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An Evaluation of the Timetabling Application Interface Design

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ABSTRACT

This study evaluated the efficiency of Solent University's web-based Timetabling interface design. A survey was conducted to gather views of students and lecturers on the current timetabling application. Analysis of the data showed that most users face difficulties when booking and finding out about the availability of classrooms, laboratories and lecture theatres. The results were analysed to inform the design and implementation of User Interface which uses visual cues instead of the text-based User Interface. The implementation employed the Dart programming language for the frontend of the web application together with Flutter a cross platform frontend development framework. Firebase Auth was used for the user authentication and firebase messaging was used for email correspondence throughout the application. This improvement focused on reducing clicks, using visual cues and intuitive colour codes to make it more user friendly.

ACKNOWLEDGEMENT

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CHAPTER 1

1.1 INTRODUCTION

The advent of the desktop computer and the internet has resulted in wide application for automation of organisational processes. Process such as scheduling, timetabling and booking of resources is part of the everyday expectation of the average user in any organisational setting. Over the years, the evolution of web technologies has gradually moved from the static and simple user interface to more dynamic, data base applications operating with ever more sophisticated user interfaces that are aesthetically pleasing. (Wollschlaeger *et al*. 2017).

The need to have a seamless, user-friendly user interface has become a staple for the average user's web experience. Intuitive design that enforces organisational usage policy whiles meeting the user experience calls for modern design approaches that blends design theory and functional requirements of the user. (Kurdi *et al*.2014).

As technology is getting more advanced, many universities and institutions are now using timetabling applications that are capable of producing and organizing timetables in a way that is automated. Current timetables are now using programs and tools such as spreadsheets, web-based tools, timetabling editors and user interfaces that are more improved. (Vrielink *et al.* 2019).

The way a timetable is constructed is very important as it can influence how students perform. To enhance academic performance of students, it should be scheduled such that lessons or lectures are not too packed or busy and it should not also be too free but must have breaks and lessons evenly spread throughout the week or day. (Larabi-Marie-Sainte *et al.* 2021).

Timetabling is a way of allocating classes, lectures, labs and meetings to specific time periods which may be dependent on different constraints. Some educational scheduling problems includes scheduling of school timetable, scheduling of university course timetable and scheduling of examination timetable. (Kadam *et al.* 2016).

Timetabling constraints may be hard or soft. A hard constraint describes a number of constraints that need to be fully fulfilled and a soft constraint describes constraints which don't have to be fully fulfilled. Examples of soft constraints to course timetabling of universities include instructor having preference for some periods or timeslots, the instructor preferring days, some students having an off day, the instructor having preference for a particular classroom, etc. Examples of hard constraints to course timetabling of university include timetable being assigned for a term or semester, classroom not having enough seats, classroom allocated for just a lecture at a given time, insufficient resource during a particular period or timeslot. (Houhamdi *et al*. 2019, Alghamdi *et al.* 2020).

Putting together a course timetable is very demanding. Making a course timetable is not just about producing a timetable for a program or a course but has to be made taking various constraints such as availability of classrooms, number of students a class may take, clashes between courses, etc. into consideration. Course timetabling planning in many universities are usually handled manually by experienced administrators. This is a tedious job as factors such as available resources and facilities have to be considered. (Aljarrah *et al.* 2017).

In the case of this study a timetable or schedule system for allocating rooms for students and lectures of Solent University is investigated.

1.2 PROBLEM STATEMENT

Students and Teaching Staff of Southampton Solent University use a proprietary web-based system for booking and scheduling the use of classrooms and available spaces. This system has existed on the Universities Website and is managed by the TAR team. It has been observed that this system may be too old and could benefit from new design methods and styles that will enable it meet current user expectations and experience. Hence, the need to study the efficiency of the existing web-based time tabling system and existing room booking systems has become necessary to evaluate user attitudes towards the existing system and suggests ways forward.

1.3 AIM OF THE STUDY

The Aim of the Study was to examine the Southampton Solent University Timetabling and Room allocation user interface design. This was done through background research on interactive design approaches, how they are implemented and by reviewing available literature and conducting a survey on the attitudes towards the user experience

The results of the study could help inform improvements aimed at enhancing the user experience and help to further improve the existing algorithm and user interface design experience.

1.4 SCOPE OF THE PROJECT

In order to investigate the efficiency of the current timetabling system used by the lecturers and students of Solent University, the study focused on a critical analysis of the timetabling application all in order to evaluate the efficiency of timetabling application, and its interface design.

1.5 LIMITATIONS OF THE PROJECT

The study will be limited to a survey of the user current attitudes towards the Solent University Time Tabling system and development of on improvement algorithm aimed at improving the existing design.

1.6 OBJECTIVES

In order to meet the aim of this research, the following research objectives were set:

- Review different interactive design approaches that were used in developing, implementing, or upgrading systems or applications.
- Investigate and evaluate the Interface design and the efficiency of the current timetabling application used by the students and lecturers in Southampton Solent University.
- Use the results of the study to inform an improvement of the current timetabling application.
- Implement the new improvement.
- Make recommendations for future studies.

1.7 TIMEFRAME OF THE RESEARCH

This research started from June 2022 to Sept 2022. The evaluation of the efficiency of the current timetabling application and its interface design started on July 2022 to Aug 2022.

1.8 STRUCTURE OF REPORT

This report of this study is organised into chapters. Chapter 1 provides the Introduction for the research, it comprises problem statement, limitations, scope, as well as the aims, and objectives. The second chapter gives a literature review of Timetable application, and User Interface Design. The third Chapter looks at the theory of User Interface Design and current trends that are used in developing, implementing, or upgrading a system or application, this also summarize the principle and important elements of the User Interface (UI) Design, and User interaction Design. The fourth Chapter defines the methodology and methodological approach. This chapter identifies and employs the methodology for this study to evaluate the efficiency of the interface Design of the web-based timetabling system or application of Solent University. The fifth Chapter includes the evaluation findings. The sixth Chapter discusses the observation, management, and design philosophy. The seventh Chapter offers the conclusions and recommendation of the study.

CHAPTER 2

2.1 LITERATURE REVIEW

Over the past few decades, information technology has advanced and most of the timetabling applications today have a nicer user interface. The timetabling software applications modified to generate and optimise more appropriate timetables. (Vrielink *et al.* 2019).

Timetable is widely used in different fields such as transport, education, hospitals, businesses, sports, and others that requires scheduling (Bettinelli *et al.* 2015). In the context of higher education, a timetable is the assignment of events such as exams, lectures, and tutorials to a limited number of resources such as lecturers, rooms, and timeslots while adhering to a variety of restrictions (Lewis 2016).

In spite of the simplicity of timetables, educational establishments such as universities, colleges and schools all encounter timetabling problems. These timetabling problems are scheduling problems that have to do with allotting or assigning specific events to scheduled times. These allocations or assignments are subject to some hard and soft constraints that must be met in order to obtain an effective timetable. (Awad, Al-kubaisi & Mahmood 2022).

The constraints of educational timetabling could be university policies and rules or preferences of students and lecturers for some events to be allotted particular scheduled times (Aziz and Aizam 2018). Given that it is impossible to satisfy all constraints, one must seek a solution approach that can satisfy all hard constraints as well as many of the soft constraints as possible (Zhang 2005). Timetabling problems are some of the issues encountered in the field of artificial intelligence, computer science and operation research (Badoni and Gupta 2014). It is well researched, and different methods for solving the timetabling problem are being tested (Yang, Gao, and Gao. 2017). Solutions can be found in surveys, studies, and literature (Vrielink *et zal.* 2019).

Algorithms and some current measures are taking into consideration factors like the constraint requirements, issues of performance and interests of personnel or students. However, the nature of the problem, the different constraints and the kinds of requirements make timetabling problems complicated solve. (Naseem 2009).

The user interface (UI) is the central phenomenon of interaction, integrating human goals with computing resources such as application, software and system. The user interaction with the timetable is supported in order to provide additional textual information or to allow time scheduling manipulation. This is a common configuration in many timetabling systems. (Alencar *et al.* 2019).

Darejeh & Singh (2013) reviewed how usage of software may be enhanced for people who are not conversant with the use of computers. Their study found that by minimizing the number of tools, not using complex computer terminologies, making it possible for users to change the size, graphical display of texts and incorporating graphical objects such as icons or avatars will make people more interested in trying out different software.

According to Pratama & Cahyadi (2020), user interface and user experience immensely influenced the sale of applications. According to their study, users initially see how an application looks like so they will purchase an application if it looks nice and would want to test it if the display is appealing. Their study also found that people will also be interested in an application because of its higher usability.

The capability of a user to modify their user interface to fit their preference is connected to their feeling of being in control of their user interface (Hui and See 2015). According to Hui & See (2015), as the feeling of being in control of the User Interface is shown to influence perception of the degree of efficiency, the capability to be customised is linked to the perception of the easy use of the user interface. The study suggests that the development of a software that promotes the coordination of users and developers in the design of the user-favoured UI design will greatly improve the satisfaction of the user.

One of the most essential components of a computerized system is the user interface. When the interface is not well designed, the user will not be able to fully profit from the computational ability of an application. An interface which is not properly designed can make an application that is good and well implemented malfunction. Principles in the design of good user interface aims at putting the user in control, making interface consistent and minimising the memory load of the user. (Sridevi 2014).

A study by Khan *et al.* (2022) showed that user interfaces of present-day Smart TVs could not meet the needs of majority of household viewers. They suggested that by embedding data of viewers such as preferences, watching history, age, etc. in the user interface of the TV will improve user experience, viewership and reduce cognitive overload. They also suggested that the design and development of a Smart TV should be different from that of Smartphones and tablets.

Computer booking system is used widely in the area of tourism. It was initially created and used by airlines for making flight ticket reservations (Naqvi & Jia 2015). A study in Canada by Paré et. al. (2014) deployed e-booking system in six medical practices. The study showed that both patients and physicians benefit from e-booking. The study reported patient satisfaction due to flexibility of scheduling and also because it saved time. Their study found that automated reminders greatly minimized the amount of appointments that were missed appointments.

The advancement in technology resulted in the creation of booking systems which have become useful components of our daily lives. We come accross booking systems in the areas of communication, health, tourism, education, transportation, etc. With booking systems agents are able to get itenaries and other travel information such as airfares, car rentals and check availability of flights. Booking systems enable people to book hotel accomodation and also access many useful additions to their travels and holidays. (The 3rd International Scientific Conference 2020).

In many room booking or scheduling systems, room availability are generally pre-determined or meetings are allocated specific timeslots. There are occassions where some meetings rooms may not be fully utilized as meeting durations may not always be

precise as planned. There have been studies undertaken that present systems able to detect the status of room occupancy at a given time and incorporate that in scheduling application so as to maximize room usage. (Tran *et al*. 2016).

Atkinson and Lee (2018) tested Google calendar as a room booking system in a university library and found that that it was capable of providing a basic free booking system for libraries. Their research found that it needed a considerable amount of management and control from staff compared to other expensive options. Atkinson & Lee (2018) recommended that eventhough google calendar was able to work functionally, there is a need to choose booking systems that work automatically to implement procedures and policies.

User Interface is also called Human-machine interface and it describes systems which could be software or hardware, that provides information and specific orders to the user so that a particular action may be attained in an interactive system. Every machine has got a user interface and this serves as the connection between the device and the user. (Iannessi *et al*. 2018).

In a user interface there is an interaction between a user and a system by means of commands to use the system, put in data and utilize the contents (Joo 2017). Sharma & Tiwari (2021) lists Figma, Sketch and Adobe XD as some of the tools used in the creation of user interfaces.

The interface is how the software tool and the user interract or communicate. The user interface is the way user communicate with software and interpret it, thereby making good use of the software functionalities. (Dankov 2019).

A poorly designed timetable will lead to spaces not being fully utilized. In order to fix the problem of space allocation in institutions and schools, available rooms, lecture halls, laboratories, etc. Need to be established jointly with their various uses, allotted dtime and aditional constraints. The state of these resources at any given time has to be

checked to ensure that they are fully utilized and opportunities for developing improved timetables are not overlooked. (Abdelhalim and El Khayat 2016).

When designing interactive product, it is important to understand the needs of the user. The plan of interactive products should be tailored to the user's requirements. Systems that are created should be user friendly, thus they should be easy to use, enjoyable and perceived as effective by the user. The user should be at the centre of every design. (Granić 2017).

Users choose and use different applications for different reasons but most importantly many users choose applications based on how easy they are to use or their functionalities (Jung & Yin 2018). When the user interface of a digital product is well structured, the user tends to have a good experience, and this makes them want to use the product again (Dey *et al*. 2019). User interface is made up of colour system, guidelines, design process, workflows, etc. (Sharma & Tiwari 2021).

CHAPTER 3

3.1 INTERFACE DESIGN

Interface design is fully centred on the visuals, such as how the interface will appear, organisation of the different elements and the connection between the elements by way of hierarchy. Interface designing is about the picking of the graphical elements, fonts, buttons, colour and menu style. (Sharma & Tiwari 2021).

User interface design is not just about how nice a product looks but dwells largely on its ability to deliver useful functionality. It determines the kind of experience the user will get whether good or bad. (Granić 2017).

Interface design is described as the display appearance of a product (Kamaruddin & Sulaiman 2018).

The User Interface (UI) Design is concerned with anticipating the tasks that the user will have to complete and ensuring that the interface has features that are simple to understand, access, use and enable tasks to be completed. UI combines visual design, information architecture, and interaction design concepts. (Usability.gov 2019).

The graphic, textual, and other information displayed to the user as well as the control sequences, such as keystrokes on a computer keyboard, mouse movements, and touchscreen selections, are together referred to as the user interface of a computer application (El-Bakry *et al.* 2010).

The user interface enhances the usability of an application. Regardless of how well the application supports the functional requirements, it will fail unless it is simple, and efficient. The UI gives an abstract view of the whole system and also the system's performance is greatly dependent on it. (Debasmita, Ardhendu, and Pal 2015).

When creating an interface, the designer has to understand or have an idea of what the user wants. Before development it is good to get views and feedback from audience and incorporate that in the interface. (Kamaruddin & Suleiman 2016).

3.2 User Interface Elements

UI elements are interface components that contribute to the overall appearance of apps or websites. The user interface elements are essential components of software applications such as desktop, mobile, Virtual Reality app, web, etc. UI elements are the foundation of all applications. (UXPin 2022).

Input controls, navigation components, informational components, and containers are examples of interface elements (Usability.gov 2022).

3.2.1 Input Controls

Input Controls allow users to interact with the interface and fill in information. Examples include search bars, forms, Text boxes, Date pickers, list boxes, dropdown menus, etc. (Rapcikova 2021).

3.2.2 Navigational Components

It allows users to move or navigate around the applications or website to complete a goal. Menus, Breadcrumb, Sliders, Tabs, Pagination, and Navigation Drawers, Bars for navigation are some of the navigational components. (Usability.gov 2019).

3.2.3 Informational Components

Informational components tell users about what a particular button is able to do or gives information about status of a specific task. Modal window, Message Boxes, Notification, Progress Bar, Tool tips are some of the information components. (Raroque 2022).

3.2.4 Container

This collection of elements is intended to hold specific content or features. It is typically shorter or wider than the screen size of the user. The three most common elements in software applications are accordions, widgets, and sidebars. (Raroque 2022).

In the 1990s, Jakob Nielsen, a well-known web usability consultant, developed a set of ten usability heuristics for user interface design guidelines (Nielsen 1994). The following are some of the guidelines;

- Users should be kept up to date on system activities at all times, with understandable and visible status presented on the screen in a fair length of time (Harley 2018).
- Designers should aim to emulate the concepts and language encountered by their target users in the actual world. Showing information rationally and capitalising on user expectations gained from real-world experiences would lessen cognitive strain and make systems more user-friendly. (Kaley 2018).
- Designers of user interfaces should make sure that vocabulary and graphic elements are the same or consistent across different platforms (Krause 2021).
- When feasible, system designs should strive to minimise potential mistakes. Users resent being expected to discover and resolve problems that are not familiar with or beyond them. Error prevention can be accomplished by either removing or emphasising actions that may contribute to errors. (Laubheimer 2015).
- By only keeping information that are crucial for tasks in the display, cognitive load may be reduced (Wong 2020).

3.3 Interaction Design

Interaction design (IxD) is a branch of User Experience Design that studies how people interact with interactive products. Although Interaction Design has a strong foundation

in traditional user interface design theory, practise, and methodology, its primary focus is the definition of the complex dialogues which occur between users and various types of interactive devices. (Ding, Lin, and Zarro 2017).

The interaction design process which is also called IxD process, is used by designers to create products that are focused on the user's goals, behaviour, goals and requirements when interacting with the system. The five stages of the IxD process are discovering the requirements of users, examining them, coming out with a solution that is practical, prototyping it, and finally applying and its deployment. (Usability.gov 2019).

A user's interaction with a product frequently includes elements such as aesthetics, motion, sound, space, and many others (Siang 2020).

Users will be able to make system decisions more readily if the user interface is interactive. Important feedback on the state of processing in applications that are user friendly is communicated. (Techie-Menson & Nyagorme 2021).

3.3.1 Types of interactive design approaches.

Four design approaches namely user-centred design, activity centred design, genius design and system design are mentioned by Chammas, Quaresma & Mont'Alvão 2015.

User-Centred Design is a method of IxD that entails creating software from the point of view of the user in order to fulfil their demands and provide a better user experience. This approach begins with research to assist the team create a more complete knowledge of users' viewpoints, experiences, and objectives for using the software, designers can then convert that insight into interfaces that are appealing and useful for the users. The background research inspires designers to put themselves in the shoes of the intended users. Empathy is important in IxD because it helps the team to feel and think like consumers, eventually assisting designers in developing options with a complete focus on the users. (Wray et al. 2019).

• ***Activity Cantered Design*** is a model driven approach where models that have been made less complex inform and guide the whole development process, from concept to finished solution. The emphasis is on comprehending and simulating the activities in which users participate and then generating a design that directly and successfully assists users in carrying out such activities. (Constantine 2011).

• ***System Design*** is a method that focuses on system components. The designer verifies that all system components are in place. (Chammas, Quaresma & Mont'Alvão 2015).

• ***Genius Design*** is a design style which does not need user research or the testing cycles and iterative design of user-centered design but relies on the abilities of creative designers. The theory is that if a skilled designer concentrates on addressing issues for users, the designer will be able to use his or her abilities to produce innovative solutions where the consumers' prior knowledge has no bearing. This method obviously necessitates less resources for usability testing and user research, with the goal of developing customised solutions to each user concerns. (Hawley 2009).

3.4 User Interaction Elements

The user interaction design elements are more abstract. Nonetheless, It provides interaction designers with a strong set of components. Appearance/Aesthetics, Motion, Time, Sound, and Space are the important elements of user interaction. (Saffer 2006).

3.4.1 Aesthetics

Product usability may be influenced by the aesthetics of appearance. Perception of how nice a product is may involve object stimuli and stimulation duration. The object could be a website, app, desktop application, etc and an example of stimuli may be colour. (Mõttus & Lamas 2015).

The aesthetics of the user interface are the most important factors in gaining the user's attention and accolades. The thoughtful application of aesthetic concepts can improve acceptability and learnability. (Ngo, Teo, and Byrne, 2002).

3.4.2 Motion

Motion is used to describe spatial relationships between states and individual element functionality. Motion in design may enhance user experience and tells stories about a product by demonstrating how an app is organised and what users can do in it. Motion defines navigation and creates a more natural experience by adding depth to interaction design. Motion design makes user interfaces more predictable and easier to navigate by emphasising the right elements at the right time. (Babich 2016).

3.4.3 Sound

Most interaction designs include sound as a small component, but it may be important, especially for ambient devices and alerts. There are numerous variables in sound that can convey information. (Saffer 2006).

3.4.4 Space

Space is a method of creating a sense of separation between elements, which makes a design more visually appealing and usable (Spacey 2015).

3.4.5 Time

Interaction designers need to be cognizant of this component. All interactions occur over time that can be near-instantaneous at times, such as when computer user clicks nbnthe mouse. It can take a long time. It takes some time to move through space that pressing buttons takes around 8 milliseconds at the fastest. Rhythm is created by time. How quickly something appears on the screen or how long it takes to perform an action and complete a task. (Saffer 2006).

3.4.6 Visual Design

Visual design is a process of combining design elements to create well-rounded and thoughtful visuals (Gordon, 2020).

It seeks to increase a product's usability and visual appeal appeal and by using relevant imagery, colours, fonts, and other elements. The various elements of a website are placed with care to create interfaces that maximise user experience. (Siang 2020).

It is vital for the designer to understand the requirements of the audience when creating an interface (Kamaruddin cited in Kamaruddin and Sulaiman 2018).

3.4.7 Information Architecture

Page layout, classification, navigation system, and search system are all significant aspects of information architecture in web page design (Nie & Hao 2007).

CHAPTER 4

4.1 METHODOLOGY

A mixture of research methodologies was adopted for the analysis of data. This method offers insight into explanation and also investigation. (Creswell and Hirose 2019).
The study used both quantitative and qualitative approach that best supported the study's aims and objectives.

4.1.2 Qualitative Method

To acquire a greater understanding of the views of people, experiences, behaviour, attitudes and interactions, the qualitative technique is applied. It provides nonnumerical data. (Pathak, Jena, and Kalra 2013).
In qualitative research data from direct fieldwork observations, interviews that are open-ended and detailed, and also written materials are analysed. Qualitative researchers utilise naturalistic inquiry to develop descriptions that are valuable and case studies by analysing real-world contexts inductively. (Patton 2005).

4.1.3 Quantitative Method

Quantitative research is social research that uses empirical methodologies and empirical assertions. An empirical statement is one that reflects what "is" the situation in the "actual world" instead of what "ought" to be the situation. Empirical assertions are typically stated numerically. The use of empirical assessments is another component in quantitative research. Empirical evaluations are described as a kind of assessment that aims to evaluate the level to which a particular policy or programme empirically fulfils or fails to satisfy a particular standard or norm. (Cohen, Manion and Morrison 2007).

Quantitative research is a research method used in explaining cases by gathering numerical data and analysing it using mathematically based approaches particularly statistics. (Cresswell and Hirose 2019).

Every quantitative or qualitative research approach tackles various kinds of questions, collects various types of data, and delivers various types of answers. Every approach has its own set of advantages and disadvantages and each of them offers a distinct way to tackling various kinds of research questions. (Sarwono 2006).

Mixed methods is an approach that involves the mixing and integration of both quantitative and qualitative methods in a single study (Halcomb and Hickman 2015).

Mixed methods began between 1985 and 1990. This new methodology was founded at the time by a group of people came from a variety of backgrounds and countries, including evaluation, management, sociology, medicine, and education. (Creswell and Clark 2018). The functions of mixed methods are obvious in understanding the situation, norms, meaning and values in a single research question that combines the strengths of two separate methodologies and offers several perspectives on the research subject. (Silverman 2015).

A mixture of both quantitative and qualitative research method was employed for the study. Additionally, to gain more naturalistic data, the data collection used direct conversation with the respondents.

A questionnaire was administered online and distributed amongst 28 respondents to obtain a fair idea of user attitudes. The respondents were students and lecturers at the Solent University. The data was obtained anonymously, and no personal information was collected.

The Southampton Solent University ethics board was approached and approved an ethical release.

Microsoft Forms was used as an online tool for the distribution of questionnaires and data collection. This enabled a collection of responses in real-time and automatic generation of charts to visualize and interpret the data. Further analysis was performed using Microsoft Excel. Results of the study was used to inform the improvement on the existing application. Dart programming language together with the front-end development framework, Flutter, Firebase Auth and Firebase Cloud Firestore were used for authentication and database management and to manage access and to store relevant user information respectively.

4.1.4 Data Collection

Data gathering is very important when conducting research and the sources of data may be secondary or primary (Mazhar et al. 2021).

Data collection methods are classified into two types (Parveen and Showkat 2017*)*:

- Quantitative Data
- Quantitative Data

CHAPTER 5

5.1 RESULTS OF THE PILOT STUDY

The results obtained were from the mixed method used in the study.

A total of twenty eight (28) survey responses were gathered from the quantitative aspect of the research and three (3) respondents provided screenshots in the qualitative aspect of the study.

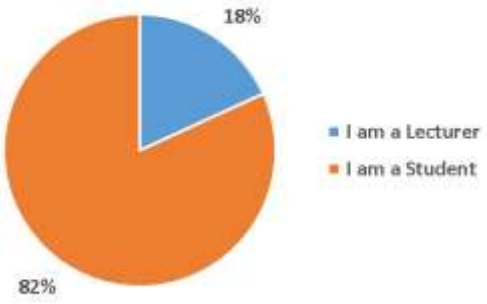


Fig 1. Subject Demographic

Fig 1. It shows that 82 % of the respondents were students and the remaining 18% were students.

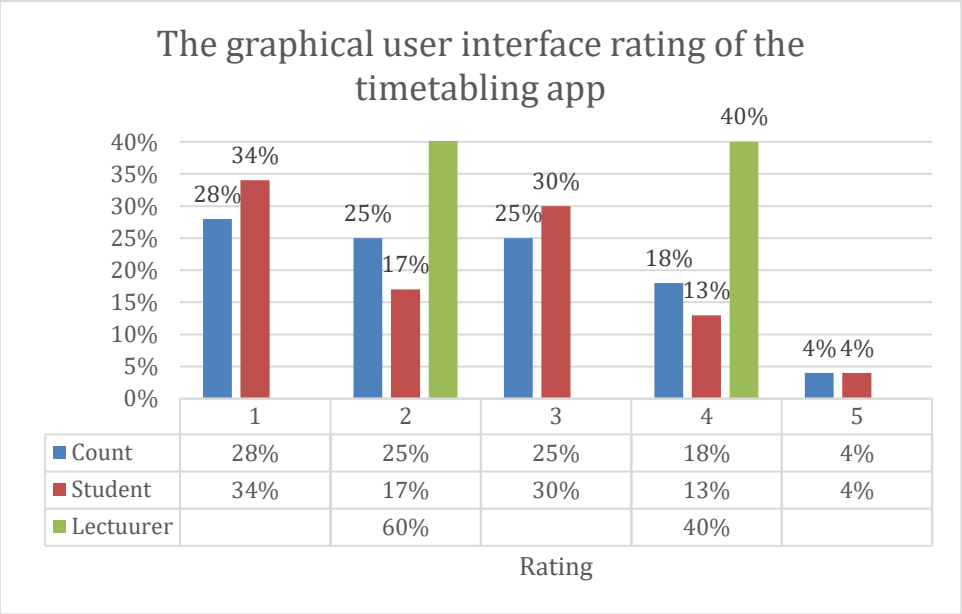


Fig 2. This shows the ratings of the Graphical User Interface in percentages by respondents

Figure 2 shows the analysis data gathered from the respondents of the survey. The respondents were asked to score the graphical user interface of the timetabling application on a scale of 1-5, 5 being excellent and 1 being poor. Thirty four percent (34%) of the student respondents gave a 1 rating, meaning they perceived the interface to have a poor design. About sixty percent (60%) of the Lecturer respondents and seventeen percent (17%) of the student respondents gave a rating of 2, meaning they perceived the graphical interface to be close to being poor. About thirty percent (30%) of the student respondents gave a 3 rating, meaning they perceived the graphical interface design to be in the median of being excellent and poor. The remaining respondents gave a scoring of 4 and 5 meaning they felt that the graphical interface was well developed.

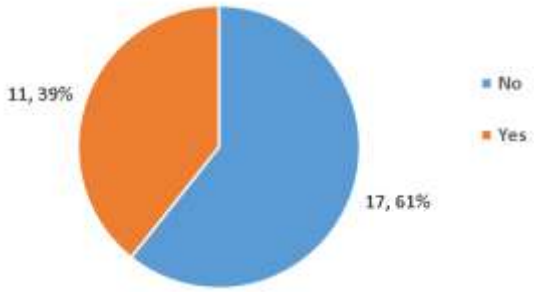
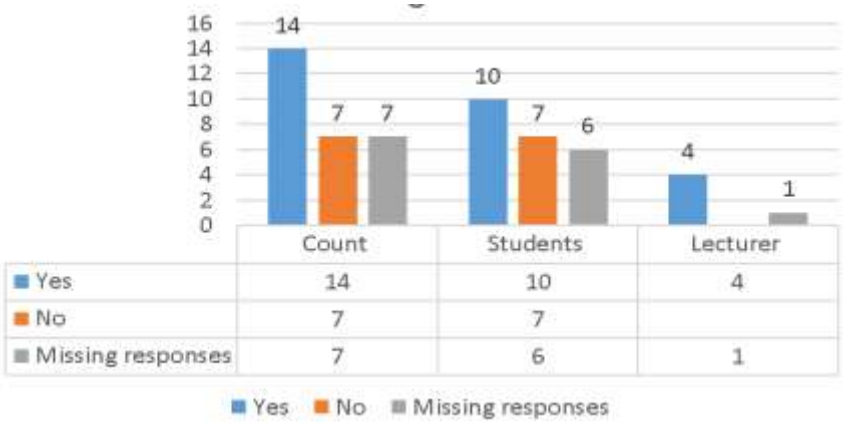


Fig 3. This shows how informative the Timetabling application is to respondents

Fig 3 shows that about eleven (11) of the respondents representing thirty-nine (39%) of the total number of respondents answered Yes (that the timetabling interface was informative enough), thus it gave adequate information such as the room capacity and availability. About seventeen (17) of the respondents representing sixty-one percent (61%) of the total number of respondents answered No, thus they perceived the timetabling interface not to be informative enough.



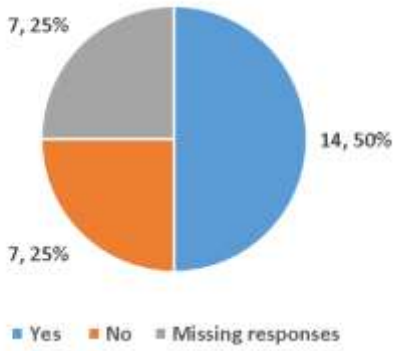


Fig 4. Shows responses for question 4.

Fig 4 shows that Ten (10) out of twenty-three (23) students and four (4) out of five (5) lecturers representing approximately fifty percent (50%) of the respondents answered "Yes" in question no.4. Thus they had tried making a booking, checking and finding a room using the scheduling application or sending an email with a booking request to the Timetable and Room (TAR) team.

Twenty-five percent (25%) of respondents said they had not used the schedule application or sent an email request to the TAR staff to book, find, or check a room. The other half of the pie chart indicate that twenty-five percent (25%) did not respond to that particular question.

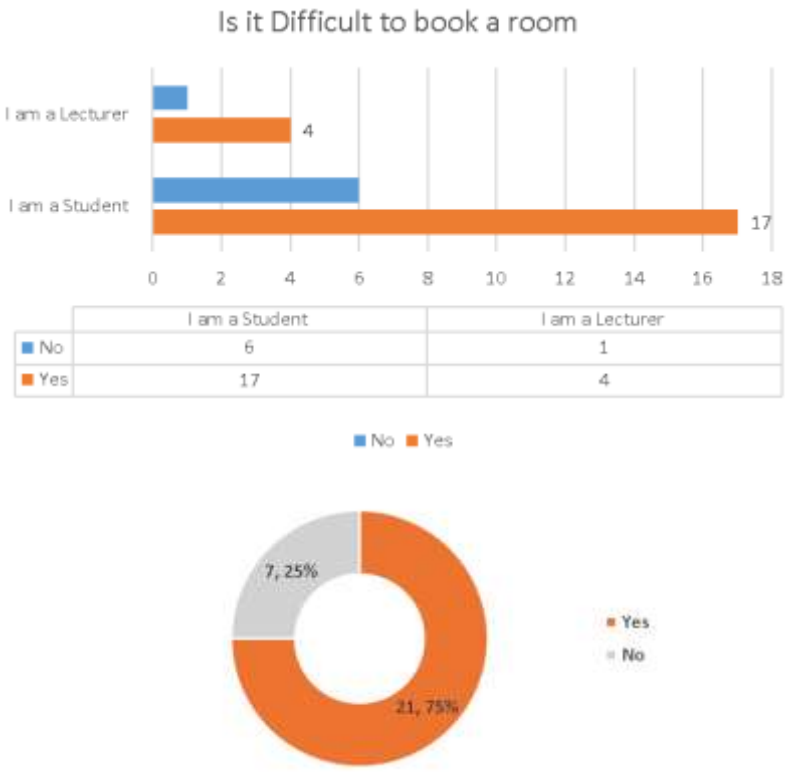


Fig 5. Shows responses for question no.5

Fig 5 shows that four (4) lecturers and seventeen (17) students representing seventy-five percent (75%) of the total number of respondents answered "Yes" and confirmed that they had experienced difficulty booking a room. The other part of the diagram

shows that 1 out of 5 lecturers and 6 out of 23 students responded “No” indicating that they had not experienced difficulty when booking a room.

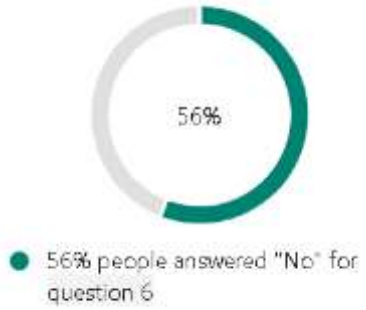


Fig 6. Does the timetabling application and email request to book a room at TAR help you make timely reservations?

Figure 6 depicts the outcome of the data obtained for question no.6. The replies obtained for question no. 6 will be modified because 25% respondents did not answer question no. 4. Although hundred percent (100%) of respondents responded and regardless of whether respondents answered "yes" or "no," only 75% of all replies would be evaluated. The majority of responders said "no." That their reservation was not completed on time. The remaining 19% of the 75% said their bookings using the application and email requests to book to TAR were completed on schedule.

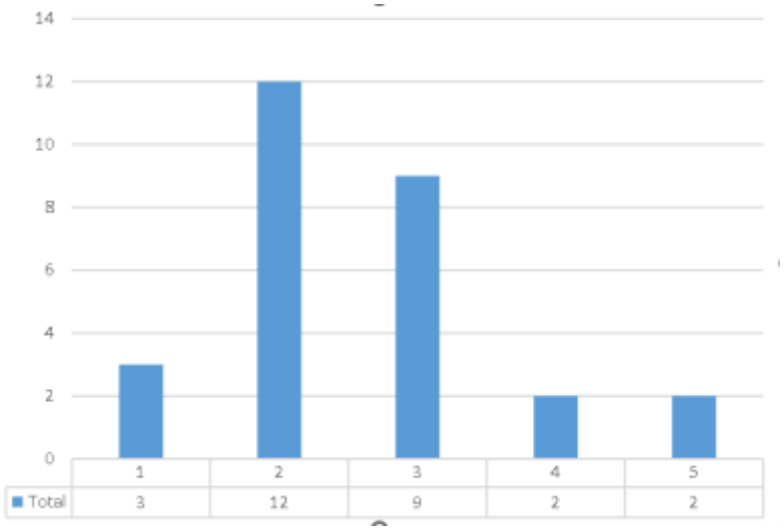


Fig 7. Rating the application efficiency in terms of room bookings on a scale of 1-5, 1 being poor and 5 being excellent.

Fig 7 shows that twelve (12) respondents representing forty-three percent (43%) of the 28 respondents scored the timetabling application's efficiency rating for room bookings as 2, which is close to poor. However, nine (9) respondents representing thirty-two percent (32%) of the 28 respondents ranked the app's efficiency as 3, putting it somewhere between poor and excellent.

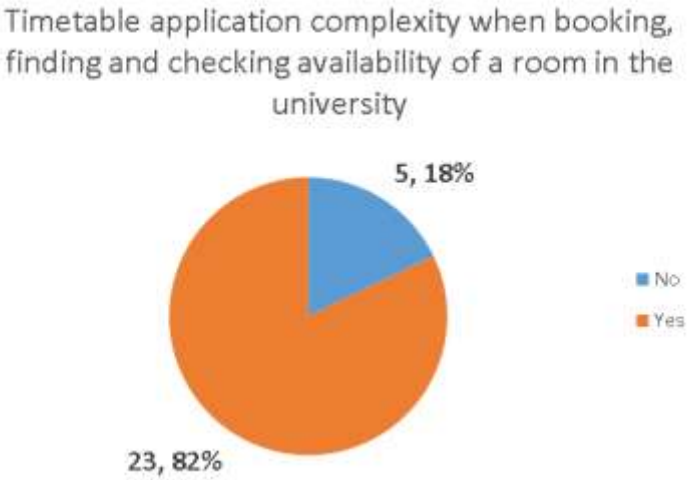


Fig 8. Complexity of Timetabling, measured by Yes or No

Figure 8 shows that twenty-three (23) out of 28 respondents representing Eighty-two percent (82%), believe finding a room, checking and booking at the university using the timetabling app is too complicated. However, five (5) respondents representing eighteen percent (18%) of respondents said "no," indicating that they do not find timetabling applications difficult to use for finding a room, checking and reserving a room at the university.

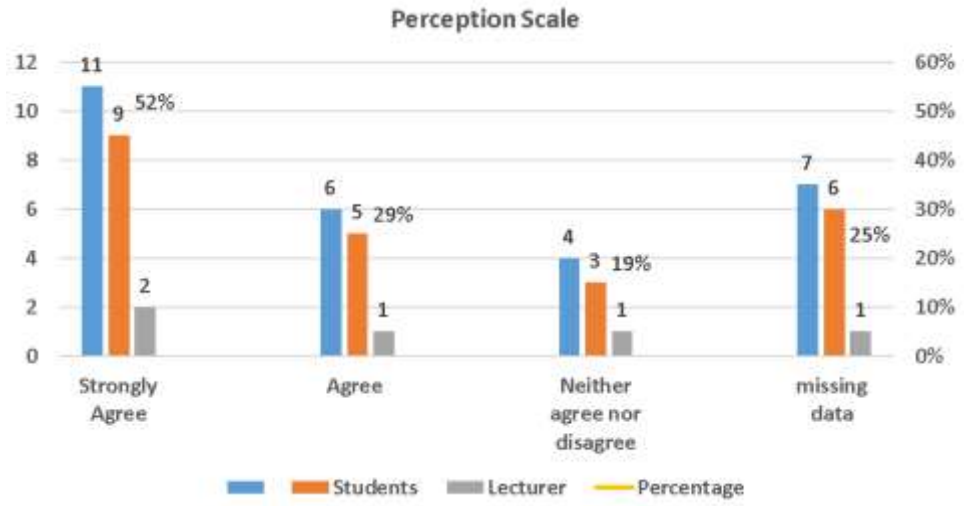


Fig. 9 Perception Measurement

Fig. 9 The researcher employed the Persona Perception Scale (PPS) to assess the subject's perception (Salminen et al. 2020). The results indicate that fifty-two percent (52%) of respondents strongly agree with the notion of improving the design of the booking interface of the university's timetabling application. While twenty-nine percent (29%) just agree, nineteen percent (19%) said they neither agree nor disagree with the notion of improving the booking interface design of the timetabling programme. Six (6) respondents representing (25%) of the 28 respondents did not respond to this question.

Completion Time	Email	Respondent	Interface Design Improvement Suggestions
6/30/22 17:49:37	Anonymous	Lecturer	Reduce the number of clicks when booking a room.
6/30/22 18:07:27	Anonymous	Student	Eliminating sending an email request to TAR, and creating a request button in the application makes it more functional
6/30/22 18:13:03	Anonymous	Student	Make it more informative when clicking the booking button, students should be able to see the rooms, their location, find and check the rooms
6/30/22 21:20:45	Anonymous	Student	A mobile view needs to be created
7/4/22 21:55:32	Anonymous	Lecturer	Reduce the clicks
7/5/22 11:36:43	Anonymous	Student	Make it more informative
7/5/22 15:02:24	Anonymous	Lecturer	As, a new lecturer who might not be familiar with the rooms and buildings around the university, some map pictures to find the location of the room on each building might help to see where the room is before deciding whether to book that room. However, this is just a thought which might be practical for the real application

Fig. 10 The result of application of User design thinking method in answering question no. 10

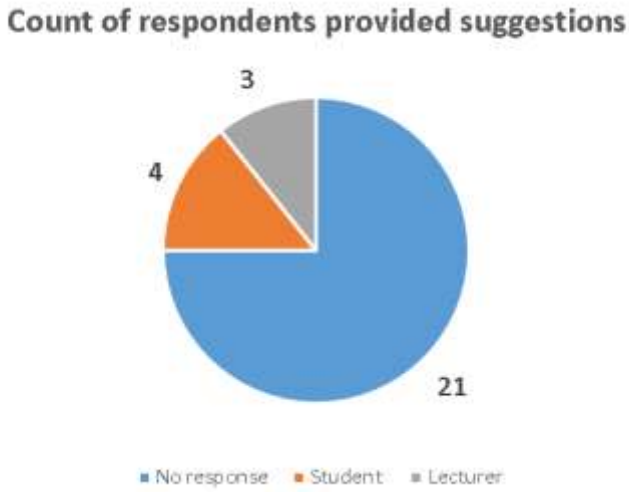


Figure 10 depicts the information gathered from survey respondents in response to question number 10. Framework analysis was used to synthesis the respondents' experiences and perceptions from both qualitative and quantitative data. According to the qualitative data obtained, three of the five lecturers suggested improving the interface design of the timetabling application. One of the three offered screenshots (Appendix 3) to demonstrate the necessity to minimise the number of clicks in booking, locating, or confirming a room.

Furthermore, four out of twenty-three students submitted a response for enhancing the interface design of the timetabling programme, which can make it more informative and efficient. Also, two out of four have given screenshots (Appendix 4) to illustrate the necessity for the request button to be included in the booking interface, eliminating the requirement to make an email request to the TAR team to search, book or check the availability of a room. However, the data shows that twenty-one (21) respondents did not answer the question or make recommendations.

CHAPTER 6

6.1 DISCUSSIONS

6.1.2 Observations

From the study it was observed that the booking interface which was available for students was different from what was available for lecturers. For students, an error message is displayed on the screen and students are unable to book for rooms. This error message informs students that they are unable to book a room however the student could book a room through emailing the administrators who are the Time Tabling and Room Team (TAR). lecturers, who are able to book a room are able to use the booking button at the timetable interface, however the availability of the room, and the capacity of the room is not displayed.

To obtain feedback for a successful booking by the lecturer, the process involved several clicks (8 clicks).

Additionally, the terminology of the buildings and other information available on the interface, are difficult to understand. Because the terms used are not the similar to the language used. Example, “zone” is used instead of the building name.

6.1.3 Management

It was also observed that the process for booking a room was managed by an administrator, which made the process cumbersome and non-responsive. This means that inface could benefit from improvement which could enhance efficiency by eliminating human intervention. By adding visual and scheduling algorithms which employ colour cues.

6.1.3 Design:

The design of the current interface was built 20 years ago and so used the old web design styles. Aesthetically, the user's expectation of more intuition and user-friendly experience will not be met. This provides the opportunity to add more contemporary design elements and compositions to reflect current user taste.

6.1.4 Design philosophy:

The current design relies on an approval system managed by the TAR team. Which enforces the policy of making sure that users of the system of booking employ the resource for approved used. That decision is left to the discretionally powers of the TAR team. This process fails to communicate directly the criteria or terms of usage; thus, it is arbitral and takes time. This design could be based on the assumption that the user will not book the resource for the approved uses. The assumption expects the negative behaviour so adds a process of enforcement.

Enforcement to ensure compliance could be eliminated by adopting a design philosophy with assumes a positive behaviour of the user which predicts that a positive expectation of social behaviour leads more compliance. This system of honour has shown itself effective in several design situations.

6.1.5 Algorithms of the Old and the improved design for Finding and Booking Room

6.2 Old Design Algorithms for Finding and Booking Room

User: Lecturer

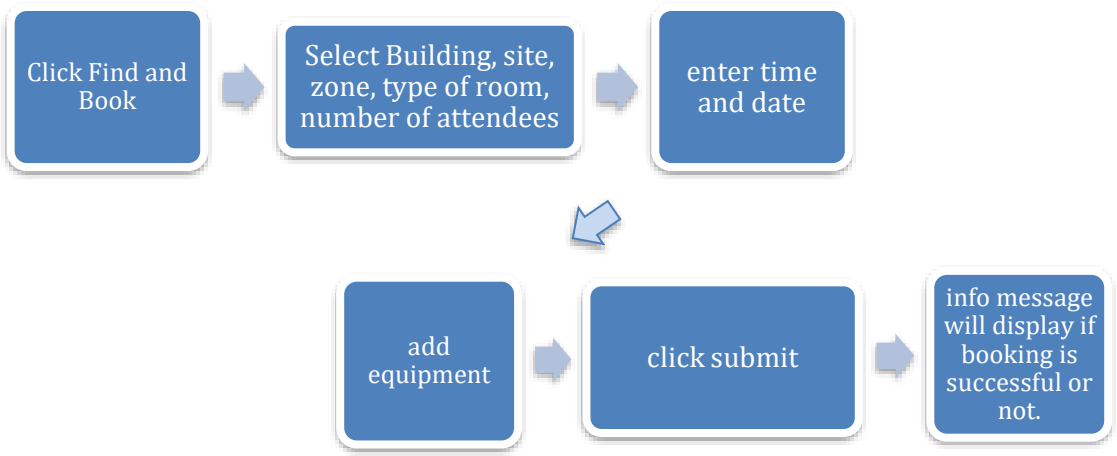


Fig 11. Old design Step-by-Step process for Lecturer of finding and Booking Room see (Appendix 3)

Step1

The user can click Find and Book Room from the timetable application navigation bar

Step 2

If the user is a Lecturer a window will display with a form to select for site, zone, category and number of attendees.

Else if the user is a student a window with the information will display that no rooms are configured for them to book (Appendix)

Step 3

A window with a calenda and a form for the time and duration of the booking will display

Step 4

After completing step 3 requirements, a window will display a drop-down menu of list of the equipment required for the room.

Step 5

If next button is clicked, an information box will show indicating whether booking is successful or not.

User: Students

Fig 12. Old Design Step by Step process for Students of finding and Booking Room see (Appendix 4)

Step 1

The user can click Find and Book Room from the timetable application navigation bar

Step 2

If the user is a student an information box of no bookable room will display.

6.3 Improved Design Algorithms for Finding and Booking Room

User: Students and Lecturers

Fig 13. Step by Step process of Finding Booking Room see (Appendix 5)

Step1

From the booking interface, students and lecturers can click on 'Find and book room'.

Step 2

Lecture Rooms and Theatre Hall with pictures will display in colour cues.

If the green circle coloured is displayed in the picture of the room, it indicates that room is available

Else, If the red circle coloured is displayed in the picture of the room, it indicates that the room is unavailable.

Step 3

If available room is clicked, information like seating capacity of the room will display, students and lecture can both book the room.

Else, If the unavailable room is clicked, information like seating capacity will display, lecturer can override the booking of the room that was booked by a student.

Step 4

Click Book and Hit Submit

- Booked Successfully-

6.4 Implementation

This web application is intended to assist users in booking rooms on The Sparks Building of the Southampton Solent University. The language used to write the web application is Dart together with the frontend development framework, Flutter.

Firebase Auth and Firebase Cloud Firestore were used for authentication and database to manage access and to store relevant user information respectively.

The application is built such that the two users (lecturers and students) are able to book any room at all times once the room is available. However, if a room is booked by a student, it can be overridden by a lecturer based on the terms and conditions of the booking.

During onboarding, student users are separated from lecturers and have less privileges. A room is available if it's marked with the indicator green and unavailable if marked with the indicator red. All room booking information is emailed to the user..

The programming language used to write the frontend of the web application is Dart, together with Flutter, a cross platform frontend development framework. A document-oriented database called Firebase Cloud Fire store was used to manage user data and all data related to the various rooms. Firebase Auth was used for user authentication and Firebase messaging was used for email correspondence throughout the application.

CHAPTER 7

7.1 Conclusion

Despite the study's use of a small survey sample data set, satisfactory results were obtained which gave an idea of what could be wrong with the existing application. A mixed method approach was employed in the study. The acquired data, both qualitative and quantitative, were thoroughly analysed. According to the findings of the survey, the majority of lecturers and students considered the current timetabling application difficult to use when finding, booking and verifying the availability of a room at the university. Approximately eighty-two percent (82%) of respondents had difficulty using the timetabling programme. The study recommended improvements which sought to enhance the efficiency of the timetabling application and to make it more user friendly.

The design and implementation of the User Interface used visual cues instead of the text-based User Inface. The implementation employed the Dart programming language for the frontend of the web application together with Flutter a cross platform frontend development framework. Firebase Auth was used for user authentication and Firebase messaging was used for email correspondence throughout the application. The improvement focused on reducing clicks, using visual cues and intuitive colour codes to make it more user friendly. The improvement also minimized the human involvement in the approval system managed by the TAR team.

This element of enforcement of the policy of making sure that users of the system of booking employed the resource for approved use was eliminated by utilizing the expectation of positive behaviour from the users instead of the implicit design assumption of negative behaviour. Additionally, users could see the availability of rooms with the colour code indicator. The study recommends the addition of a yellow visual code to the algorithm to indicate that rooms that were booked will be available soon. For that to function and to minimize friction between the users, a prewarning of the

lecturer overriding policy could be sent to the students by email. The recommends an expansion of the scope of implementation to include other buildings in the University

APPENDICES

Appendix 1. Questionnaire

An Evaluation of the Timetabling Application Interface Design

The purpose of this survey is to evaluate the efficiency of the current timetabling application and its interface design used by Solent University.

1. Identify yourself

- ◯ I am a Student
- ◯ I am a Lecturer

2. How would you rate the graphical user interface of the timetabling application of Solent University on a scale of 1-5, 1 being poor and 5 being excellent.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5

3. Is the Timetable interface informative enough, thus providing information about availability of a room, capacity of the room, etc.

- ◯ Yes
- ◯ No

4. Have you tried booking, finding, checking a room using the timetabling app or sending an email request to TAR?

- ◯ Yes
- ◯ No

5. Have you experienced difficulty in booking a room?

- ◯ Yes
- ◯ No

6. Does the timetabling application and email request to book a room to TAR facilitate your bookings in good time?

- ◯ Yes
- ◯ No

7. How would you rate the efficiency of the application when it comes to room bookings on a scale of 1-5, 1 being poor and 5 being excellent.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5

8. Do you find the use of the timetable application complex when booking, finding and checking availability of a room in the University?

- ◯ Yes
- ◯ No

9. Would you agree that enhancing the booking interface design of the timetabling application will increase its efficiency?

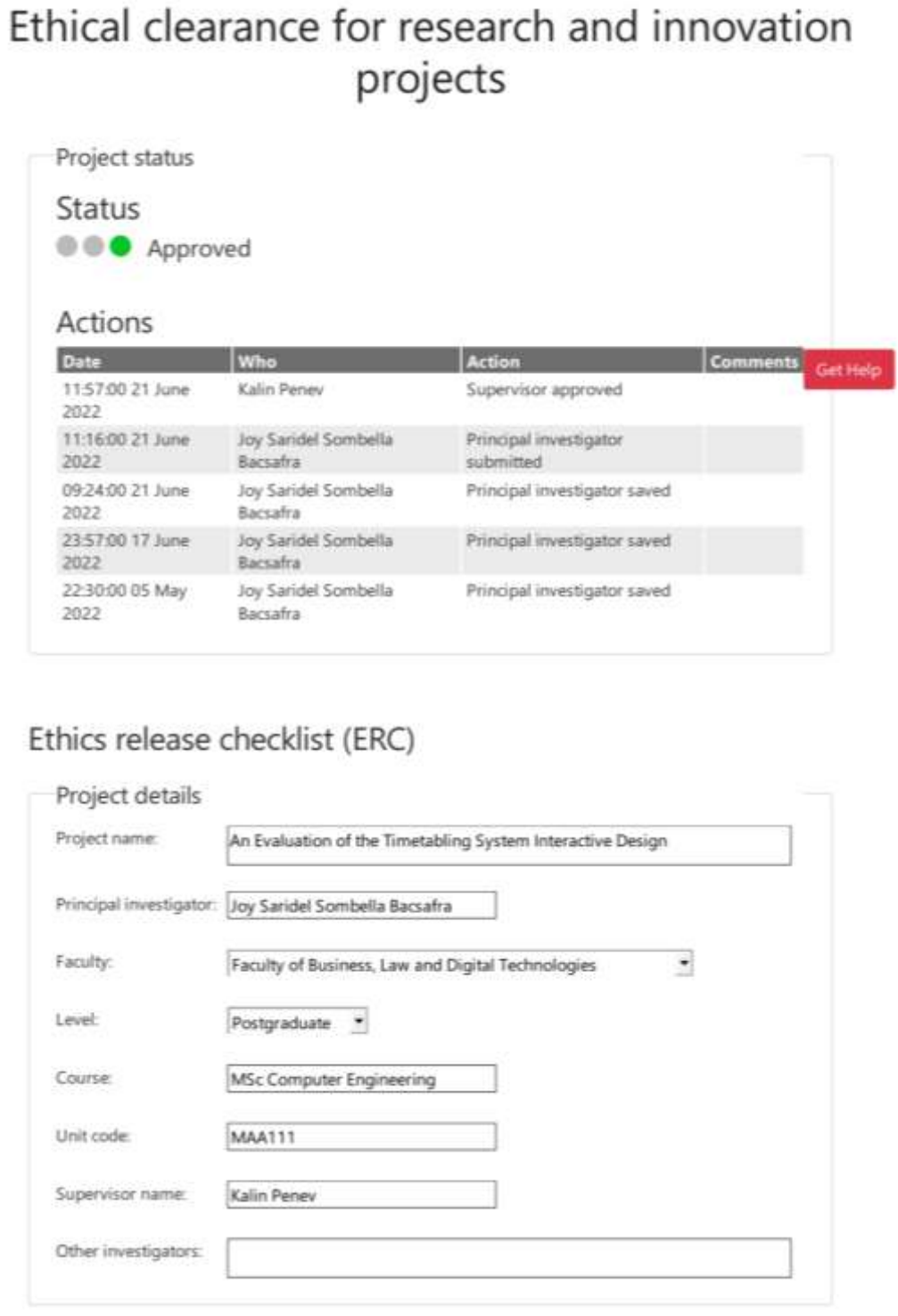
- ◯ Strongly Agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly Disagree

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Microsoft Forms

10. Do you have any suggestions on improving the interface design of the timetable application ?

Appendix 2. Ethical Clearance for research and innovation projects



Ethical clearance for research and innovation projects

Project status

Status

Approved

Actions

Date	Who	Action	Comments
11:57:00 21 June 2022	Kalin Penev	Supervisor approved	
11:16:00 21 June 2022	Joy Saridel Sombella Bacsafra	Principal investigator submitted	
09:24:00 21 June 2022	Joy Saridel Sombella Bacsafra	Principal investigator saved	
23:57:00 17 June 2022	Joy Saridel Sombella Bacsafra	Principal investigator saved	
22:30:00 05 May 2022	Joy Saridel Sombella Bacsafra	Principal investigator saved	

Get Help

Ethics release checklist (ERC)

Project details

Project name: An Evaluation of the Timetabling System Interactive Design

Principal investigator: Joy Saridel Sombella Bacsafra

Faculty: Faculty of Business, Law and Digital Technologies

Level: Postgraduate

Course: MSc Computer Engineering

Unit code: MAA111

Supervisor name: Kalin Penev

Other investigators:

Checklist

Question	Yes	No
Q1. Will the project involve human participants other than the investigator(s)?	●	○
Q1a. Will the project involve **vulnerable participants** such as children, young people, disabled people, the elderly, people with declared mental health issues, prisoners, people in health or social care settings, addicts, or those with learning difficulties or cognitive impairment either contacted directly or via a **gatekeeper** (for example a professional who runs an organisation through which participants are accessed; a service provider; a care-giver; a relative or a guardian)?	○	●
Q1b. Will the project involve the use of **control groups** or the **use of deception**?	○	●
Q1c. Will the project involve any **risk to the participants' health** (e.g. intrusive intervention such as the administration of drugs or other substances, or vigorous physical exercise), or involve psychological stress, anxiety, humiliation, physical pain or discomfort to the investigator(s) and/or the participants?	○	●
Q1d. Will the project involve **financial inducement** offered to participants other than reasonable expenses and compensation for time?	○	●
Q1e. Will the project be carried out by individuals unconnected with the University but who wish to use staff and/or students of the University as participants?	○	●
Q2. Will the project involve sensitive materials or topics that might be considered offensive, distressing, politically or socially sensitive, deeply personal or in breach of the law (for example criminal activities, sexual behaviour, ethnic status, personal appearance, experience of violence, addiction, religion, or financial circumstances)?	○	●
Q3. Will the project have detrimental impact on the environment, habitat or species?	○	●
Q4. Will the project involve living animal subjects?	○	●
Q5. Will the project involve the development for export of 'controlled' goods regulated by the Export Control Organisation (ECO)? (This specifically means military goods, so called dual-use goods (which are civilian goods but with a potential military use or application), products used for torture and repression, radioactive sources.) Further information from the Export Control Organisation *	○	●
Q6. Does your research involve: the storage of records on a computer, electronic transmissions, or visits to websites, which are associated with terrorist or extreme groups or other security sensitive material? Further information from the Information Commissioners Office *	○	●

Declarations

I/we, the investigator(s), confirm that:

☑ The information contained in this checklist is correct.

☑ I/we have assessed the ethical considerations in relation to the project in line with the University Ethics Policy.

☑ I/we understand that the ethical considerations of the project will need to be re-assessed if there are any changes to it.

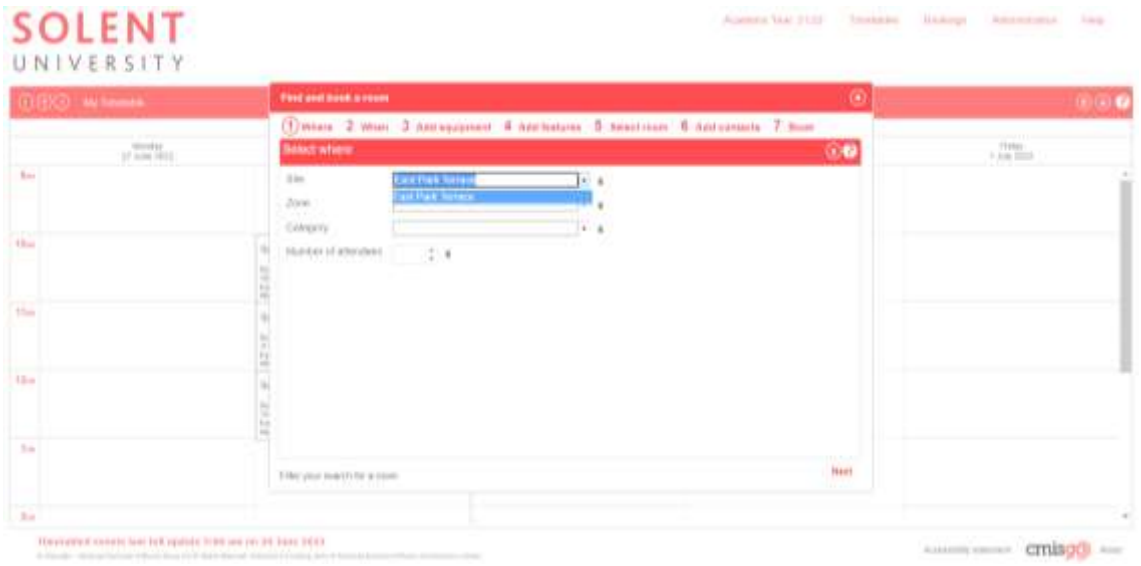
☑ I/we will endeavor to preserve the reputation of the University and protect the health and safety of all those involved when conducting this research/enterprise project.

☑ If personal data is to be collected as part of my project, I confirm that my project and I, as Principal Investigator, will adhere to the General Data Protection Regulation (GDPR) and the Data Protection Act 2018. I also confirm that I will seek advice on the DPA, as necessary, by referring to the Information Commissioner's Office further guidance on DPA and/or by contacting information.rights@solent.ac.uk. By Personal data, I understand any data that I will collect as part of my project that can identify an individual, whether in personal or family life, business or profession.

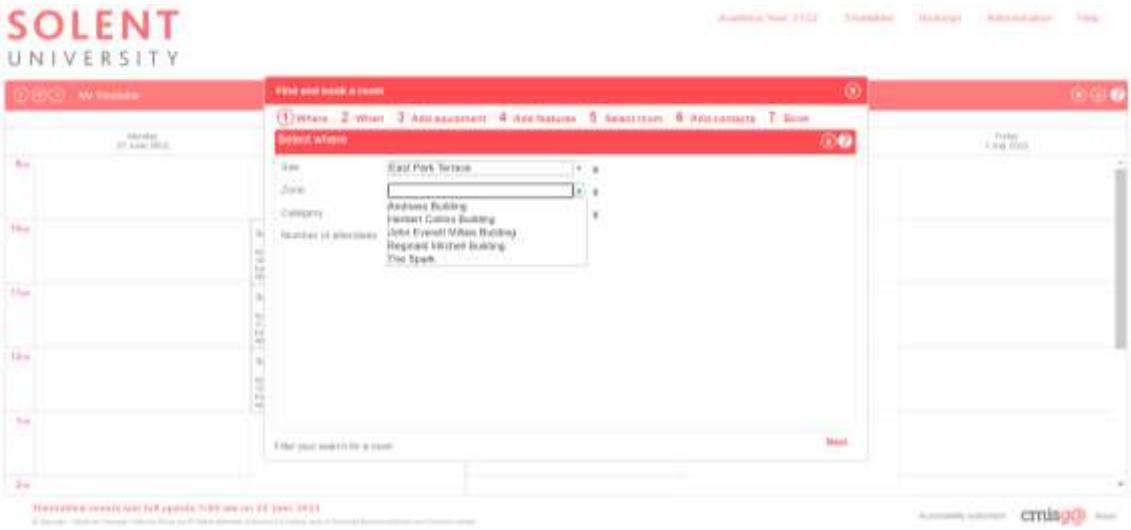
☑ I/we have read the prevent agenda.

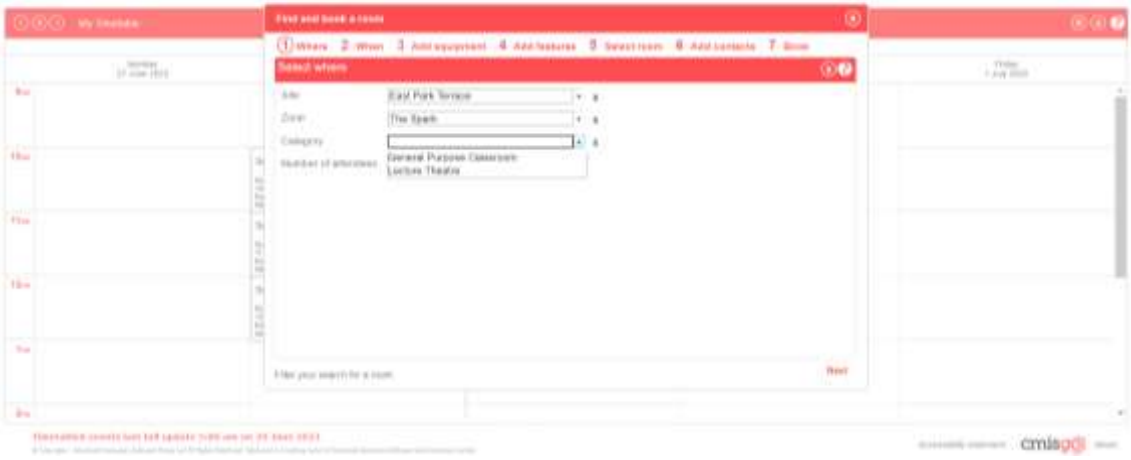
Appendix 3. Lecture finding and Booking Room

Step 1. The user can click Find and Book Room from the timetable application navigation bar



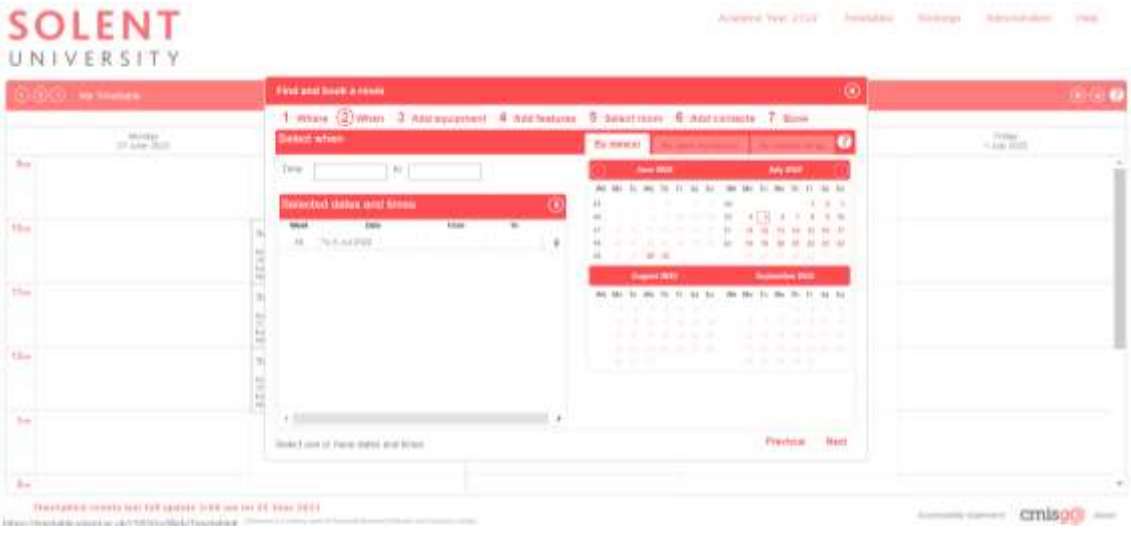
Step 2. If the user is a Lecturer a window will display with a form to select for site, zone, category and number of attendees. Else if the user is a student a window with the information will display that no rooms are configured for them to book (Appendix 4)

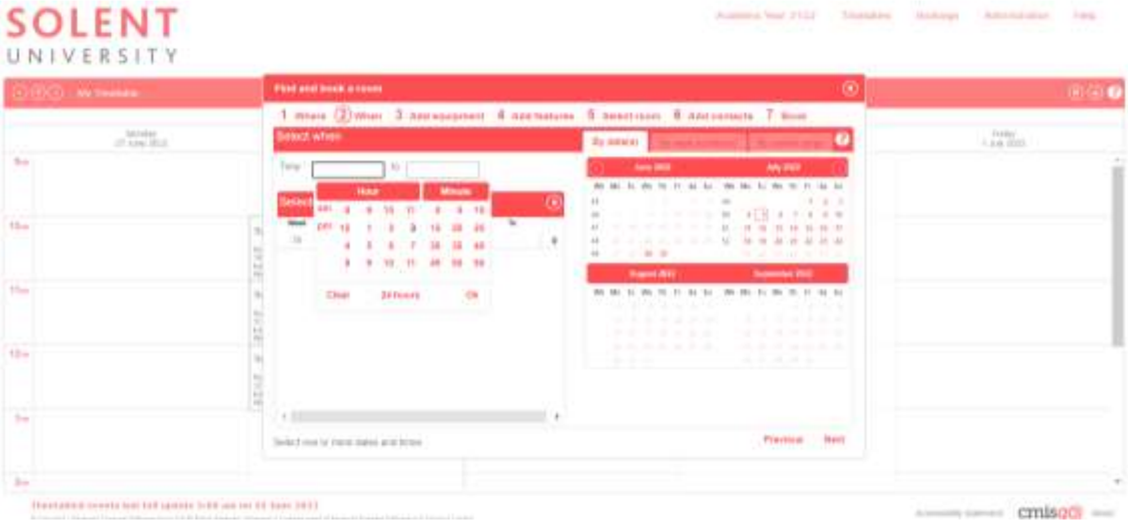

SOLENT
UNIVERSITY
Find and book a room
1 Where 2 When 3 Add equipment 4 Add features 5 Select room 6 Add contacts 7 Book
Select where
Site
East Park Terrace
Zone
Category
Number of attendees
Andrews Building
Herbert Collins Building
John Everett Millais Building
Reginald Mitchell Building
The Spark
Filter your search for a room
Next
cmisgo


SOLENT
UNIVERSITY
Find and book a room
1 Where 2 When 3 Add equipment 4 Add features 5 Select room 6 Add contacts 7 Book
Select where
Site
East Park Terrace
Zone
The Spark
Category
Number of attendees
General Purpose Classroom
Lecture Theatre
Filter your search for a room
Next
cmisgo

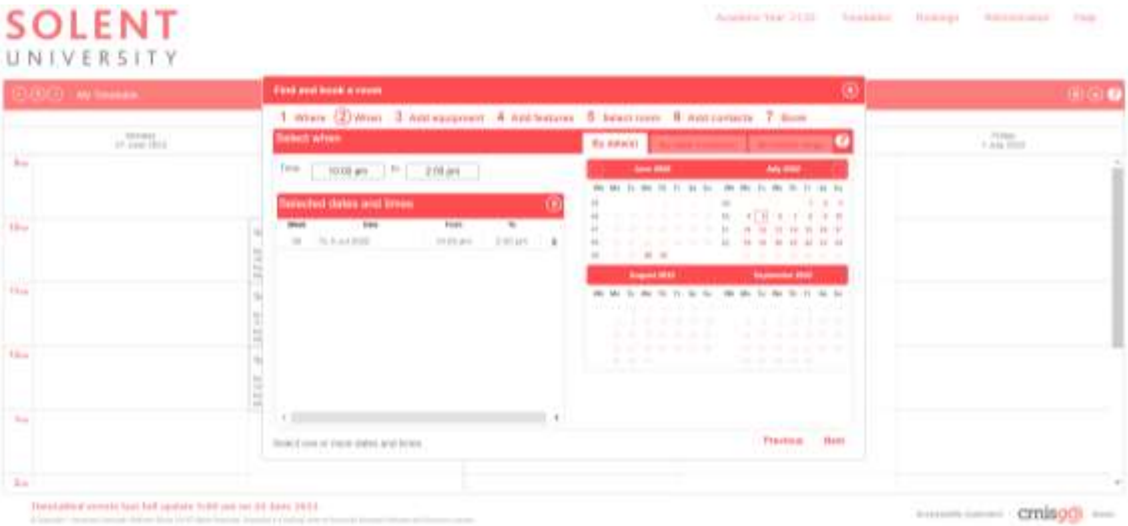

SOLENT
UNIVERSITY
Find and book a room
1 Where 2 When 3 Add equipment 4 Add features 5 Select room 6 Add contacts 7 Book
Select where
Site
East Park Terrace
Zone
The Spark
Category
General Purpose Classroom
Number of attendees
Filter your search for a room
Next
cmisgo

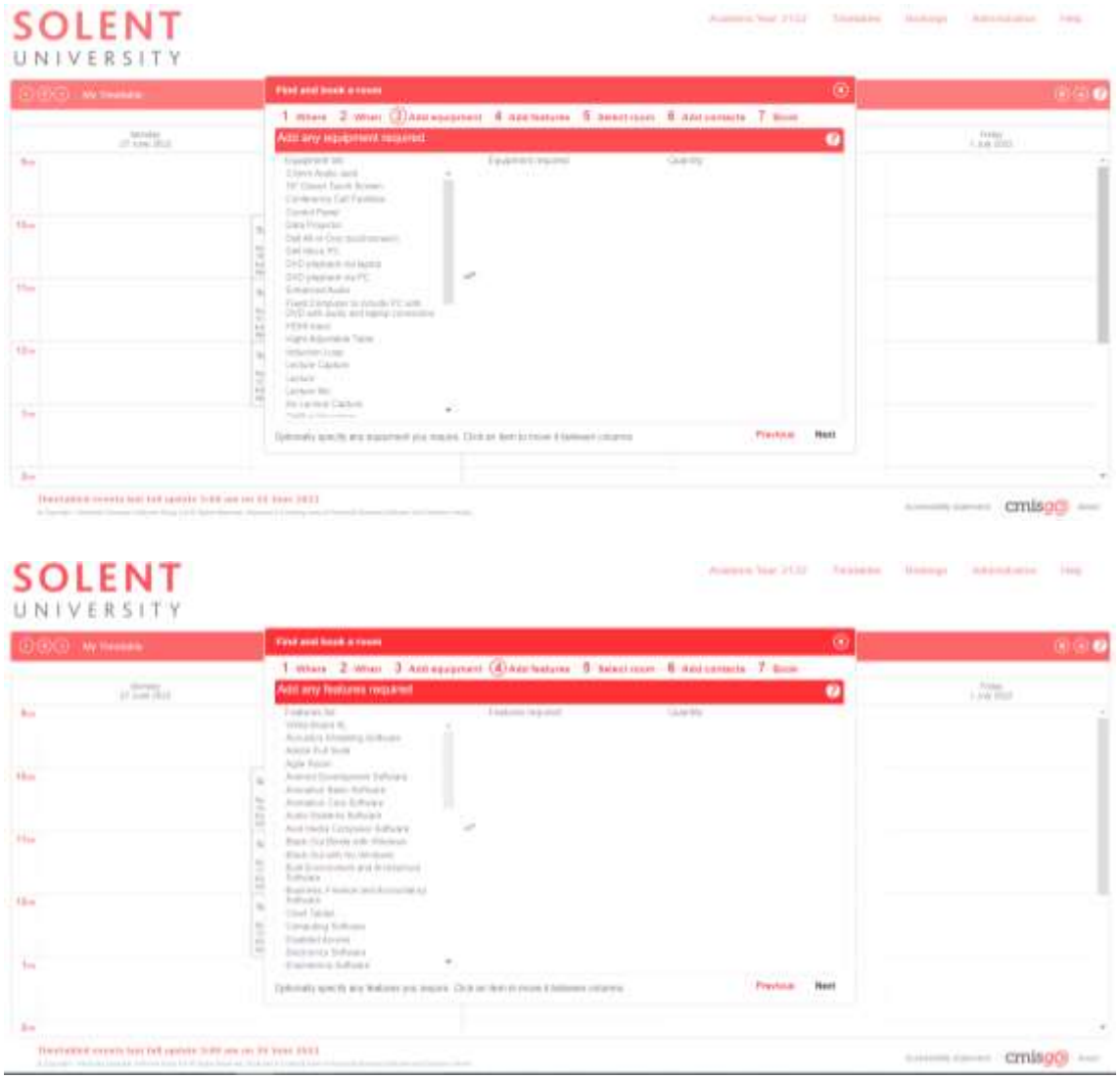
Step 3. A window with a calenda and a form for the time and duration of the booking will display



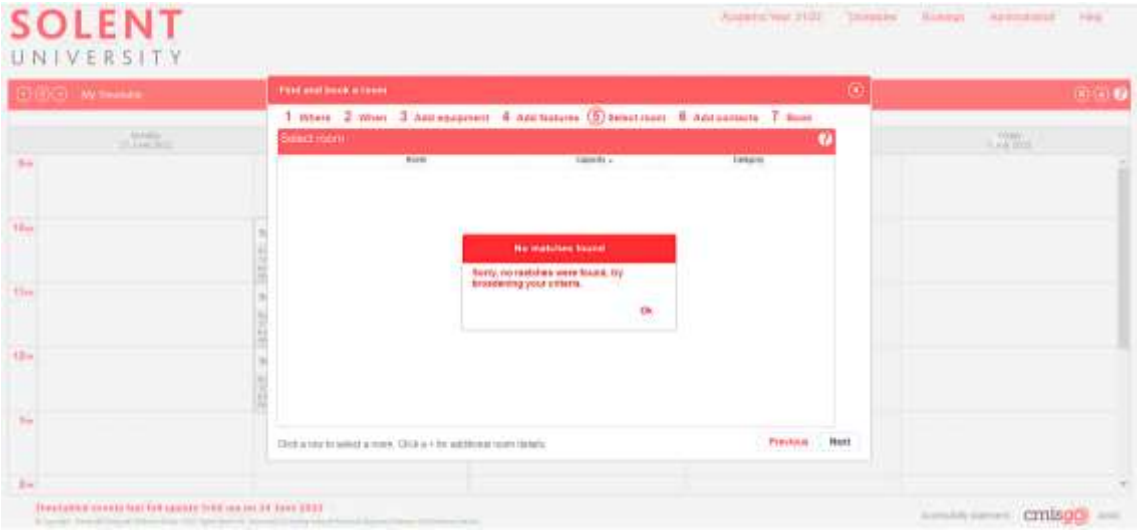

SOLENT UNIVERSITY
Find and book a room
Select when


SOLENT UNIVERSITY
Find and book a room
Select when
Selected dates and times


SOLENT UNIVERSITY
Find and book a room
Select when
Selected dates and times

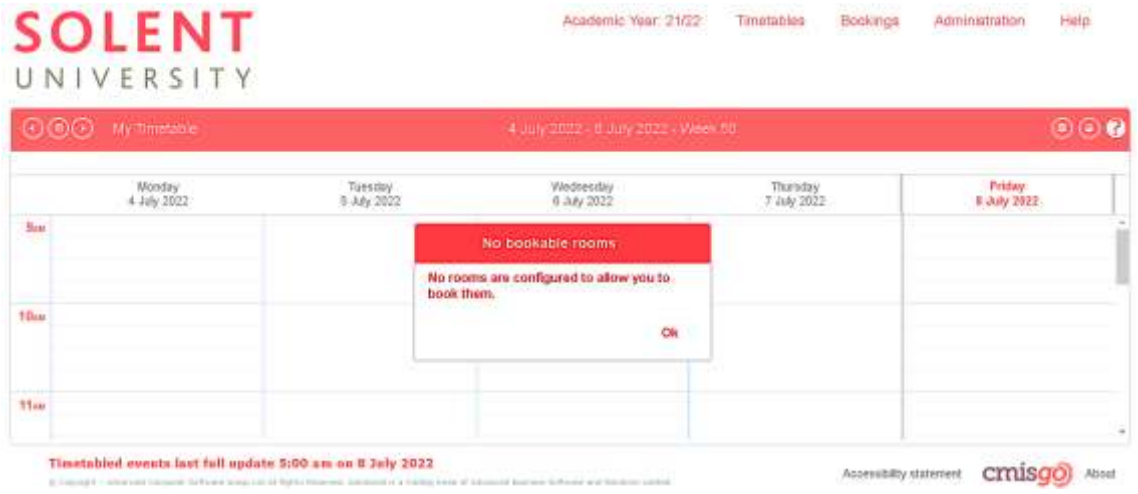


Step 4 After completing step 3 requirements, a window will display a drop-down menu of list of the equipment required for the room.



Step 5 If next button is clicked, an information box will show indicating whether booking is successful or not.

Appendix 4. Student Finding and Booking Room

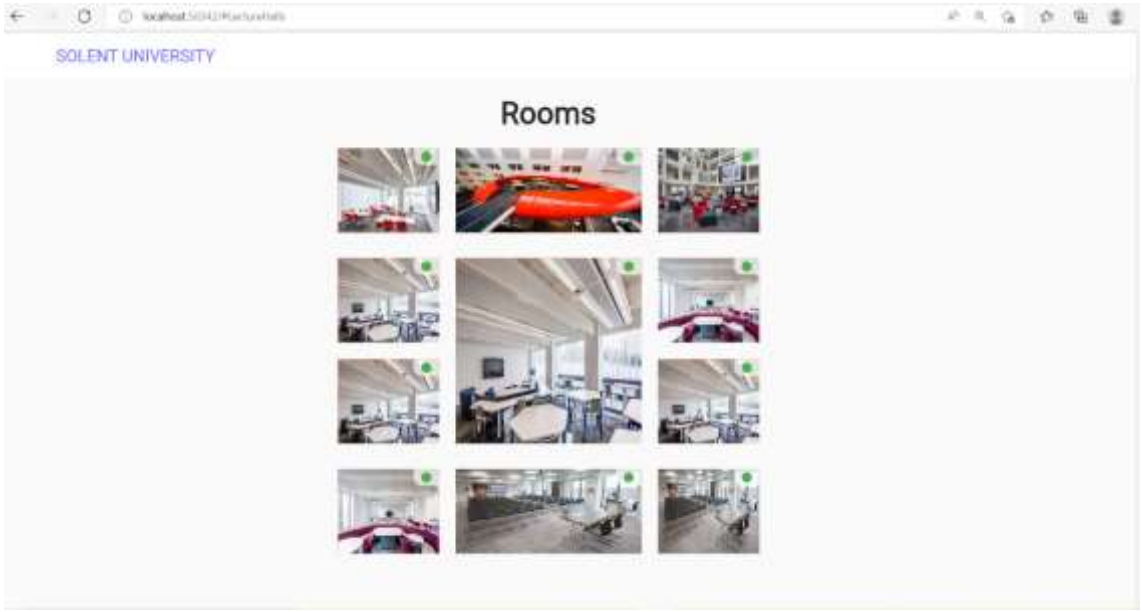


Step 1 The user can click Find and Book Room from the timetable application navigation bar

Step 2 If the user is a student an information box of no bookable room will display.

Appendix 5. Improved Interface Design of the Finding and Booking Room

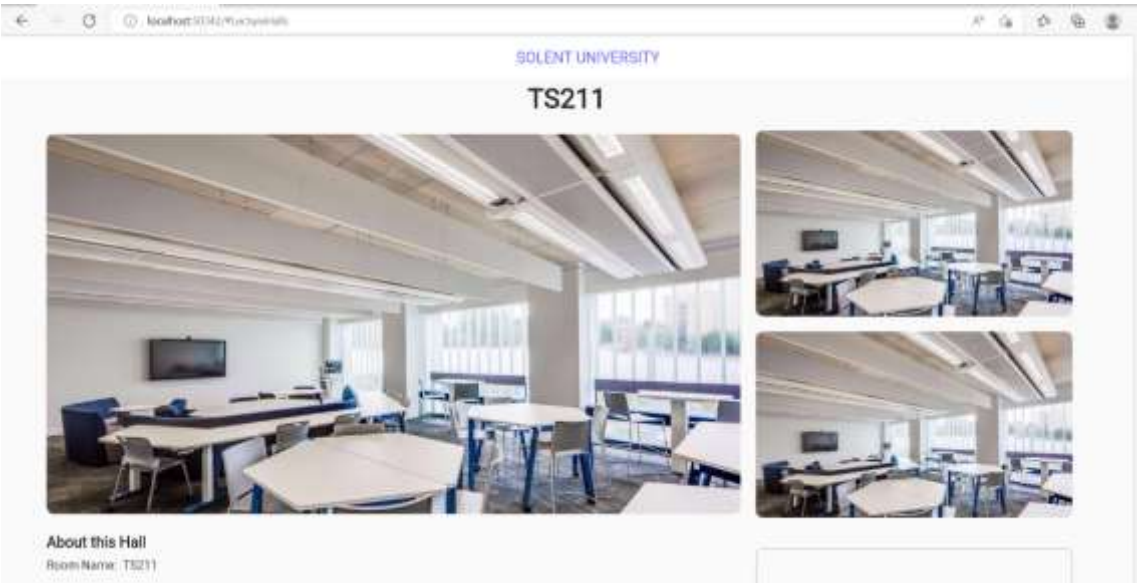
Step1 From the booking interface, students and lecturers can click on 'Find and book room' and both can be able to find and book a room.

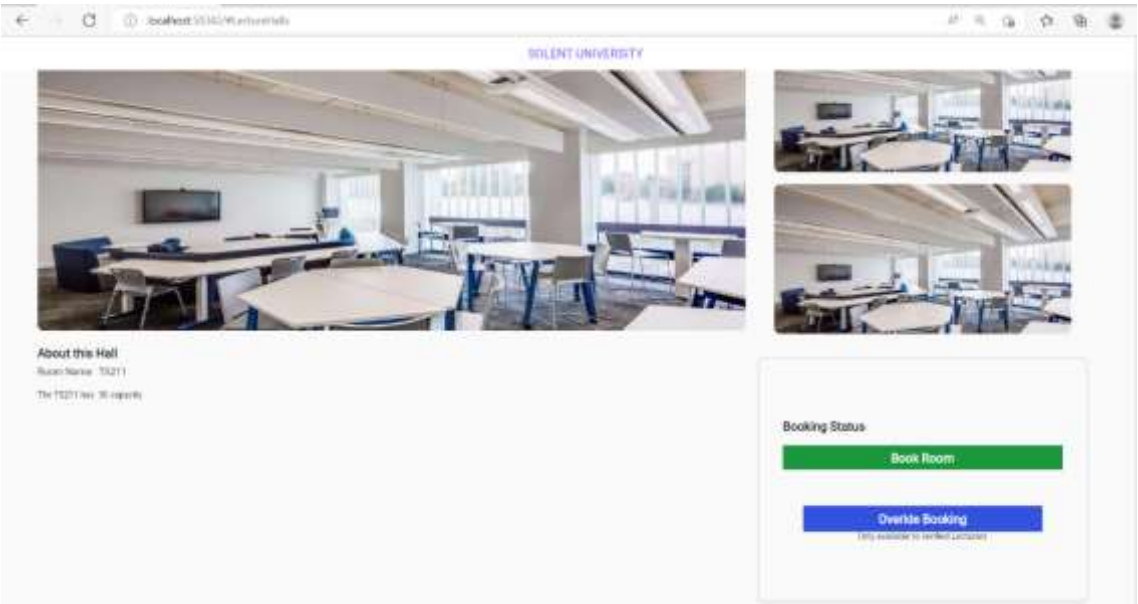


Step 2 Lecture Rooms and Theatre Hall with pictures will display in colour cues.

If the green circle coloured is displayed in the picture of the room, it indicates that room is available

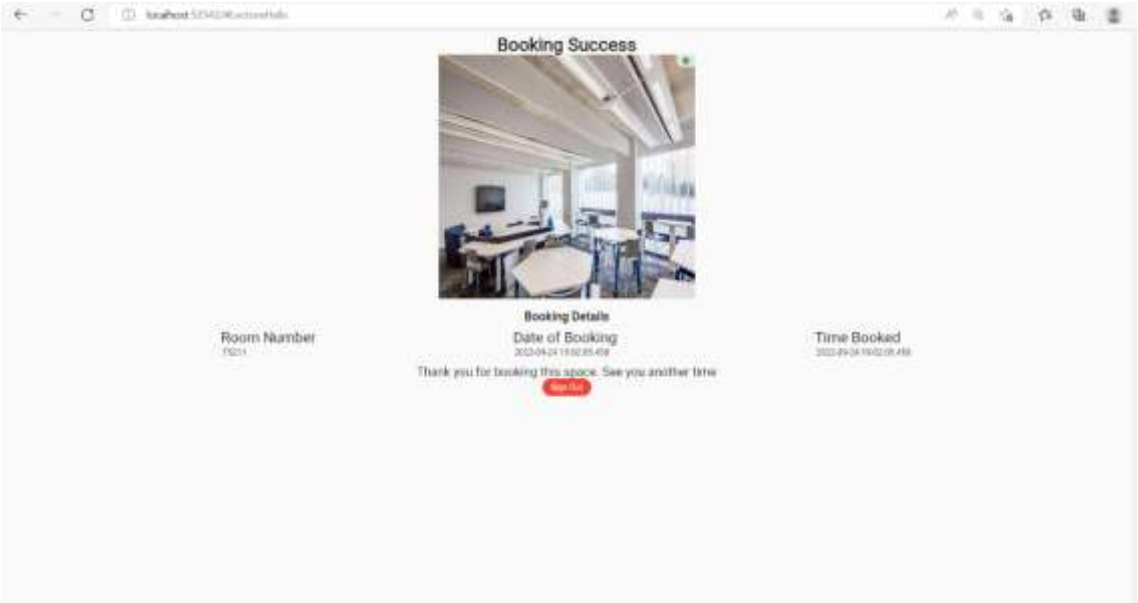
Else, If the red circle coloured is displayed in the picture of the room, it indicates that the room is unavailable.





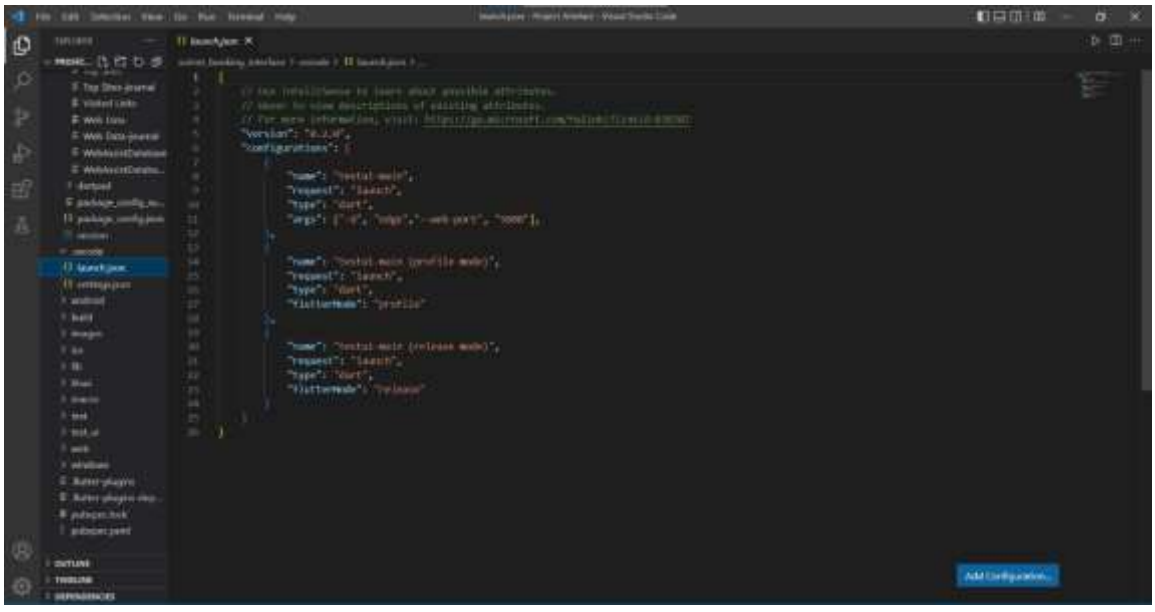
Step 3 If available room is clicked, information like seating capacity of the room will display, students and lecture can both book the room.

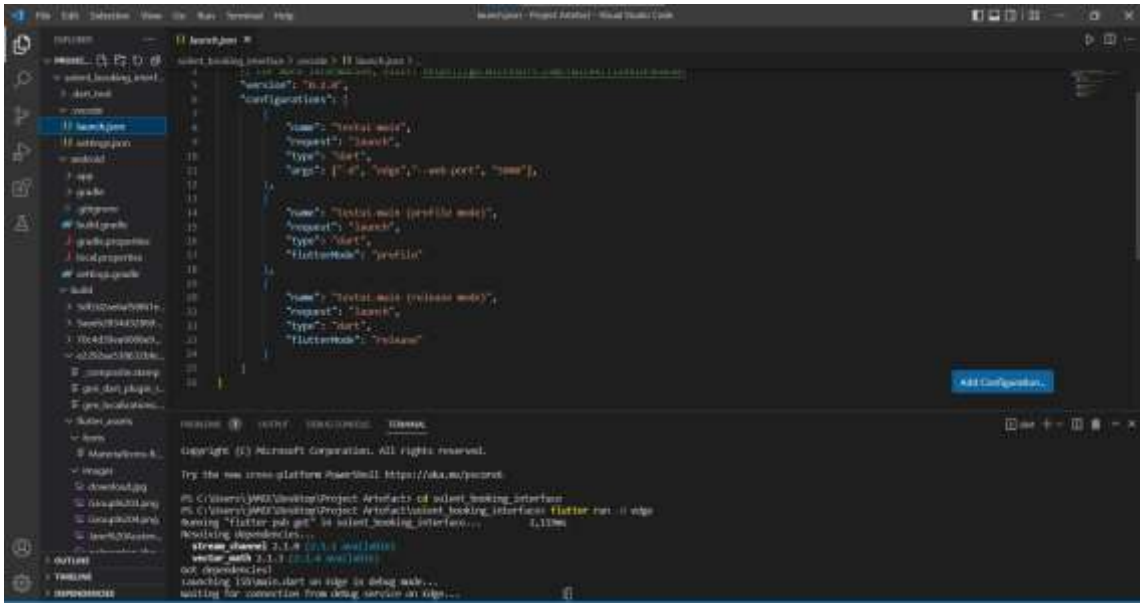
Else, If the unavailable room is clicked, information like seating capacity will display, lecturer can override the booking of the room that was booked by a student.

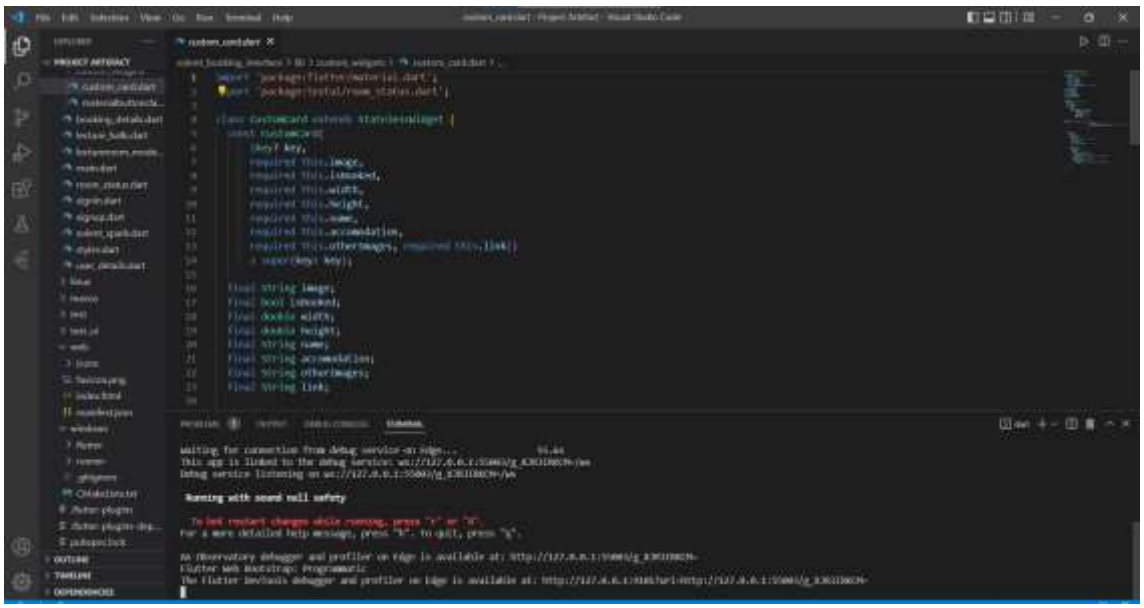


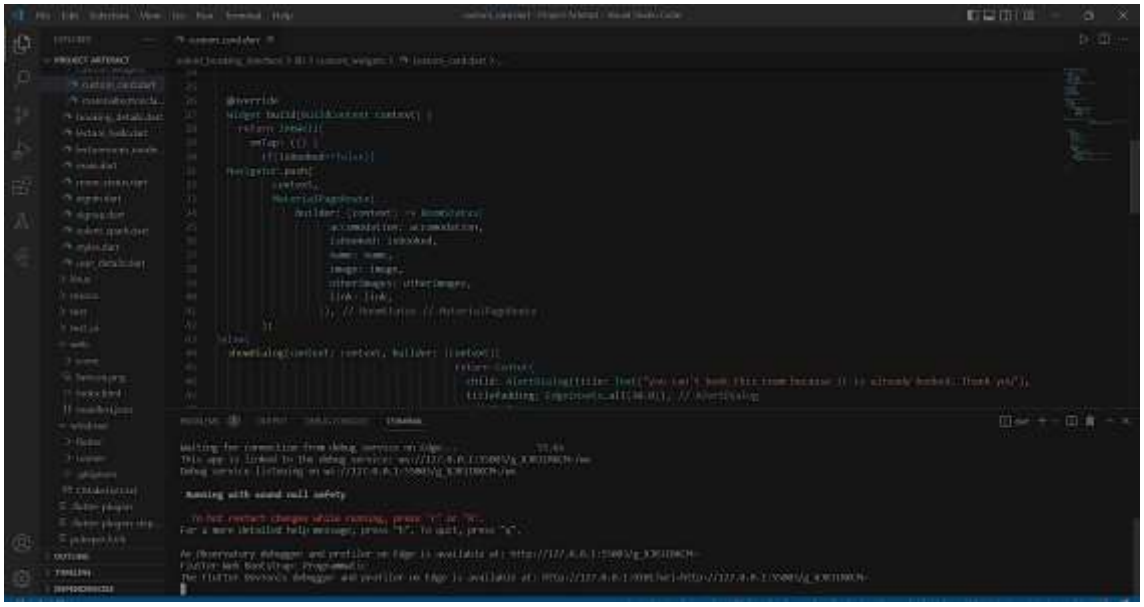
Step 4 Click Book and Hit Submit - Booked Successfully-

Appendix 6. Screen Shots of the Design process and Source Code









```dart
import 'package:flutter/material.dart';
import 'package:testui/styles.dart';
import 'package:testui/custom_widgets/custom_card.dart';
import 'package:provider/provider.dart';
import 'package:testui/user_details.dart';
class LectureHalls extends StatefulWidget {
  const LectureHalls({Key? key}) : super(key: key);
  static const String id = "LectureHalls";
  @override
  State<LectureHalls> createState() => _LectureHallsState();
}
class _LectureHallsState extends State<LectureHalls> {
  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
        elevation: 0,
        backgroundColor: Colors.white,
        title: const Text(
          'SOLENT UNIVERSITY',
          style: TextStyle(color: KColor1),
          textAlign: TextAlign.left,
        ),
      ),
      body: SingleChildScrollView(
        child: Container(
          width: double.infinity,
          child: Row(
            children: [
              SizedBox(
                width: MediaQuery.of(context).size.width * 0.3,
```

```
            ),
            Column(
                mainAxisAlignment: MainAxisAlignment.center,
                crossAxisAlignment: CrossAxisAlignment.center,
                children: [
                  const Padding(
                    padding: EdgeInsets.all(20.0),
                    child: Text(
                      'Rooms',
                      style: TextStyle(
                          fontSize: 36, fontWeight: FontWeight.bold),
                    ),
                  ),
                  Row(
                    //  mainAxisAlignment:
MainAxisAlignment.spaceBetween,
                    children:  [
                      CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/ts201.jpg',
                        accomodation: '31',
                        otherImages: 'images/ts201.jpg',
                        name: 'TS201',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts201']['booked'] ,
                        link: 'ts201'
                      ),
                      const SizedBox(
                        width: 20,
                      ),
                      CustomCard(
                        height: 100,
                        width: 220,
                        image: 'images/pod.png',
                        accomodation: '40',
                        otherImages: 'images/pod.png',
                        name: 'The Pod',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['pod']['booked'] ,
                        link: 'pod'
                      ),
                      const SizedBox(
                        width: 20,
                      ),
                      CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/spark_atrium.jpg',
                        accomodation: '200',
                        otherImages: 'images/spark_atrium.jpg',
                        name: 'The Spark Atrium Main Reception Area',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['spark']['booked'] ,
```

```
                        link: 'spark'
                      ),
                    ],
                  ),
                  const SizedBox(
                    height: 30,
                  ),
                  Row(
                    //   mainAxisAlignment:
MainAxisAlignment.spaceBetween,
                    children: [
                      Column(
                        //mainAxisAlignment:
MainAxisAlignment.spaceBetween,
                        children:  [
                          CustomCard(
                            height: 100,
                            width: 120,
                            image: 'images/ts202.jpg',
                            accomodation: '60',
                            otherImages: 'images/t202.jpg',
                            name: 'TS202',
                            isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts202']['booked'],
                            link: 'ts202'
                          ),
                          SizedBox(
                            height: 20,
                          ),
                          CustomCard(
                            height: 100,
                            width: 120,
                            image: 'images/ts209.jpg',
                            accomodation: '30',
                            otherImages: 'images/ts209.jpg',
                            name: 'TS209',
                            isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts209']['booked'],
                            link: 'ts209'
                          ),
                        ],
                      ),
                      const SizedBox(
                        width: 20,
                      ),
                       CustomCard(
                        height: 220,
                        width: 220,
                        image: 'images/ts211.jpg',
                        accomodation: '30',
                        otherImages: 'images/ts211.jpg',
                        name: 'TS211',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts211']['booked'] ,
```

```
                        link: 'ts211'
                      ),
                      const SizedBox(
                        width: 20,
                      ),
                      Column(
                        //  mainAxisAlignment:
MainAxisAlignment.spaceBetween,
                        children:  [
                          CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/ts401.jpg',
                        accomodation: '35',
                        otherImages: 'images/ts401.jpg',
                        name: 'TS401',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts401']['booked'] ,
                        link: 'ts401'
                      ),
                          SizedBox(
                            height: 20,
                          ),
                          CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/ts515.jpg',
                        accomodation: '31',
                        otherImages: 'images/ts515.jpg',
                        name: 'TS515',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts515']['booked'] ,
                        link: 'ts515'
                      ),
                          ],
                        ),
                    ],
                  ),
                  const SizedBox(
                    height: 30,
                  ),
                  Row(
                    // mainAxisAlignment:
MainAxisAlignment.spaceBetween,
                      children:  [
                          CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/ts311.jpg',
                        accomodation: '30',
                        otherImages: 'images/ts311.jpg',
                        name: 'TS311',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts311']['booked'] ,
```

```
                        link: 'ts311'
                      ),
                      SizedBox(
                        width: 20,
                      ),
                      CustomCard(
                        height: 100,
                        width: 220,
                        image: 'images/ts402.jpg',
                        accomodation: '60',
                        otherImages: 'images/ts402.jpg',
                        name: 'TS402',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts402']['booked'] ,
                        link: 'ts402'
                      ),
                      SizedBox(
                        width: 20,
                      ),
                     CustomCard(
                        height: 100,
                        width: 120,
                        image: 'images/ts412.jpg',
                        accomodation: '40',
                        otherImages: 'images/ts412.jpg',
                        name: 'TS412',
                        isBooked: Provider.of<AllData>(context,
listen:false).getRoomStates['ts412']['booked'],
                        link: 'ts412'
                      ),
                    ],
                  )
                ]),
              SizedBox(
                width: MediaQuery.of(context).size.width * 0.3,
              ),
            ],
          ),
        ),
      ),
    );
  }
}
```

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