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GP Booking system for elderly users

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Abstract

Many patients have their own GP they want to see and find it difficult to book an appointment on the phone and in person. Elderly patients may have difficulties to book an appointment and cannot travel to their local surgery due to circumstances. Elderly people have a disadvantage when using new technology as they were not raised using it when growing up. This makes it harder for many older users to understand and navigate/use technologies such as websites and applications. This project involves creating an interactive GP booking system prototype to ensure elder users are capable of easily understanding the system and can navigate through the system with no errors. The aim of this is to improve the user experience of online health services in terms of GP services. This project will consist of using the waterfall methodology which will include gathering requirements, design, implementation, testing and evaluation. These phases will contribute in addressing the problem for elderly users and create an interactive booking system to ensure users have an improved user experience to access online health services.

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I would like to give thanks to Professor Rob Macredie, who has helped and given guidance to me this academic year.

I certify that the work presented in the dissertation is my own unless referenced.

Signature



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1 Chapter One Introduction

1.1 Introduction

Online services have become very popular with young people as they use technology more frequently than elderly people (Citizensadvice.org.uk, 2019). Elderly people have a disadvantage when using new technology as they were not raised using it when growing up. This makes it harder for many older users to understand and navigate/use technologies such as websites and applications. However, research suggests that many adults over the age of 65 are still dependent on technology in their daily lives to stay connected to people and to stay up to date with news (Pew Research Center, 2019).

Yet, despite this there is evidence that older people do not seem to be using technology, in the form of online service, to access healthcare, with the suggestion being that the services are poorly designed and difficult to use (England, 2019). GP websites for local surgeries have been suggested to be the weakest online health services in terms of functionality and features (Ramesh, 2019), implying that these websites tend to be poorly designed, leading users to find the websites difficult to use and to them not understanding how to access the features that are provided online.

Improving the user experience of existing online health services for elderly patients should improve access to healthcare, allowing users to more easily book and cancel appointments, order prescriptions, check on their medical records, and so on. This could lead to lower workloads for receptionists as they would, for example, be taking fewer calls to book appointments, and may reduce GP waiting times owing to fewer errors in the bookings that arise from users' experiences of poor design, for example by offering clearer ways to cancel appointments.

1.2 Aims and Objectives

The aim of this project is to improve existing online health services in the context of GP surgeries by providing a better user experience for elderly users who are over the age of 65, so that they can more easily navigate and use these online health services than is currently the case. This will be done by making it easier for elderly users to navigate around a booking system smartphone application and make it clear to book appointments, cancel appointments

and more. This will allow elderly users to be more confident using the booking system and to make less mistakes while using it.

The aim will be met through the following objectives:

1. Background investigation – The background research will analyze relevant research in areas related to the use of technology by older users and will highlight the importance of design techniques that make user experience more user friendly. Further research will be conducted to determine why online health services are poorly designed such as by looking at existing services and analyzing the problems with them. Moreover, UX literature will be researched to look at methods and theories that may help to improve user experience, with a particular focus on older users.
2. Design – based on the findings from the background investigation an appropriate design method will be used, such as prototyping to show how the application will look as design will be a main focus of this project. This will be done by gathering information from research online and looking at existing problems with online health services user experience. This will lead to designing low-fidelity and high-fidelity prototypes. Moreover, conceptual designs will be created to understand how the booking system will operate, this will be done by making user flow diagrams and use case diagrams. This will also help understand how many screens need to be designed before it is implemented.
3. Implementation – By using the prototypes from the design objective, develop a working prototype by using design software's such as Sketch and Adobe. Furthermore, using the relevant methods to complete the front-end development of the application to ensure that it meets the requirements/needs of elderly users so that they can use the application with ease and have fewer problems using and navigating the online services.
4. Testing – based on the implementation of the application, tests scenarios will be conducted to show if the booking system runs and works with all the features that are designed, this will ensure that the booking system is ready and fully working before it is evaluated.

5. Evaluation – Evaluate the prototype of the application with its target user group and analyze the results to determine whether the application meets the user's requirements and so that elderly users can navigate/use online health services more fluently and easier than previous designs of health services.

1.3 Project Approach

The project will consist of four stages, these stages will be done using the waterfall methodology. The first stage is literature analysis, which will involve analyzing relevant literature to identify the problems with existing user experiences of online health services, with a focus on those of elderly users, and strengths that may be adopted in the designs for the project work. Additionally, this phase of the project will look at websites and applications that provide similar, existing services, such as local GP websites which provide online booking services for patients and also UX literature which will provide more information about design concepts and theories, this will allow appropriate research to be conducted as to why the booking system needs to be designed in such way.

The second stage will be to design the solution to the problem and to develop a design prototype to showcase what the solution may look like. This stage will involve designing a website and/or an application for a local surgery using methods such as drawing sketches and using low-fidelity prototypes/paper prototypes. Furthermore, conceptual designs will be made such as user flow diagrams and use case diagrams, this will help understand how many screens need to be designed and what functions they may have.

The third stage is implementation. From the design stage, the prototypes will be used to create a high-fidelity prototype using design software to show users what the final product will look like. The prototype will ensure that the aim is met and that the user experience of the website/app meets the aims of the booking system so that elderly people can use the app without any problems.

The next stage of the approach is testing, in this stage the final version of the booking system will be tested to ensure that it runs and is fully working before it is shown to its targeted audience, so that there is no mistakes when users are using the system.

The last stage is the evaluation, when evaluating this project, testing will be done by presenting the visual design to people and measure the user's reactions by asking controlled questions about their interaction with it (Nielsen Norman Group, 2019).

1.4 Ethical issues

This project involves a group of elderly people in the evaluation stage of the project to assess the developed prototype and subsequently come to a view on whether the aim of the project has been met. As such, ethical approval was required. This was sought and granted through the BREO system. However, circumstances changed and expert based evaluation was looked at to replace the use of using a group of elderly people. The approval letter is included in appendix B. Further detail on the ethical issues in the project is presented in Chapter 6.

1.5 Dissertation Outline/Structure

The remainder of the dissertation is structured as follows:

Chapter 2 will discuss the background research that will be undertaken to research the issues and literature that will help design the booking system. This will involve establishing requirements for the booking system such as the functional requirements and design requirements.

Chapter 3 will discuss how the requirements established in Chapter 2 will be translated into the designs of the booking system. This will involve creating prototypes and conceptual designs of the booking system for a smartphone.

Chapter 4 will discuss the implementation of the booking system, translating the designs of the booking system to make an interactive booking system that users can interact with.

Chapter 5 will discuss the testing phase of the project; this will involve individual testing on the booking system to make sure the interactions users make on it will be fully functional before users can evaluate the booking system.

Chapter 6 will discuss the evaluation phase of the project; users will test out the prototype system and evaluate the system by answering a questionnaire. Results will be discussed and analysed.

Chapter 7 is the last chapter of the project which will discuss if the aims and objectives have been met from Chapter 1. This will establish if the user experience of the booking system created has no problems and users can navigate through the system without any errors.

2 Chapter Two Background

2.1 Introduction

In this chapter, the importance of improving the user experience of existing online GP services for elderly patients will be discussed, arguing that they tend to be poorly designed in terms of their support for elderly patients, and suggesting that designing an improved booking system for GP surgeries would benefit surgery employees and elderly patients. Elderly people are the core user group on which this analysis will focus as they are an age group that often lacks awareness in the use of computer technology. Improving the user experience for elderly people could lead to lower workloads for receptionists in GP surgeries as they would, for example, be taking fewer calls to book appointments, and may reduce GP waiting times owing to fewer errors in the bookings that arise from users' experiences of poor design, for example by offering clearer ways to cancel appointments.

The NHS provides information online which lets patients find out how they can book an appointment with their GPs. Some local surgeries have websites of their own and offer applications on smartphones which make it easier for patients to book an appointment rather than relying on the conventional ways of booking an appointment, in person or by telephone (nhs.uk, 2020).

The use of GP booking systems is in high demand for people in the UK as they represent an easy alternative to calling a patient's local surgery and waiting to find out when appointments are next available (England, 2020). Moreover, they also offer important information for patients, such as their booking times and previous appointment information. Patients who use these booking systems may potentially reduce waiting times to see their GPs because other patients using the system are able to cancel appointments more easily, as the system is more accessible to them through platforms like smartphone applications, allowing these appointments to be offered to other patients. Furthermore, the use of GP booking systems can help users to change their appointments if needed and to see which doctors are available. Moreover, the recent/on-going coronavirus outbreak has led to some patients not attending booked appointments as they are advised to not attend and not to travel (Smith, 2020). This is where the use of an online booking system may help as they can cancel their appointments and change them to when they feel comfortable attending. Also, some local surgeries are

advising that patients do not attend their appointments and are closing down during the outbreak (Blackall, 2020).

2.2 Issues with technology for elder users

Elderly people have a disadvantage when using new technology as they were not raised using it when growing up. This makes it harder for many older users to understand and navigate/use technologies such as websites and applications (Vaportzis, Giatsi Clausen and Gow, 2017). However, research suggests that many adults over the age of 65 are still dependent on technology in their daily lives to stay connected to people and to stay up to date with news (Pew Research Center, 2019). Yet, despite this there is evidence that older people do not seem to be using technology, in the form of online service, to access healthcare, with the suggestion being that the services are poorly designed and difficult to use (England, 2019).

GP websites for local surgeries have been suggested to be the weakest online health services in terms of functionality and features (Ramesh, 2019), implying that these websites tend to be poorly designed, leading users to find the websites difficult to use and to users not understanding how to access the features that are provided online. However, there are strengths to using online GP services as they provide information that patients can access without needing to telephone or visit the surgery, such as the availability of appointments, which include the times and which doctors are available for patients to see (Medium, 2020). Moreover, the use of these services provides higher levels of overall patient satisfaction as travel is reduced as patients do not need to visit their local surgery to receive information such as booking appointments and ordering prescriptions (England, 2020). While these online services offer benefits, it is important that they are designed to be accessible and easily usable for elderly people to use. This is why design guidelines will be looked at to show the importance of changes in colour and font can have an impact on accessibility and usability.

When designing the GP booking system the user experience of elderly people will therefore be looked at to show what problems exist when they use devices through which such a booking system might be accessed, and how they can be overcome to make it easier for elderly people to understand and navigate when using a smartphone or tablet, particularly, as they are devices that an increasing number of people have and use every day (Rise of the Social Seniors revealed, 2020).

2.3 Design guidelines

In terms of supporting good design from this perspective, Zaphiris, Ghiawadwala and Mughal (2005) proposed a set of 38 design guidelines for web-based designs for senior people. These design guidelines still seem applicable for the design of applications for elderly people. Furthermore, they can be used to help to design an improved GP booking system that is aimed at providing better user experience for elderly people. Of the 38 guidelines, the most relevant in terms of their fit with the design of a mobile application are introduced here to highlight the design requirements that they frame for the booking system. The requirements that have been chosen which are related to mobile application design are:

1. Target Design – This guideline proposes that icons and buttons that are presented on websites should have larger targets. The targets should be clear and large so that they can be easily visible to older adults. Users should also not be required to double click on the target. Having a larger target will make it easier for elderly people to touch targets on the screen as some older adults aged over 65 have trouble touching the screen (Xiong and Muraki, 2016).
2. Content Layout Design – The language used should be clear and simple for older users to understand. There should not be large amounts of information on the screen; instead, the layout should only include important information which is related to a screen's purpose. By using this guideline the layout of each screen should be simple and consistent with other screens to avoid confusion for older users. Features such as positioning of titles and buttons should be consistent throughout the booking system to avoid confusion and ensure that titles and information of text are also consistent.
3. Browser Window Features – The use of scroll bars should be avoided as older users find them confusing, especially when using a swipe gesture to scroll up and down. One screen should only appear in the window and pop ups should be avoided as they can be distracting to users. This is important when implementing in the design process as users find it easier looking at information on just one screen rather than going to a different page and scrolling up and down as it can be confusing.

4. Use of Colour and Background – colour should be used consistently throughout the design. Colour tones such as green and blue should be avoided as they appear faded to older users owing to visual impairments that older users may have as a result of deterioration in their eyesight. This guideline shows that the backgrounds colours should be consistent and the use of coloured text on coloured backgrounds should be avoided as they can be difficult to see for elder users, as colours such as green and blue are difficult to see for them. However, it will be difficult to associate NHS with the booking system to the application as they have a blue theme. Therefore, blue will be avoided as evidence shows that it is a colour to be avoided.
5. Use of Graphics – The graphics used should be relevant and not be there for decoration. The images used should be relatable to elderly users. This is an important guideline as pictures make the application more attractive and irrelevant pictures to the booking system can confuse elder users.
6. Text Design – The text should be justified and be short in length. Suitable spacing should be used between the lines to present the text clearly. The use of all capital letters in a sentence case should be avoided as it can be confusing for older users. The text font that is used should clear and simple and also the font size should be larger than usual. This guideline will ensure that text size is consistent throughout the booking system and that users will be able to distinguish the size of titles and normal text on the screen such as medical information.

2.4 Usability principles

According to Jacob Nielsen (10 Heuristics for User Interface Design: Article by Jakob Nielsen, 2020) there are ten principles for designing a user interface, these ten principles can be seen below in Table 2.1. Each principle will be looked at during the designing phase of the project as these principles are very important to improving the usability of the system. Moreover, the principles can also be seen as guidelines for design as they show design characteristics that can be implemented. Furthermore, these principles will be looked at further in the evaluation phase of the project. This is because a heuristic evaluation approach has been chosen to evaluate the prototype so that users can give a score to grade each principle, the scores will be evaluated to show if the booking system application shows any

problems with its designs. The principles are general and by implementing them into the designs should improve the user experience of the booking system for elderly people.

Usability principles for user interface design	
1	Visibility of system status - The system should always keep users informed about what is going on, through appropriate feedback within reasonable time
2	Match between system and the real world - The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
3	User control and freedom - Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
4	Consistency and standards - Users should not have to wonder whether different words, situations, or actions mean the same thing.
5	Error prevention - Even better than good error messages are a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
6	Recognition rather than recall - Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
7	Flexibility and efficiency of use - Accelerators unseen by the novice user may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
8	Aesthetic and minimalist design - Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
9	Help users recognize, diagnose, and recover from errors - Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10	Help and documentation - Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Table 2.1 Usability principles (10 Heuristics for User Interface Design: Article by Jakob Nielsen, 2020)

Table 2.1 shows Jakob Nielsens ten general principles of usability design. These design principles will be used also as a guideline when designing the prototype.

2.5 Factors that Influence elderly users

According to Holzinger, Searle and Nischelwitzer (2007), cognitive, physical impairments and motivational issues present design barriers that need to be overcome by elderly users so that they can easily navigate and understand an application. These issues can also be used to inform the design of the booking system, so it is important to introduce and understand them:

Cognitive barriers are the mental actions or processes of acquiring information and understanding thought and experiences. This is related to the consideration of memory use and attention span of users while using an application. Since cognitive performance weakens with age, making application less complex and easier for users to use is vital when designing for older users. Cognitive complexity theory states that altering the design of an interactive application can lead it to be more usable and that simplifying information can lead to it having the same effect as a more complex application (Kieras and Polson, 1985). Reducing the complexity of an application will therefore let older users be more effective, in line with younger users using an application.

Physical impairments are important to consider as the effects of aging cannot be reversed. All users will experience the ageing process which will physically have an impact, for example on speed and movement of joints. Furthermore, the effects of ageing will have an effect on our response, coordination and visual impairments, making it more difficult for elderly users when using a computer or mobile device.

According to Holzinger, Searle and Nischelwitzer (2007) there are five distinct human factors that show the difference between older and younger people when using modern technology. The factors that have been chosen which are related to mobile application design are:

1. speed of performance
2. error rate

All of these factors are important when designing a booking system for elderly people. It has been shown that elderly people are slower when it comes to speed of performance compared to younger people as it takes them longer to process information and to interact with applications on smartphones (Murman, 2015). Therefore, when designing such a booking system, there should be less information on the screen for them to process and only relevant information that they need to perform a task. Furthermore, error rates will be looked at as elderly people are more likely to make errors when using smartphone applications as a result of selecting an incorrect button. This will be addressed by ensuring that there is sufficient space between buttons and that buttons are clearly labelled.

Motivational issues are also important in the context of this project. Some older people are less motivated to accept and use new technology than younger people as they have not been brought up using it and lack awareness of using it. This may be because they do not feel comfortable with the idea of new technology. However, research shows that adults over the age of 65 do use new technology, such as smartphones, when they understand the benefits of doing so and have relevant knowledge of their use (Tang, Leung, Haddad and McGrenere, 2012). This implies that with the right understanding, older adults are open to using technology-based applications like GP online booking systems as long as they understand how to use them and would use them more frequently if they were easier and less complex to use.

2.6 Functional and non-functional requirements

Table 2.2 shows the functional requirements that are needed for the booking system to represent a suitable design targeted at elderly people. These requirements are drawn from the research identified through the background research presented in this chapter, and aim to ensure that participants will be able to easily navigate through the system with no, or few, errors, and also to seek to ensure that users can successfully complete tasks on the application without any help.

GP Booking system functional requirements	
1	Book appointment and choose which GP to see

2	Cancel existing appointments
3	View previous appointments
4	View previous appointments information
5	Sign in and out of the booking system

Table 2.2 Functional requirements

Table 2.3 shows the non-functional requirements that are needed for the booking system to be more accessible and usable. These design requirements are drawn from the design guidelines identified through the background research and aim to ensure that participants will be able to easily navigate through the system with no, or few, errors, and also to seek to ensure that users can successfully do tasks on the application without any help. The requirements shown will be attempted to be implemented into the design and final product of the booking system.

GP Booking system non-functional requirements	
1	Use large icons and buttons with text to ensure they are clickable and easily located
2	Avoid using blue or green in any screen of the booking system as they can cause problems viewing certain things as some elderly people have visual impairments.
3	Ensure that the system does not have complex interactions to get to certain features. Such as simple ways to get to booking an appointment or to cancel an appointment.
4	Provide minimum information on each screen to ensure that only important information is available as too much information can be unmotivating for users.
5	Provide a help icon on every screen for users to touch if they are having trouble understanding what the information on the screen is saying or what they need to do to complete a task on the screen.
6	Provide a Back button on each screen as some applications do not provide this function as some applications expect users to swipe the screen to go back.
7	Provide suitable spacing between buttons and information so that users do not find other bits of information to be distracting and to avoid accidental touches of buttons

Table 2.3 Non-functional requirements

2.7 Summary

Overall in this chapter the designs of booking systems have been discussed, looking at the existing designs and improvements that can be made to them. Requirements have been formed by the research that has been taken, this includes functional and non-functional requirements. These requirements have been formed by looking at factors that affect elderly people when using a smartphone. Furthermore, design guidelines and heuristics have been researched to help with the designs of the booking system. These ten heuristics have also been looked at to help evaluate the usability of the booking system to judge the booking system if it has any problems.

3 Chapter Three Design

3.1 Introduction

In this chapter, the design process applied to improving the user experience of GP services will be discussed, and the requirements that have been gathered will be translated into the design of a GP booking system application for a smartphone. During this design process, use case diagrams and flowcharts were used to represent the functionality of the booking system with its intended users, showing the user's steps to complete a task on the application. Each function is shown in flowchart to show how easy it is for users to book an appointment, cancel an appointment and to view their previous appointments with their medical information shown. Furthermore, prototypes were created to show how the booking system would look before it was actually implemented. Low- and high-fidelity prototypes were created to compare the designs and to show what improvements could be made before system implementation.

3.2 Conceptual designs

The use of conceptual designs has been employed in the design process of the GP booking system. This has helped map out the potential number of screens that are required and what information they may have on it. Use case diagrams and flowcharts have been used to visualise the designs of the screens.

Figure 3.1 shows a use case diagram of the user's interaction with the booking system. The diagram shows all the possible tasks that the user can complete by using the system, that is the features that the booking system provides: booking an appointment; cancelling an appointment; viewing previous appointments; and viewing their medical information that was discussed during that appointment. Most GP booking applications on smartphones only allow focus on appointments to be booked and cancelled such as 'myGP', which is a service provided by the NHS (myGP app - NHS, 2020); however, in the proposed booking system, medical history will be added so that users can view when they last visited and why they needed to see a GP.

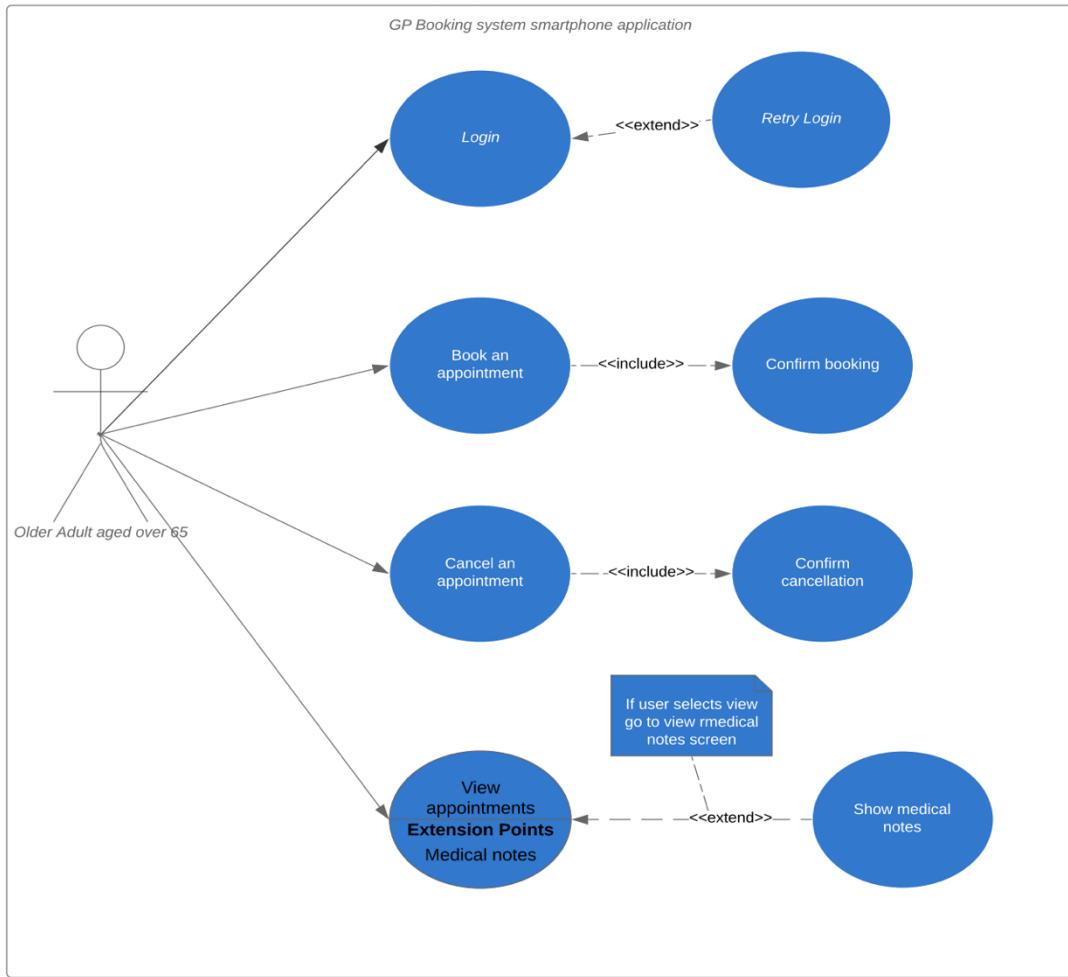


Figure 3.1 Use case diagram

Figure 3.2 shows another conceptual design of the booking system application in flowchart form. This flowchart shows the view of all the functions of the booking system: booking an appointment, cancelling an appointment, viewing appointments and viewing medical notes. Creating this flowchart/user flow diagram allows an understanding of the process involved when interacting with the application and the screens that need to be created when a user completes a task.

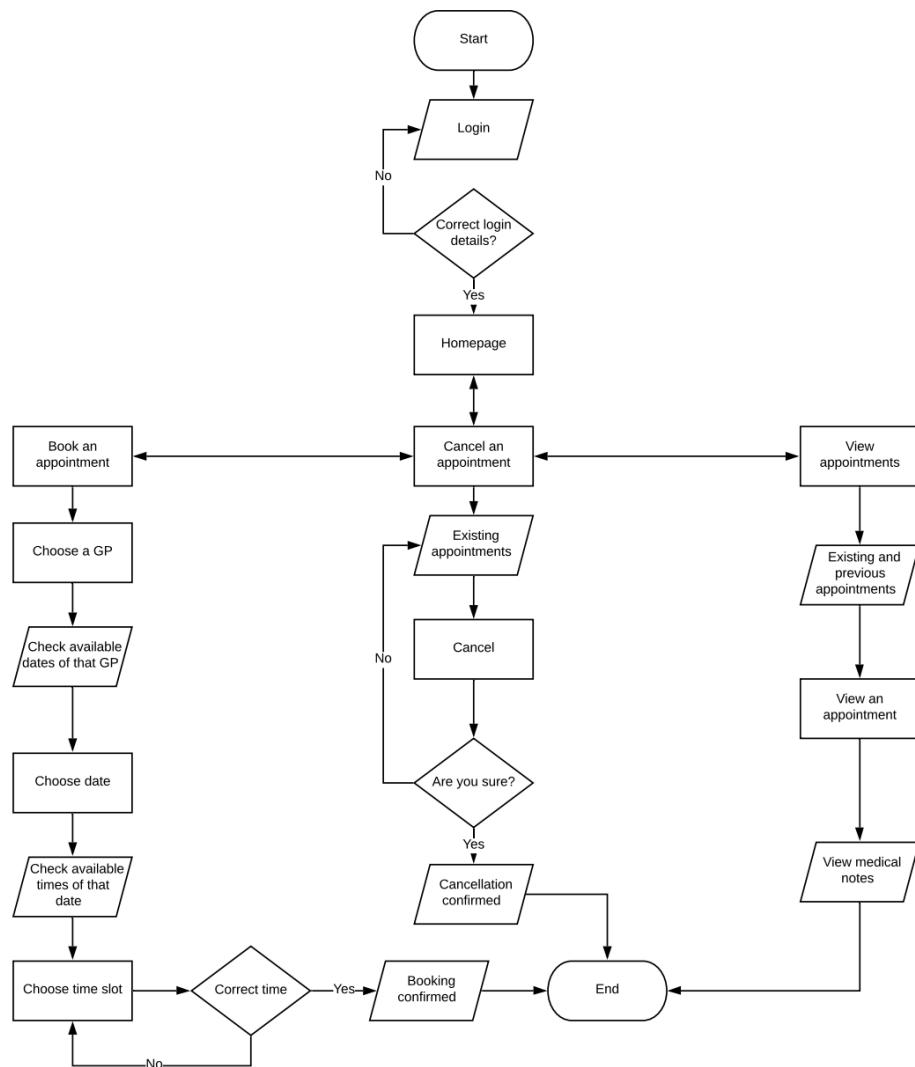


Figure 3.2 User flow diagram

The user flow diagram shows the steps involved when a user interacts with the booking system. The first step is a trigger which could be a number of reasons such as a user wanting to book an appointment or view previous medical notes. The user needs to login with credentials that are valid, in this instance the user needs to obtain this information from their GP surgery for security reasons etc. If these login details are not correct the user will be able to try again and repeat to login. If the login credentials are correct then the user will be able to proceed to the homepage which has three options for the user to choose. If the user wants to book an appointment, they will be able to choose it from the homepage which they will then proceed to choosing a GP which is available at the surgery. Once a GP is chosen the available dates are shown which the user will be able to select to book. They will then go to the next screen which will show the time slots available for that date. When a time is selected the user will be asked to confirm the time to confirm the booking. If the user does not

confirm the time, they will then go back to the previous screen which shows the available time slots.

When a user wants to cancel an appointment, they will be able to choose the option from the homepage. When they have chosen that option, they will then be shown the existing appointments that they are able to cancel. After the user have chosen which appointment to cancel, they will be asked to confirm if they want to cancel, if they do then the appointment will be cancelled. Unless they do not choose so and the appointment will remain confirmed.

If the user wants to view an appointment, they have the option to do so from the homepage. When selected the user will be shown all existing and previous appointments, they will then have an option to view medical notes from previous appointments.

3.3 Low-fidelity prototypes

In the prototyping stage of the design process, paper prototypes were created to show an early visualisation of the GP booking system. This was helpful at the beginning as it was very easy to create; all that was needed was a pencil and paper. This early visualisation of the booking system had many mistakes and allowed changes to be made quickly and easily to improve the system. In most cases, paper prototyping is used as a technique for usability testing to gain feedback and improve products (low-fidelity vs high-fidelity prototyping, 2020); however, in this case it was only used to visualise the application and map out how many screens there should be for the application.

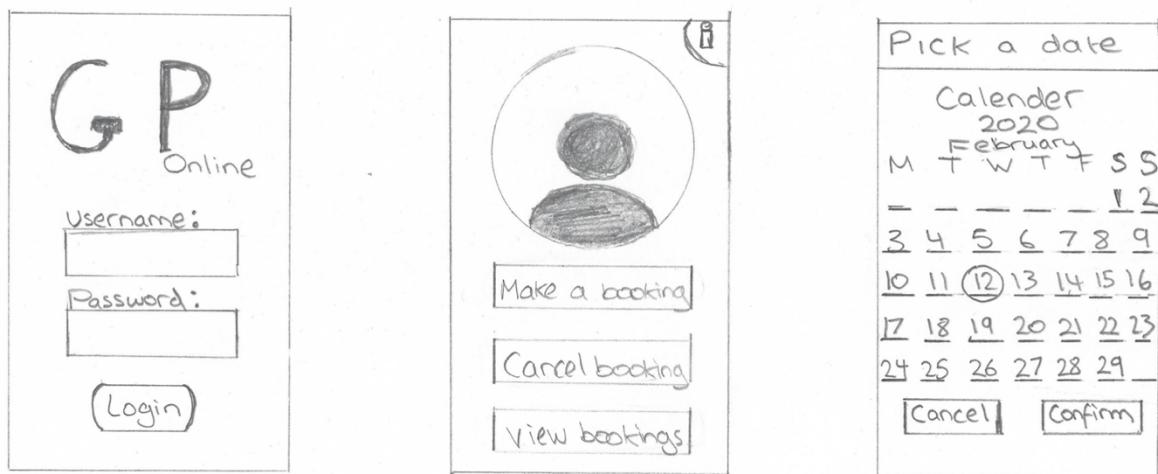


Figure 3.3 Paper prototype

Figure 3.3 shows the first set of paper prototype screens that were created. When sketching out the screens, the requirements that were presented in Chapter 2 were being attempted to be visualised in the drawings.

The aim of this project is to improve the usability experience for elderly people when using GP services, specifically a GP booking system. The first screen was sketched out to show what it would look like for users to login to gain access using the application. The login credentials that are needed should be discussed with the GP surgery as the application contains medical information that only patients should access. Once login credentials have been provided, users would be able to login to the service. The screen was sketched out like this to make it easier for the user to see and understand what the login page requires. The username and password are spaced out to avoid confusion and is sketched out to appear big. Everything is labelled so that users understand what is required. Once logged in to the booking system, the next screen that should appear is the homepage, which has three options to choose from in the middle of the screen – which are the main features of the application: booking an appointment; cancelling an appointment; and viewing appointments. These features are buttons on the homepage which users are required to press to go on to that feature. The buttons are designed to be large and spaced out evenly as this is requirement 1 from the requirements gathered from Chapter 2. There is also an information button in the top right-hand corner of the screen in case a user has any problems and does not understand what is needed from them. Additional screen designs can be seen in Appendix B which shows the additional screens sketched out for the application.

The conceptual designs and paper prototyping that was used at the beginning of this chapter showed the process and what screens needed to be drawn. Once the sketches were completed it showed the first visual designs of the booking system. The sketches drawn gave a basic idea of what the booking system may look like without the effect of using animations and interactions (Prototyping Design: Low Fidelity Prototype is Everything, 2020). This was easy to create as it was time efficient and needed just pencil and paper. The designs were easy to change as they could be rubbed out. This then led to creating a high-fidelity prototype of the booking system, showing more detailed designs of the user interface that was researched in Chapter 2, by applying colour schemes and elements of the user interface.

3.4 High-fidelity prototypes

In the high-fidelity prototyping stage of the design process, a more detailed version of the sketches was created to show a more sophisticated and detailed version of the sketches. The high-fidelity prototype was created using design software called ‘Sketch’ (Sketch, 2020). This software allowed the creation of the application with colours and pictures to make the booking system more realistic.

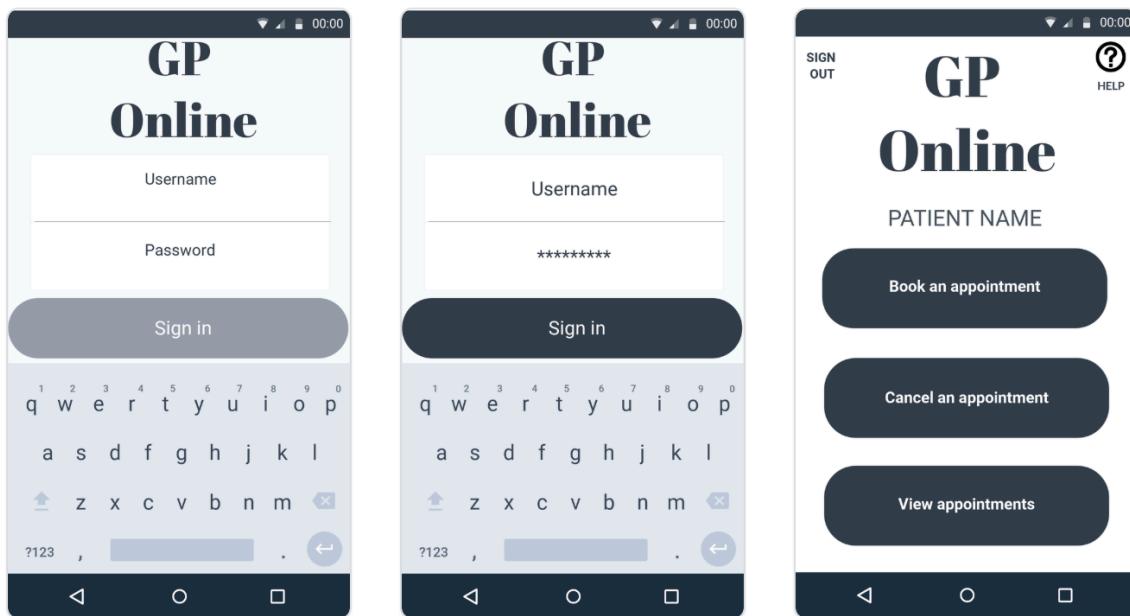


Figure 3.4 Login screen and Home page

Figure 3.4 shows the first three screens that were created using sketch; the application designed here is using the screen of an Android phone, however these designs should be the same when using an iOS phone or tablet. The designs are very similar to the paper prototypes that are created and shows the large buttons labelled so that users cannot mistakenly press the wrong button. There is also a help icon pictured as a question mark which has been improved from the information button from the paper prototypes to help users if they are stuck on a screen. This was improved as a help icon which is labelled to show a better understanding of what the function of it does. The function of the help button helps users when they are stuck on a screen by providing short information on what the screen requires from the user to do. The colours used on the screen are plain and simple colours; dark grey and white are used as research shows that bright colours are difficult for elderly users to see (Etkisi, 2020).

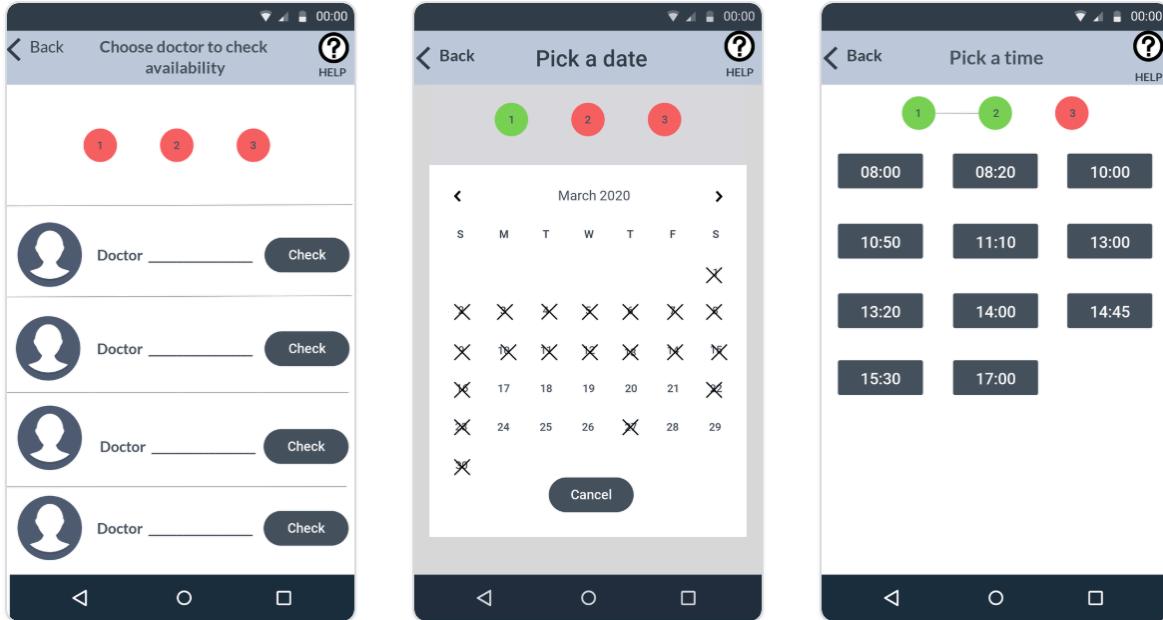


Figure 3.5 Booking an appointment

Figure 3.5 shows the screens that will appear when a user wants to book an appointment. When pressing book an appointment on the homepage screen, the next screen that appears is “Choose doctor to check availability”. This screen shows the available doctors at the surgery clinic that patients can choose to see. The screen is one page and is not scrollable; in this instance the users can choose one of four doctors that are available on the booking system. The text is large and shows a profile picture of the doctors that the users can see in case they do not remember the doctor’s name and can select by looking at their picture. There is also a progress bar for users to see how many more steps are involved for the user to complete a booking. This is done as Nielsen (1994) states that a system should keep users informed about their actions. The next screen that should appear after choosing a doctor is the calendar screen. This screen is labelled “pick a date” so users understand what task needs to be completed on the screen. This is positioned at the top of the screen in black, along with the back button, which is labelled and, on every screen, so that users can go back whenever they want to. This screen lets users to choose an available date on the screen which the GP that they have chosen is available on (however, only in the month of March as this is a prototype). The dates shown are only days that the GP is available on as they are not available every day, due to having days off and some days may be fully booked for a patient to book. Users can select a date and then press ‘confirm’ or ‘cancel’. If users have a date that they want to see

their GP, they can press confirm to go to the next screen or press cancel to go to the previous screen which shows the list of doctors available to see. The next screen shows the times that are available on the date selected. The times are shown as large buttons in grey boxes spaced out to ensure no buttons are mistakenly pressed. Furthermore, the progress bar is shown, indicating that this is the last step on order to book an appointment. The green is shown for steps that are completed and red is shown for the remaining steps. The times are designed like this to show all the available times on one screen rather requiring users to make more effort to scrolling to find a date, like other booking systems such as ‘myGP’ and ‘Booksy’.

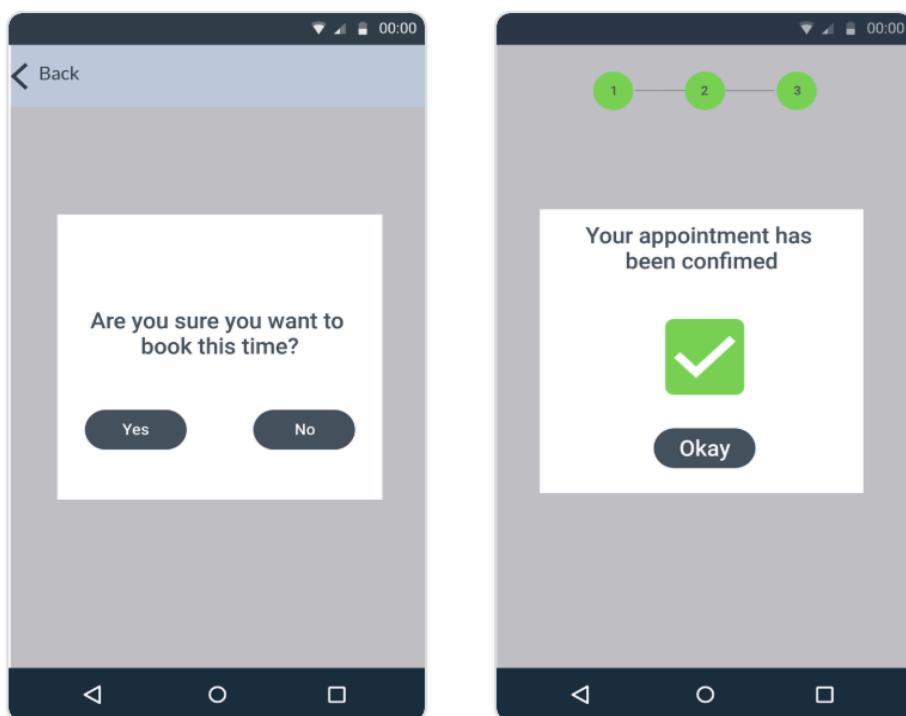


Figure 3.6 Confirmation of booking

Figure 3.6 shows the last set of screens when booking an appointment. Once a time has been selected, the user is prompted with a screen that asks, “are you sure you want to book this time?” This is to allow users if they have made a mistake to rectify it and confirm by selecting “yes” or “no”. The buttons are labelled clearly and spaced out to show users what they need to do. By selecting “yes”, users are taken to the next screen which shows the confirmation of the booking. This is shown as a green tick to show users it is confirmed; the green tick is associated with completion. Once the user selects “okay” they are taken back to the homepage. At this point, the progress bar is also all green to show users that all required steps have been completed.

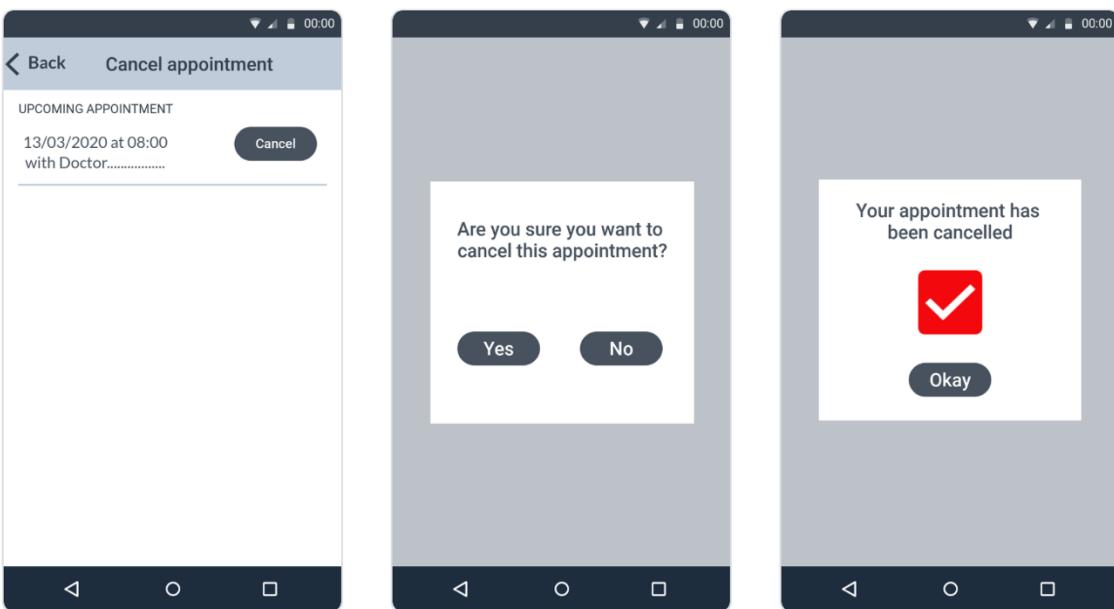


Figure 3.7 Cancelling an appointment

Figure 3.7 shows the next two screens when a user selects “cancel an appointment” from the homepage. The designs show that it is very easy for a user to cancel an appointment. When they want to cancel, they are shown their upcoming appointments which they can cancel. In this case there is one appointment showing in Figure 3.7. This shows the time and date of the appointment with the name of the doctor that they have selected to see. If the user wants to cancel an appointment, they will be able to do so on the same screen as there will be a button labelled “cancel” for users to press if they wish to cancel. If they proceed to cancel, they will be then taken to another screen to cancel the appointment with a ‘yes or no’ question. If the user selects “no” the user is then sent back to the homepage. If the user selects “yes” they are then prompted with another screen showing a confirmation that the appointment has been cancelled. This screen shows a red tick to indicate that the appointment has been cancelled. The text is large and in black, like every screen, to show consistency and to avoid confusion for the user. The button shown on the screen is an “okay” button which users have to select to leave the page. Once selected, the user should be taken back to the homepage.

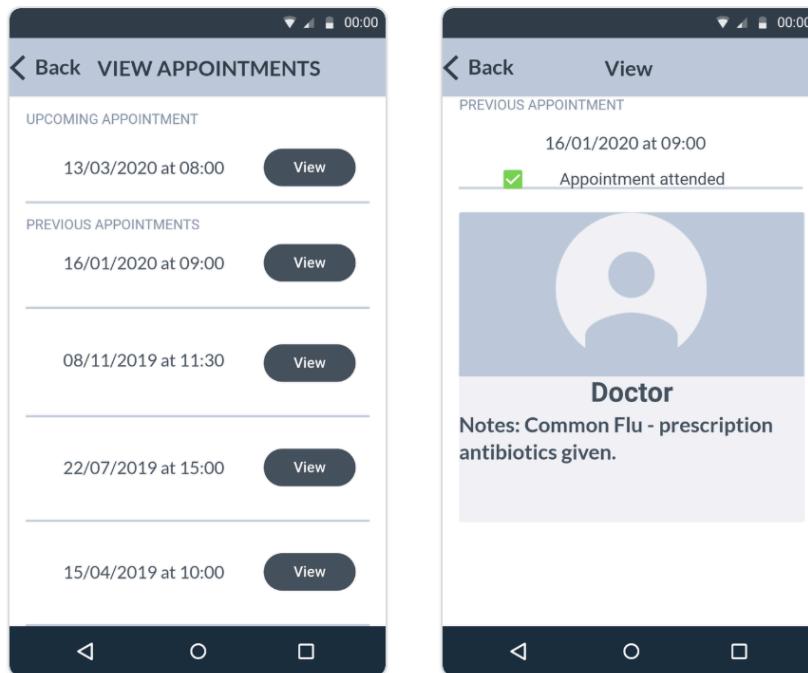


Figure 3.8 Viewing an appointment

Figure 3.8 shows the screens when a user selects "view an appointment" from the homepage. Users are taken to a screen which shows any upcoming appointments they may have and previous appointments that they have booked. The appointments are shown as date format with the times in 24-hour format. These dates and times are spaced out evenly with them being all the same size and colour. There is also a button positioned next to all the appointments which says "view". If users select this button, they are taken to another screen which shows additional information about that appointment such as which doctor they saw and any notes on that appointment. This is a feature added to this booking system so that users can check why they had an appointment on a particular day. This screen is designed to give users additional information with a picture and name of the doctor they had booked with and other information. Only a small amount of information is given to avoid complexity and confusion to the user.

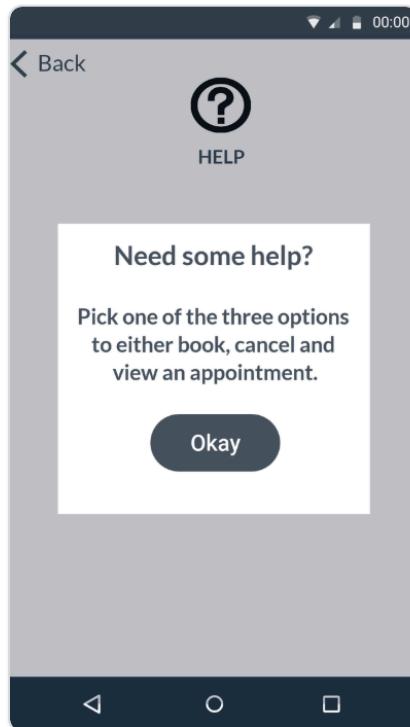


Figure 3.9 Help screen

Figure 3.9 shows one of the designs of the help screens that the booking system offers. This screen appears when a user selects it from the homepage. The screen is designed to inform users what the main screen requires them to do. The design of the screen is consistent with all of the other screens, keeping the same theme of colours. Moreover, the text used is large and the same as other screens so that users understand what is being said.

3.5 Requirements

The non-functional requirements gathered in Chapter 2 are translated in the designs created in the prototypes. This can be seen below in Table 3.1 which shows the how the requirements have been implemented in the design process.

GP Booking system non-functional requirements		How has the requirements been implemented in the design?
1	Use large icons and buttons with text to ensure they are clickable and easily located	This is implemented in every screen of the designs to ensure users can select buttons easily. All the buttons are labelled and is in suitable positions on the screen.
2	Avoid using blue or green in any screen of the booking system as they can cause problems viewing certain things as some elderly people have visual impairments.	The colour theme used in the designs of the booking system are dark colours which should not have any effects on elderly people's sight.
3	Ensure that the system does not have complex interactions to get to certain features. Such as simple ways to get to booking an appointment or to cancel an appointment.	The booking system was designed in a way that users can complete a task by simply selecting a button. All the interactions are made to ensure users do not make errors.
4	Provide minimum information on each screen to ensure that only important information is available as too much information can be unmotivating for users.	The screens are designed to have small amounts of information. The text is large and consistent on every screen. The information on the screen is only relevant to what the screen is about.
5	Provide a help icon on every screen for users to touch if they are having trouble understanding what the information on the screen is saying or what they need to do to complete a task on the screen.	The help icon is designed to be on the top right corner of the screen. The icon is labelled and provides information that helps users to inform them what the screen is about.
6	Provide a Back button on each screen as some applications do not provide this function as some applications expect users to swipe the screen to go back.	This is implemented on every screen of the design and is labelled to ensure users understand what the arrow means and is large enough for users to see.
7	Provide suitable spacing between buttons and information so that users do not find other bits of information to be distracting and to avoid accidental touches of buttons	This requirement is met to ensure user do not make mistakes when selecting a button. Moreover, buttons are labelled and

		are spaced out. This can be seen in the full set of designs in appendix b
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Table 3.1 Requirements implementation

3.6 Summary

Overall, in this chapter the requirements that have been gathered in Chapter 2 has been discussed to show how it has had an impact on the designs and how it has been implemented. Conceptual designs have been used to show how the booking system will run, showing how the functional requirements will be implemented. This involved creating user flow diagrams and use case diagrams to represent the booking system and define the potential number of screens. Low-fidelity and high-fidelity prototypes has been created by sketching designs out on paper and the use of Sketch (Sketch, 2020) a design software on Mac systems to create the high-fidelity prototypes. The full set of the high-fidelity prototypes can be seen in Appendix B.

4 Chapter Four Implementation

4.1 Introduction

In this chapter, the implementation process applied to the designs of the GP booking system application will be discussed, along with the ways in which the system requirements that were gathered have been translated to create the implementation of the booking system. The implementation stage of this project consisted of developing the high-fidelity designs that were created to have interactive functionality. This was done by using a service that is provided Sketch (Sketch, 2020) and Marvelapp (marvelapp, 2020) which allow both services to connect with each other so that designs can be compatible with Marvelapp. This chapter is short as the main focus of this project was on the design process. However, the translation of the functional requirements is important to ensure that the prototype is interactive and that the screens provide the functions that they are supposed to.

4.2 Requirements implementation

The functional requirements gathered in Chapter 2 were implemented into the interactive prototype using Marvelapp. These requirements are important to ensure that the user can complete tasks as they are designed to, using the interactive functions that are provided by Marvelapp.

GP Booking system functional requirements		Have these requirements been met?
1	Book appointment and choose which GP to see	Requirement 1 was met as users are able to book an appointment by choosing a doctor, picking a date and choosing a time in this interactive prototype.
2	Cancel existing appointments	Users are able to cancel appointments from the home screen, where they can choose to pick the ‘cancel an appointment’ option from the screen. Users are then taken to a screen where they are shown upcoming appointments which they can cancel by interacting and choosing to cancel by selecting the cancel button.
3	View previous appointments	Users are able to view their previous appointments from the home screen where they can select the option to go to the screen which shows all the previous appointments that have been recorded.
4	View previous appointments information	This is an extension of the option where users can view their previous appointments. Users will see a “view” button which

		they can select to view medical information of that particular appointment that they have chosen.
5	Sign in and out of the booking system	Requirement 5 is met as before users can access the booking system, they are required to enter a username and password. In this case, the booking system provides a username and password for them to access the system. Moreover, users are able to sign out of the system using the “sign out” button on the homepage.

Table 4.1 Functional requirements implementation.

Table 4.1 shows the functional requirements that were implemented to create the interactive prototype using Marvelapp. These requirements are essential for users to complete the intended tasks of the booking system, targeted at elderly people.

4.3 Interactive prototype

By using Marvelapp, users are able to use an interactive prototype that allows them to select buttons on the screen to interact with the prototype as if it was the final, fully implemented application. (A link to the booking system can be accessed in Appendix B).

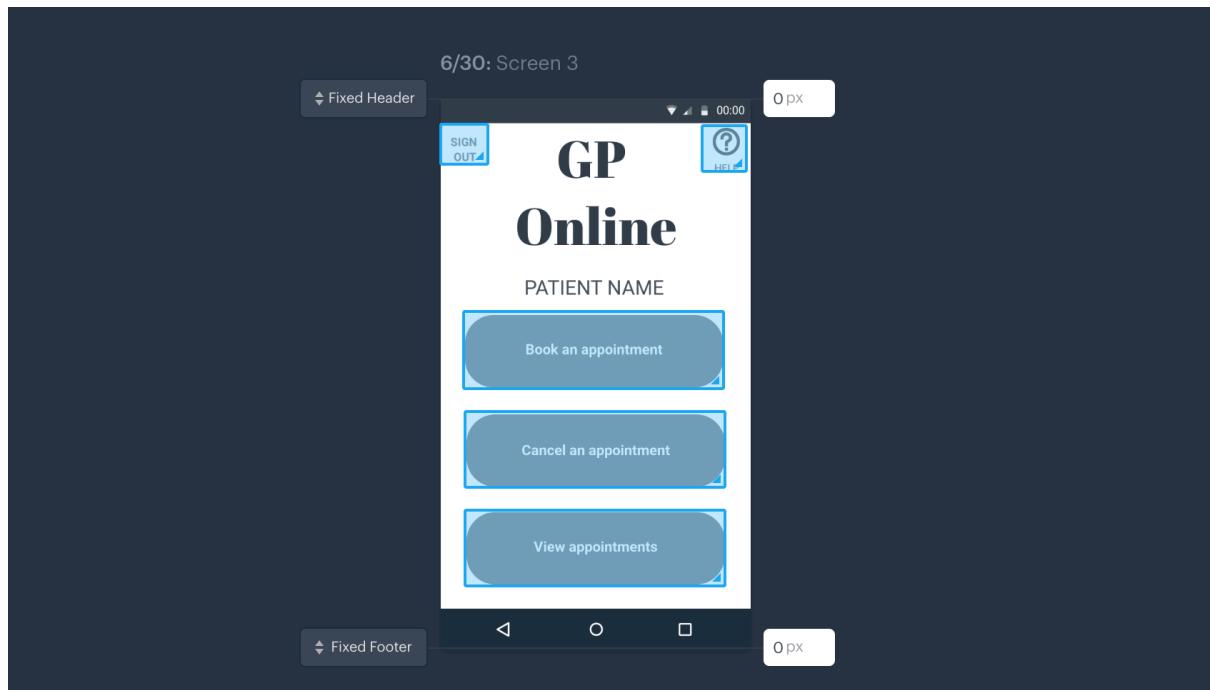


Figure 4.1 Creating the interactive prototype

Figure 4.1 shows how it was possible to make the buttons interactive and be able to act as though they were carrying out the required functions. MarvelApp allows users to link Sketch to the service so that their designs can be shown. Figure 4.1 shows the homepage screen which was designed to show users three options, to either book, cancel or view appointments. By using MarvelApp, the buttons that were designed were able to be selected by creating ‘hotspots’ This was done by drawing a number of hotspots to correspond to the positions of the different buttons. Each ‘hotspot’ that was created is linked to the relevant screen in the prototype; this allowed users to select a button, such as “book an appointment” to take them to the next screen, which is to choose an available GP. These ‘hotspots’ were created on each of the screens to ensure that the user is able to interact with the prototype as if it was a fully-functioning smartphone application.

4.4 Booking system implementation

In the booking system created (which can be seen in Appendix B), there are 30 screens in total implemented from the designs in Chapter 3. All 30 screens can be seen in Appendix B. These screens are important for the interactive booking system to work. The High-fidelity prototypes which was designed using sketch was then translated into the interactive prototype that is created now. The interactions which were created using marvelapp has let the designs created be interactive and show what each screen implemented does. In Table 4.2 shown below, we can see each screen and the function of that screen to show what each screen does once it had been translated from the designs from Chapter 3.

Screen		What is the function of the screen?
1	Sign in screen 1	This is the first screen of the booking system, which shows the users they need a username and password to proceed.
2	Sign in screen 2	Second screen of the sign in which shows the username and password filled out and ready to sign in.
3	Homepage	The homepage shows the options in which users can choose from whether they need to book, cancel or view an appointment.

4	Choose GP screen	This screen is shown when a user chooses to book an appointment. They are asked to choose a GP they want to see so that they can see when they are available to book.
5	Pick a date 1	Users after choosing a GP are shown the available dates that they can pick from, deepening on the GP they choose, this screen shows one variation of dates available to see a GP.
6	Pick a date 2	Users after choosing a GP are shown the available dates that they can pick from, deepening on the GP they choose, this screen shows one variation of dates available to see a GP.
7	Pick a date 3	Users after choosing a GP are shown the available dates that they can pick from, deepening on the GP they choose, this screen shows one variation of dates available to see a GP.
8	Pick a date 4	Users after choosing a GP are shown the available dates that they can pick from, deepening on the GP they choose, this screen shows one variation of dates available to see a GP.
9	Pick a time 1	Once users have picked a date to see a GP, they are then taken to the next screen which shows the available times on the day that they have picked. This screen shows one of the variations of the times available depending on the date they have picked
10	Pick a time 2	Once users have picked a date to see a GP, they are then taken to the next screen which shows the available times on the day that they have picked. This screen shows one of the variations of the times available depending on the date they have picked
11	Pick a time 3	Once users have picked a date to see a GP, they are then taken to the next screen which shows the available times on the day that they have picked. This screen shows one of the variations of the times available depending on the date they have picked
12	Pick a time 4	Once users have picked a date to see a GP, they are then taken to the next screen which shows the available times on the day that they have picked. This screen shows one of the variations of the times available depending on the date they have picked
13	Dialogue 1	This screen is shown when users have chosen a time and want to confirm appointment.
14	Appointment confirmed	This screen is shown when users have confirmed their appointment and shown a confirmation that their appointment is booked.
15	Cancel appointments	This screen is shown when users have decided to cancel an appointment from the homepage screen (3). Users are shown a list of future appointments that they can cancel.
16	Dialogue 2	This dialogue is shown when users have selected the cancel button from Screen 15. They are asked to confirm if they are sure if they want to cancel the appointment they have chosen.
17	Appointment cancelled	Once users have cancelled an appointment, they are shown this screen to show that their appointment has been cancelled.
18	View appointments	This screen is shown when users have selected to view appointments from the homepage screen (3). This screen shows the upcoming and previous appointments users have booked.
19	View 1	This screen is shown when users have decided to select the “view” button from screen 18. This screen shows more detailed information of the appointment that they have chosen to view. This is one variations of the appointments shown.
20	View 2	This screen is shown when users have decided to select the “view” button from screen 18. This screen shows more detailed information of the appointment that they have chosen to view. This is one variations of the appointments shown.
21	View 3	This screen is shown when users have decided to select the “view” button from screen 18. This screen shows more detailed information of the appointment that they have chosen to view. This is one variations of the appointments shown.

22	View 4	This screen is shown when users have decided to select the “view” button from screen 18. This screen shows more detailed information of the appointment that they have chosen to view. This is one variations of the appointments shown.
23	View 5	This screen is shown when users have decided to select the “view” button from screen 18. This screen shows more detailed information of the appointment that they have chosen to view. This is one variations of the appointments shown.
24	Help 1	This screen is shown when users have selected it from the homepage screen (3) to help them if they are confused and stuck.
25	Help 2	This screen is shown when users have selected the “help” button from screens 9, 10, 11 or 12. This screen shows some guidance to users to help them if they are having any trouble on the screen.
26	Help 3	This screen is shown when users have selected the “help” button from screen 15. This screen shows some guidance to users to help them if they are having any trouble on the screen.
27	Help 4	This screen is shown when users have selected the “help” button from screen 18. This screen shows some guidance to users to help them if they are having any trouble on the screen.
28	Help 5	This screen is shown when users have selected the “help” button from screen 4. This screen shows some guidance to users to help them if they are having any trouble on the screen.
29	Help 6	This screen is shown when users have selected the “help” button from screens 5, 6, 7 and 8. This screen shows some guidance to users to help them if they are having any trouble on the screen
30	Dialogue 3	This dialogue screen is shown when users have decided to sign out of the booking system from the homepage screen (3).

Table 4.2 Screen functions

During the implementation of the booking system there were other issues in hand, such as the use of text fields when users sign into the booking system. In the interactive prototype the use of a keyboard was not able to be used as marvelapp did not allow this. Therefore, an image of a keyboard was used to represent the use of a keyboard when users interact when logging in. This can be seen in Screen 1. Once users select the keyboard, the username and password are filled out to show what it would look like once they have entered it. The sign in button also changes colour to represent that they can attempt to sign in, this can be seen in screen 2.

Moreover, when users want to book an appointment and have chosen a GP they want to see, they will be asked to pick a date. This was done by using a calendar, in this case the month of march was only shown on the calendar. On this calendar the dates that were not available for users to book were crossed out with an “X”, this was to represent to users that the dates were not available to them. The dates that are available are shown without a cross. Users are able to choose a date by selecting on the date, this was done by the use of “hotspots”. A large “hotspot” was put on each available date so that users can select it without making any errors such as selecting the wrong date.

4.5 Summary

This chapter has explained how the interactive functions were created to ensure that users are able to complete the intended tasks offered by the prototype. Moreover, the chapter has explained how the functional requirements that was gathered in Chapter 2 were translated into, or met by, the prototype.

5 Chapter Five Testing

5.1 Introduction

Based on the implementation of the GP booking system, which allowed the high-fidelity prototype to be interactive, test scenarios were identified and conducted to test whether all of the booking system's functions, features, and interface items (such as buttons) work as intended. Furthermore, test cases were identified and conducted to test the user tasks on the booking system that would form part of the subsequent evaluation (see Chapter 6). These tasks were designed for users to be able to use the booking system fully and have a good understanding of how it operates.

5.2 Test cases for interface items such as buttons

Testing was conducted on the individual interface items, such as buttons, that had been employed in the booking system's interface. Details of these tests are presented in Table 5.1.

What is the function of the button?		Does the button work?
Back button	The function of this button when selected is to go back to a previous screen. This button is on most screens designed.	Yes
Sign in button	This button is on the first screen of the prototype. It requires users to sign in to access the booking system.	Yes
Book an appointment button	This button is on the homepage screen of the booking system. This button when selected should go to the next screen which is the screen which requires users to choose a doctor to see.	Yes
Cancel an appointment button	This button is on the homepage screen of the booking system. When selected this button should go to the next screen which shows the upcoming appointments which can be cancelled.	Yes
View appointment button	This button is on the homepage screen of the booking system. When selected this button should go to the appointments screen which show the upcoming and previous appointments that users have booked.	Yes
Okay button	This button is on the Help screen as well as other screens. When selected this button should return the user to the previous screen which it was selected from. This button also appears when users have completed or cancelled a booking. When selected the user should be directed to the homepage screen	Yes
Check button	This button Is on the “choose doctor to check availability” screen. When selected it should direct the user to the “Pick a date” screen	Yes
Yes button	This button appears on multiple screens when users are asked to confirm something such as to confirm a booking or to confirm a cancellation. When the button is selected to confirm a booking it should direct the user to the next screen which is the confirmation of the booking. When the button is used to confirm the cancellation of a booking, when selected it should direct the user to the confirmation of cancellation screen	Yes
No button	This button appears on multiple screens when users are asked to confirm something such as to confirm a booking or to confirm a cancellation. When the button is selected to not confirm a booking it should direct the user to the previous screen which is the “Pick a date screen”. When the button is used not to confirm the cancellation of a booking, when selected it should direct the user back to the previous screen which is the cancel appointment screen which shows the appointments that can be cancelled.	Yes
Cancel button	This button appears when users are asked to either confirm or cancel the date that users have selected on the “Pick a date” screen. When selected it should direct the user to the previous screen which is the “Choose doctor to check availability screen”.	Yes

Confirm button	This button appears when users are asked to either confirm or cancel the date that users have selected on the “Pick a date” screen. When selected it should direct the user to the next screen which is the “Pick a time” screen.	Yes
Time buttons	This button is one of multiple buttons on the “Pick a time” screen. This button does the same function as the other buttons on the screen. When users select a time, they will be directed to the next screen which confirms the time of the booking. Where they will be asked if they are sure this is the time they are booking.	Yes
View	This button is one of five buttons on the “view appointments” screen. When selected users will be directed to a screen which shows the information of that particular appointment.	Yes
Help button	This button appears on six screens. When selected it should direct the user to a Help screen for that particular screen, showing the user useful information that may help them if they are stuck.	Yes

Table 5.1 Individual button tests

5.3 Testing for tasks

These test scenarios were conducted to ensure that users are required to complete the tasks that are required for evaluation. The test scenarios can be seen below in Table 5.2.

	Task	Can the task be completed?
1. Book an appointment	Book an appointment – This task requires the user to Sign into the booking system application. Select the “book an appointment” button from the homepage screen, choose a doctor by selecting the “check” button to check the availability of the doctor. Next, pick a date that the doctor is available by choosing a date and then confirming that date by selecting the “confirm button”. The user should then be taken to the next screen which shows the available times that the doctor available on for that day. Once a time is chosen and have confirmed if it is correct the user should be taken to the next screen which shows the confirmation of the booking. An “okay” button will appear that the user should select to go back to the homepage screen.	Yes
2. Cancel an appointment	Cancel an appointment – This task requires the user to sign into the booking system or access it from the homepage screen anytime once signed in. Once selecting this option the user will be directed to the next screen which shows a list of available appointments that the user can cancel. Users can cancel an appointment by selecting the “cancel” button which will then direct the user to the next screen which will ask the user if they are sure they want to cancel. Once they have chosen to cancel the appointment, they will then be taken to the next screen which shows the confirmation that the appointment they have selected has been selected. An “okay” button will appear that the user should select to go back to the homepage screen.	Yes

3. View a previous appointment	View a previous appointment – this task requires the user to sign into the booking system or access it from the homepage screen anytime once signed in. When the user selects the “view appointments” button from the homepage they will be directed to the next screen which shows the upcoming and previous appointments that the user has booked previously. The user then has the option to select the “view” button which will show the appointments details such as medical information and which doctor they booked with.	Yes
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Table 5.2 Task testing

5.4 Summary

This chapter had presented test scenarios that were conducted to ensure that the prototype was interactive and functioned as expected. This was first done by testing the individual buttons of the booking system. The testing was successful and the buttons functioned as intended. Then, testing was conducted on the tasks that users were to be asked to complete during the evaluation phase of the project. These testing were also successful as the tasks were able to be completed without any errors being identified. The next chapter will present the user-based evaluation of the prototype system.

6 Chapter 6 Evaluation

6.1 Introduction

In this chapter, the user-based evaluation of the prototype system will be evaluated. This involved testing users' reactions to the design of the booking system by using Nielsens ten heuristics. By testing users using the ten heuristics this can help establish if the aim has been met. This is because Nielsens ten heuristics represent what a good user experience should have and by evaluating the booking system against these ten heuristics, should show if the booking system prototype that has been created has a good user experience that should be suitable for elderly people.

6.2 Description of the evaluation study

The evaluation study was done remotely using marvelapp and google forms. By using marvelapp (marvelapp, 2020) participants were able to use the interactive prototype system that was designed. Google forms (Google forms, 2020) was used so that participants can complete the questionnaire online. Participants who were invited were asked to evaluate the prototype system. They did this by completing three tasks on the interactive booking system so that they have a good understanding of the system and can fully utilise the functions of the booking system. These tasks involved; book an appointment, cancel an appointment and view a previous appointment. Once users completed these tasks, they were then asked to fill out a questionnaire based on their use of the booking system. The questionnaire that users filled out are based on Nielsens ten heuristics (10 Heuristics for User Interface Design: Article by Jakob Nielsen, 2020). Users were asked to give a severity rating from 0 to 4 based on their experience for each heuristic. Each score has a meaning based on if they had a usability problem. These score rating definitions can be seen below in Table 6.1

Severity definitions	
0	I don't agree that this is a usability problem at all.
1	Cosmetic problem only: need not be fixed unless extra time is available on project.
2	Minor usability problem: fixing this should be given low priority.
3	Major usability problem: important to fix, so should be given high priority.

4	Usability catastrophe: imperative to fix this before product can be released.
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Table 6.1 Severity ratings

6.3 Inclusion criteria, sample size and recruitment process

This project involved a group of elderly people in the evaluation stage of the project to assess the developed prototype and subsequently come to a view on whether the aim of the project has been met. However, circumstances changed and amendments had to be made. This involved the use of a different group of people to assess the developed prototype. Expert-based evaluation was used to evaluate the prototype as participants involved have some knowledge that can be used to analyse the system as they already know some principles used in the project. Ethical approval was required and was sought and granted through the BREO system. The approval letter is included in appendix B.

The project was extended to the use of Staff, PhD students and Level 3 students in the computer science department at Brunel University London. A minimum of 5 participants was needed so that the data collected could be analysed efficiently and a conclusion could be made. The recruitment process of this project involved an email being sent out to potential participants. Emails were sent out to Staff and PhD students that specialise in Human computer interaction and Information technology. Moreover, they were also sent to students in Computer science and Business Computing as they also have some knowledge and understanding of usability designs because of past modules such as level 2 usability engineering. These participants were sent a link which had the information they needed to evaluate the study. This included the google forms document (the form can be accessed in Appendix B) and the marvelapp link for them to access the prototype.

6.4 Process, constraints and pilot study

The process involved the completion of the interactive prototype. Once the booking system was completed it then needed to be tested. Testing was done by testing the individual buttons and the tasks that users were intended to complete. The pilot study consisted of testing the system myself before it was given to participants. The study involved interacting with the prototype by completing the tasks set and then answering the questions given. This allowed for the system to be tested and to check if there were any errors in the system such as buttons

not working and screens not displaying the correct information. The online questionnaire was also checked to see if when answered gave results to the questions. The pilot study was successful as there were no errors in the booking system and online questionnaire when taken. An email was then sent to participants who were able to take part in the study such as staff, PhD and Level 3 students. The email included a link which users could select which would then take them to a Google forms document. This form included a participation information sheet and request to agree to take part in the study. The form also included a link to the interactive prototype provided by marvelapp. The form can be seen in Appendix B.

6.5 Results from the study

In total, six participants took part in the main study. The participants involved gave consent to take part and answer the questions given to them. Participants were given a questionnaire to fill out which included giving a score of each ten heuristics from 0-4 based on the interactions they had on the prototype. The results of the Heuristics can be seen below in Table 6.2.

Heuristic	Severity scores					Average severity
	0	1	2	3	4	
1. Visibility of system status	4	1	0	0	1	0.83
2. Match between system and the real world	2	3	0	1	0	1
3. User control and freedom	1	4	0	0	1	1.3
4. Consistency and standards	3	1	1	1	0	0.83
5. Error prevention	2	2	1	0	1	1.3
6. Recognition rather than recall	2	3	0	1	0	1
7. Flexibility and efficiency of use	1	4	0	0	1	1
8. Aesthetic and minimalist design	1	3	1	0	1	1.6
9. Help users recognize, diagnose, and recover from errors	3	1	1	0	1	0.83
10. Help and documentation	3	2	0	0	1	1

Table 6.2 Results of severity scores

The results shown in Table 6.2 show the scores that participants have given for each heuristic and the average scores of severity from the six participants given to each heuristic. The average was given for each heuristic by calculating the mean of the scores given by participants.

6.6 Data analysis and conclusions

The results show that on average users have given a score between ratings 0 – 1, meaning that users do not think that there are major usability problems for each heuristic. The heuristics used in this study are evaluated here to show if there are any major flaws in the booking systems user experience and their designs. However, some users have chosen to score some heuristics a rating of 4. This means that this is a “Usability catastrophe: imperative to fix this before product can be released” according to Table 6.1. For a user to choose this means that they think there is a problem that needs to be looked at and is important to fix before it can be given to its intended user.

Six participants were used in total of this study, research suggests that a larger number of participants are required to fully benefit using heuristic evaluation technique as they believe more participants are likely to find more problems when evaluating a user interface (Heuristic Evaluation: How-To: Article by Jakob Nielsen, 2020). Furthermore, participants were supposed to identify problems in the booking system however, circumstances changed and had to be done online by just giving a rating for each heuristic.

Moreover, the results show that the problems with the usability of the booking system are on average between 0-1. From Table 6.1 we can look at the severity ratings, which show us that these problems are minor and can be changed if there was additional time given. Therefore, according to the average score of the results there are not major problems with the booking system.

From the results shown in Table 6.2, a conclusion can be drawn looking at the scores, showing that on average users do not find the booking system to have major usability problems. Therefore the booking system has proven to have a good user experience for users. However, some people may suggest that the use of expert based evaluation is not a technique that would give valid and efficient results. This is because the application designed is for elderly people and the participants used in the study are experts in the knowledge of the use of heuristics and usability designs. Therefore, the scores that participants have given may not be sufficient enough to the standards of the target user group (Affairs, 2020).

6.7 Summary

Overall in this chapter the process of the evaluation study has been discussed, explaining the process of the study, the recruitment process and the results of the study. A conclusion has been drawn from the results of the study suggesting that the booking system has no major usability problems and has a good user experience for users.

7 Chapter 7 Conclusion

7.1 Introduction

In this chapter the aims and objectives will be discussed to see if they have been met, also to summarise the findings that have been found from the study to conclude if the aim has been met. The problem that was set in Chapter One will be discussed to decide if the problem has been solved by completing the aims and objectives of the study.

7.2 Review of aims and objectives

In Chapter One, the aim of the project was set to improve existing online health services in the context of GP surgeries by providing a better user experience for elderly users so that they can more easily navigate and use these online health services than is currently the case. This was done by making it easier for elderly users to navigate around a booking system and make it clear to book appointments, cancel appointments and more. The aim was met by completing the objectives which can be seen in Table 7.1. This table shows the objectives from Chapter One and how these objectives have been met by the work done throughout this project.

		Objectives	How has the objectives been met in this project?
1	Background investigation		Objective 1 was met by analysing the relevant research related to the use of elderly people using technology such as smartphones and web applications. heuristics was looked at by Nielsen which has a huge impact on how the booking system should be designed. Moreover, design guidelines were looked at how designs should look. This research led to gathering appropriate requirements for the booking system. Functional and non-functional requirements were made to ensure the booking system met the appropriate methods and guidelines.
2	Design		Objective 2 was met by creating conceptual designs such as use case diagrams and user flow diagrams to fully understand how the booking system should function and look. Prototyping was used to create low and high-fidelity prototypes. This involved making sketches on paper and using design software's such as sketch to make more sophisticated designs.

3	Implementation	Objective 3 was met by using marvelapp to create interactions with the designs created in the prototyping phase of the project. This involved using sketch and marvelapp which let the designs to be imported to marvelapp. “Hotspots” were used to create the interactions for buttons. This objective was partly met as the front-end development of the booking system was supposed to be created and instead only the interactive prototype was created.
4	Testing	Objective 4 was met by creating test scenarios to ensure the interactive prototype was ready before users could evaluate the system. This was done by testing the individual buttons and tasks that users were intended to do. The testing came out successful as all the buttons worked as they intended to do and tasks were completed without any errors.
5	Evaluation	Objective 5 was met by evaluating the interactive prototype using Expert-based evaluation which involved the use of participants who has knowledge of the principles and heuristics involved in the study. This study was conducted remotely by users by using a link to the prototype using the free services provided by marvelapp and google forms which let them answer the questions they needed to answer. A conclusion was drawn from the study to show if the booking system has any usability problems. The results showed if there were any errors in specific areas of the booking system.

Table 7.1 Review of objectives

Overall, by completing the objectives that were set from the start of this project. An interactive booking system was created by the use of sketch and marvelapp. This was done by the requirements and design guidelines gathered in Chapter 2. The interactive prototype was given to users to test and evaluate the system by giving a score based on Nielsens ten heuristics. The average of the results has proved that there are no major usability problems in the booking system. However there are some users who think that there are some problems with the booking system that do not provide a good user experience, according to the results recorded in Chapter 6. Therefore, the interactive prototype system that has been created does address the problem in some extent that was stated in Chapter 1.

7.3 Limitations

The problem and aim have been solved at some extent however, there are some limitations in place that has prevented this from completely solving the problem and aim stated. The first problem is that a different evaluative method could have been used to evaluate the prototype system. In this case, expert-based evaluation was used to test the system and give a score

using heuristic evaluation. Another method could have been used for users to test the system such as using a focus group and inviting the targeted user group to take part and use the system. This was first proposed to evaluate the study but circumstances changed and the targeted group were not able to take part in the study.

Expert-based evaluation techniques are good at getting results if users understand the principles involved. They can find specific problems with the booking system that some people would not notice or care. However, the use of this evaluation method can suggest “false alarms” in the study which would suggest that a user feels that there are major problems with the booking system. This can be seen in the results that have been produced using this method in Table 6.2. Participants are shown to give a rating of “4” which suggests a usability catastrophe however, the score has only been given once for the score “4” in some heuristics which show that it is not consistent and may be a false alarm (Heuristic Evaluation: How to Conduct a Heuristic Evaluation, 2020).

7.4 Future work

The implementation of the booking system could have been done better by completing the front end and back end development of the application than showing an interactive version of the booking system. This could have been done if there was more time provided so that the appropriate learning materials could be utilised to help develop a working application. This is the one part of the project which could have been done if more time would have been given. There are some parts of the project which could have been better such as the evaluation method, more participants could have been involved to get more consistent results which could help give a better understanding of the usability problems. Furthermore, the method of the study could have been changed instead of doing it remotely as this had an effect on the ability of users raising their opinions and identifying problems with the booking system themselves. By developing a smartphone application in which users can access a booking system like this could lead to lower workloads for receptionists as they would, for example, be taking fewer calls to book appointments, and may reduce GP waiting times owing to fewer errors in the bookings that arise from users’ experiences of poor design, for example by offering clearer ways to cancel appointment.

References:

1. Citizensadvice.org.uk. (2019). [online] Available at:
<https://www.citizensadvice.org.uk/Global/CitizensAdvice/Public%20services%20publications/Understanding%20Patient%20access%20to%20online%20GP%20services.pdf>
[Accessed 6 Nov. 2019].
2. Ramesh, R. (2019). NHS spends millions on websites that fail patients, says government report. [online] the Guardian. Available at:
<https://www.theguardian.com/society/2010/aug/04/nhs-websites-failing-patients>
[Accessed 4 Oct. 2019].
3. Pew Research Center: Internet, Science & Tech. (2019). Technology use among seniors. [online] Available at: <https://www.pewinternet.org/2017/05/17/technology-use-among-seniors/> [Accessed 17 Oct. 2019].
4. England, N. (2019). NHS England » GP Online Services. [online] England.nhs.uk. Available at: <https://www.england.nhs.uk/gp/review-of-access/infrastructure/patient-online/> [Accessed 17 Oct. 2019].
5. England, N. (2019). NHS England » GP Online Services. [online] England.nhs.uk. Available at: <https://www.england.nhs.uk/gp/review-of-access/infrastructure/patient-online/> [Accessed 17 Oct. 2019].
6. Nielsen Norman Group. (2019). How to Test Visual Design. [online] Available at:
<https://www.nngroup.com/articles/testing-visual-design/> [Accessed 17 Oct. 2019].
7. nhs.uk. (2020). Book, cancel or change an appointment. [online] Available at:
<https://www.nhs.uk/contact-us/book-cancel-or-change-an-appointment/> [Accessed 9 Jan. 2020].

8. England, N. (2020). NHS England » GP online services: the key benefits. [online] England.nhs.uk. Available at: <https://www.england.nhs.uk/gp-online-services/learning-so-far/key-benefits/> [Accessed 9 Jan. 2020].
9. Medium. (2020). UX Case Study — App for Booking Doctors. [online] Available at: <https://uxdesign.cc/ux-case-study-app-for-booking-doctors-7c78f954547f> [Accessed 9 Jan. 2020].
10. Zaphiris, P., Ghiawadwala, M. and Mughal, S. (2005). Age-centered research-based web design guidelines. CHI '05 extended abstracts on Human factors in computing systems - CHI '05.
11. Pak, R. and McLaughlin, A. (2011). Designing displays for older adults. Boca Raton, Fl: Crc Press.
12. Holzinger A, Searle G, Nischelwitzer A. On Some Aspects of improving mobile applications for elderly. Universal Access in Human Computer Interaction Coping with Diversity. Berlin Heidelberg: Springer; 2007. p. 923–32.
13. Vaportzis, E., Giatsi Clausen, M. and Gow, A. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Frontiers in Psychology*, 8.
14. Murman, D. (2015). The Impact of Age on Cognition. *Seminars in Hearing*, 36(03), pp.111-121.
15. Blackall, M. (2020). 'They have no idea': government failing on coronavirus, say GPs. [online] the Guardian. Available at: <https://www.theguardian.com/world/2020/feb/27/they-have-no-idea-government-failing-on-coronavirus-say-gps> [Accessed 6 Mar. 2020].
16. England, N. (2020). NHS England » Dramatic annual surge in online GP services as patients sign up for convenience. [online] England.nhs.uk. Available at:

<https://www.england.nhs.uk/2018/03/dramatic-annual-surge-in-online-gp-services-as-patients-sign-up-for-convenience/> [Accessed 6 Mar. 2020].

17. Medium. 2020. *Prototyping Design: Low Fidelity Prototype Is Everything*. [online] Available at: <<https://medium.com/@tristaljing/prototyping-design-low-fidelity-prototype-is-everything-212fd1ce2bb9>> [Accessed 7 March 2020].
18. Xiong, J. and Muraki, S. (2016). Thumb performance of elderly users on smartphone touchscreen. SpringerPlus, 5(1).
19. Renketkisi.com. 2020. *Renk Etkisi | The Effect Of Color | Color Preferences In The Elderly*. [online] Available at: <<http://renketkisi.com/en/color-preferences-in-the-elderly.html>> [Accessed 13 March 2020].
20. nhs.uk. 2020. *Mygp App - NHS*. [online] Available at: <<https://www.nhs.uk/apps-library/mygp/>> [Accessed 12 March 2020].
21. Invisionapp.com. 2020. *Low-Fidelity Vs. High-Fidelity Prototyping*. [online] Available at: <<https://www.invisionapp.com/inside-design/low-fi-vs-hi-fi-prototyping/>> [Accessed 13 March 2020].
22. Smith, J., 2020. *DON'T GO TO YOUR DOCTOR: GP Surgeries Across Edinburgh 'On Lockdown'*. [online] edinburghlive. Available at: <<https://www.edinburghlive.co.uk/news/edinburgh-news/doctors-surgeries-across-edinburgh-on-17934609>> [Accessed 16 March 2020].
23. Ofcom. 2020. *Rise Of The Social Seniors Revealed*. [online] Available at: <<https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2017/rise-social-seniors>> [Accessed 26 March 2020].
24. Nielsen Norman Group. 2020. *Heuristic Evaluation: How-To: Article By Jakob Nielsen*. [online] Available at: <<https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/>> [Accessed 26 March 2020].

25. Affairs, A., 2020. *Heuristic Evaluations And Expert Reviews | Usability.Gov*. [online] Usability.gov. Available at: <<https://www.usability.gov/how-to-and-tools/methods/heuristic-evaluation.html>> [Accessed 26 March 2020].

26. 2020. *Marvelapp*.

27. 2020. *Sketch*.

28. 2020. *Google Forms*. Google.

29. Nielsen Norman Group. 2020. *10 Heuristics For User Interface Design: Article By Jakob Nielsen*. [online] Available at: <<https://www.nngroup.com/articles/ten-usability-heuristics/>> [Accessed 27 March 2020].

Appendix A Personal Reflection

A.1 Reflection on Project

This project has consisted of developing an interactive GP booking system to improve the user experience of existing online health services for elderly patients. By developing this booking system it should improve access to online healthcare, allowing users to easily book and cancel appointments and also view previous appointments. Moreover, when accessing previous appointments, detailed information about previous appointments should be able to be accessed to improve the services for elderly patients so that they have access to it whenever they want. While working on this project software programs were utilised to complete the designs and interactions of the booking system. “Sketch” was used to design the prototype, by using this software often I got confident in using the services which will help me in the future if it was to be used again.

Healthcare is very important to elderly people, especially in recent times due to COVID-19. Therefore, it is important to develop an improved user experience so that they can access online healthcare systems more easily so that they can get the help they need. Some stages of the project could have been changed to improve the project such as, improving the evaluation method that was used rather than using expert-based evaluation. The implementation phase of the project could have been improved by developing the front-end development of the booking system and back end development to show my coding knowledge.

A.2 Personal Reflection

The problem chosen for this project was something that took some time to think of as I did not know what to base this project on. After choosing to base this project on GP medical services, the research that I have done has shown me that healthcare is huge and provides many services to people online. There are many services provided online for users to access such as advice and applications for fitness. I chose to improve the user experience of booking systems provided by local GPs. This was chosen as the topic I chose for my degree was Human-Computer Interaction (HCI). There are many research papers and findings to show that HCI has a big impact on how users interact with online healthcare services, such as the type of people that use the services, how they should be designed and how easy it should be for users to interact with these services. This encouraged me to target elderly people using these online services. In recent times I can see that the online services provided by the NHS and other private organisations are helping millions of people stay updated with important information and provide vital services to users from home anytime.

If I were able to work on this project more or change it, I would have improved the implementation phase of the project. The implementation of the booking system could have been done better by completing the front end and back end development of the application, than showing an interactive version of the booking system. This could have been done if there was more time provided so that the appropriate learning materials could be utilised to help develop a working application. This is the one part of the project which could have been done if more time would have been given. There are some parts of the project which could have been better such as the evaluation method, more participants could have been involved to get more consistent results which could help give a better understanding of the usability problems. Furthermore, the method of the study could have been changed instead of doing it remotely as this had an effect on the ability of users raising their opinions and identifying problems with the booking system themselves.

Appendix B



College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom
www.brunel.ac.uk

21 February 2020

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 21/02/2020 AND 27/03/2020

Applicant (s): Mr Manraj Rai

Project Title: Designing a GP booking system for elderly users

Reference: 22505-LR-Feb/2020- 24700-1

Dear Mr Manraj Rai

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

A handwritten signature in black ink, appearing to read "Hua Zhao".

Professor Hua Zhao

Chair of the Committee Name

Brunel University London

Amendment form approval:



College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

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17 March 2020

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY

Applicant (s): Mr Manraj Rai

Project Title: Designing a GP booking system for elderly users

Reference: 22505-A-Mar/2020- 25080-1

Dear Mr Manraj Rai

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

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- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

A handwritten signature in black ink, appearing to read "Hua Zhao".

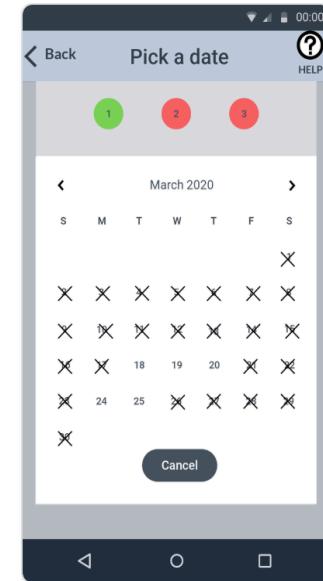
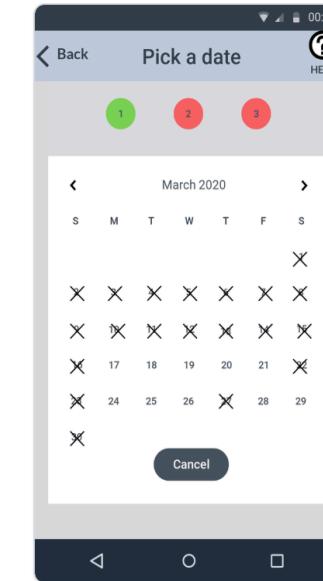
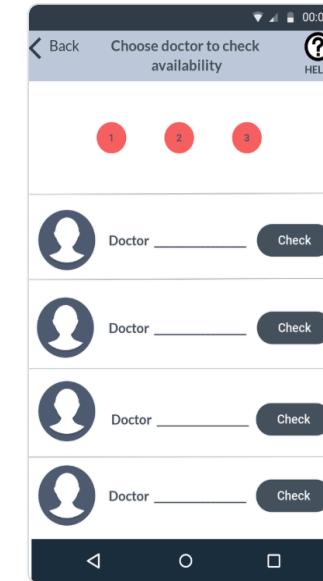
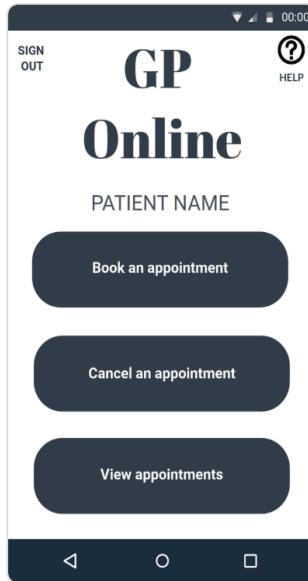
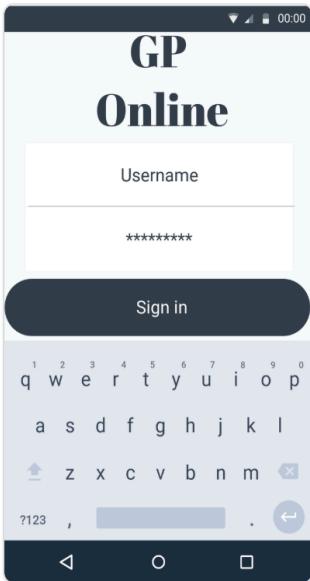
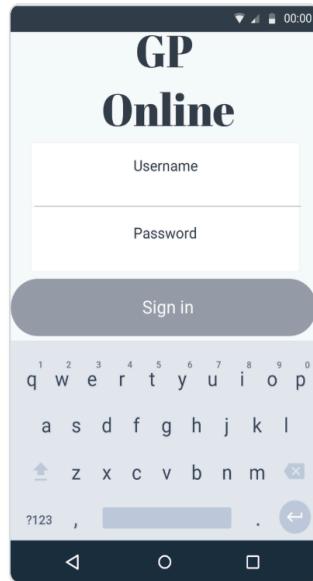
Professor Hua Zhao

Chair of the Committee Name

Brunel University London

GP booking system for elderly users

Full set of High-fidelity designs:



Screen 1

Screen 2

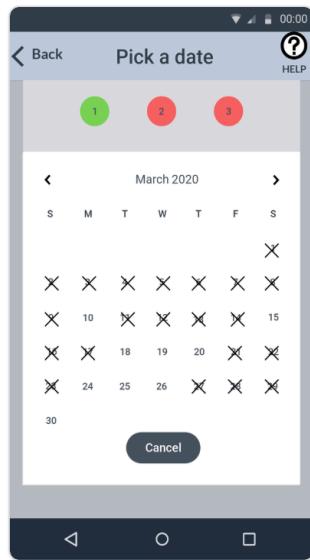
Screen 3

Screen 4

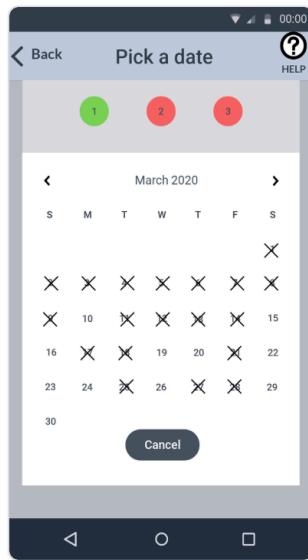
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Screen 6

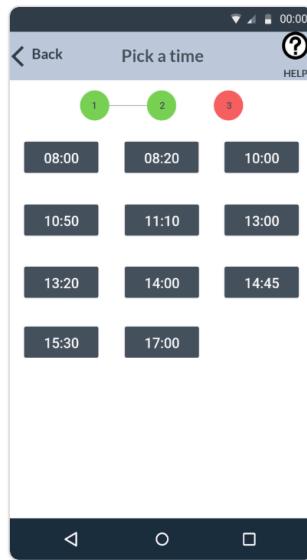
GP booking system for elderly users



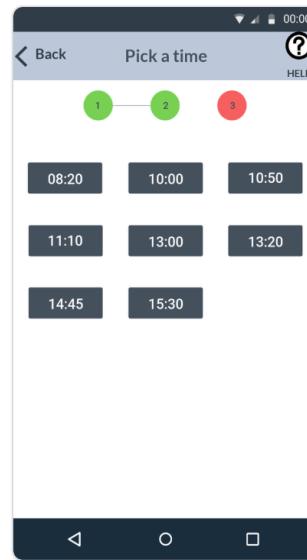
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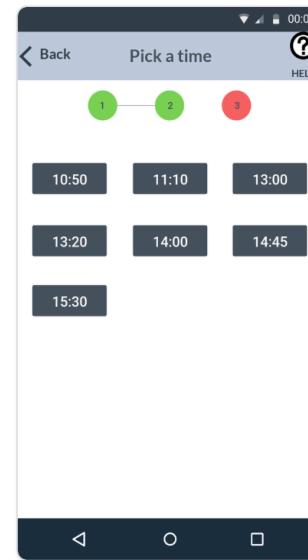
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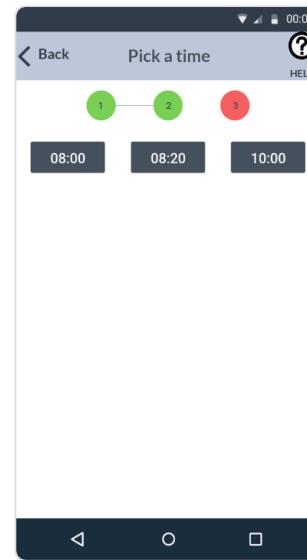
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Screen 10

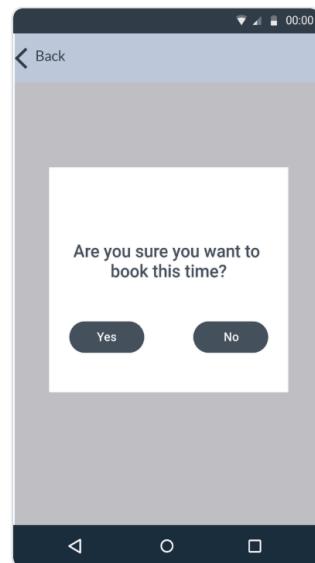


Screen 11

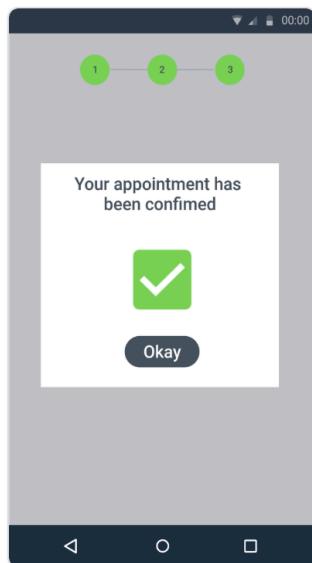


Screen 12

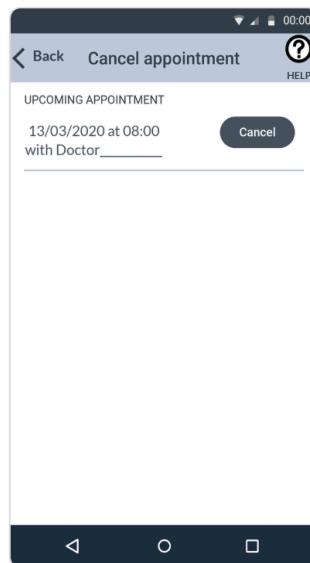
GP booking system for elderly users



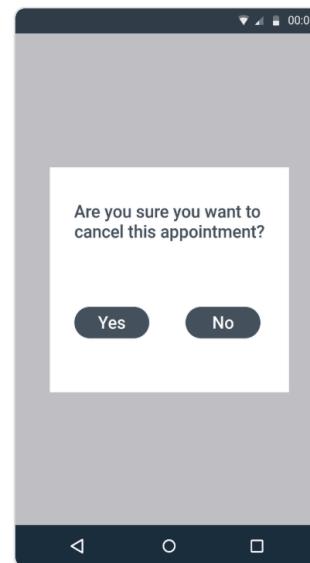
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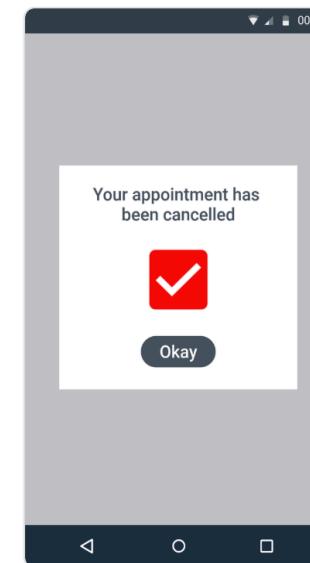
Screen 14



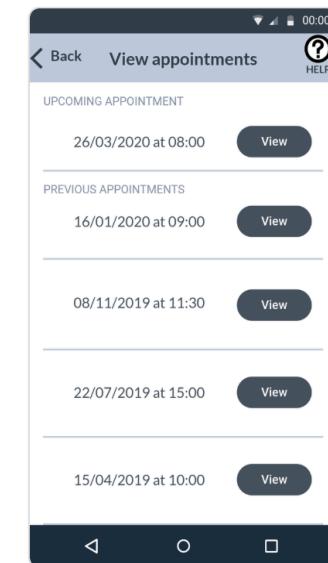
Screen 15



Screen 16

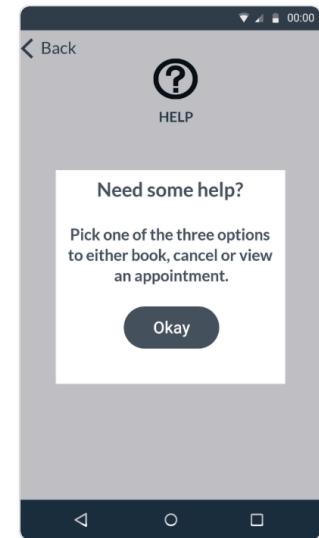
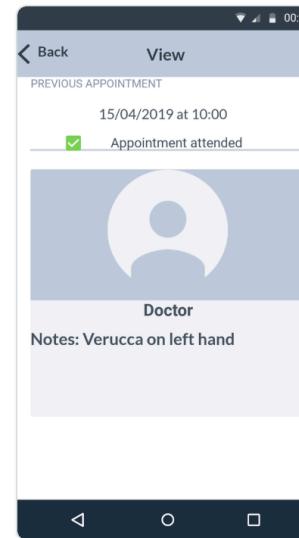
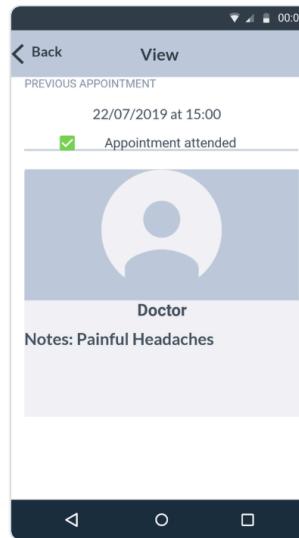
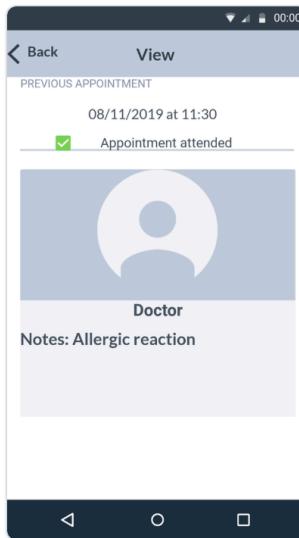
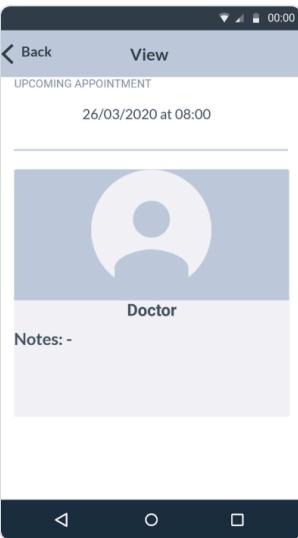
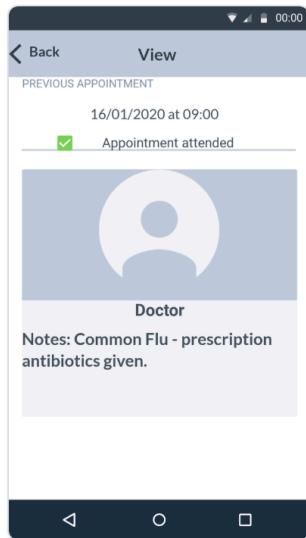


Screen 17



Screen 18

GP booking system for elderly users



Screen 19

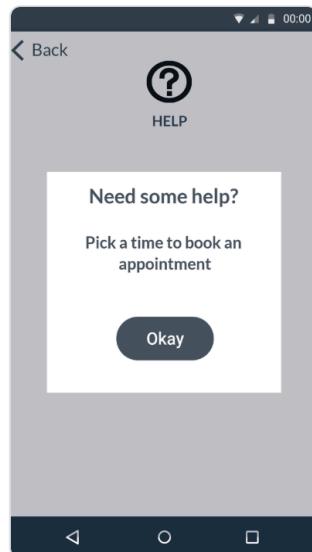
Screen 20

Screen 21

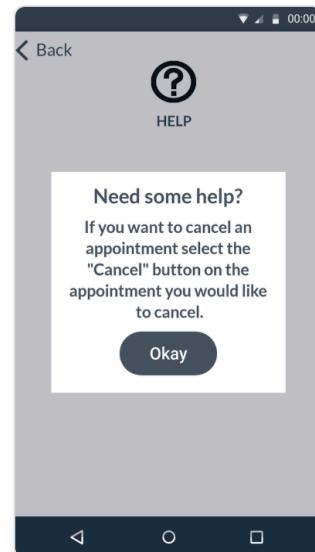
Screen 22

Screen 23

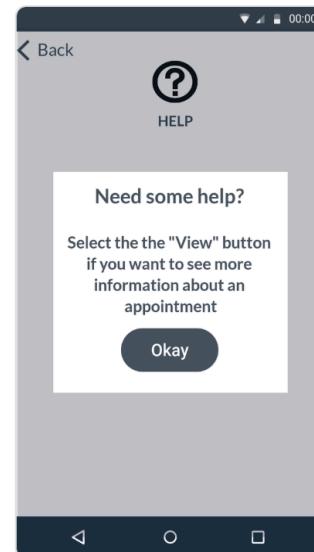
Screen 24



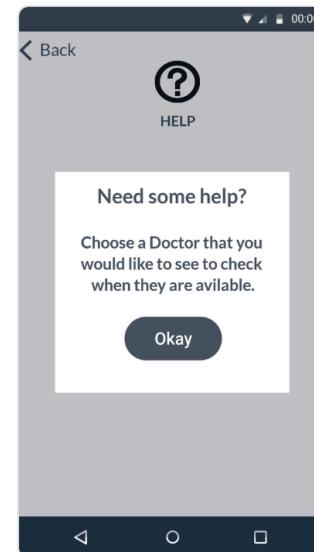
Screen 25



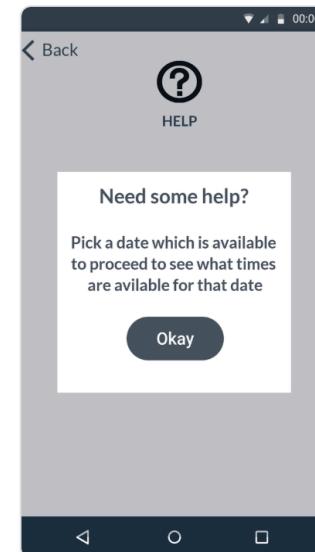
Screen 26



Screen 27



Screen 28

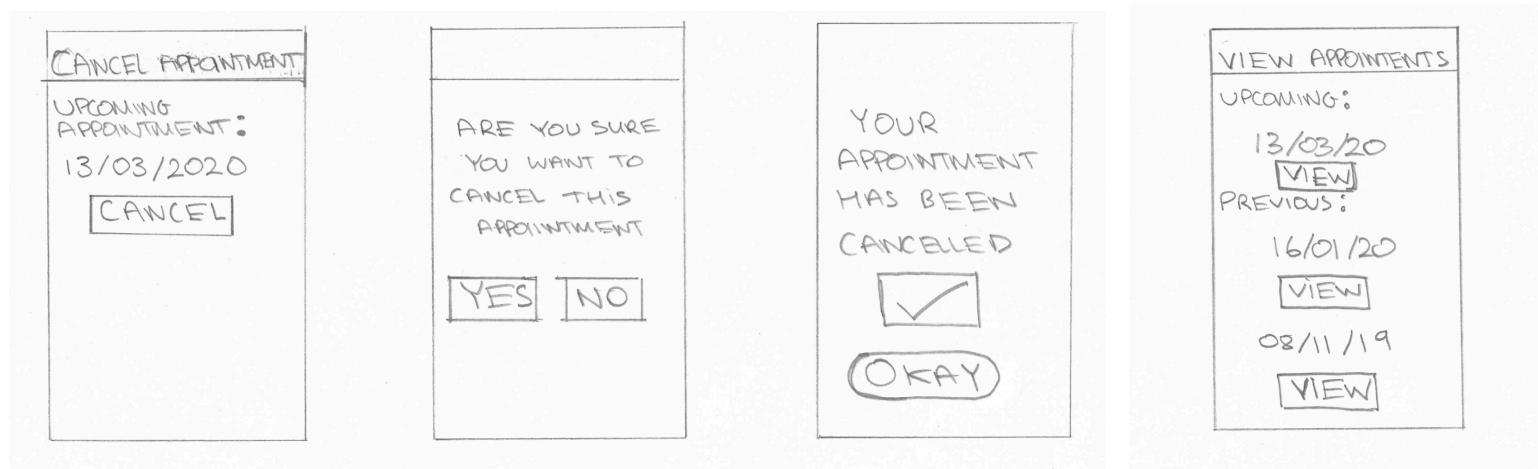
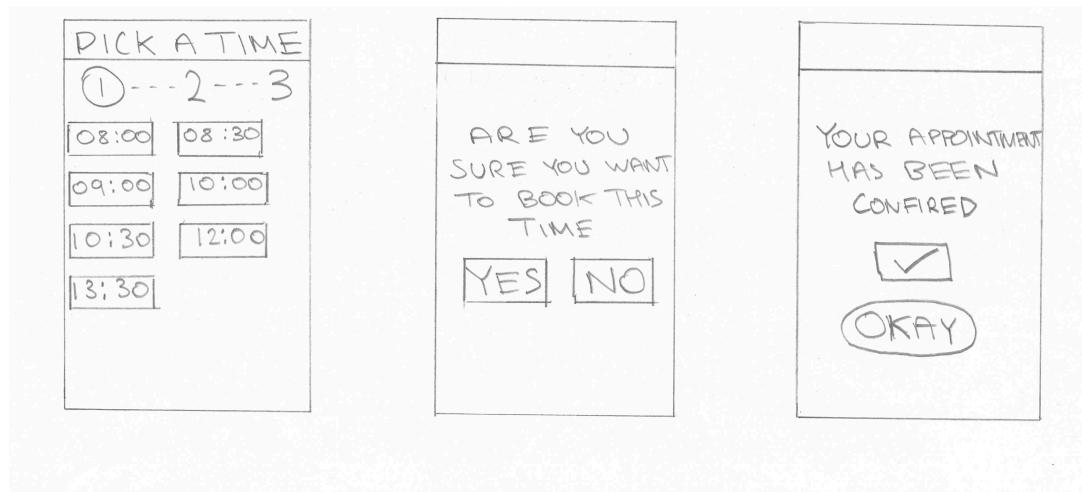


Screen 29



Screen 30

Low-fidelity prototypes:



GP booking system for elderly users

Questionnaire examples

Have you read the Participant information sheet? *

- Yes
 No

Do you understand that you are free to withdraw from the study? *

- Yes
 No

I agree to my data being recorded *

- Yes
 No

Do you agree to take part in this study? *

- Yes
 No

Complete tasks on marvelapp

Thank you for participating. The interactive booking system that has been created has been aimed to meet the usability requirements for elderly people. You will be assessing and rating the prototype as a user who understands the needs and requirements elder people may have when using the booking system. Next, you will be given a link to the interactive prototype that you will be assessing. To have a good understanding and feeling of the prototype you will be required to complete three tasks.

1. Book an appointment
2. Cancel an appointment
3. View a previous appointment.

You can access the interactive prototype here : <https://marvelapp.com/547agfh>

Once you have completed these tasks please provide a rating from 0 - 4 to the following 10 Heuristics (Nielsen 1994)

The following heuristics can be given a score based on this:

- 0 = I don't agree that this is a usability problem at all
1 = Cosmetic problem only: need not be fixed unless extra time is available on project
2 = Minor usability problem: fixing this should be given low priority
3 = Major usability problem: important to fix, so should be given high priority
4 = Usability catastrophe: imperative to fix this before product can be released

1. Visibility of system status - The system should always keep users informed about what is going on, through appropriate feedback within reasonable time. *

- 0 1 2 3 4
-

2. Match between system and the real world - The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order. *

- 0 1 2 3 4
-

3. User control and freedom - Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo. *

- 0 1 2 3 4
-

4. Consistency and standards - Users should not have to wonder whether different words, situations, or actions mean the same thing. *

- 0 1 2 3 4
-

5. Error prevention - Even better than good error messages are a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action. *

- 0 1 2 3 4
-

6. Recognition rather than recall - Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate. *

- 0 1 2 3 4
-

7. Flexibility and efficiency of use - Accelerators unseen by the novice user may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions. *

- 0 1 2 3 4
-

8. Aesthetic and minimalist design - Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility. *

- 0 1 2 3 4
-

9. Help users recognise, diagnose and recover from errors - Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution. *

- 0 1 2 3 4
-

10. Help and documentation - Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large. *

- 0 1 2 3 4
-



PARTICIPANT INFORMATION SHEET

GP Booking system for elderly people

Invitation Paragraph

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

The purpose of this study is to evaluate how suitable ('usable') the designed interface design for a GP booking system app is for elderly people.

Why have I been invited to participate?

You have been selected because you fall into a set of people likely to be able to evaluate the design of a new interface design for such a booking system app as a result of your expertise in Human-Computer Interaction and Computer science.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. If you wish to withdraw from the study after it has commenced, you can still withdraw your data any time before 27/03/20.

What will happen to me if I take part?

You will be asked to examine or use an interactive design of a smartphone app (which may be a paper mock-up or a software app on a laptop or smartphone). Following this, you will be asked to complete a 10-question questionnaire. Overall, the activity is expected to take no more than 15 minutes. No payment will be made for this study. Questionnaire data will be permanently deleted after the end of the course (no later than August 2020).

What do I have to do?

You will be requested to use the system being designed (this may be a paper mock-up or a software app on a laptop or smartphone). This will be done on "MarvelApp", a free service that users can access on either a laptop or smartphone. Users will then be asked to perform three tasks so that they are able to use the system appropriately and complete the questionnaire as truthfully as you can for each task. These tasks include users to Book an appointment, cancel an appointment and viewing an appointment.

What are the possible disadvantages and risks of taking part?

There are no reasonably foreseeable disadvantages, risks or discomforts associated with taking part in this assessment.

What if something goes wrong?

If for any reason you need to make a formal complaint about the events of the study, please contact the Chair of College Research Ethics Committee, Professor Hua Zhao, who can be contacted by e-mailing CEDPS-Research@brunel.ac.uk.

Will my taking part in this study be kept confidential?

Yes. All information which is collected about you during the course of the research will be kept strictly confidential and anonymous. Any information about you from this study will have your name removed so that you cannot be identified from it (you will not be requested to provide your address).

What will happen to the results of the research study?

Data will be kept until the end of the academic year (August 2020), and then deleted/destroyed.

Please follow the link for information on how Brunel University uses data:

<https://www.brunel.ac.uk/about/documents/pdf/stunotice13-14.pdf>

Who is organising and funding the research?

This research is non-funded and will be organised with Brunel University London's College of Engineering Design and Physical Sciences, as part of an undergraduate final-year project

Contact for further information and complaints

If you have any concerns or would like to request for further information that has not been clarified in this participant information sheet, please do not hesitate to contact me through the following email: 1615076@brunel.ac.uk or my supervisor Professor Rob Macredie at Robert.Macredie@brunel.ac.uk.

Participation information sheet

Interactive booking system link:

<https://marvelapp.com/547agfh/screen/67483377>

Please Copy and paste the link to a browser, to view the interactive booking system.

Google forms link:

<https://forms.gle/yB1FnunDPNG4pMV7>

Please Copy and paste the link to a browser, to view the online questionnaire.