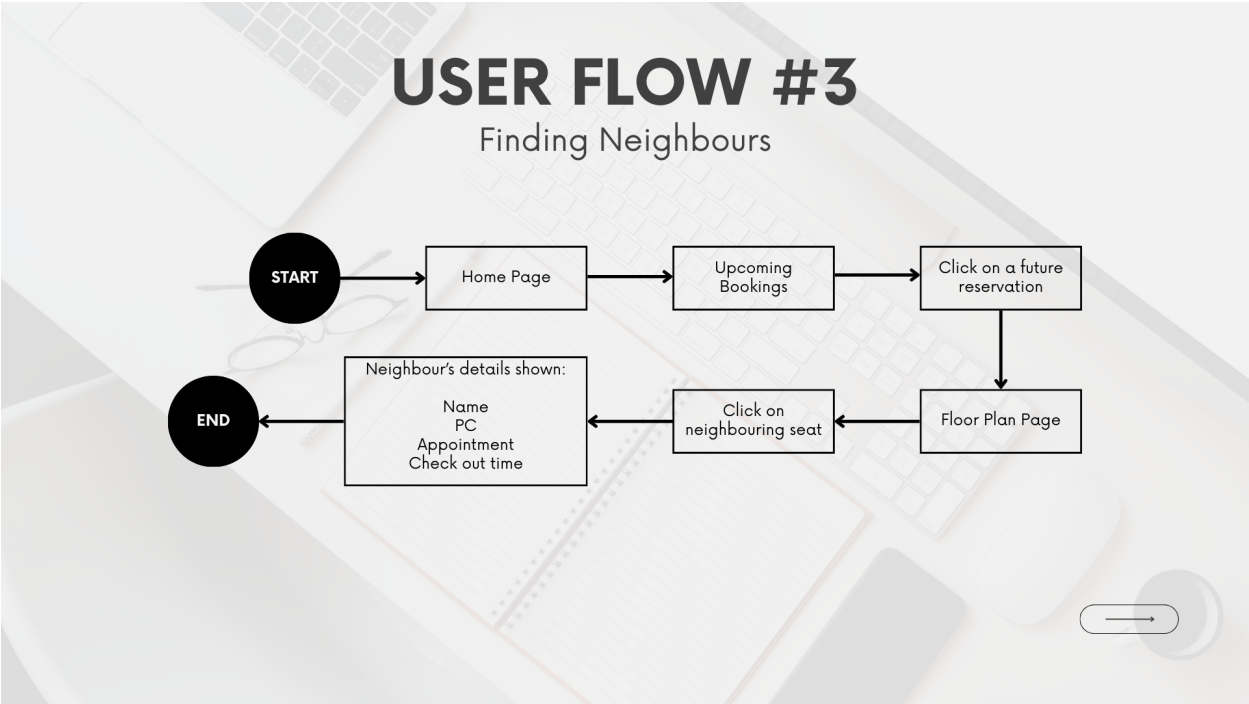

Figure 20. *Diagram of "Finding Neighbours" User Flow*

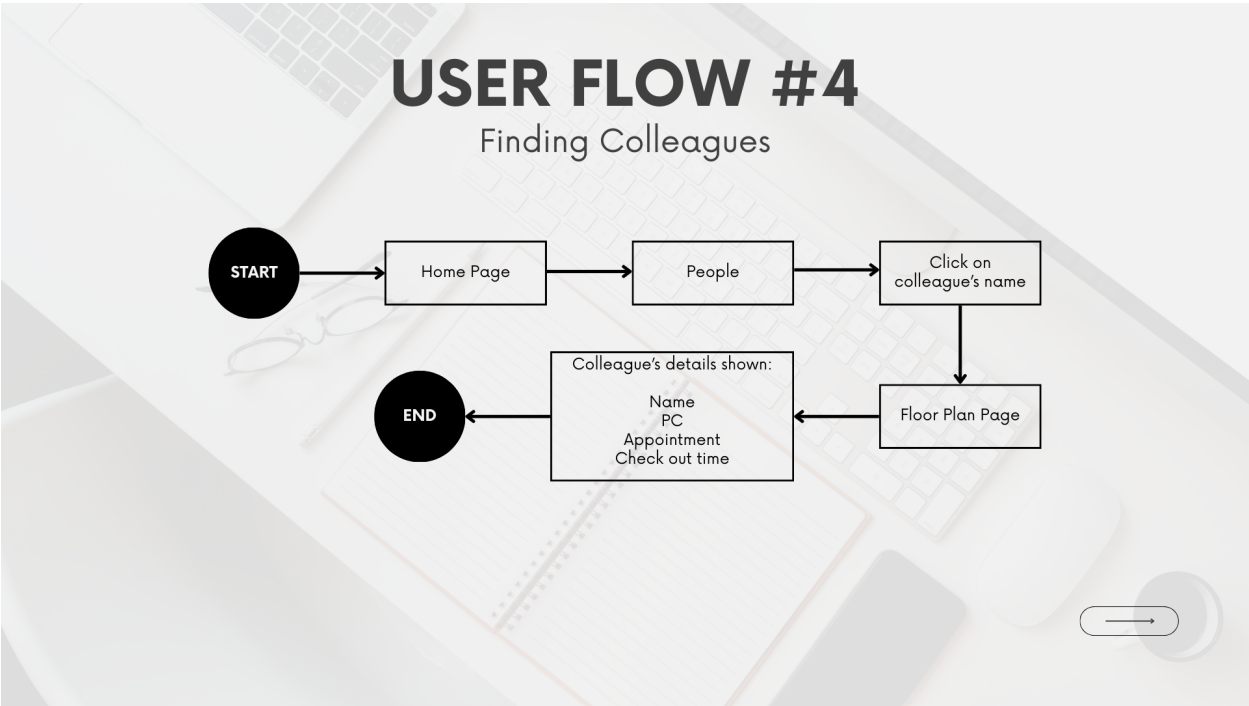

Figure 21. *Diagram of "Finding Colleagues" User Flow*

Annex F: Mid-fidelity Prototypes

Figure 22. *Mid-fidelity prototype of "Regular Booking" User Flow*

Figure 23. *Mid-fidelity prototype of "Fast Booking" User Flow*

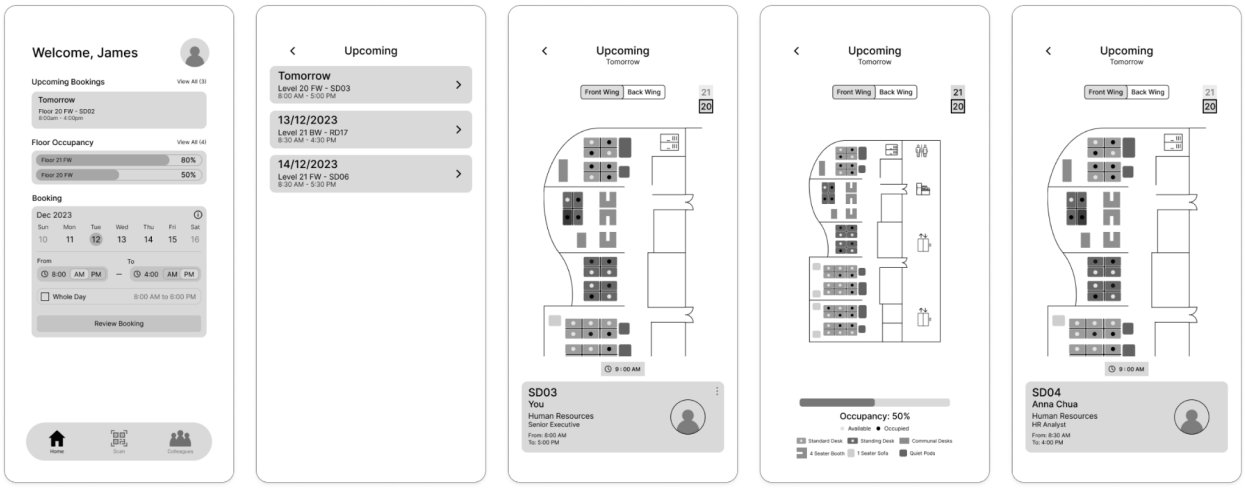

Figure 24. *Mid-fidelity prototype of "Finding Neighbours" User Flow*

Figure 25. *Mid-fidelity prototype of "Finding Colleagues" User Flow*

Annex G: UT Scenarios and Tasks

The scenarios and tasks were:

1. Assuming you are from HR where you are required to hot desk, and you are interested in booking a seat to work.
    1.1. Imagine the date is 12/12/23, and you want to sit on the standing desk closest to the lockers from 9:00 AM to 5:00 PM on the front wing of the 21st floor. Show me how you would book it.
    1.2. Now that you're done booking, you wish to see who will be sitting beside you in tomorrow's reservation. Show me how you would do it.

2. Assuming you are from HR where you are required to hot desk, and you are in front of the desk you want to seat on
    2.1. Imagine there is a QR code on the desk which allows you to book a seat, show me how you would book it for the entire day.
    2.2. After booking your seat, you wish to know where your colleague, Max Ling, is seated and how long he would be seated for. Show me how you would find him.

Annex H: Final High-fidelity Prototype

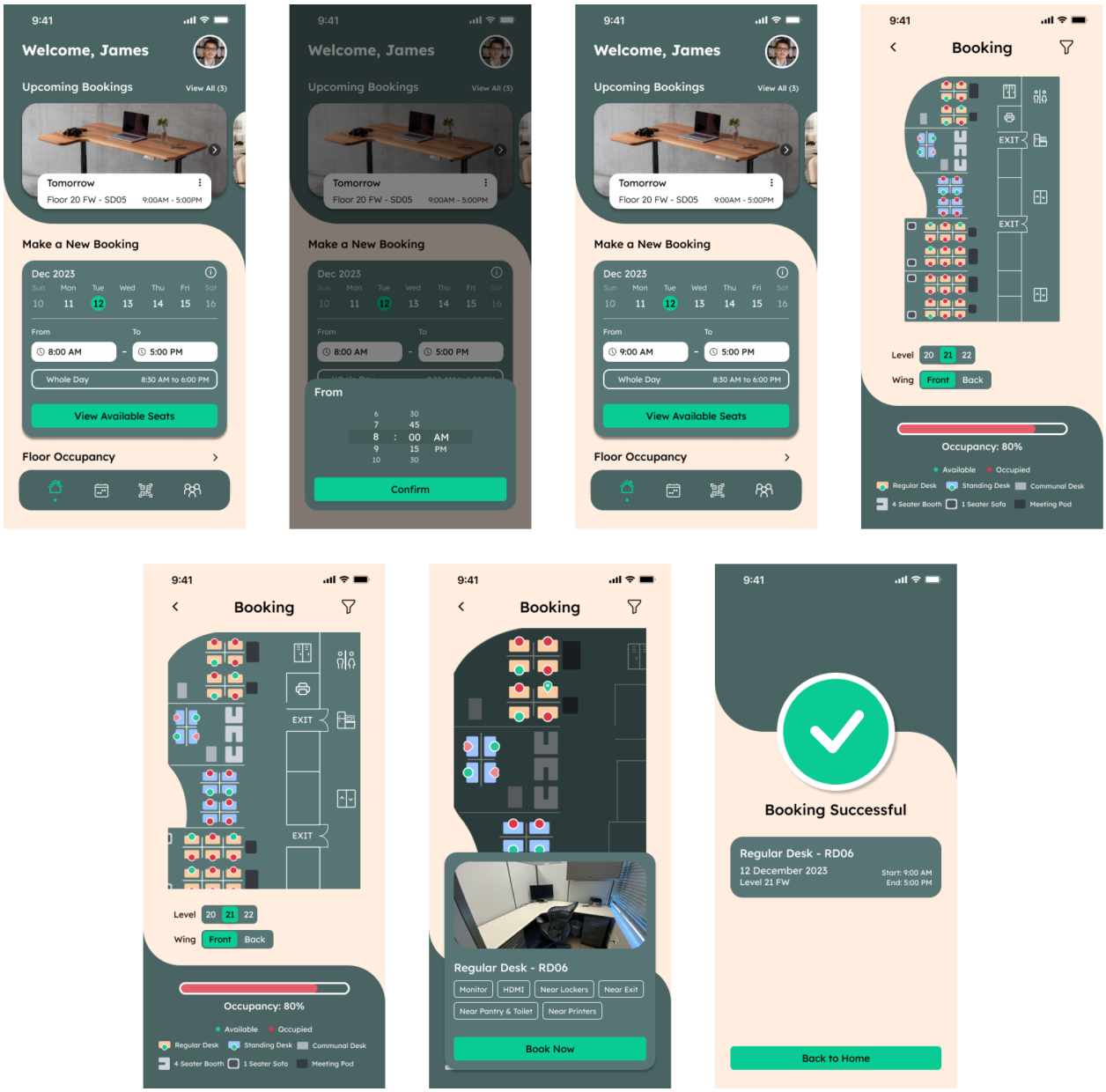

Figure 26. *High-fidelity prototype of "Regular Booking" User Flow*

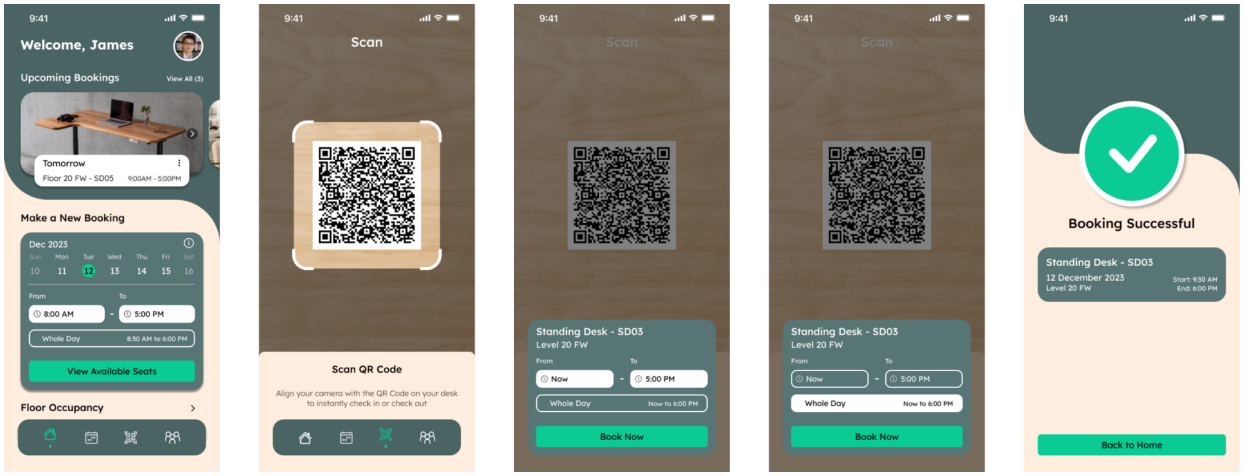

Figure 27. *High-fidelity prototype of "Fast Booking" User Flow*

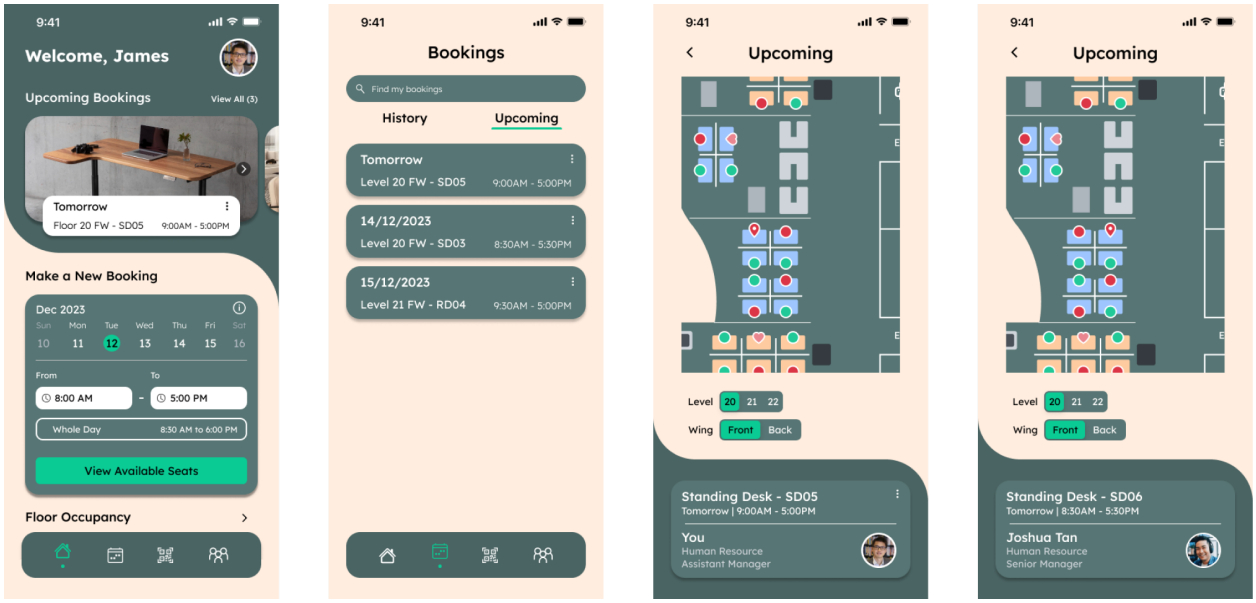

Figure 28. *High-fidelity prototype of "Finding Neighbours" User Flow*

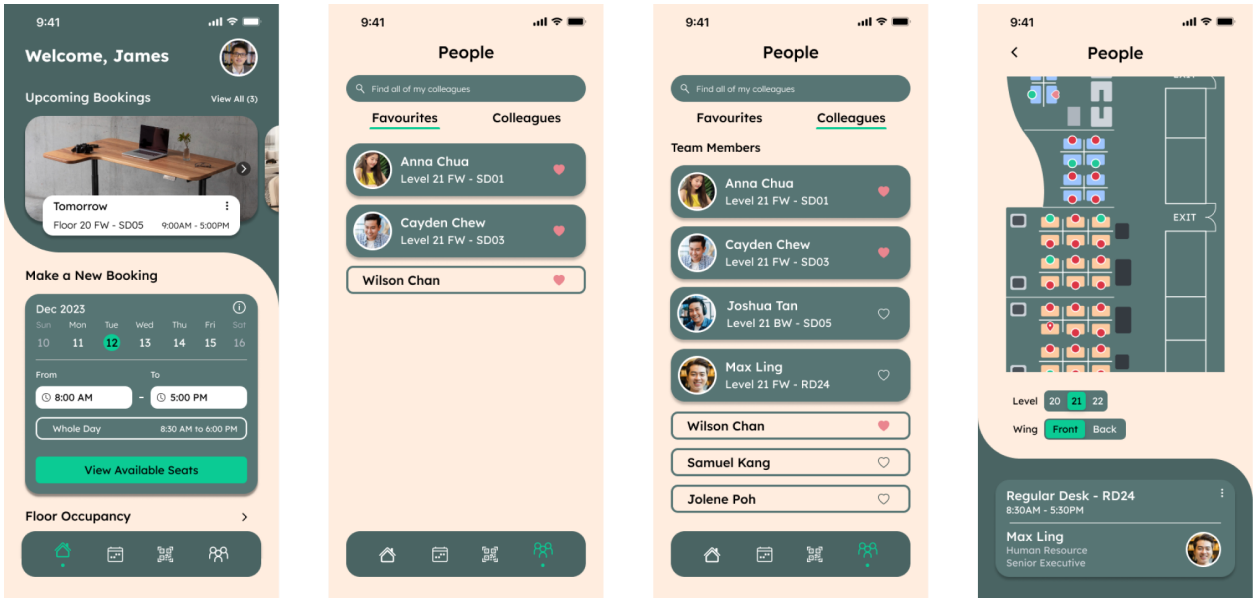

Figure 29. *High-fidelity prototype of "Finding Colleagues" User Flow*