

IxD LAYOUT AND BEHAVIOUR FOR A ROOM RESERVATION SYSTEM

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IxD LAYOUT AND BEHAVIOUR FOR A ROOM RESERVATION SYSTEM

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By

Abdullateef Aliyu

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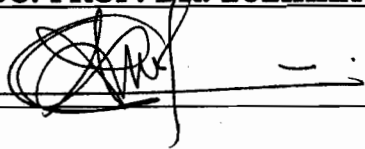
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ABSTRACT

Interacting with a system can be pleasurable when the design is good, but this is not true for a system that was poorly designed. Poor design emerges mostly when the interface which to the user is the system was designed poorly in terms of interaction design elements. With such an interface, accomplishing task become tedious, consumes a lot of time and effort as users interact with the system. User usually get frustrated and dissatisfied as accomplishing task becomes complex. A room reservation system (RRS) was explored as the study domain which attempted to solve the problems in designing a poor system in terms of Interaction design elements of layout and behaviour. A conceptual design of a RRS was designed after research on the existing interface of RRS. Selected elements, namely layout and behaviour were compared and tabulated. The deficiencies in the existing interface were improved in the new concept. A high fidelity prototype was designed from the concept which was evaluated with Questionnaire for user interface satisfaction (QUIS).

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DEDICATION

*To my late mum Hajiya Hassana Aliyu, my late sisters Amina Aliyu and Maryam Aliyu,
may your souls rest in peace, Amin.*

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LIST OF ABBREVIATIONS

B_n	Behaviour element (n)
EUC	End User Computing
HAI	Human Agent Interaction
HCIL	Human Computer Interaction Laboratory
H_n	Horizontal grid line (n)
ISS	Interface Satisfactory Score
IxD	Interaction Design
IxDA	Interaction Design Association
L_n	Layout element (n)
L_m	Line number (m)
PDA	Personal Digital Assistant
QUIS	Questionnaire for User Interface Satisfaction
RRS	Room Reservation System
System A	University of Tampere Library Reservation System
System B	musb.sourceforge.net Room Reservation System
System C	Room Booking System V2.2
UCD	User Centred Design
UI	User Interface
USI	User Satisfaction Index
V_n	Vertical Grid Line number

CHAPTER ONE

INTRODUCTION

Interaction design (IxD) is a design field concern with designing interactive products that are pleasurable to use and provides user satisfaction. This field is concern with the behaviour of interactive products for example the room reservation system which users interact with to accomplish the task of reserving resources for use. The behaviour of a product is considered one of the elements of IxD, other elements includes form and content. One of the sub elements of form is the layout. Layout is the sizing, spacing, and placement of content within an interface. Effective layout is crucial in interactive system as it helps users to find what they are looking for quickly, as well as making the interface appearance visually appealing. The study is on the layout and behaviour element of a room reservation system.

1.1 Background

Systems are designed for user to interact with to accomplish a specific task. When a task is quickly accomplished by a user, they could be a possibility that the user is an expert user, the system is easy to use or has been easily learned or the interface has been designed properly. Whichever the reason, it has to do with the user interacting with the system.

Interacting with a poorly designed system could lead to frustration (Preece, Rogers, & Sharp, 2002; 2007), this is true especially if the task is to be completed and the behaviour of the system is not favourable. The task of completing a room reservation by a user could amount to frustration and dissatisfaction in circumstances like poorly design interface and bad behaviour to mention a few.

Room reservation system (RRS) is a system that provides user with functionality such as making reservation, cancelling reservation, viewing reservation, checking for availability of room, and equipments. Interacting with such a system is much more interesting when the behaviour, form and content comply with user's functional requirement and non functional requirement which are the added value to the design, hence user will be satisfied. In situations where the interface is poorly designed, then frustration and dissatisfaction will be the results of interacting with such reservation system.

This study is about interaction design attributes in an interactive product specifically on behaviour of a system. The other two elements of IxD namely form and content are also highlighted. For better understanding, below are definitions of important key words for this study, namely form, content, behaviour and user centred design (UCD):

Form can be defined as the visible shape or arrangement of something, can also be considered as the look and feel of a product (Copper *et al.*, 2007; Preece, Roger & Sharp, 2007). Various product have their forms, for instance, the look of a chair differ from the look of a book or chair. Attribute associated with form includes the layout, shape, grid, background, colour and size. This falls under the field of visual design.

Content is term used to describe what is actually contained in a product (Copper *et al.*, 2007). This can be data or information that can be in the form the user required. Some product pay more attention to content, an informational web site is an example of site where emphasis is on the content and less on the look. The study of content falls under the field of information architecture (Garrett, 2000).

Behaviour can be the manner in which something functions or operates, Saffer (2006) said " behaviour: the way that products behave in response to the way that people behave". Also behaviour can be seen as the reaction we get for every action that has taken place. Let consider the operation of an electronic calculator for example. Calculator has number buttons and a display, when a button is pressed (action), the expected number on the display (reaction) is the number engraved of the button pressed. A good behaviour by the calculator can be the display of the corresponding number of the punched button, but when a number 5 is punched and a number 7 is displayed, then we can conclude that the calculator is not functioning properly or is faulty. This is

actually a bad behaviour. The study of behaviour falls under the field of interaction design (Cooper *et al.*, 2007; Saffer, 2006).

User Centred design (UCD) is a method of designing interface which the needs, wants, and limitations of the end user of a system are given extensive attention at each stage of the design process. In practice, Developers often pay attention to functionality and features which they often forget to consider the user during the process (Abrams *et al.*, 2004; Tayoma, 2007). Tayoma points out steps involve in user centred design as:

1. Spend time with actual users or potential end-users to identify challenges they face, often with respect to a particular issue.
2. Prototype potential solutions.
3. User-test to see how the prototypes work or don't work
4. Iteratively prototype and test, repeating steps 2 and 3.
5. Conduct a rigorous user study of your best solution. (Optional, but recommended).

In relation to the introduced elements form, content and behavior, there are issues which relate to interface of an interactive system such as room reservation system. These issues are discussed below.

1.2 Problem Statement

The main problem of this study is dissatisfaction and frustration among user of room reservation system as they interact with the system that is poorly designed (Jonasson, Fjeld & Yamashita, 2007). A poorly designed system in terms of form, content and behaviour might emerge as result of wrong implementation of concept or users were not considered during the design.

In every organization, for a maximum efficiency to be achieved, there must be adequate and efficient allocation of resources. Such a scenario is applicable to room reservation and allocation within academic environment for different educational purposes. Peoplecube.com (2008) acknowledged the fact that room reservation system in an academic environment will helps both the students and teachers to save a lot of their valuable time. Although, the importance of room reservation system has always been

significantly mentioned, it was equally noted that, for any room reservation system to be efficient, it must be made user-centred (Jonasson, Fjeld & Yamashita, 2007; peoplecube.com, 2008) by incorporating a reliable user interface into the system. Preece *et al.* (2007) identified appearance as one of the cause of user frustration.

Similarly, Constantine (1995) identified usability as the primary element of a good system design. According to the author, such usability level can only be achieved by clearly defining what the intended users really want before system design and implementation. It is those needs that constitute the user interface.

This is found lacking in some existing room reservation system (Jonasson *et al.*, 2007) as most of these systems are only usable but not useful. This study involves looking at various requirements with a view to design a prototype for a room reservation system that will meet user's expectation in terms of behaviour, content and form. It is hoped that such a scenario will present an exemplary solution for designing an interactive room reservation system.

Figure 1.1 below shows the problem flow of a room reservation system (RRS). In the figure, the first rectangle identify the cause of the problem which is poorly design RRS in terms of element of interaction design (behaviour, form and content). The second rectangle represents the problem and the third rectangle which is the last rectangle in the figure represents the effect that is caused by a poorly design RRS.

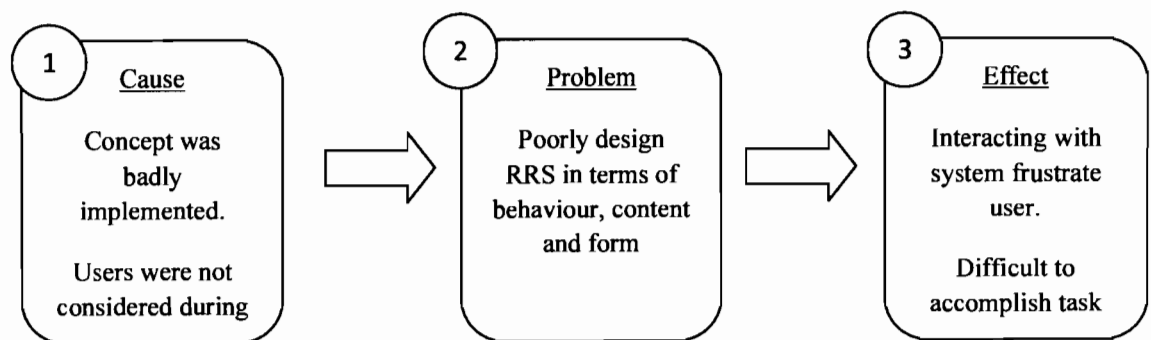


Figure 1.1: Problem flow showing the cause, problem and effect

In trying to solve the problem, this study will have to address the following questions.

1.3 Research Questions

In the previous section, the problem the study is trying to solve has been identified as poorly designed RRS in terms of interaction design elements, for that reason the following are the research questions:

1. What are the significant elements to be compared in RRS?
2. Can the form, content, and behaviour of RRS be conceptually designed so that it will improve user interaction and satisfaction?
3. Can the conceptual design be utilized in developing a physical prototype?
4. What method can be used to evaluate user satisfaction for a RRS?

By answering these questions we hope to achieve the following objectives.

1.4 Objectives

The main objective is to design a prototype of a room reservation system which will serve as exemplary solution for designing an interactive room reservation system. In order to do this, there are few sub objectives to be achieved. They are as follows:

- To identify elements to be compared in RRS.
- To conceptually design the form, content and behaviour of RRS so that it will improve user interaction and satisfaction.
- To develop a physical prototype from the conceptual design.
- To evaluate user satisfaction for a RRS.

By user interaction, we mean how the users interact with the RRS. The way the user login, the way booking is done, the steps users need to accomplish before a task is completed.

Satisfaction deals with how user perceived the RRS in the context of their environments, it also measures the acceptance level or success of a system.

1.5 Scope

The study domain is the room reservation system, specifically the meeting rooms in the department of information technology (IT), college of Art and science (CAS), since this room are frequently use and the existing system is not automated. RRS is selected since it relevant for academic institution to manage and allocate resources. Secondly, less emphasis on the interaction design elements in previous design were noticed which resulted to criticism of existing system (Jonasson, Fjeld & Yamashita, 2007).

The subjects to perform the evaluation of the prototype are staff of department of information technology (IT) with basic knowledge of computer and students of department of (IT) with knowledge of designing interactive application. Suggestions from this subject will be relevant for system improvement. On the method of analysis of the evaluated results, data gathered from the QUIS will be analysed using mean and standard deviation (S.D) as a more statistical analysis will not be necessary since the subjects will be 10 user that will be randomly selected (QUIS, n.d) .

To add more value to the study and to achieve the goal within the time frame, comparison will be carried out among three (3) already existing room reservation systems. The minimum number required for a comparison is two, but to acquire more knowledge in the domain, three was considered.

The elements to be compared are the layout element, and the behaviour which is narrowed down to feedback, assistive, affordance and navigation (see Figure 1.2).

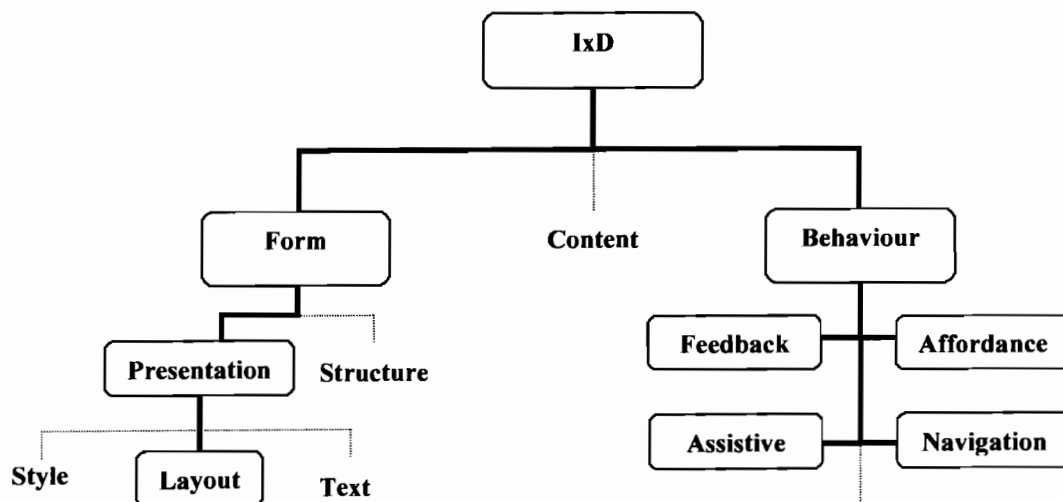


Figure 1.2: Scope chart

1.6 Significance of Study

The significance of this study can be seen from different perspectives which include the designers, developers, the persona and institution of use.

For the designer, it provides an exemplary solution which can be used in design that deals with interactive system such as the room reservation system. The techniques that will be adapted by the study in comparing existing interface can be used in analysing interactive interfaces. This will help in saving time and effort spent in brainstorming on how analysis will be performed on interface.

For the developer, it provides a wake-up call on developing interactive product with interaction design element in a way users will be able to accomplish task on time rather than getting frustrated when interacting with products.

Finally for the persona (primary and secondary), it provides them with a system that help them in conserving knowledge, as interactive behaviour such as feedback, affordance, assistive, navigation provide them with a sense of relief as they interact with the RRS and also accomplishing task will be done with ease and effectively.

The design will serve as a better replacement for existing paper based system in institution where it is still used.

1.7 Summary

In this chapter, poorly designed room reservation systems have been identified as the cause of user frustration and dissatisfaction. In an attempt to solve the identified problem, room reservation system will be prototyped, from a conceptual design. In order to achieve the main objective, sub objective such as identification of elements to be compared in RRS, conceptual design of the form, content and behaviour of RRS so that it will improve user interaction and satisfaction, and to evaluate user satisfaction for a RRS need to be achieved. On the scope of the study, meeting room reservation system of department of IT will be design. Evaluation will be performed by 10 users that are selected randomly among staff and student of department of IT. The gathered data will be analysed with mean and S.D. The study will benefit the designer, the developer and the user of the system.

Subsequent chapters includes; chapter two which discussed literatures related to the domain and field of the study, chapter three describes the methodology adapted in this study. Chapter three is structured into three part, the first phase is the researching where existing system were explored, users need were indentified, the secondly phase is the design phase where conceptual design will be transformed into a physical prototype and the final phase is the evaluation phase. The preceding chapter presents the findings and the discussion regarding the study and the final chapter concludes the research.

CHAPTER TWO

LITERATURE REVIEW

This chapter relates the study domain to literatures. The relationship of the study to literatures was established as the chapter discussed reservation system, the interaction design approach to solving problem associated with reservation system, interaction design elements, interfaces and finally user satisfaction, which is the measure that was used by the study in the evaluation stage.

2.1 Reservation System

In most literature the term reservation and booking usually has the same meaning (Shiang *et al.*, 2004; Jonasson *et al.*, 2007; Wang, Zheng & Hu, 2008; Zhang & Zhao, 2009). Booking is an act of reserving resources for use within specific time frame. A system that allows the reservation of resource for use within specific time period can be term reservation system. Resource for reservation can be room, equipment (such as computer, music instruments), ticket, seat to mention a few. Reservation systems like airline, hotel room, theatre ticket are common. All these systems have long history since the time reservation were done manually and to present time where most of these systems are now automated.

The manual reservation system or non-automated reservation systems are known as the traditional systems (see Figure 2.1).

UC San Diego Cross-Cultural Center
ROOM RESERVATION FORM

PRIMARY CONTACT (Must be present at the program/meeting)

Name _____ Org./Dept. & Position _____

Email _____ Phone _____ Mail Code _____

Secondary Contact

Name _____ Email _____

PROGRAM/MEETING INFO

Name _____

Time: _____ AM/PM to _____ AM/PM Total Hours _____

Date _____ Quarter _____

For recurring reservations only

<input type="checkbox"/> Weekly	<input type="checkbox"/> Monday
<input type="checkbox"/> Even weeks	<input type="checkbox"/> Tuesday
<input type="checkbox"/> Odd Weeks	<input type="checkbox"/> Wednesday
	<input type="checkbox"/> Thursday
	<input type="checkbox"/> Friday

Room Requested

Tranquility Room (5) Conference Room (25) Comunided Room Large (60-80)

ArtSpace/Gallery (40-55) Comunided Room All (150) Comunided Room Small (40-65)

Expected Attendance _____

Type of Program

Class Training/Workshop Special Event _____

Meeting Lecture/speaker

User Group

LGBT Resource Center Women's Center Campus Committee _____

Faculty/Graduate _____ Department _____

Student Organization _____ Staff Organization _____

Equipment Request (Availability is limited and must be confirmed by CCC staff)

Dry Erase Board Projector Projector Screen TV/VCR/DVD Sound system/Mic

USER AGREEMENTS:

Figure 2.1: Traditional reservation system (From http://ccc.ucsd.edu/pdf/CCC_Room_Reservation.pdf
Retrieved July 20, 2009)

In the late 1960s personal computer did not exist, in early 80s computer systems were bulky and expensive (Pejakovic, 2006). Personal computers were rarely available; in essence resources were managed and allocated manually. Documentation of the allocated resource is done with organizer, forms, charts or other means which is similar to the form shown in Figure 2.1. The entire process is tiring and complicated.

Personnel handling task of reservation do find it complex, tiring, tedious and difficult to keep records of reservation. Kim, Lim and Tang (2005) cited an example with a conference room where in early days there would be pieces of paper having time lines on it and whoever wants to use the room makes a note on the paper to prevent possible conflicts. But with advent of personal computer and advance technology, the old means of reservation are now gradually transforming into electronic systems (Kim *et al.*,

2005), hence, the automated reservation system was born. Reid (1983) observed that computers were replacing the traditional paper and pencil systems, thereby improving customer services, providing ease of use compared to the manual system.

Automation means the use of automatic equipment instead of manual, reservation system other than manual that are computerized are termed automated reservation system (Sidborn *et al.*, 2004; Jonasson *et al.*, 2007). These reservation systems are usually in form of software running on individual desktop computers, running online real-time in a network or in a small devices such as personal digital assistant (PDA), mobile phones. In this present time, most reservation systems are automated, and ways of making these systems to become much more suitable for usage are been proposed from time to time. With just a single click of a mouse, computerized reservation systems has the potential to provide the precise type of information required to the end user (Kim *et al.*, 2005), this has brought much relief compared to the manual counterpart (See Figure 2.2), but however user dissatisfaction and frustration still occur as some of these system were poorly design in terms of element of interaction design (Shneiderman, 1997).

Figure 2.2: Automated reservation system (University Of Wisconsin-Madison, 2006)

The automated reservation system provides interface for interaction, tasks are accomplished via this interfaces which is the medium of interaction with the system, but to the user, these interfaces are the system (Constantine & Lockwood, 1999; Stone *et al.*, 2005). In order for task to be accomplished quickly, they are need for a good user interface. Various reservation system exist but are different in design depending on the task to be accomplished or based on the device the system is to be used, irrespective of these, reservation system are accessible via the interface to the end user.

2.1.1 Room Reservation System

Room reservation system is very popular as compare to other reservation systems. It includes reservation system such as the hotel room, meeting room, conference room, library room, music room, concert room, and theatre room to mention few. All these systems have one main purpose which is to help the user of such a system in reserving a room for the purpose of use. Besides reserving rooms, there are usually other purposes which the system is likely to provide. Studies on room reservation systems are discussed below.

Sidborn, Wiberg and Ohman (2004) redesigned a traditional reservation system into an automated systems (see Figure 2.3) as task like combination of different rooms with different sizes and equipment, the choice of different date and time in conference buildings or universities or other large building were complicated, especially when the way of accomplishing tasks were not automated. In their study of solving problems of room reservation system, the author began by evaluating existing system from which several sketches were drawn of the interface, basic functionality and user scenarios were performed. The prototype developed shows an example of how such a system could look like, however, the study was more on the system, but little was said on element of the interface.

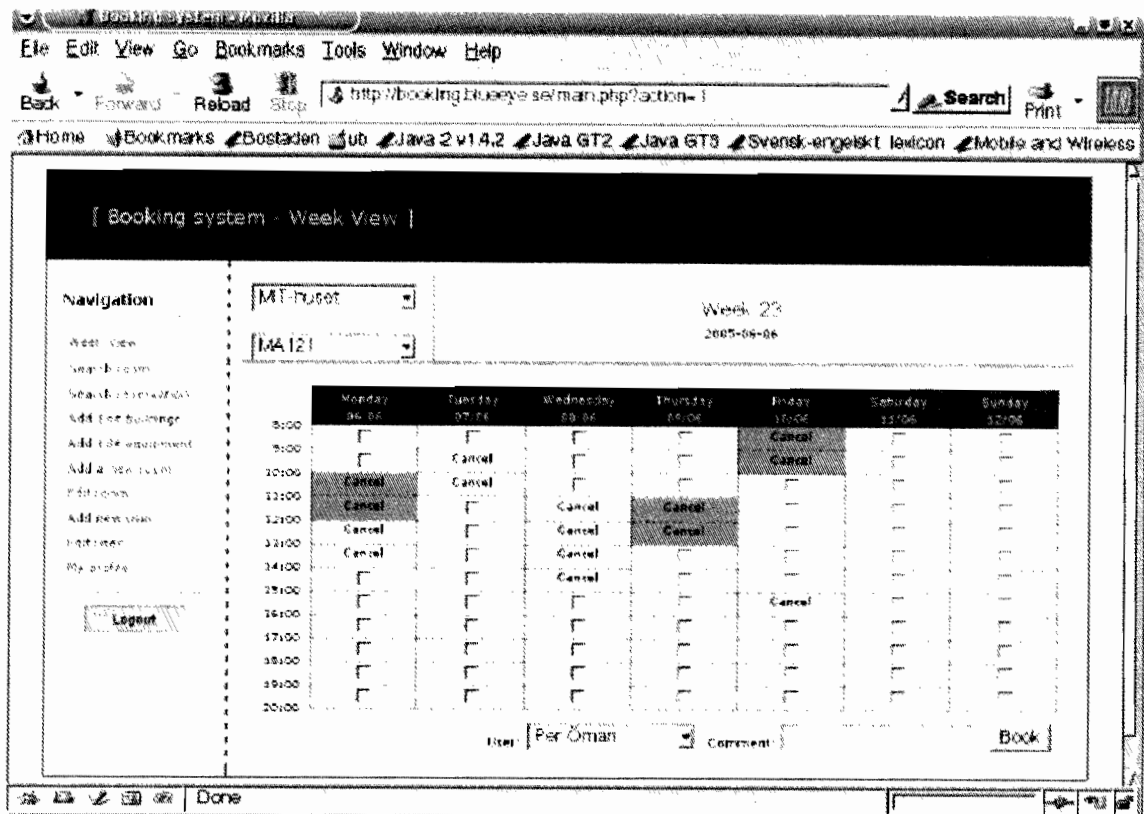


Figure 2.3: Snap Shot of Prototype by Sidborn *et al.*, 2004.

In another study, Jonasson, Fjeld, and Yamashita (2007) examined prototyping as a method in re-designing a user interface (UI). In the case presented, a web based room reservation system running on a university website was re-designed because the existing system has caused much critique amongst the users. The study reported some element of behaviour that includes affordance, navigation, and feedback were lacking in the existing system. User's expectations for a new UI were increase ease of use, less effort required, and less time consumed. In their study, a new UI was prototyped using a low fidelity prototype, although low fidelity prototypes is cheaper but only provide limited detail of how the UI will function, or how tasks might be undertaken (Stone *et al.*, 2005). The prototype which was developed by Visio was tested by both experienced and novice users. However, the method adapted in analyzing the existing system was not mentioned, design guidelines on layout, alignment, whitespace, screen balancing and how they were implemented in the prototype was not stated. The result of the study partly favours the existing system and partly the improved system.

Shiang *et al.* (2004) study on room booking system suggested a way of increasing flexibility of the system by providing user with greater control. Ideas from argumentation-based negotiation was incorporated into human-agent interaction (HAI) to increase the flexibility of the system, however the study was more on the system flexibility improvement, but other behaviour which the system will exhibit as the user interacts with the system were not highlighted.

In the study of Teuber and Forbrig (2004) on different pattern for online booking systems, pattern concepts were applied to the analysis and user interface design of online booking applications. Their study presented the pattern-oriented user interface design approach and applied theory to practice with the example of online booking applications. In the study they described the patterns along with the scenario of Anne and Paul (Persona) which was based on thorough analysis. The online booking pattern include analysis patterns that define users, tasks and business objects and user interface design patterns that specify the dialog structure, dialog design, and visual design. Heuristic evaluation was performed with domain and usability experts. However, pattern solution to a design problem will only provide a generic solution to recurring problems with fundamental support for software, which is not necessarily the solution that will satisfy the need of the users.

Studies on room reservation system have covers low-fidelity prototyping, re-design, fidelity in Prototyping, user-centred prototyping, and patterns for the redesign of online booking systems (Teuber & Forbrig, 2004), they have not been much study aiming to guide designing interaction for an automated room booking (Jonasson *et al.*, 2007). This study may contribute towards establishing such knowledge.

2.2 Interaction Design

The term interaction design was coined by two industrial designers, Bill Moggridge and Bill Verplanck in the mid 1980's (Cooper *et al.*, 2007) and since then, there has been several meaning to what is interaction design. Various experts in the field that are members of the Interaction design association (IxDA), a global non profit professional organisation of designer incorporated in 2005 sees IxD in different context. Erickson (2005), a member of IxDA sees interaction design as:

“Interaction design has to do with the design of any artefact, be it an object, system, or environment, whose primary aim is to support either an interaction of a person with the artefact or an interaction among people that is mediated by the artefact”.

It is obvious that it has to do with design of artefact for use. Saffer (2004; 2005) opinion about interaction design refers to it as an art of facilitating or instigating interaction between humans (or their agents), which is mediated by products. Saffer sees interaction design beyond optimization, but making things pleasurable to use and affecting emotions. The definition of interaction design by Preece *et al.* (2002) is also similar to both definitions, designing interactive products to support people in their everyday and working lives. It also about developing interactive product (technology, environment, tool, application, or device) that is easy, effective and enjoyable to use. All these definitions are similar, in the sense that they all refer to it as designing artefacts that user will interact with and also for the designed artefact to be pleasurable and provides satisfaction as they are used. IxD approach to design problem provides a system that is usable and useful, hence adapting such technique in designing a reservation system would yield a system that task of completing reservation will be accomplished with ease.

2.2.1 Interaction Design Elements

Form, content and behaviour are the three elements of interaction design. These elements are associated with other design fields like visual design known for graphic treatment of interface elements (Cooper *et al.*, 2007; Garrett, 2000). These elements have sub elements which form part of the broad categories.

Saffer (2006) indentified motion, space, time, appearance, texture and sound as interaction design elements. According to the author, form which is the look and feel has appearance as one of the sub elements. Appearance has several characteristics that include texture, proportion, structure, size, shape, weight and colour, these characteristics helps in providing affordances to an interactive product. Layout is another sub element of form. Layout helps in providing visual structure to an interface (Stone *et al.*, 2005). Layout has properties like grid, alignment and whitespace which

help in providing structure to an interface design. Zong, Wang and Zong (2008) discussed the advantages of white space design in visual communication and visual psychology, and then study the special artistic influence of whitespace in website interface design. According to the authors appropriate use of white space for interface will provide wonderful performance for interface. In layout clarification on user interface, white space is considered more important than lines (Stone *et al.*, 2005).

User interface behaviour element can be discussed in terms of sub elements that include affordance, navigation, assistive, forgiveness and feedback (Galitz, 2007; Cooper *et al.*, 2007). User interface combines the three elements, although emphasis on these elements is more on some user interface. In this study, emphasis will be on the layout element and some of the behaviour elements as discussed in the scope.

2.2.2 User Centred Design Approach

The term user-centred design (UCD) is said to have originated in Donald Norman's research laboratory at the University of California San Diego in the 1980s and it has become widely used after the publication of a co-authored book entitled: *User-Centred System Design: New Perspectives on Human-Computer Interaction* (Norman & Draper, 1986). After which it has been built upon up till this present day.

User-centred design is a broad term to describe design processes in which end-users influence how a design takes shape (Abrams, Maloney-Krichmar, & Preece, 2004; Constantine, 2002; Stone *et al.*, 2005). According to Tayoma (2007), "UCD is a broad approach to technology design, in which the constraints and desires of the eventual user of the technology are taken into account throughout the design process". This do not only focuses on understanding the user, but also requires understanding of the tasks that user will perform and also the environment of use. Emphasis of UCD is on user to be involved in the design process.

A good user interface cater for the end user and supports them in the tasks they wish to undertake, having good knowledge of the user and what the user wants to achieve with the system will help in the design of a good interface. A system might be usable but not

necessarily useful (Stone *et al.*, 2005), these is normally the case when users of an interactive product are not considered during design process or in another scenario building a system to accommodate all users (Cooper *et al.*, 2007). A computer system which was developed without a good knowledge of the user's need and task which the user want to accomplished may be usable, but it may not be useful to user to achieve their goal (Stone *et al.*; Landseadel, 1995). Adapting UCD in design will help task accomplishment as user will not have to think unnecessarily about the intricacies of how to use computer to achieve goals. In this study, users are considered in the design process with the anticipation that an interface which will be built will not only be usable by the user, but also help user accomplish task with ease.

Preece *et al.* (2007) identified four essentials of UCD design activities which are:

1. Understand and specify the context of use.
2. Specify the user and organizational requirements.
3. Produce design solutions (prototypes).
4. Evaluate designs with users against requirements.

The steps involve in UCD as specify by Tayoma (2007) includes the essentials of UCD as specify by Stone *et al.* (2005), Tayoma highlighted five steps, and these steps are listed below:

1. Time should be spent with actual users or potential end-users to identify challenges they face, often with respect to a particular issue.
2. Potential solutions should be prototype.
3. User-test prototype to see how it work or do not work.
4. Iteratively prototype and test, repeating steps 2 and 3.
5. Conduct a rigorous user study of your best solution. (Optional, but recommended).

Figure 2.4 below is the representation of the five steps highlighted by Tayoma (2007).

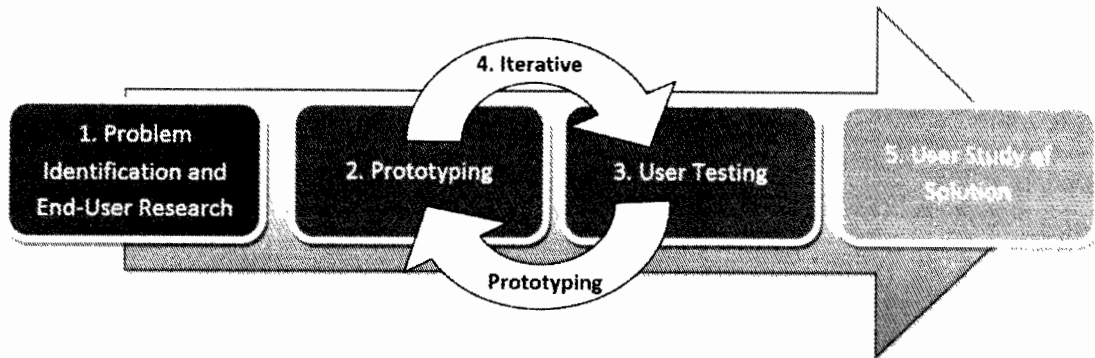


Figure 2.4: User Centred Design steps (Tayoma, 2007).

For the purpose of satisfying the need of the user and to produce an interactive products that is more efficient and effective UCD will be adapted in this study as a method for designing the user interface of the RRS.

2.3 User Interface

The User Interface (UI) is the system layer through which the computer and the users communicate. Although the UI is generally thought of as software alone, the UI system includes the keyboard, display, buttons, switches, labels, and any hardware, software, or person that is part of the human computer interaction (Landseadel, 1995; Preece *et al.*, 2002; Stone *et al.*, 2005). To the user the interface is the system (Stone *et al.*; Constantine & Lockwood, 1999). It is the medium of interaction with the system due to this reason the design of user interface is vital to the entire system. Interaction Design is often associated with the design of system interfaces in a variety of media but concentrates on the aspects of the interface that define and present the system behaviour, with a focus on developing the system to respond to the user's experience.

A model developed by Baxlely (2003) describes user interface as a series of nine layers which was further grouped into three higher level tiers (see Figure 2.5).

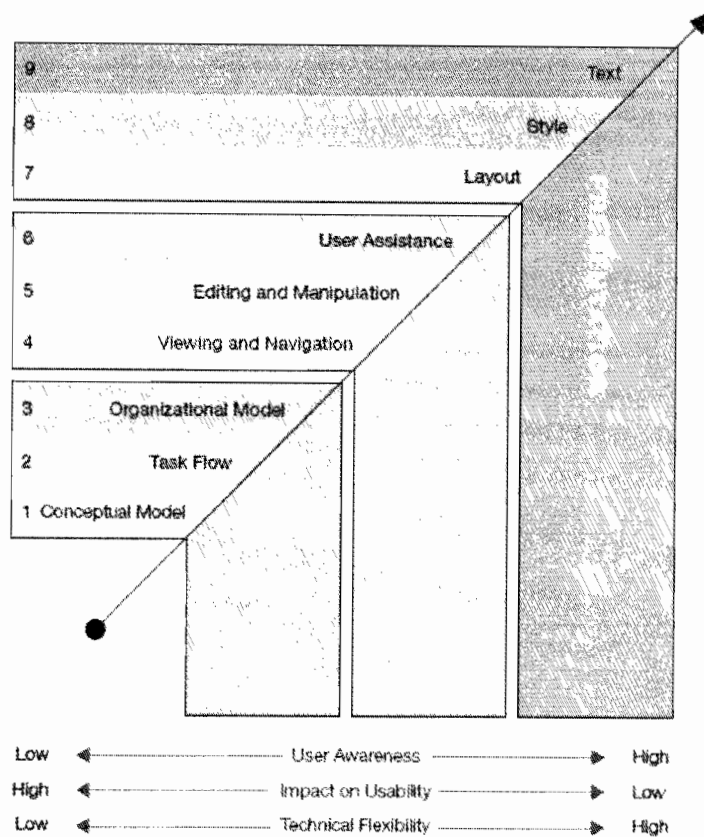


Figure 2.5: Universal Model of the User Interface (from: www.baxleydesign.com)

The layers are ordered from foundational to supporting highlighting their relative impact on user awareness, influence on usability, and technical flexibility. The model is useful as a common vocabulary, a method for interpreting user feedback, and as a tool for ordering design decisions and prioritizing design efforts. The model can as well be visualized in terms of IxD elements which are; form, content and behaviour.

2.3.1 Comparison and Evaluation of User Interface

User interface can be compared or analysed based on techniques developed by experts, some of the techniques most adapted by designers are the user observation and inspection of the user interface which can also be referred to as heuristic inspection (Stone *et al.*, 2005; Nielson & Mack, 1994). Inspection of interface is a generic name for a set of techniques that involves inspectors examining the user interface based on design principles and guidelines known as heuristics. Heuristic inspection is one of the

most popular and well researched inspection techniques for evaluation (Molich & Nielson, 1990; Stone *et al.*, 2005; Harvey, 2005). Heuristic inspection methods include heuristic evaluation, heuristic estimation, Cognitive walkthrough, Pluralistic walkthrough, guideline review, Feature inspection, Consistency inspection, Standards inspection and Formal usability inspection (Nielson & Mark, 1994).

Cognitive Walkthrough is a technique in which the designer (or design team) specifies the tasks to be performed and sequences of actions necessary to complete the tasks. Once these steps had been completed, the ease of learning the interface is evaluated (Stone *et al.*, 2005). Initially, cognitive walkthrough was developed for evaluating Walk-Up-and-Use systems and several applications of this technique have been reported with varying success. Cognitive walkthroughs have potential for evaluating user interfaces, but several important issues must be addressed. First, cognitive walkthroughs appear to place too much of a demand on developers who must focus on many aspects of design including usability. Second, cognitive walkthrough requires more time.

In a study conducted by Ranawaka (2008) to compare the user interface banking websites in Sri Lanka, heuristic inspection was used for the analysis. The analysis of the banking websites was based on model referred to as the Rayport and Jaworski's 7C model for the analysis of user interface element in e-commerce applications as cited by the author. A ten factor checklist was developed for the comparison, user interface element were compared with the checklist. The checklist served as a guide for the comparison. Although the methodology was useful for the comparison of the banking websites but it will not be applicable to room reservation. In order to adapt the author's methodology, it required modification of heuristic which will make it relevant for comparing room reservation system.

2.3 User Satisfaction

User satisfaction evaluation is a subjective evaluation (Slaughter, Norman, Shneiderman, 1995). It has had a long history within software engineering discipline. Several studies have been conducted as regarding how the perception of end user interacting with a product or software can be evaluated and also on how the most immediate antecedent factors that contributes to user satisfaction can be measured (Doll

et al., 1988, 1989; Chin & Lee, 2000; Xiao & Dasgupta, 2002). Although, one of the common techniques adapted today for evaluating user interface satisfaction is the use of questionnaire (QUIS), the questionnaire is usually in semantic or likert scale (Laqua, Ogbechie & Sasse, 2007; Slaughter *et al.*), other approach such as the use of user satisfaction index (USI) as used by Chen, Huang, Huang, and Lei (2006) is used.

In a study to measure system effectiveness by Ong and Lai (2004), user satisfaction evaluation was used to accomplish the study objective. The essences of evaluating the user satisfaction is to discover what users think and feel about interacting with a product, guide in the design or redesign of systems, to give managers a tool for assessing potential areas of system improvement, to provide researchers with a validated instrument for conducting comparative evaluations, and serve as a test instrument in usability labs (Slaughter, Norman, Shneiderman, 1995). User perception about an interface, system, software or product can be realized in quite a number of ways. Users can be asked to share their experiences and opinions by answering interviews or set of questionnaires. The interview or questionnaire can be structured so that it answers questions on aspects like functionality, reliability, usability, efficiency, maintainability, and portability.

Morkes and Nelson (1998) conducted a study where by writing guidelines were applied to web pages. In their study, they found subjective satisfaction increased by 37% as participants read on a rewritten version of web site that applied concise.

User satisfaction was identified as one of the six major categories of information system success (De Lone & Mc Lean, 1992). These six categories are quality, information quality use, user satisfaction, individual impact and organization impact. Also, Shaw *et al.* (2002) recognise user satisfaction as a key measure of information system success, and can only be improved when user's perception of the product is high (Bias & Mayhew, 1994; Courage & Baxter, 2005).

User satisfaction is regarded as one of the important measures of information systems success. A lot of researchers have worked on how this measurement can be standardized since the 80's (Ives *et al.*, 1983; Bailey & Pearson, 1983), when data computing in organizations moved from data processing to end-user computing (EUC) (Doll & Torkezadeh, 1988).

2.3.2 Type of Satisfaction

Three types of satisfaction has been indentified (Chin & Lee, 1997), these are namely expectation, perception and desire. The three types of user satisfaction combine to provide the end user overall feeling of satisfaction (Chin & Lee). This implies that, for a user to be satisfied with a product, system, and interface, the amount of satisfaction felt from expectation, desire and user perception will combine to produce the overall user satisfaction.

2.3.3 Measuring Tools

Measuring tools are instruments used by researchers, practitioners in evaluating different variables in patients/clients/subjects. The variables to be measured can range from physical functioning to psychosocial well being (Janet *et al.*, 2002). Instruments vary in format depending on what is to be measure. The Choice of appropriate instrument is a vital part of conducting good empirical research and evaluation (Neill, 2004).

Too often researches fall vulnerable to ‘availability bias’ and simply select whatever they can lay hands on, or they default to using instruments that have commonly been used in the past without proper check to see how this instrument fits what is to be measured. Poor instrument selection adds noise and error to research. Neill (2004) list some key factors to consider in selecting instrument, these are:

Length & Complexity: Is the instrument appropriate for the participant?

Match between program objectives and the instrument.

Sensitivity: Has the instrument been built with a view to being used for assessing what is to be measure?

Specificity: Specificity of a measurement is directly proportional to the performance, the greater the specificity, the more likely it is to predict actual performance.

Reliability and validity: Has the reliability and validity of the instrument been well established via peer reviewed publication? Is the strengths and limitation of the instrument understood?

Ethical/Educational issues: if possible, can the instrument be used not only for the interests of the researcher, but also in the education/ development of participants? For example, a self- assessment tool could be used not only for research purposes but also to lead onto a goal setting and feedback session with participants.

A thorough search and evaluation of all possible measures is recommended, time spend critical reviewing possible instruments is time well spend.

2.3.4 Questionnaire for User Interface Satisfaction (QUIS)

QUIS is a tool for evaluating user interaction with a product. It was developed by a multi-disciplinary team of researchers in the Human-Computer interaction Lab (HCIL) at the University of Maryland. This was designed to assess user’s subjective satisfaction with specific aspects of human computer interface (Chin & Lee, 1997). QUIS is said to be reliable as the reliability and validity problems associated with other satisfaction measures have been addressed by QUIS team (Chin & Lee, 1997; Slaughter *et al.*, 1995), besides it create measures that are highly reliable across many types of interfaces. The latest version of QUIS is version 7.0; it contains a demographic questionnaire, a measure of overall system satisfactions. Figure 2.6 below shows snippet of QUIS which will be use in this study.

SATISFACTION	1	2	3	4	5	6	7	NA
24. I am satisfied with it. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
25. I would recommend it to a friend. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
26. It is fun to use. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
27. It works the way I want it to work. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
28. It is wonderful. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
29. I feel I need to have it. <input type="checkbox"/>	strongly disagree <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>

Figure 2.6: Snippet of QUIS. Source: from www. hcibib.org

The QUIS will be used for the evaluation among randomly selected users. The Analysis for the QUIS will be on mean and standard deviation as the number of participant will not require detail statistical test (QUIS, n.d).

2.4 Summary

This chapter has established the relationship between the study and literatures in the domain of the research. It identified the interaction design elements which emphasis will be on in the study, the interaction design approach suitable for solving problems associated with interactive product like the room reservation system. The study will be adapting the UCD (Preece, 2002; 2007; Tayoma, 2007). In the researching phase of the study, interface comparison technique based on heuristic will be adapted, and finally QUIS evaluation will be performed on the prototyped design. The implementation of the methodology techniques are discussed in the next chapter.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The methodology adapted in this study consists of six processes. These processes were grouped into three stages which are: research, design and evaluation (see Figure 3.1). The methodology consists of the essential UCD activities as identified by Stone *et al.* (2005) that were discussed in chapter two.

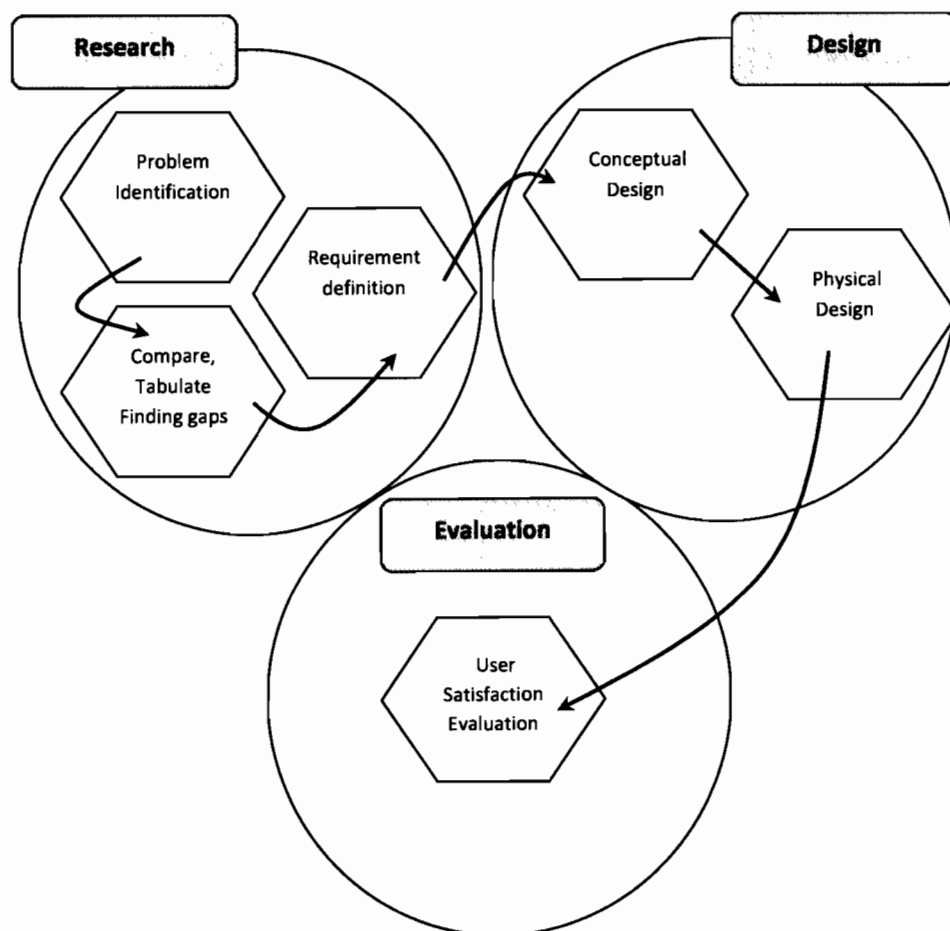


Figure 3.1: UCD method

3.2 Stage One: Researching

This stage consist of three main processes, the first process is the identification of problems which was discussed in chapter one of this report. The second stage is the study carried out on the existing room reservation system. Interfaces of three existing room reservation system; System A, System B, and System C were compared. The third stage is the user research, potential user of the system (staff of Department of Information Technology, CAS, UUM) were interviewed. Modelling was performed and finally requirement for the design were defined.

3.2.1 Comparison Analysis

Interfaces for login (Login), making reservation (Reserve), and managing reservation (Manage) were compared. These were selected because room reservation system (RRS) incorporates many interfaces that are used in accomplishing various tasks, and some of these tasks vary from one RRS to the other, hence interfaces that are common to the RRS were compared in the analysis.

A checklist was created to guide the comparison of user interface design elements (see Table 3.1); the checklist includes principles and guidelines that are useful in designing interactive elements that are good. The principles and guidelines included in the checklist are related to layout and behaviours (Benyon *et al.*, 2005; Cooper *et al.*, 2007; Galitz, 2007; Tidwell, 2006; Shneiderman, 1998; Stone *et al.*, 2005; Tognazzini, n.d).

Table 3.1 shows the format of the scorecard that was used to score the analysis made on the interface of the RRS. Interfaces that satisfactorily implements the factor considered were scored with the interface satisfactorily score (ISS) of 1 else no score is awarded. According to the scorecard a maximum total of 45 points would have been awarded to a particular RRS which had successfully implements the factors considered. The total points was scaled to 10 and referred to as total score. Total score values were calculated for all the RRS. In order to facilitate a systematic analysis and interpretation, total score values were interpreted qualitatively. The scale and the relevant interpretations used are given in Table 3.2.

Table 3.1: Format of scorecard used to compare RRS

			INTERFACE SATISFACTORY SCORE (ISS)		
			RRS		
Interface Element	No	Factors considered	Login	Reserve	Manage
Layout	L1	Alignment of widget to grid	1	1	1
	L2	Alignment of font baseline	1	1	1
	L3a	Screen Balancing (Appropriate use of white space)	1	1	1
	L3b	Screen Balancing (Appropriate use of screen assets)	1	1	1
	L4	No jumping component	1	1	1
	L5	Consistent Layout	1	1	1
Behaviour	B1	Pliancy	1	1	1
	B2a	Provide feedback (appropriate use of modeless feedback)	1	1	1
	B2b	Provide feedback (appropriate use of modal feedback)	1	1	1
	B3	Provide undo	1	1	1
	B4	Provide default	1	1	1
	B5	Linking between pages	1	1	1
	B6	Provide meaningful path and exit	1	1	1
	B7	Provide auto fill	1	1	1
	B8	Prevent error	1	1	1
		Total ISS per Interface	15	15	15
		Sum of ISS	45		
		TOTAL SCORE	10.00		

Table 3.2: The Scale used for Interpretation of Total Score

ISS Value Range	Interpretation Term	Description of Interpretations
0 – 1.99	Very Poor	Guidelines were not adhere to in the design, user interface is very poor, averaging less than 2 principle implemented
2.0 – 3.99	Inadequate	Guideline were inadequately implemented, averaging less than 4 but more than 2 implemented
4.0 – 5.99	Moderate	Guideline were moderately implemented, averaging less than 6 but more than 4 implemented
6.0 – 7.99	Good	Guidelines were adequately adhered to, averaging less than 8 but more than 6 implemented.
8.0 – 10	Excellent	Guidelines were highly considered , averaging less than 10 but more than 8 implemented.

3.2.2 Interface Satisfactory Analysis for RRS

Tempere University Library room reservation system (System A), mrbs.sourceforge.net: Meeting room booking system (System B) and Room Booking system V2.2 (System C) were compared. The interface were analysed based on the 15 factors as shown in the Table 3.1 above. System A, System B and System C were all analysed and the result were tabulated. In this report, only the referred portions of the interface are shown, for full interface view see Appendix A.

3.2.2.1 Alignment of Widget to Grid

This was used to check the alignment of various widgets on the interface to the grid. Performing the analysis, vertical and horizontal grid lines were drawn to run across the interfaces. For easy analysis, these grid lines were labelled. Vertical grid line running from top to the bottom were assigned V and a numeric subscript for easy referencing and the same was repeated for the horizontal lines represented with H. The mid lines of the grid were indentified with a subscript of 'm', for example V_m referencing the middle vertical grid line.

Analysing System A:

Login UI: Widgets (checkbox, drop down list, text box, label and button)

Widgets such as label (name, email confirmation, contact person email, group work room), and the next button were observed to be aligned to grid line V_1 (see Figure 3.2). Also the check box, textboxes and the drop down list were aligned to V_2 . Looking at the widget alignment horizontally, it is obvious that widgets were also aligned to H_1 - H_6 , and H_m . Hence, interface was scored satisfactory.

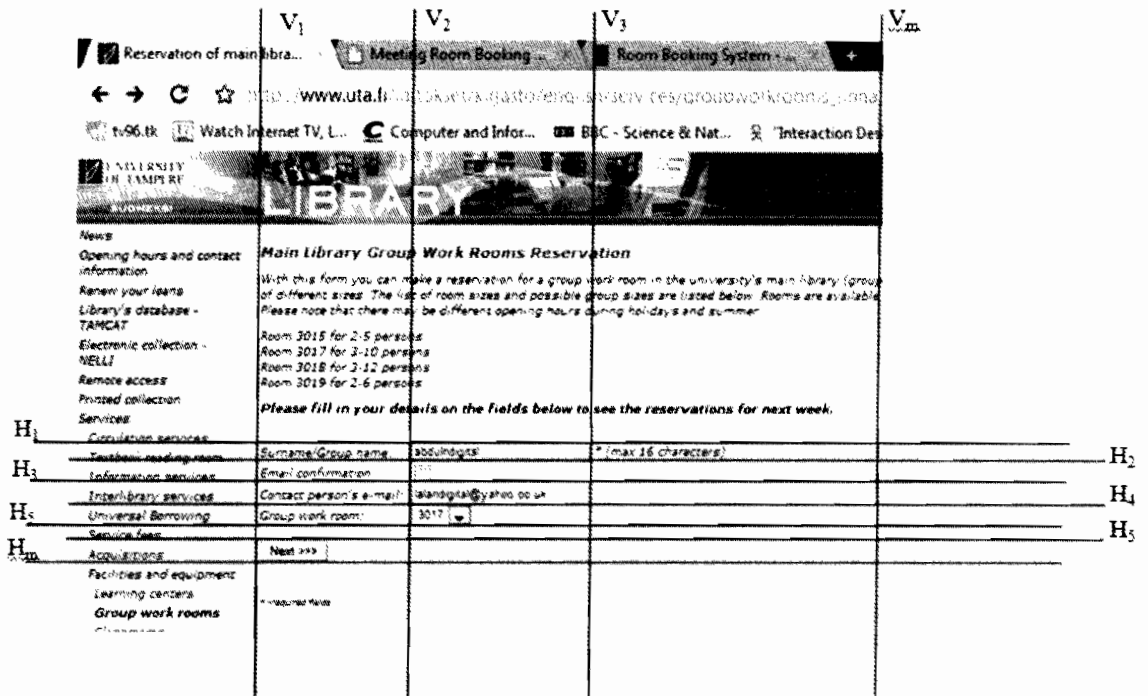


Figure 3.2: Login for System A

Reserve UI: Widgets (Labels and button)

Widget such as the 'previous' button, the name and email label were all aligned to V₂ (see Figure 3.3). Also dropdown list for select group work room and the select button were aligned to H₅. Hence the interface was scored.

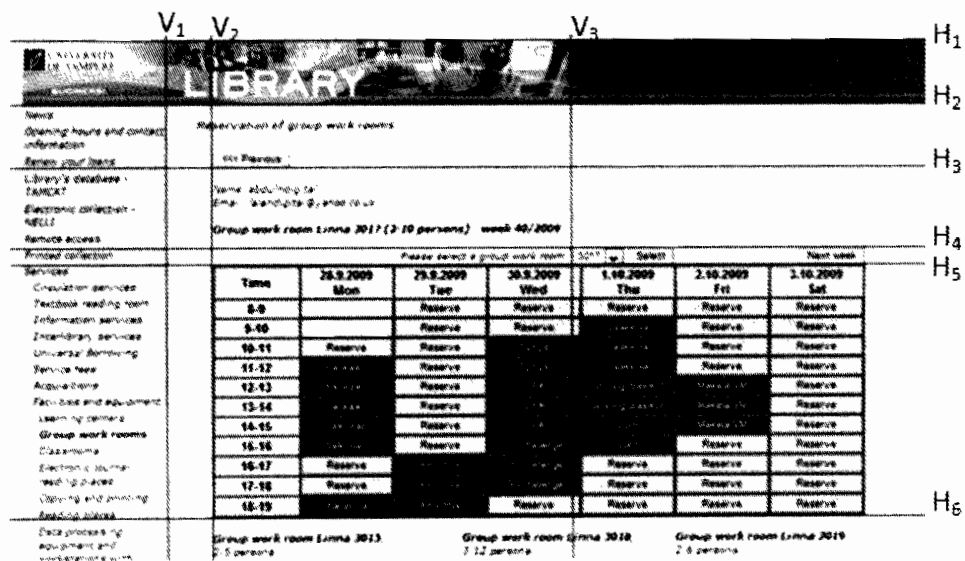


Figure 3.3: Reserve UI for System A

Analysing System B:

Login UI: Widgets (dropdown list, button, label, textboxes)

Looking at the sample grid line shown on the Login (see Figure 3.4), text label (name and password) was aligned to V_1 (right aligned). Textboxes for entering name and password were aligned to V_2 , also aligned to V_2 is the login button. These widgets are horizontally aligned to one of H_4 , H_5 , H_6 , H_7 and H_8 respectively. The dropdown list for the date, the 'go to' button, and the textbox for search function were all aligned to the horizontal grid line H_2 . The interface was scored satisfactory.

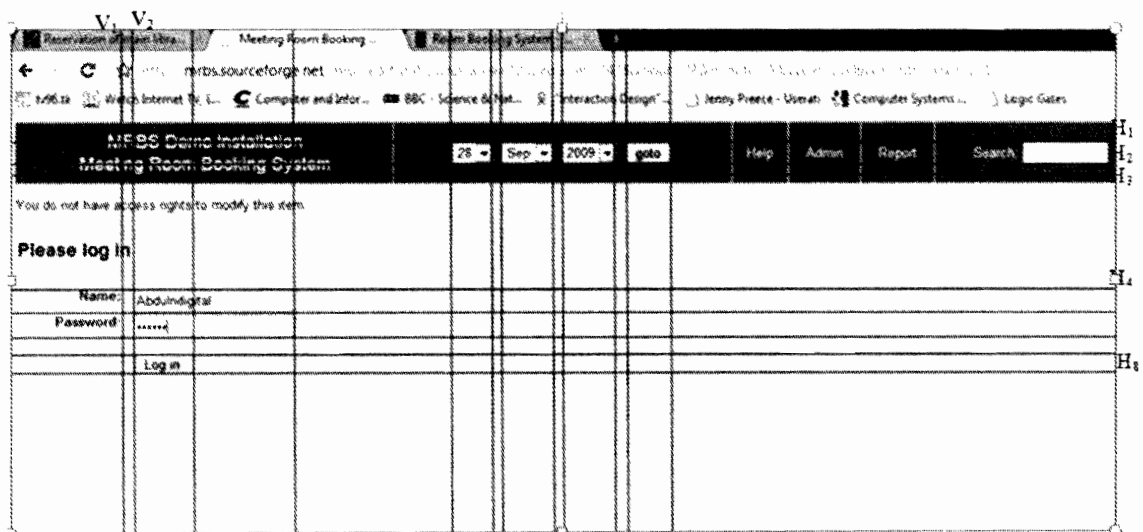


Figure 3.4: Login UI for System B

Reserve UI: Widget (Checkbox, dropdown list, button, label, and textboxes)

Widgets were aligned along grid line V_1 and V_2 as shown in Figure 3.5 below. On grid line H_1 and H_2 it is obvious that widget such as the textbox for the search, the dropdown list for the date were all aligned. For this factor the interface was satisfactory.

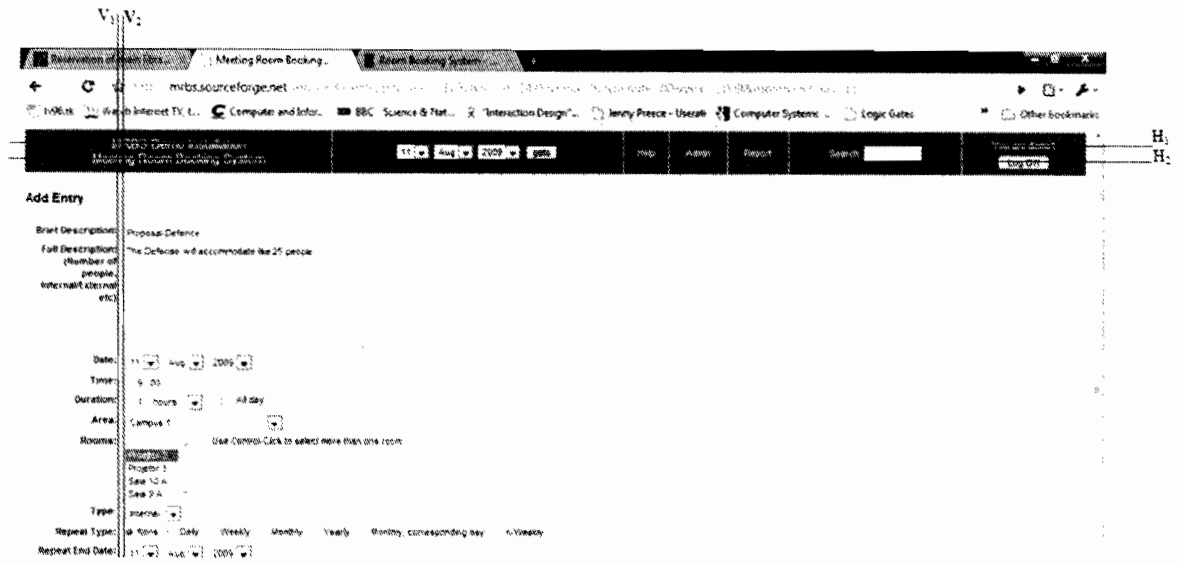


Figure 3.5: Reserve UI for System B

Manage UI:

Analysis performed on this interface is similar to the analysis on Reserve UI, widget are aligned to V1 and V2 as shown in Figure 3.6 below:

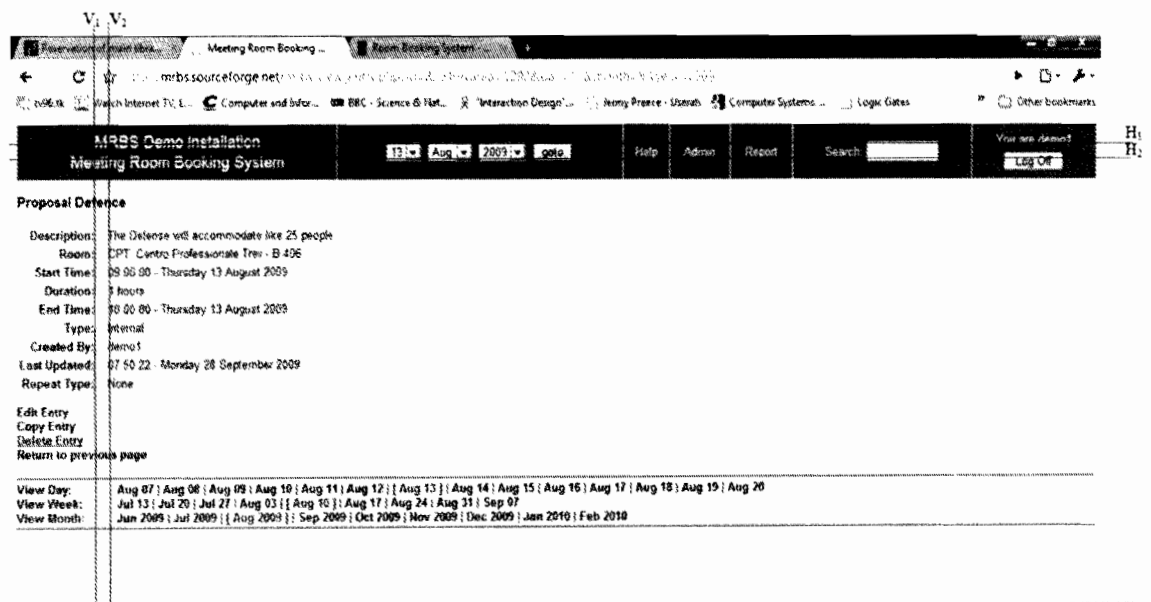


Figure 3.6: Manage UI for System B

Analysing System C:

Login UI: Widgets (textboxes, check box, button, label)

Labels (user name, password, remember me) were observed to be right aligned to V_4 (see Figure 3.7). On grid line V_5 , textboxes (user name, password), check (remember me), and the button Login were all aligned to the grid line H_5 . The icons on the right hand side of the interface were aligned to V_1 . The labels corresponding to the icons were aligned to gridline V_2 . The interface was scored satisfactory.

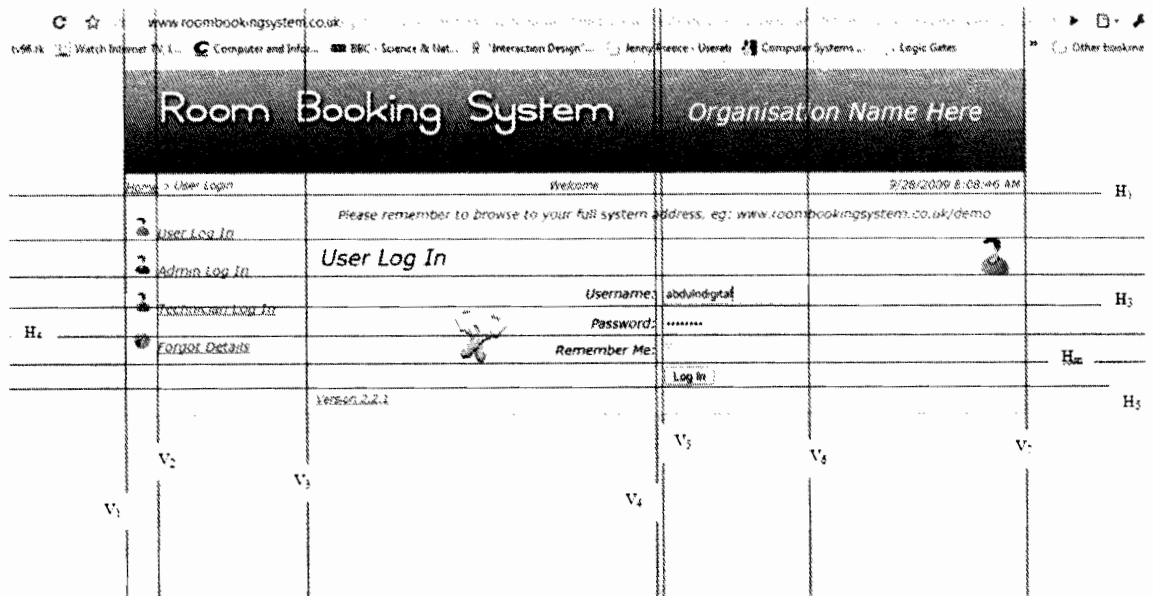


Figure 3.7: User Login UI for System C

Reserve UI: Widget (butcons, textbox, dropdown list)

Along vertical gridline V_4 , the dropdown list for selecting room category and the textbox for inputting data were aligned vertically, and horizontally they were aligned to H_3 and H_4 respectively (see Figure 3.8). Looking at the bottom of the screen, it was observed that both butcon were aligned to H_6 horizontally.

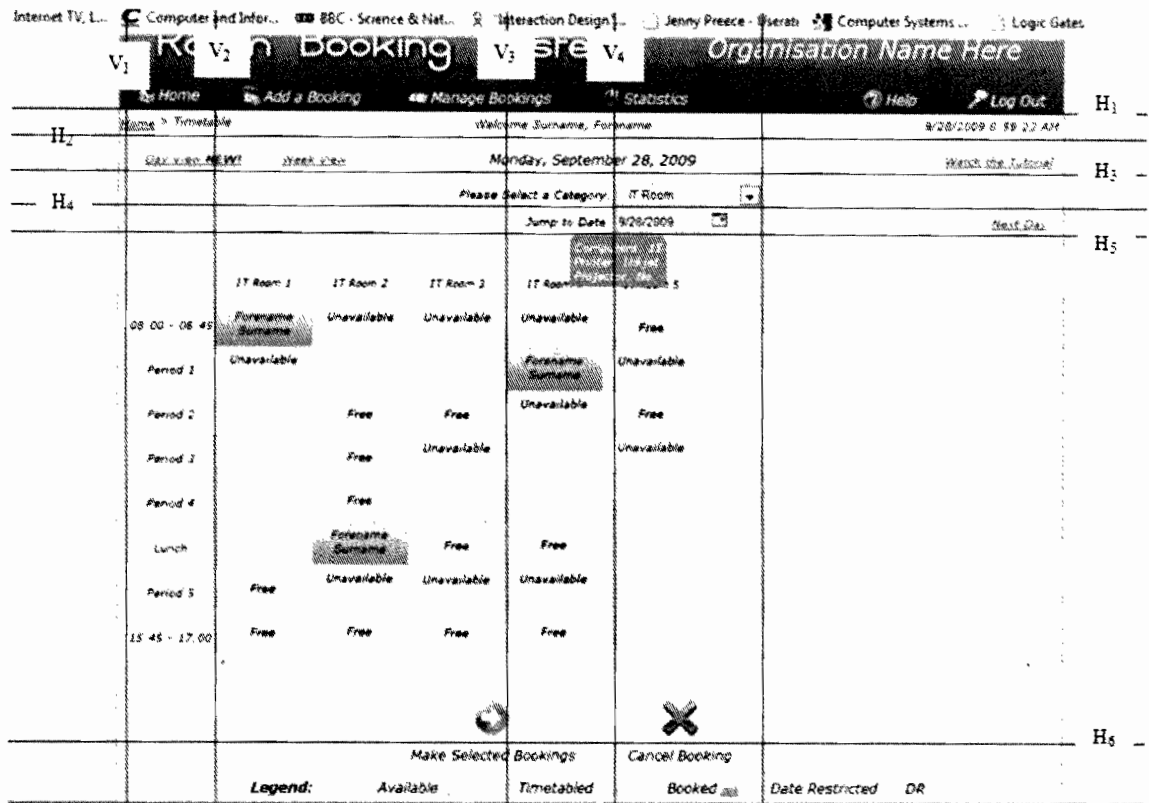


Figure 3.8: Reserve UI for System C

Manage UI: Widget (dropdown lists, button, butcon)

Considering the Figure 3.9 shown below, widgets for selection (dropdown lists: “user”, “resource”, category”, and “timeslot”), and the filter button were aligned to horizontal grid line H₅. Butcon “print booking” was aligned to H₃. The links at the top of the screen were aligned to H₁. However it was obvious that the textbox for entering start date and end date were not aligned to H₅ like the other widget close together, but vertically they seem to be aligned to V₄ and V₅ respectively. It was further analysis was made drawing a run just beneath the two textbox start date and end date. Using the line as the grid, it was observed that the other widgets aligned to H₅ were no longer aligned to it. Hence it was considered that widget start date and end date were jumping. However the interface was scored.

Room Booking System							Organisation Name Here																	
Home		About Booking		Manage Bookings		Statistics		Help		Log Out														
Manage Bookings				Welcome <i>Surname, Forename</i>				9/28/2009 9:08:18 AM																
<table border="1"> <thead> <tr> <th>User</th> <th>Resource</th> <th>Category</th> <th>Timeslot</th> <th>Start Date</th> <th>End Date</th> <th></th> </tr> </thead> <tbody> <tr> <td>All</td> <td>All</td> <td>All</td> <td>All</td> <td>MM/DD/YYYY</td> <td>MM/DD/YYYY</td> <td>Filter</td> </tr> </tbody> </table>							User	Resource	Category	Timeslot	Start Date	End Date		All	All	All	All	MM/DD/YYYY	MM/DD/YYYY	Filter	Print Bookings			
User	Resource	Category	Timeslot	Start Date	End Date																			
All	All	All	All	MM/DD/YYYY	MM/DD/YYYY	Filter																		
Date	Day	Time	Resource	User	Email	Edit	Delete																	
9/28/2009	Monday	08:00 - 08:45	IT Room 1	You		/																		
9/28/2009	Monday	08:00 - 08:45	IT Room 5	You		/																		
9/28/2009	Monday	Period 1	IT Room 4	You		/																		
9/28/2009	Monday	Lunch	IT Room 2	You		/																		
9/29/2009	Tuesday	Period 1	IT Room 2	You		/																		
9/29/2009	Tuesday	Period 2 - Period 3	IT Room 4	You		/																		

Figure 3.9: Manage UI for System C

3.2.2.2 Alignment of Font Baseline

In performing this analysis, emphasis was specifically layered specifically on the entry controls and their corresponding labels. Texts were typed into entry controls, the baseline of the text in the entry control and the corresponding label were observed.

Analysing System A:

Login UI:

Lines L₁, L₂ and L₃ were drawn as references line as shown in Figure 3.10. It was observed that the texts entered in the textboxes were aligned to the references line, it same for the corresponding labels of the textboxes. For this interface, the font baseline were aligned hence the interface was scored satisfactory for the factor.

Electronic collection - Room 3015 for 2-5 persons
 NELLI Room 3017 for 3-10 persons
 Remote access Room 3018 for 3-12 persons
 Printed collection Room 3019 for 2-6 persons

Services **Please fill in your details on the fields below to see the reservations for next**

Circulation services

Textbook reading room Surname/Group name: abduindigital * (max 16 characters) L₁

Information services Email confirmation:

Interlibrary services Contact person's e-mail: islandigital@yahoo.co.uk L₂

Universal Borrowing Group work room: 3017 L₃

Service fees


Acquisitions

Facilities and equipment

Figure 3.10: Login UI for System A; showing the reference baseline

Reserve UI:

Line L₁ was drawn (see Figure 3.11) underneath the dropdown list. The baseline was aligned to the fonts. The interface was scored an interface satisfactory score of 1.



Reservation of group work rooms

Name: abduindigital
 Email: islandigital@yahoo.co.uk

Group work room Linna 3017 (3-10 persons) - week 40/2009

Please select a group work room: 3017 Select

Time	28.9.2009 Mon	29.9.2009 Tue	30.9.2009 Wed	1.10.2009 Thu	2.10.2009 Fri	3.10.2009 Sat
8-9		Reserve	Reserve	Reserve	Reserve	Reserve
9-10		Reserve	Reserve	Reserve	Reserve	Reserve
10-11	Reserve	Reserve	Typys	Reserve	Reserve	Reserve
11-12	Pakkaen	Reserve	Typys	Reserve	Reserve	Reserve
12-13	Pakkaen	Reserve	OFA	Reserve	Reserve	Reserve
13-14	Pakkaen	Reserve	OFA	Reserve	Reserve	Reserve
14-15	Sakosalo	Reserve	OFA	Reserve	Reserve	Reserve
15-16	Sakosalo	Reserve	IR Challenge	Reserve	Reserve	Reserve
16-17	Reserve	Reserve	IR Challenge	Reserve	Reserve	Reserve
17-18	Reserve	Reserve	IR Challenge	Reserve	Reserve	Reserve
18-19	Kallasla	Reserve	Reserve	Reserve	Reserve	Reserve

Next week

Figure 3.11: Reserve UI for System A; showing the reference baseline

Analysing for System B:

Login UI:

Baseline L1 and L2 were drawn as shown in the Figure 3.12. From observation, it was obvious that the text in the textboxes were not aligned with the labels “name” and “password” respectively. No score was awarded for this interface.

Please log in

Name:	Abdulindigital	L ₁
Password:	L ₂

Figure 3.12: Login UI for System B; showing the reference baseline

Reserve UI:

This interface was not scored as it was observed that most fonts were not aligned to the baseline drawn (see Figure 3.13). It was noticed that the labels “brief description”, “Date”, “Time”, “duration”, “Area” and “Type” were all above the baseline.

Add Entry

Brief Description:	Proposal Defence
Full Description: (Number of people, Internal/External etc)	The Defense will accommodate like 25 people.
Date:	11 Aug 2009
Time:	9:00
Duration:	1 hours <input type="checkbox"/> All day
Area:	Campus 1
Rooms:	Use Control-Click to select more than one room Projector 2 Projector 1 Sala 10 A Sala 9 A
Type:	Internal

Figure 3.13: Reserve UI for System B; showing the reference baseline

Manage UI:

Reference baselines were drawn as shown in the Figure 3.14. The fonts were all aligned to the baseline.

Proposal Defence

Description:	The Defense will accommodate like 25 people
Room:	CPT, Centro Professionale Trev - B 406
Start Time:	09:00:00 - Thursday 13 August 2009
Duration:	1 hours
End Time:	10:00:00 - Thursday 13 August 2009
Type:	Internal
Created By:	demo1
Last Updated:	07:50:22 - Monday 28 September 2009
Repeat Type:	None
Edit Entry	
Copy Entry	
Delete Entry	
Return to previous page	

Figure 3.14: Manage UI for System B showing aligned font

3.2.2.3 Screen Balancing

Squint test as described by Cooper *et al.* (2007) and also a check for symmetry (vertically and diagonally) were performed on the interfaces. The Squint test was performed to uncover imbalance on the interfaces and to see how white space had been used to attain balance. In the check for symmetry, vertical lines were drawn at the middle of the interfaces and the visual weights of each half were observed (see Figure 3.15). White space for each half was observed. Unbalanced interface that appeared as if they were going to topple over to one side were not scored.

Interfaces that attained balance by appropriate use of screen assets were scored. The symmetry along diagonal line was observed for the interface. The visual weight of the interface was examined, interface elements on the upper left of the interfaces were compared to element on the lower right corners (Tidwell, 2006).

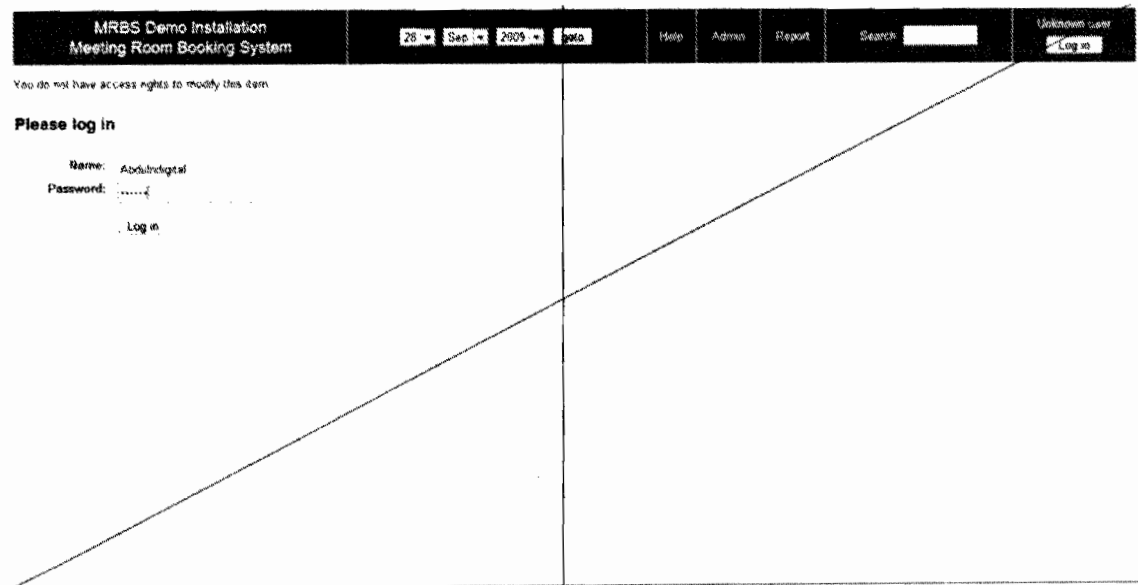


Figure 3.15: Unbalance UI for System A

The interface in the Figure 3.15 above appeared unbalanced. Considering the vertical line, the weight on the left portion of the display is more as compared to the left portion and also weight space was not properly utilized.

3.2.2.4 No Jumping Component

Component that were not aligned to the gridlines during the analysis for widget to grid were considered jumping components. Widgets such as button, butcon, dropdown list, checkbox, radio button were checked properly on the interface against the grid lines. ISS was not scored to interface with one or more jumping component.

Analysing Manage UI for System C, line H₁-H₆ were drawn as shown in Figure 3.16. It was obvious that the textboxes “start Date” and “End date” were both above the line as compared to other widgets along the same line. It was assumed that the component should align to gridline just like the other components. The interface was not scored.

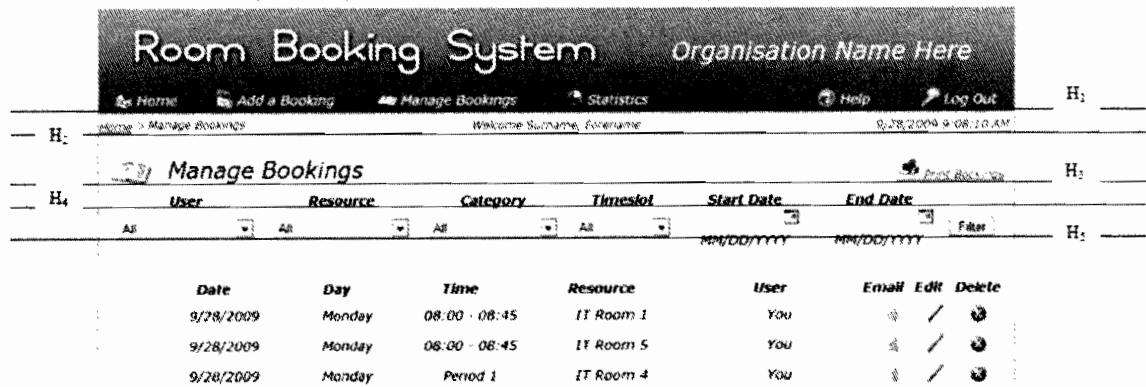


Figure 3.16: Manage UI for System C; showing Jumping component

3.2.2.5 Consistent Layout

An interface is scored in this factor when it was observed that the layout concept for the RRS remain consistent all over the interfaces. The analysis were carried out by critical observation of the interfaces from the same RRS, side by side comparison of the layout were made.

3.2.2.6 Pliancy

Pliant objects on the interface were identified since indication of pliancy is the most important role of cursor hinting (Cooper *et al.*, 2007). These objects were examined with the mouse to test visual affordance if it communicates pliancy or the type of direct manipulation action that is acceptable on the pliant object. Interface that failed to communicate pliancy were not scored.

Analysing the Reserve of System A, the mouse was drag over the pliant objects (see Figure 3.17). These objects were noticed not to communicate pliancy. The interface was not scored.

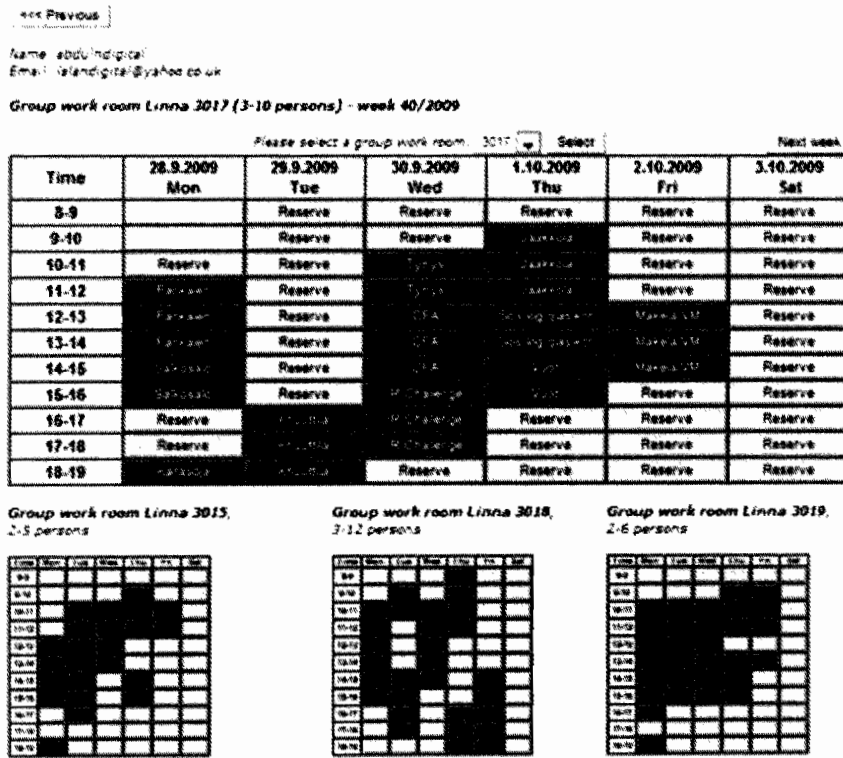


Figure 3.17: Reserve of System A that fails to communicate pliancy

3.2.2.7 Feedback

Feedback communicates to the user to confirm what action has been done or what result has been accomplished. It is very important to the user since it constantly show the user what the whole thing looks and behave like while accomplishing task. Feedback behaviours can be categorized as modal and modeless feedback (Cooper *et al.*, 2007). The later do not interrupt the users' action, it preferred in user interfaces.

The interfaces were inspected to see how these feedbacks have been used, interfaces that communicates task which the user is working on were scored for appropriate use of modeless feedback. Modal feedback are mostly discourage in good interface design by experts.

The interface shown in Figure 3.18 below communicates the to user action that have taken place. Path for accomplishing booking is obvious from the modeless feedback provided at the top of the screen.

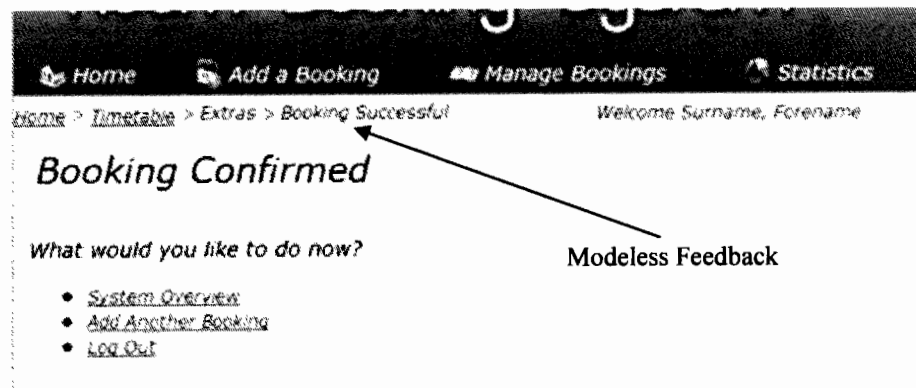


Figure 3.18: System C; showing booking confirmation

3.2.2.8 Provide Undo

A system that lacks undo functionality is usually complex and difficult to learn. Learning will be inhibited and people will be cautious interacting with the system. Accomplishing task will be slow as user will not want to make mistake hence the productivity suffers. Interface that provides user with undo are usually easy to explore and learn. Task can be accomplished by trial and error since actions can be reserve, such interface are known to forgive user.

This behaviour was inspected on the interface of the room reservation systems. Action were performed and reversed. Interface that do not permit reversal were not scored.

3.2.2.9 Provide Default

Following the design principles for placing users in control, user should be able to clear several textboxes by single click which resets them. In the absent of this, users will spend time clearing these textboxes by using backspace on the keyboard. An interface that forgives gives user the ability to reset choices and preferences to system or program defaults.

3.2.2.10 Linking between pages

Linking between interfaces were accessed in terms of how the main interface connect to the interfaces of adding reservation, manage reservation and other interfaces in the system. How well this interface link to other was taken into account and RRS that provides the user with such navigation were scored.

3.2.2.11 Provide meaningful path and exit

User interacting with room reservation system should be able to navigate the interface easily. Path should be provided for user to get to any part of the reservation system they

want. User should be informed about where they are, where they have been and where they can go next.

Path that interface of the room reservation system provide to other important functionality of the system were assessed. Analysing the U12 of SYSTEM B, the interface was scored on the path provide to the user to link other functionality of the system see Figure 3.19 below.

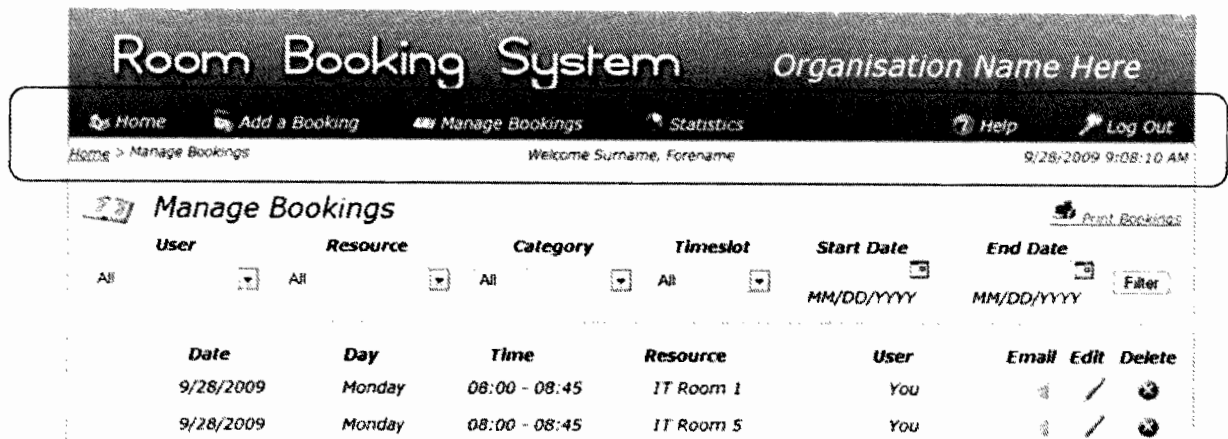


Figure 3.19: Manage UI of System C; showing meaningful path to other functionality

3.2.2.12 Provide auto-fill

The interfaces were analysed based on how they assist the user in completing required information at the point of data entering. Auto fill will ease the task for the user and save time of entering data to the system. Auto fill helps in putting user in control and help in conserving memory load.

3.2.2.13 Prevent Error

Interface that provide widgets that helps prevent user from entering wrong data were scored. Error can terminate the entire process of making a reservation if occurred, in order to avoid these, required information needed to accomplish task and are already established should be provided to the user. Inputs such as date, time, and rooms that that

are known should be provided to the user, it will help in preventing error which could be as a result of wrong spelling, wrong format for data and time.

3.2.3 Interview

To gain knowledge about users expectation for the design in terms of layout, behaviour and the requirement for the room reservation system as well as their usage of the system, a few open interviews were conducted with staffs of the main office of department of information technology and students of department of information and technology with knowledge of reservation systems.

After the interviews, it was gathered among other findings that the existing meeting room reservation system in the department is not an automated system. Reservations were documented on organiser (see Appendix A). The meeting rooms are usually used only within the working hours for purpose of meetings, presentations and other academic related purposes as specified by staff reserving the rooms. The rooms can only be reserved by staffs specifying the duration of usage. To make reservation, the staff in charge (non academic) of the room will be contacted to do the reservation.

3.2.4 Persona and Scenario

From the interview, it was gathered that the users can be categorized into two groups which are the staff reserving the rooms and the staff making the reservation. Personas were created to model these categories of users in order to keep the need of the users in mind during the design process and to ensure UCD. The Personas were “Binti” and “Walad” (see Appendix A).

A task scenario has been used to describe the usage of RRS by Binti and Walad, this was done to personalized and describe a specific instance of use. Below are task scenario for adding a reservation and cancelling reservation.

1. Task Scenario A:

Binti arrived at the main office full of excitement as usual, on entry her office she sat by her computer to continue her job from where she left it the previous day. She realized that Walad a colleague have requested a room for a presentation which she need to include in the RRS. Walad only required the

room for 30mins only. Binti accessed the RRS on her personal computer and login her username which is her staff ID and her password which is known to her in the field provided and she clicked on the Login button and she was full of excitement. Binti dragged the mouse toward the add reservation link which exhibit pliancy, she clicked on it and she was linked with the add reservation interface. On the interface she entered the Date, Time, Purpose, and the duration, and Walad ID as specified by Walad.

She click on Add button, the RRS checked for conflict of time on the requested room, in her case they was non as she already see from here main interface the existing meetings and time with the duration. Binti was acknowledged for a successful adding a reservation and she smiled, full of relief as she has accomplished a task. She logged out from the RRS.

2. Task Scenario B:

Walad received a notice from the coordinator of department that the date and time of the presentation has been rescheduled but the new date is unknown till further notice, he remembered that he already reserved a room for the presentation which must be modified also. He accessed the RRS from his personal computer using his own username and password and he was linked to his own account. He saw the reservation which Binti had made and he navigate to manage reservations and here was linked to Manage Reservation interface where he was provided with options to cancel or Edit the reservation details. Walad simply clicked the Cancel reservation option and exit the RRS.

Other task scenarios were performed to model user of the RRS so that the various tasks are accomplished with the RRS.

3.2.5 RRS Requirement

Information from the interview, study on existing system and scenario performed led to the requirements tabulated in table 3.3 below. In addition to this, the guideline and principles from the checklist are implemented.

Table 3.3: Example RSS Requirements

No.	Requirement Description
	Login
1.	Binti and Walad can key in ID and password
2.	Binti and Walad can reset their ID or password
3.	Binti and Walad can logout the system at anytime
4.	Error message should be Modeless
	Reservation and Manage
5.	Binti and Walad can add reservation
6.	Binti can cancel any reservation
7.	Walad can only cancel his own reservation
8.	Binti can modify any reservation Detail
9	Walad can only modify his Reservation detail
10.	Binti can Walad can view existing Reservation
11.	Binti and Walad Can reserve any room choosing anytime
12.	Binti and Walad can search existing reservation
13.	Binti and Walad can modify their profile
14.	Biniti can Add and delete Walad's account
15.	Binti can add more rooms
16.	Binti can add more equipment

3.3 Stage Two: Design

After the modelling and definition of requirements, the information gathered were used as a basis for the user interface design, which is divided into two design steps conceptual design, and the physical design (prototype).

3.3.1 Conceptual Design

In this phase, content diagram (see Figure 3.20) was developed as specified by stone *et al.* (2005) after requirement gathering activities and task allocation between user and the system which is beyond the scope of this study and have been left out in the report. Four activities were involved in this phase which are:

- Derivation of concrete use cases from the essential use cases
- Identification of primary task objects, attribute and actions
- Identification of different containers and task objects that go into each container
- Linking the containers to show the navigation flow as shown in Figure 3.20

Table 3.4 shows an example of concrete use case for adding reservation, the primary tasks objects is “Reservation” and the attributes includes: Date, purpose, room, start time, and duration. The attributes have been underlined.

Table 3.4: Concrete use case: “Reservation”

Binti Action	System Response
Enters : <u>purpose</u> , <u>date</u> , <u>Start time</u> , <u>Duration</u> , <u>room</u>	Displays proceed after checking conflicts
Confirm Reservations details	Confirms reserved <u>Room</u>

From the above table the following can be retrieved:

Task: Add Reservation

Attributes: Date, Purpose, Start time, Finish Time, Room

Action: Key in attribute, Confirm reservation details.

All this attributes were noted on paper which was used in designing various widgets on the interfaces.

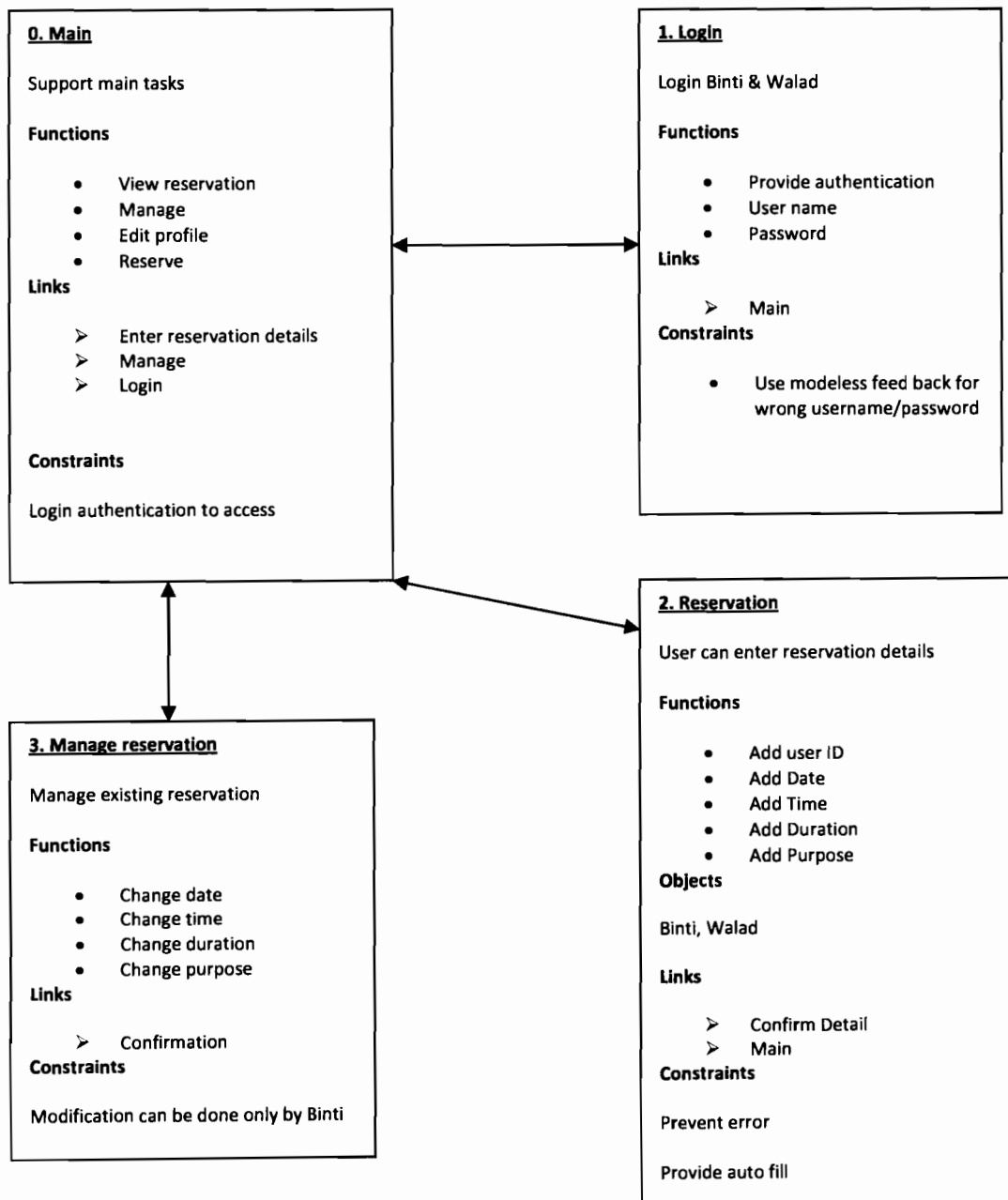


Figure 3.20: A section of the content diagram for RRS

3.2.2 Prototype

A high fidelity prototype was developed using Macromedia Dreamweaver 8.0 under the university license. A low fidelity prototype was not sufficient for the level of user evaluation required by the study as the prototype needs to show the behaviour and the layout look and feel within the scope of the study, although rough sketches were made on paper to ensure that widgets are well placed in the design area.

Gridlines were used during the design to ensure that components are well aligned and not jumping (see Figures 3.21 and 3.22) and also to show grouping of similar elements. Concepts from the conceptual design were implemented and it was ensured that all principles and guidelines that makes up the checklist during the comparison were put to practice. Emphases of the prototype design were not on the content but rather on the layout and behaviour.

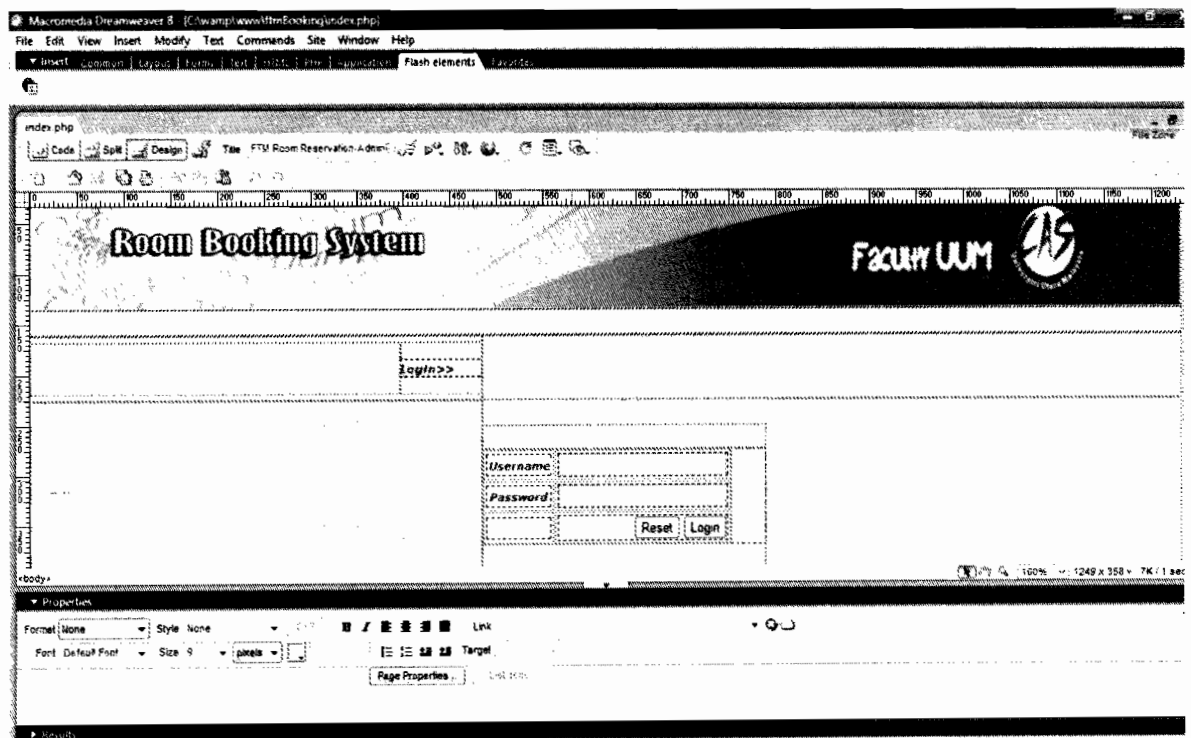


Figure 3.21: RRS Login Design showing gridline and design area

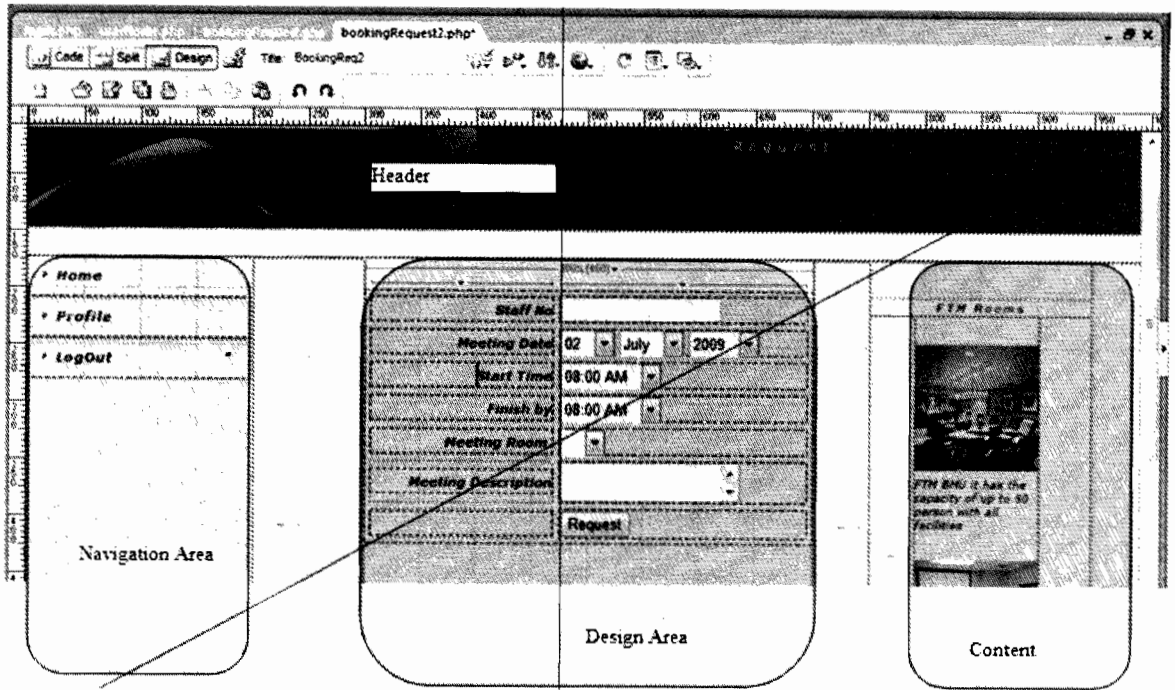


Figure 3.22: RRS showing design area and navigation

The prototype was tested among the subjects. The results obtained from the evaluation are discussed in the next chapter.

3.4 Stage Three: Evaluation

The Evaluation was conducted among ten participants on separate occasions. All participants have the basic knowledge of computer interaction, they were selected randomly. Participants were asked to complete 5 different tasks which include reserve room, find existing booking, modify booking details, delete booking and modify user profile. QUIS (see Appendix B) was used to evaluate the prototype by the participants on completing specified tasks. Results of the evaluation are discussed in the next chapter.

3.5 Summary

In this chapter, the methodology adapted in this study has been implemented. In the researching stage, the study has identified relevant attributes of layout and behaviour of RRS. Comparison among three existing RRS was performed with emphasis on the identified attributes which include white space, alignment, feedback, pliancy, and

navigation, also requirements was gathered by analysis existing systems and also by user interview, during this is was noted that all the room have similar facilities and the meeting room varies only in capacity. Modelling was performed and a high fidelity prototype was developed. The developed prototype was evaluated among 10 respondents. The preceding chapter discuss the findings and results.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter discussed in details the findings from the study in terms of tables and charts. The results discussed here include the finding of the researching and evaluation stage of the method. The results will be analysed with mean and standard deviation as discussed in the introductory chapter of this report. Discussed below are the results and from the previous chapter

4.2 Results from Comparison of RRS

The total score for the three RRS compared is shown in Table 4.1, the total score for each RRS is analysed in phases.

Table 4.1: Results from RRS comparison

Interface Element	Factors considered	INTERFACE SATISFACTORY SCORE (ISS)												
		System A			System B			System C			SUGGESTION			
No		LogIn	Reserve	Manage	LogIn	Reserve	Manage	LogIn	Reserve	Manage	LogIn	Reserve	Manage	
L1	Alignment of widget to grid	1	1		1	1	1	1	1	1	1	1	1	Font of text in textbox should be check with corresponding labels
L2	Alignment of font baseline	1	1				1	1	1					White space should be use to balance the visual weight on interfaces
L3a	Screen Balancing (Appropriate use of white space)										1			Component should place in a way screen balance will be attained vertical along a vertical axial or diagonally
L3b	Screen Balancing (Appropriate use of screen assets)										1			Element should be aligned to grid
L4	No jumping component		1								1			Layout concept should be adhere to throughout the design
L5	Consistent Layout	1	1		1	1	1	1	1	1	1	1	1	Pliant object should be communicated to the user
B1	pliancy	1									1	1	1	Interface should communicate ingoing task without interrupting the user
B2a	Provide feedback (appropriate use of modeless feedback)													User should not be interrupted
B2b	Provide feedback (appropriate use of modal feedback)	1	1								1	1	1	reversal of action should be provided
B3	provide undo	1	1					1	1	1	1	1	1	Easy way to return to default state should be provided
B4	provide default													Easy navigation between pages should be provided
B5	linking between pages	1	1								1	1	1	
B6	provide meaningful path and exit	1	1					1	1	1	1	1	1	
B7	provide auto fill		1											established input should be made available
B8	prevent error	1	1					1	1	1	1	1	1	much typing should be discourage
	Total ISS per Interface	9	10	0	6	4	10	13	8	13	8	13	13	
	Sum of ISS	19			20			34			7.56			
	Total Score	4.22			4.44									

SYSTEM A: Table 4.2 shows the overall score obtained by the system which is 3.96, this place it as a moderate system in terms of the layout and the behaviour principle and guideline on the checklist. The system score high in terms of L1, L2, L6, B2b, B3, B6 and B8 which indicated that some of the design principles have been implemented, but the interfaces failed totally in L3a, L3b, B2a, and B4. The system scored zero for all the factors considered on Manage UI due to the fact that the system do not provide users with the possibility to manage reservations. Reserve UI scored highest in terms of the interfaces in the comparison.

Table 4.2: Interface Satisfactory Score for System A

			INTERFACE SATISFACTORY SCORE (ISS)		
			SYSTEM A		
Interface Element	No	Factors considered	Login	Reserve	Manage
Layout	L1	Alignment of widget to grid	1	1	
	L2	Alignment of font baseline	1	1	
	L3a	Screen Balancing (Appropriate use of white space)			
	L3b	Screen Balancing (Appropriate use of screen assets)			
	L4	No jumping component		1	
	L5	Consistent Layout	1	1	
Behaviour	B1	Pliancy	1		
	B2a	Provide feedback (appropriate use of modeless feedback)			
	B2b	Provide feedback (appropriate use of modal feedback)	1	1	
	B3	Provide undo	1	1	
	B4	Provide default			
	B5	Linking between pages	1	1	
	B6	Provide meaningful path and exit	1	1	
	B7	Provide auto fill		1	
	B8	Prevent error	1	1	
		Total ISS per Interface	9	10	0
		Sum of ISS	19		
		Total Score	4.22		

SYSTEM B: Table 4.3 shows the result obtained for the interfaces inspected. A score of 6 out of 15 was obtained for the Login UI, Reserve UI obtained 4 out of 15 which is quite low and Manage UI obtained the highest which is 10 out of 15. These scores summed up to give a total of 20 out of 45 available score. System B obtained a total score of 4.17 which place it as moderate. It was observed that for L1, L6, B1, and B3, System B obtained full score of 3 out of the possible 3, but it was the reverse case for L3a, L3b, B2a, B2b and B5 where score of 0 was obtained.

Table 4.3: Interface Satisfactory Score for System B

			INTERFACE SATISFACTORY SCORE (ISS)		
			SYSTEM B		
Interface Element	No	Factors considered	Login	Reserve	Manage
Layout	L1	Alignment of widget to grid	1	1	1
	L2	Alignment of font baseline			1
	L3a	Screen Balancing (Appropriate use of white space)			
	L3b	Screen Balancing (Appropriate use of screen assets)			
	L4	No jumping component			1
	L5	Consistent Layout	1	1	1
Behaviour	B1	Pliancy	1	1	1
	B2a	Provide feedback (appropriate use of modeless feedback)			
	B2b	Provide feedback (appropriate use of modal feedback)			
	B3	Provide undo	1	1	1
	B4	Provide default			1
	B5	Linking between pages			
	B6	Provide meaningful path and exit	1		1
	B7	Provide auto fill			1
	B8	Prevent error	1		1
		Total ISS per Interface	6	4	10
		Sum of ISS	20		
		Total Score	4.44		

SYSTEM C: Table 4.4 presents the score obtained by System C; a score of 7.56 was obtained as the total score which is quite high as compared to system A and System B. A total of 34 out of possible 45 are obtained. The interface obtained full core of 3 on L1, L2, L6, B1, B5, B6 and B8 which signifies that the principles and guidelines have been properly adhere to in the design, although low scores were obtained for L3a, B4 and B7. The interface for login and managing reservation obtained 13 each out of the possible 15. The total score obtained place the system C as a better design than System A and system B.

Table 4.4: Interface Satisfactory Score for SYSTEM C

			INTERFACE SATISFACTORY SCORE (ISS)		
			SYSTEM C		
Interface Element	No	Factors considered	Login	Reserve	Manage
Layout	L1	Alignment of widget to grid	1	1	1
	L2	Alignment of font baseline	1	1	1
	L3a	Screen Balancing (Appropriate use of white space)	1		
	L3b	Screen Balancing (Appropriate use of screen assets)	1		1
	L4	No jumping component	1		1
	L5	Consistent Layout	1	1	1
Behaviour	B1	Pliancy	1	1	1
	B2a	Provide feedback (appropriate use of modeless feedback)	1	1	
	B2b	Provide feedback (appropriate use of modal feedback)	1		1
	B3	Provide undo	1		1
	B4	Provide default			1
	B5	Linking between pages	1	1	1
	B6	Provide meaningful path and exit	1	1	1
	B7	Provide auto fill			1
	B8	Prevent error	1	1	1
		Total ISS per Interface	13	8	13
		Sum of ISS	34		
		Total Score	7.56		

Table 4.5 shows the mean and standard deviation of the comparison, the highest standard deviation (S.D) is 1.53 which was obtained for Linking between pages (B5). Table 4.4 also presents the mean score of the comparison (i.e. mean of the total score) which is 5.41 and S.D obtained among the RRS is 1.86 which is quite high.

Table 4.5: Means and Standard Deviations of RRS

Factors Considered	No.	SYSTEM A	SYSTEM B	SYSTEM C	Mean	S.D
Alignment of widget to grid	L1	2	3	3	2.67	0.58
Alignment of font baseline	L2	2	1	3	2.00	1.00
Screen Balancing (Appropriate use of white space)	L3a	0	0	1	0.33	0.58
Screen Balancing (Appropriate use of screen assets)	L3b	0	0	2	0.67	1.15
No jumping component	L4	1	1	2	1.33	0.58
Consistent Layout	L5	2	3	3	2.67	0.58
Pliancy	B1	1	3	3	2.33	1.15
Provide feedback (appropriate use of modeless feedback)	B2a	0	0	2	0.67	1.15
Provide feedback (appropriate use of modal feedback)	B2b	2	0	2	1.33	1.15
Provide undo	B3	2	3	2	2.33	0.58
Provide default	B4	0	1	1	0.67	0.58
Linking between pages	B5	2	0	3	1.67	1.53
Provide meaningful path and exit	B6	2	2	3	2.33	0.58
Provide auto fill	B7	1	1	1	1.00	0.00
Prevent error	B8	2	2	3	2.33	0.58
ISS		19	20	34	24.33	8.39
Total Score		4.24	4.44	7.56	5.41	1.86

Elements L2, L3b, B1, B2a, B2b, and B5 have S.D that exceeds 1.0. These elements were not implemented well in the existing RRS compared. In designing the prototype, it was ensured that these layout and behaviour elements were improved.

The chart shown in Figure 4.1 represents the findings graphically.

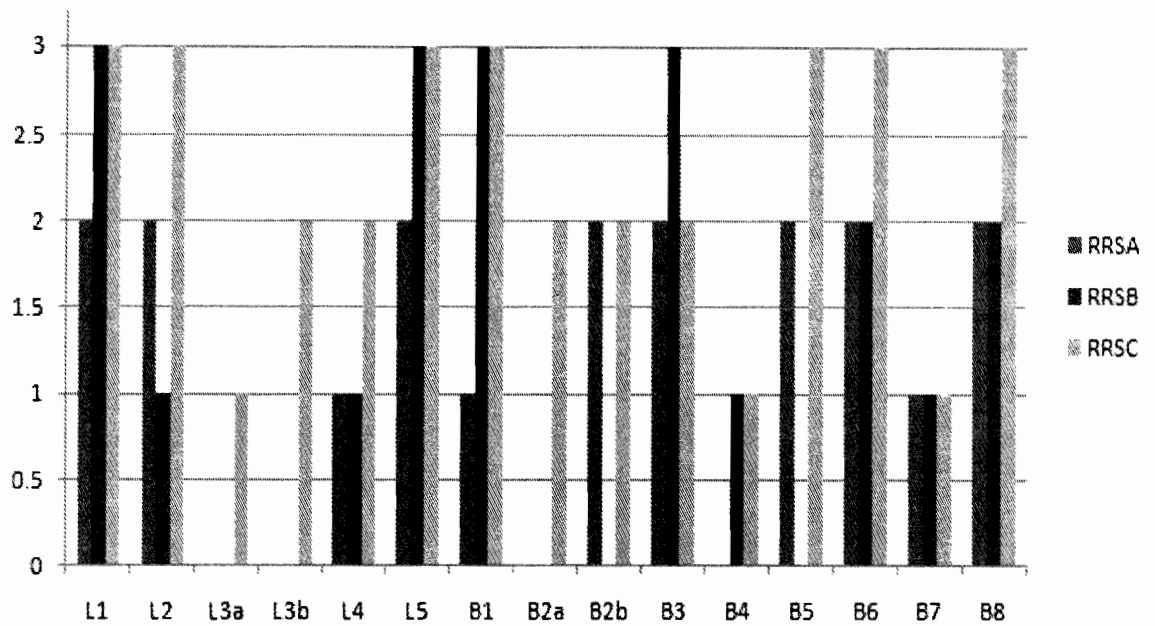


Figure 4.1: Graphical representation of ISS for Layout and Behaviour elements

From the chart above, it is obvious that RRC is a better design in terms of layout and behaviour element compared, however System B is slightly better in terms of B3 (provide undo).

4.2 Results from Prototype Evaluation

Data from the evaluation were mined using statistical package for social science (SSPS) data mining tool, a descriptive statistic analysis was performed to measure the user satisfaction as participant interact with the system. The result is shown in table 4.6.

Table 4.6: Descriptive Statistics of QUIS data

Descriptive Statistics						
		N	Min	Max	Mean	Std. Deviation
Usefulness	Q1	10	5	7	5.80	0.632
	Q2	10	5	7	6.00	0.816
	Q3	10	3	7	5.60	1.174
	Q4	10	3	7	5.60	1.174
Ease of Use	Q5	10	5	7	6.50	0.850
	Q6	10	5	7	5.90	0.876
	Q7	10	5	7	6.10	0.738
	Q8	10	5	7	5.90	0.994
	Q9	10	5	7	6.00	0.816
	Q10	10	3	7	5.40	1.350
	Q11	10	5	7	6.10	0.738
Ease of Learning	Q12	10	4	7	5.40	1.265
	Q13	10	4	7	5.80	0.919
	Q14	10	4	7	5.40	0.966
	Q15	10	5	7	5.70	0.823
Satisfaction	Q16	10	5	7	6.40	0.699
	Q17	10	5	7	5.80	0.632
	Q18	10	4	7	5.50	0.850
	Q19	10	5	7	5.70	0.823
	Q20	10	5	7	5.60	0.699
Valid N (listwise)		10				

Emphases were on the highest and lowest ratings as detail statistical tests are not supported by the number of participants (QUIS, n.d).

From Table 4.6 above, the rating of the RRS based on the QUIS varies from 5.40 to 6.50. The standard deviation varies from 0.632 to 1.35. Figure 4.2 presents the result graphically.

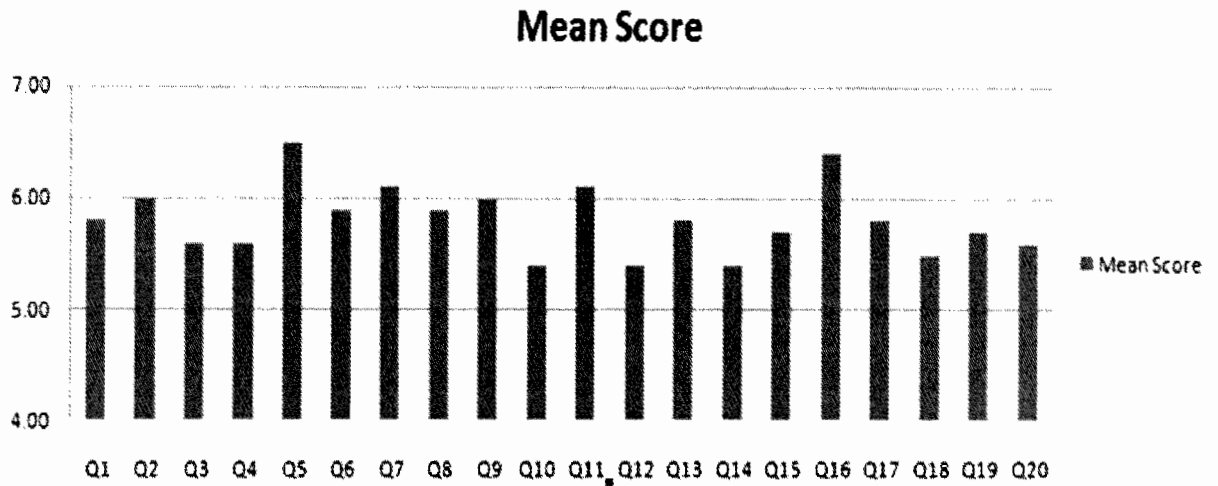


Figure 4.2: Graphical representation of QUIS

The mean score in terms of usefulness, ease of use, ease of learning and satisfaction is shown Table 4.7.

Table 4.7: QUIS rating in terms of usefulness, ease of use, ease of learning and satisfaction

	Mean	S.D
Usefulness	5.95	0.10
Ease of Use	6.04	0.23
Ease of Learning	5.80	0.18
Satisfaction	5.82	0.33

From the table 4.7, the prototype rating for usefulness, ease of use, ease of learning and satisfaction all exceed 4 which is the mid rating.

Figure 4.3 is the graphical representation of table 4.7. From the chart in Figure 4.3, it is obvious that the prototype has provided some degree of satisfaction that exceeds 50%.

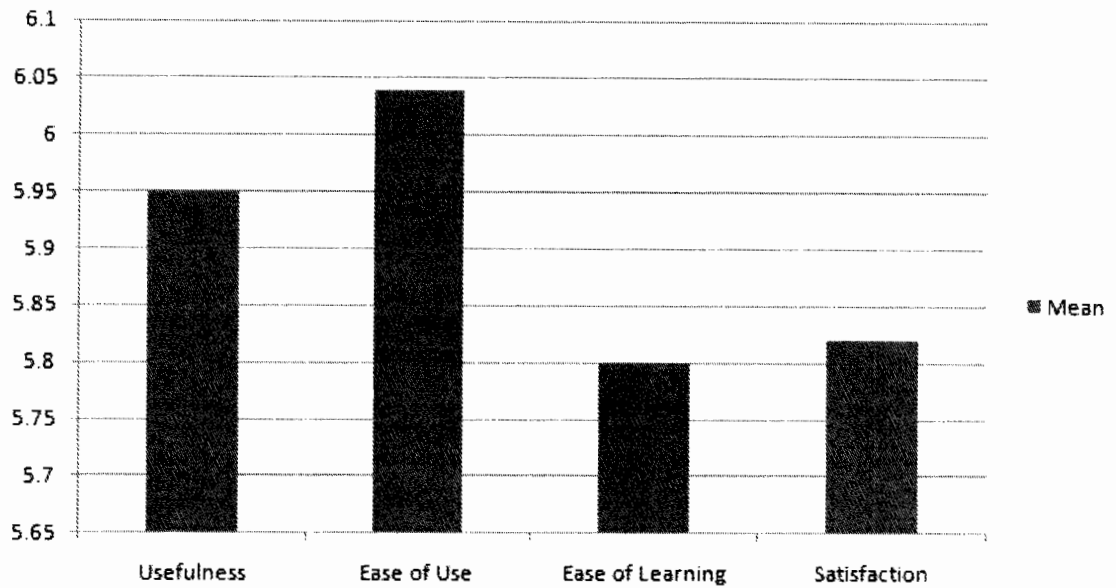


Figure 4.3: Chart showing mean of usefulness, ease of use, ease of learning, satisfaction

4.3 Summary

In this chapter, the results of the study have been discussed. The first result presents the result of the comparison between the layout and the behaviour elements of the existing room reservation system. In the analysis it was noticed that elements like white space, and balancing were not satisfactory in the existing system. The second part presents the result of the QUIS data among ten participants that evaluate the developed prototype. The preceding chapter concludes on the findings from this study.

CHAPTER FIVE

CONCLUSION AND FUTURE WORK

This chapter concludes the study in such a way that it highlights all that was done in the study and also the future work.

5.1 Conclusion

In this study, three existing room reservation system were compared using a checklist that identified interaction design elements that includes layout and behaviour. In creating the checklist, various principles and guideline on interface design were explored. The considered principles and guidelines that made the checklist that was used to conduct the comparison were relevant to the room reservation system. Conducting a comparison between existing systems was never an easy task especially when the elements to be compared vary in systems which are to be compared. This involves a lot of brainstorming to figure out the best method that will be suitable for the comparison. In this study, interfaces that were similar in terms functions were compared (Login, Reserve, and Manage). Interfaces that were compared were scored ISS from which total score of individual RRS were considered and the best design in terms of the interaction design elements of layout and behaviour was identified.

During the comparison, some good qualities were discovered among the existing room reservation system and also bad quality which were not considered during the requirement stages. Requirements from users of the room reservation system were added to that gathered during the domain research. Modelling was performed with the requirement and a conceptual design was developed. The conceptual design was prototyped using a high fidelity tool. The physical design was evaluated with QUIS.

The result shows that adapting the methodology will provides users with an interactive product with high level of user satisfaction especially when the elements of interaction design were orchestrated.

5.2 Recommendations

The checklist can be used by designer is comparing interfaces in terms of elements of layout and behaviour which are relevant to the compared interfaces with little or no modification, this will help in saving time and effort of improvising heuristic for comparison. It will also help in avoiding mistakes during design as it will guide the designer on how layout and behaviour elements can be used efficiently.

The prototyped room reservation system can be a better replacement for manual system in institutions where is still in use. This will help in conserving knowledge of the users as task would be accomplished with ease.

5.3 Future work

Iteration of the prototype will help in improving the design. In doing the iteration, other elements that were excluded for example content elements, style and text can also be explored during iteration.

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APPENDIX A: DOMAIN AND USER RESEARCH



Main Library Group Work Rooms Reservation

With this form you can make a reservation for a group work room in the university's main library (group work rooms 3015, 3017, 3018 and 3019 in Linna Building). Rooms are meant for students of the University of Tampere. Rooms are of different sizes. The list of room sizes and possible group sizes are listed below. Rooms are available for reservation from Monday through Friday 8:00-19:00, Saturday 9:00-15:00. There is a limit of 3 hours per person per day. Please note that there may be different opening hours during holidays and summer.

Room 3015 for 2-5 persons
 Room 3017 for 3-10 persons
 Room 3018 for 2-12 persons
 Room 3019 for 2-6 persons

Please fill in your details in the fields below to see the reservations for next week.

Surname/Group name: * (max. 16 characters)
 Email confirmation:
 Contact person's e-mail:
 Group work room:
 Next >>>

Group work rooms: reserved free not available

Group Work Rooms - reservations made so far

Group work room 3015

Group work room 3017

Group work room 3018

Group work room 3019

Week	3015	3017	3018	3019
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
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66	0	0	0	0
67	0	0	0	0
68	0	0	0	0
69	0	0	0	0
70	0	0	0	0
71	0	0	0	0
72	0	0	0	0
73	0	0	0	0
74	0	0	0	0
75	0	0	0	0
76	0	0	0	0
77	0	0	0	0
78	0	0	0	0
79	0	0	0	0
80	0	0	0	0
81	0	0	0	0
82	0	0	0	0
83	0	0	0	0
84	0	0	0	0
85	0	0	0	0
86	0	0	0	0
87	0	0	0	0
88	0	0	0	0
89	0	0	0	0
90	0	0	0	0
91	0	0	0	0
92	0	0	0	0
93	0	0	0	0
94	0	0	0	0
95	0	0	0	0
96	0	0	0	0
97	0	0	0	0
98	0	0	0	0
99	0	0	0	0
100	0	0	0	0

Group work room 3015
 Group work room 3017
 Group work room 3018
 Group work room 3019

Group work room 3015
 Group work room 3017
 Group work room 3018
 Group work room 3019

Group work room 3015
 Group work room 3017
 Group work room 3018
 Group work room 3019

Group work room 3015
 Group work room 3017
 Group work room 3018
 Group work room 3019



- News
- Opening hours and contact information
- Renew your loans
- Library's database - TAMCAT
- Electronic collection - NELLI
- Remote access
- Printed collection
- Services
- Circulation services
- Textbook-reading-room
- Information services
- Interlibrary services
- Universal Borrowing
- Service fees
- Acquisitions
- Facilities and equipment

Main Library Group Work Rooms Reservation

With this form you can make a reservation for a group work room in the university's main of different sizes. The list of room sizes and possible group sizes are listed below. Rooms Please note that there may be different opening hours during holidays and summer.

- Room 3015 for 2-5 persons
- Room 3017 for 3-10 persons
- Room 3018 for 3-12 persons
- Room 3019 for 2-6 persons

Please fill in your details on the fields below to see the reservations for next

Circulation services	Surname/Group name:	<input type="text" value="abduldigital"/>	* (/ L ₁ ; characters)
Textbook-reading-room	Email confirmation:	<input type="checkbox"/>	
Information services	Contact person's e-mail:	<input type="text" value="islandigital@yahoo."/>	L ₂
Interlibrary services	Group work room:	<input type="text" value="3017"/>	L ₃
Universal Borrowing	<input type="button" value="Next >>>"/>		

Reservation of main libra... Meeting Room Booking ... Room Booking System ...

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Name: Abduindigital

Password:

Log in

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28 Sep 2009 photo

MRBS Demo Installation Meeting Room Booking System

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Please log in

Name:

Password:

Room Booking System

Organisation Name Here

Home > User Login 9/28/2009 8:08:46 AM H₁

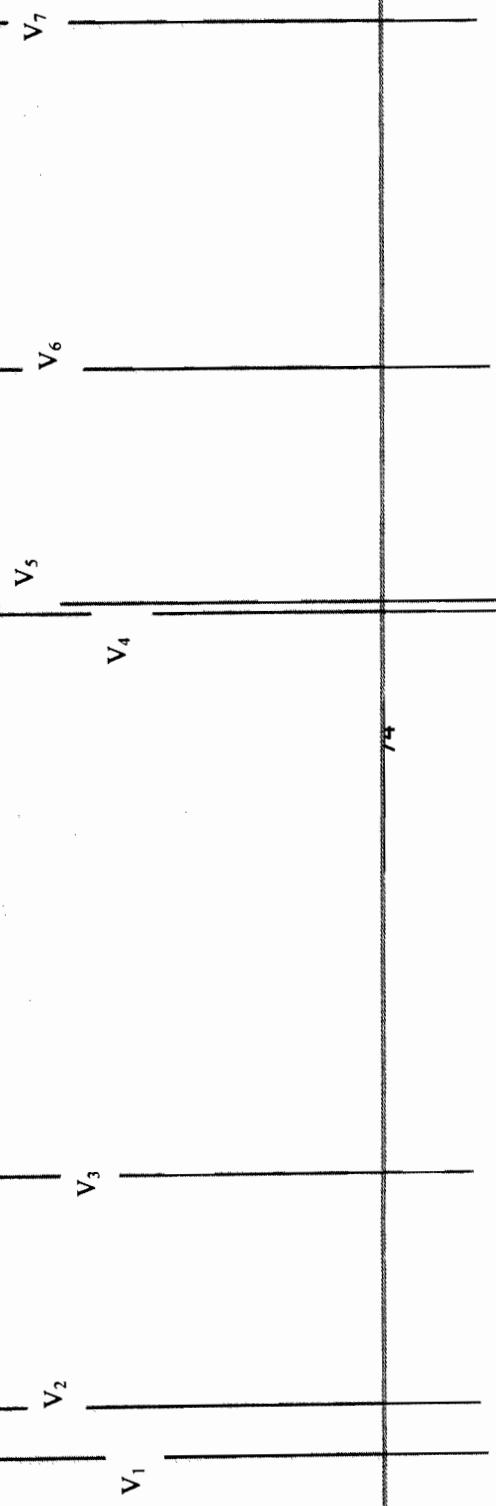
Welcome

Please remember to browse to your full system address, eg: www.roombookingsystem.co.uk/demo

User Log In

Username: H₃
 Password:
 Remember Me: H_m

Version 2.2.1





UNIVERSITY OF TAMPERE
 News
 Opening hours and contact information
 Renew your loans
 Library's database - TAMCAT
 Electronic collection - NELLI
 Remote access
 Printed collection
 Services
 Circulation services
 Textbook reading room
 Information services
 Interlibrary services
 Universal Borrowing
 Service fees
 Acquisitions
 Facilities and equipment
 Learning centers
 Group work rooms
 Classrooms
 Electronic journal reading places
 Copying and printing
 Reading places
 Data processing equipment and workstations with software
 Public access network
 Using and reserving group work rooms
 Computer support services
 Liaison work
 Publishing services
 Book sales
 House managers
 Courses
 Guides

Reservation of group work rooms
 Name: abdulmudjalid
 Email: laandigital@yahoo.co.uk
 Group work room Linna 3017 (3-10 persons) - week 40/2009

Please select a group work room: 3015 Select

Time	28.9.2009 Mon	29.9.2009 Tue	30.9.2009 Wed	1.10.2009 Thu	2.10.2009 Fri	3.10.2009 Sat
8-9	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
9-10	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
10-11	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
11-12	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
12-13	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
13-14	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
14-15	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
15-16	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
16-17	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
17-18	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
18-19	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve

Group work room Linna 3015, 2-5 persons
 Group work room Linna 3018, 3-12 persons
 Group work room Linna 3019, 2-6 persons

Time	28.9.2009 Mon	29.9.2009 Tue	30.9.2009 Wed	1.10.2009 Thu	2.10.2009 Fri	3.10.2009 Sat
8-9	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
9-10	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
10-11	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
11-12	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
12-13	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
13-14	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
14-15	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
15-16	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
16-17	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
17-18	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve
18-19	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve

Legend: Reserved Selected Free Not available

Add Entry

Brief Description: Proposal Defence
 Full Description: The Defense will accommodate like 25 people, people, Internal/External etc)

Date: 11 Aug 2009

Time: 9:00

Duration: 1 hours All day

Area: Campus 1

Rooms: **Projector 2**, Projector 1, Sala 10 A, Sala 9 A

Type: Internal

Repeat Type: None Daily Weekly Monthly Yearly Monthly, corresponding day n-Weekly

Repeat End Date: 11 Aug 2009

Repeat Day: Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Number of weeks: (for n-weekly)

Reservation of main libra... Meeting Room Booking ... Room Booking System ...

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MRBS Demo Installation Meeting Room Booking System

11 | Aug | 2009 | go to

Help Admin Report Search

You are demo1 [Log Off](#)

Scheduling Conflict

The new booking will conflict with the following entries:

- [meecum](#) (Tuesday 11 August 2009 09:00:00) ([View Day](#) | [View Week](#) | [View Month](#))

[Return to calendar view](#)

View Day: Aug 05 | Aug 06 | Aug 07 | Aug 08 | Aug 09 | Aug 10 | Aug 11 | Aug 12 | Aug 13 | Aug 14 | Aug 15 | Aug 16 | Aug 17 | Aug 18
View Week: Jul 13 | Jul 20 | Jul 27 | Aug 03 | Aug 10 | Aug 17 | Aug 24 | Aug 31 | Sep 07
View Month: Jun 2009 | Jul 2009 | Aug 2009 | Sep 2009 | Oct 2009 | Nov 2009 | Dec 2009 | Jan 2010 | Feb 2010

[MPRS Demo Installation](#)
[Meeting Room Booking System](#)

[CPT, Centro Professionale Tre...](#)
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[13](#)
[Aug](#)
[2009](#)
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Arabs
 CPT, Centro Professionale Tre...

July 2009							August 2009							September 2009						
Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6	7	8	9	10	11	12	3	4	5	6	7	8	9	1	2	3	4	5	6	
13	14	15	16	17	18	19	10	11	12	13	14	15	16	7	8	9	10	11	12	
20	21	22	23	24	25	26	17	18	19	20	21	22	23	14	15	16	17	18	19	
27	28	29	30	31			24	25	26	27	28	29	30	21	22	23	24	25	26	
							31							28	29	30				

<< Go To Day Before **Thursday 13 August 2009** Go To Day After >>
 Adelaide (150) B 406(24) B 407(24) B 408(24) Carr Mobile 1 Carr Mobile 2

Time	Proposed Distance
07:00	
07:30	
08:00	
08:30	
09:00	
09:30	
10:00	
10:30	
11:00	
11:30	
12:00	
12:30	
13:00	
13:30	
14:00	
14:30	
15:00	
15:30	
16:00	
16:30	
17:00	
17:30	
18:00	
18:30	

<< Go To Day Before **Go To Today** Go To Day After >>
 External Internal
http://mrb.sourceforge.net/mrbs/view_entry.php?id=82940&area=1292&da...

Proposal Defence

Description: The Defense will accommodate like 25 people

Room: CPT, Centro Professionale Trev - B 406

Start Time: 09:00:00 - Thursday 13 August 2009

Duration: 1 hours

End Time: 10:00:00 - Thursday 13 August 2009

Type: Internal

Created By: demo1

Last Updated: 07:50:22 - Monday 28 September 2009

Repeat Type: None

[Edit Entry](#) | [Copy Entry](#) | [Delete Entry](#) | [Return to previous page](#)

View Day:	Aug 07 Aug 08 Aug 09 Aug 10 Aug 11 Aug 12 Aug 13 Aug 14 Aug 15 Aug 16 Aug 17 Aug 18 Aug 19 Aug 20
View Week:	Jul 13 Jul 20 Jul 27 Aug 03 Aug 10 Aug 17 Aug 24 Aug 31 Sep 07
View Month:	Jun 2009 Jul 2009 Aug 2009 Sep 2009 Oct 2009 Nov 2009 Dec 2009 Jan 2010 Feb 2010

Reservation of main libra... Meeting Room Booking ... Room Booking System ...

http://mrbs.sourceforge.net/mrbs/view_entry.php?id=82940&area=1202&day=13&month=8&year=2009

Watch Internet TV, L... Computer and Infor... BBC - Science & Nat... "Interaction Design" ... Jenny Preece - Userati ... Computer Systems ... Logic Gates

MRBS Demo Installation Meeting Room Booking System

13 Aug 2009 goto

You are demo1 Log Off

Proposal Defence

Description: The Defense will accommodate like 25 people.

Room: CPT, Centro Professionale Trev - B 406

Start Time: 09:00:00 - Thursday 13 August 2009

Duration: 1 hours

End Time: 10:00:00 - Thursday 13 August 2009

Type: Internal

Created By: demo1

Last Updated: 07:50:22 - Monday 28 September 2009

Repeat Type: None

[Edit Entry](#)

[Copy Entry](#)

[Delete Entry](#)

[Return to previous page](#)

View Day: Aug 07 | Aug 08 | Aug 09 | Aug 10 | Aug 11 | Aug 12 | Aug 13 | Aug 14 | Aug 15 | Aug 16 | Aug 17 | Aug 18 | Aug 19 | Aug 20

View Week: Jul 13 | Jul 20 | Jul 27 | Aug 03 | Aug 10 | Aug 17 | Aug 24 | Aug 31 | Sep 07

View Month: Jun 2009 | Jul 2009 | Aug 2009 | Sep 2009 | Oct 2009 | Nov 2009 | Dec 2009 | Jan 2010 | Feb 2010

Room Booking System

Organisation Name Here

Home > Overview
Home
Add a Booking
Manage Bookings
Statistics
Help
Log Out

Welcome Surname, Forename 9/28/2009 8:56:51 AM

System Overview

Your Upcoming Bookings

Date	Day	Time	Resource	Edit	Del
9/28/2009	Monday	08:00 - 08:45	IT Room 1	/	✕
9/28/2009	Monday	Period 1	IT Room 4	/	✕
9/28/2009	Monday	Lunch	IT Room 2	/	✕
9/29/2009	Tuesday	Period 1	IT Room 2	/	✕
9/29/2009	Tuesday	Period 2 - Period 3	IT Room 4	/	✕

Your Resource - IT Room 1

Computers: 24
 Printer: Colour Laser
 Projector: Yes
 Interactive Whiteboard

Account Details

Resource Fault

Help

Log Out

Room Booking System

Organisation Name Here

Home Add a Booking Manage Bookings Statistics Log Out
9/28/2009 9:06:06 AM

Home > [Timetable](#) > Extras > Booking Successful
Welcome Surname, Forename

Booking Confirmed

What would you like to do now?

- [System Overview](#)
- [Add Another Booking](#)
- [LOG OUT](#)

Room Booking System

Organisation Name Here

Home > Manage Bookings | Welcome Surname, Forename | 9/28/2009 9:08:10 AM

Manage Bookings

Date	Day	Time	Resource	Category	Timeslot	Start Date	End Date	User	Email	Edit	Delete
9/28/2009	Monday	08:00 - 08:45	IT Room 1	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/28/2009	Monday	08:00 - 08:45	IT Room 5	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/28/2009	Monday	Period 1	IT Room 4	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/28/2009	Monday	Lunch	IT Room 2	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/29/2009	Tuesday	Period 1	IT Room 2	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/29/2009	Tuesday	Period 2 - Period 3	IT Room 4	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
9/30/2009	Wednesday	Period 1	IT Room 1	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
10/1/2009	Thursday	Period 1	A9	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
10/4/2009	Sunday	Period 2	IT Room 1	All	All	MM/DD/YYYY	MM/DD/YYYY	You			
10/7/2009	Wednesday	Period 5 - 15:45 - 17:00	IT Room 2	All	All	MM/DD/YYYY	MM/DD/YYYY	You			

Organizer for documenting reservations

SEPTEMBER

Ramadan 1429H

Perancangan Bulanan 2008

<p>17 September 2008 (Rabu) <small>17 Ramadan 1429H</small></p> <ul style="list-style-type: none"> • Hari Nuzul Al-Quran (Kelantan, Pahang, Perak, Perlis, Pulau Pinang, Selangor dan Terengganu Sahaja) <p>MES - BMU, 4-6 pm Dr. Fauziah - 3-5 pm</p> <p>Mesy. D.K. - 2.00 pm BMU, CAS</p> <p>BME 3 - Phd Group 9.00 → 1.00 pm.</p> <p>BME 2 - 3.00 pg (Pr. Huda)</p>	<p>21 September 2008 (Ahad) <small>21 Ramadan 1429H</small></p> <p>Kolekium luar mesra</p> <p>BME 2 - 10.00 - 12.30</p> <p>Defende Proposal</p> <p>BME 2 - 10.00 - 12.30</p> <p>BME 2 - 12.00 - 9.00 pm</p> <p>BME 3 - 2.30 pte (FRGS) <small>Dr. Huda.</small></p>
<p>18 September 2008 (Khamis) <small>18 Ramadan 1429H</small></p> <p>MES - BMU, 4-6 pm BME 3 - (9.00 - 10.00)</p> <p>BME 3 - 11.00 - 12.30</p> <p>BMU - Kolekium Proposal PhD</p> <p>9.00 am - 4.00 pm</p> <p>BME 2 - Kolekium Proposal PhD</p> <p>BME 2 - ICOCI 9.00 - 12.00 pm</p> <p>2.30 - 4.30 pg.</p> <p>BME 3 - 3P (12.30 - 1.30)</p>	<p>22 September 2008 (Isnin) <small>22 Ramadan 1429H</small></p> <p>BME 3 - 9.00 - 4.30 (Dr. Zul)</p>
<p>19 September 2008 (Jumaat) <small>19 Ramadan 1429H</small></p>	<p>23 September 2008 (Selasa) <small>23 Ramadan 1429H</small></p> <p>9am - 11am BME 2 - (FRGS) Dr. Fauziah</p> <p>BME 3 - 9.00 pg (Dr. Zul)</p> <p>BME 2 - 1.30 - (PM Bashah)</p> <p>BMU - 9.00 pg (TU)</p>
<p>20 September 2008 (Sabtu) <small>20 Ramadan 1429H</small></p>	<p>24 September 2008 (Rabu) <small>24 Ramadan 1429H</small></p> <p>BME 3 - 9.20 pg (Ph. Hair Link).</p> <p>BME 2 - 9.30 pg (TU - UUM)</p> <p>BME 3 - 12 - 5 (Dr Zul)</p>

Persona

Name : Binti

Age : 32

Nationality : Malaysian

Experience : 10 year Working experience

Work Hours : 8.00 am till 4.30 pm (Sun – Thurs)

Education : Degree

Location : Alor Star, Kedah.

Income : RM 24000 / year

IT Skill : Power User Microsoft Office, Intermediate Internet User,
frequent user for desktop

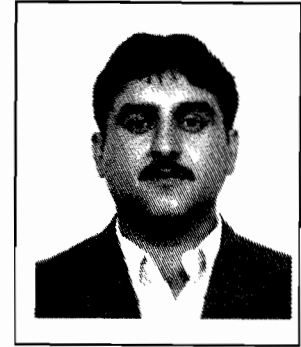
Disabilities : Short sighted

Family : Married with 3 kids



Binti works in the Main office of Department of Information technology as a secretary. She has a good record working as secretary as she is dedicated to her job. She usually busy during her working hours, most time Binti go back home tired. Binti is very organized and full of praise from her boss always. She is always happy and dislikes complex situations that will make her run out of ideas. Her goal is to be very successful in life and to help contribute to Humanity.

Persona



Name : Walad

Age : 37

Nationality : Malaysian

Experience : 15 year Working experience

Work Hours : 8.00 am till 4.30 pm (Sun – Thurs)

Education : PhD

Location : Jitra, Kedah.

Income : RM 38000 / year

IT Skill : Power User Microsoft Office, Power Internet User,
Excellent programming skills

Disabilities : None

Family : Married with 2 kids

Walad is a lecturer in Department of Information technology Universiti Utara Malaysia. He teaches Advance programming in Java. Walad travels frequently to attend conferences, workshops and symposium all over the globe. Walad likes to go far away from Malaysia during his vacations, he enjoys spending time with his family. He loves his wife and kids. His goal is to become a professor. Walad likes getting things done with ease and quickly.

APPENDIX B: SAMPLE OF QUIZ

Please rate your agreement with these statements after interacting with the RRS.

- Try to respond to all the items.

USEFULNESS		1	2	3	4	5	6	7	
1. It helps me be more effective.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
2. It is useful.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
3. It makes the things I want to accomplish easier to get done.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
4. It saves me time when I use it.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
5. It meets my needs.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
EASE OF USE		1	2	3	4	5	6	7	
6. It is easy to use.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
7. It is simple to use.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
8. It is user friendly.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
9. It reqReserves the fewest steps possible to accomplish what I want to do with it	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
10. I can use it without written instructions.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
11. I can recover from mistakes quickly and easily.	strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree

EASE OF LEARNING

	1	2	3	4	5	6	7	
12. I learned to use it quickly.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
13. I easily remember how to use it.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
14. It is easy to learn to use it.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
15. I quickly became skillful with it.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree

SATISFACTION

	1	2	3	4	5	6	7	
16. I am satisfied with it.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
17. It is fun to use.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
18. It works the way I want it to work.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
19. It is wonderful.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree
20. It is pleasant to use.	strongly disagree <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	strongly agree

1 2 3 4 5 6 7