UTILISATION OF TECHNOLOGY ACCEPTANCE MODEL (TAM) IN DETERMINING USER PERCEPTIONS OF HOSPITAL APPOINTMENT SYSTEM

ALI IBRAHIM LATIFF

DISSERTATION SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF COMPUTER SCIENCE

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

UNIVERSITY OF MALAYA

2011
Abstract

The traditional method of appointment making was based on physical visits to hospital or through telephone calls. With the rapid development of computer hardware and network environment, hospital system is changing to digital environment for reducing time wasted and efforts. The system design and implementation shown is a process of patients' ability to book for a special appointment related to the digital data base belonging to the hospital. The objective of this study is to prepare a suitable hospital appointment system for the benefit of improved convenience for both the medical team and also the patients. Quantitative methods are used in this research in order to obtain ideas to develop the prototype of the system. This is followed by system development, by which the researcher developed a Patient Appointment System. This system was put to test by the potential users. The prototype system is used as a base to measure the feedback of the target respondents as to the acceptance of the patient appointment system. The findings of the study are used to identify the attitude, ease of use and usefulness of the proposed system. The three target groups including doctors, hospital staff and patients are not very different from each other in terms of the mean values obtained. However, the result clearly shows that the system is very useful. Overall, the hospital appointment system is an effective approach to reduce time, cost and effort to make hospital appointment. The system is conceived to be acceptable, friendly, easy to be accessed and culturally acceptable. The development and provision of quality healthcare could be promoted through the usage of ICT. The researcher believes that the prototype can be further improved to enable the hospital appointment system to be fully implemented in private hospitals as an ongoing development.
The researcher considers capitalizing on quantitative methods in this study. In the stage leading to identifying the crucial contents for the proposed system, the researcher uses mainly the quantitative method. Based on the literature review and the analytical observation the researcher compiled a list of groups to be included in the proposed system.

At this stage the researcher used the quantitative method to identify the responses and feedback of the potential users of the newly developed system.

Upon identifying the relevant groups, the researcher was able to develop a prototype to be tested among the potential users. The questionnaire self-administered questionnaire was used by the researcher to extract the feedback from the potential users of the system.
# Table of Contents

Abstract ................................................................................................................................. ii

Table of Contents ................................................................................................................... iv

List of Figures .......................................................................................................................... x

List of Tables ............................................................................................................................ xiii

Dedication ................................................................................................................................. xiv

Acknowledgement ..................................................................................................................... xv

Definitions Specific to Thesis ................................................................................................. xvi

1. CHAPTER ONE: INTRODUCTION .................................................................................. 1
   1.1. Research Motivation ................................................................................................. 1
   1.2. Problem Statement .................................................................................................. 4
   1.3. Research Questions .................................................................................................... 5
   1.4. Research Objectives ................................................................................................. 5
   1.5. Scope and Limitation of the study ............................................................................ 6
   1.6. Assumption ............................................................................................................... 6
   1.7. Contribution of the study ....................................................................................... 7
   1.8. Conclusion ............................................................................................................... 8

2. CHAPTER TWO: LITERATURE REVIEW ....................................................................... 9
   2.1. Introduction ............................................................................................................... 9
   2.2. Role of Information Communications Technology (ICT) ...................................... 9
   2.3. Benefits of ICT ....................................................................................................... 10
   2.4. ICT in Healthcare ................................................................................................... 10
   2.5. Health Information System ..................................................................................... 11
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.1. Demographics</td>
<td>34</td>
</tr>
<tr>
<td>4.3. Definition</td>
<td>35</td>
</tr>
<tr>
<td>4.4. Accessibility of the system</td>
<td>35</td>
</tr>
<tr>
<td>4.5. Tracing number of visits</td>
<td>36</td>
</tr>
<tr>
<td>4.6. Identifying number of patients in waiting list</td>
<td>36</td>
</tr>
<tr>
<td>4.7. Time taken for appointment</td>
<td>36</td>
</tr>
<tr>
<td>4.8. Efforts needed for making appointment</td>
<td>37</td>
</tr>
<tr>
<td>4.9. Cost of making appointment</td>
<td>37</td>
</tr>
<tr>
<td>4.10. Perception of Quality of Health Care</td>
<td>37</td>
</tr>
<tr>
<td>4.11. Helpfulness on Planning Duties</td>
<td>38</td>
</tr>
<tr>
<td>4.12. Comments</td>
<td>38</td>
</tr>
<tr>
<td>4.13. Findings related to the System</td>
<td>38</td>
</tr>
<tr>
<td>4.14. Conclusion</td>
<td>40</td>
</tr>
<tr>
<td>5. CHAPTER FIVE: SYSTEM DESIGN AND IMPLEMENTATION</td>
<td>41</td>
</tr>
<tr>
<td>5.1. Introduction</td>
<td>41</td>
</tr>
<tr>
<td>5.2. Overview</td>
<td>41</td>
</tr>
<tr>
<td>5.3. System framework</td>
<td>41</td>
</tr>
<tr>
<td>5.4. System workflow</td>
<td>42</td>
</tr>
<tr>
<td>5.5. Overall System use case diagram</td>
<td>43</td>
</tr>
<tr>
<td>5.5.1. The administrator log in</td>
<td>43</td>
</tr>
<tr>
<td>5.5.2. Patient log in</td>
<td>44</td>
</tr>
<tr>
<td>5.5.3. Doctor log in</td>
<td>45</td>
</tr>
<tr>
<td>5.6. Data Flow diagram</td>
<td>48</td>
</tr>
<tr>
<td>5.7. Description of system modules and functionality</td>
<td>49</td>
</tr>
<tr>
<td>5.7.1. Create a new account</td>
<td>50</td>
</tr>
</tbody>
</table>
6.1. Objective ............................................................................................................. 78
6.2. System Testing .................................................................................................. 79
6.3. Self administered questionnaire - Part A - Demography ................................. 79
   6.3.1. Gender ......................................................................................................... 81
   6.3.2. Age ............................................................................................................... 81
   6.3.3. Monthly Income .......................................................................................... 82
   6.3.4. Education ...................................................................................................... 83
   6.3.5. Browsing per month ..................................................................................... 84
   6.3.6. Internet use .................................................................................................. 85
6.4. Part B Data collected ......................................................................................... 86
   6.4.1. Category 1: User Level ................................................................................ 87
   6.4.2. Category 2: Attitude .................................................................................... 88
   6.4.3. Category 3: Usefulness ................................................................................ 89
   6.4.4. Category 4: Ease of Use ............................................................................. 90
6.5. Profiling of the Demographics ....................................................................... 91
6.6. Data analysis ..................................................................................................... 92
   6.6.1. Overall System Analysis ............................................................................ 92
   6.6.2. Highest Mean ............................................................................................... 93
   6.6.3. Lowest Mean ............................................................................................... 93
6.7. Research Question ............................................................................................ 94
   6.7.1. Question 1 ................................................................................................... 94
   6.7.2. Question 2 ................................................................................................... 95
   6.7.3. Question 3 ................................................................................................... 95
   6.7.4. Question 4 ................................................................................................... 95
   6.7.5. Question 5 ................................................................................................... 96
6.8. Conclusion .............................................................................................................. 96

7. CHAPTER SEVEN: CONCLUSION........................................................................... 97

7.1. Introduction............................................................................................................. 97

7.2. Concluding Discussion ......................................................................................... 97
    7.2.1. Attitude............................................................................................................. 98
    7.2.2. Usefulness ........................................................................................................ 99
    7.2.3. Ease of Use ...................................................................................................... 99

7.3. Contribution ......................................................................................................... 100

7.4. Limitation ............................................................................................................... 100

7.5. Future Work ......................................................................................................... 101

7.6. Future directions of the prototype system ......................................................... 102

7.7. Recommendation for Improvement of the System ........................................... 102

7.8. Benefits ................................................................................................................. 103

7.9. Significance of the study ..................................................................................... 104
    7.9.1. For the researcher ............................................................................................. 104
    7.9.2. Healthcare industry ........................................................................................ 104

In nutshell .................................................................................................................... 106

Appendices .................................................................................................................. 114

Questionnaire ............................................................................................................. 114

Appointment System Characteristics ........................................................................ 120

Interview: System Requirement before Development ............................................. 120
List of Figures

| Figure 3-1 | Content Factors of the prototype ......................................................... | 31 |
| Figure 3-1 | Flow chart of the proposed research ....................................................... | 26 |
| Figure 5-1  | System workflow ...................................................................................... | 43 |
| Figure 5-2  | Use case diagram administrator log in ..................................................... | 44 |
| Figure 5-3  | Use case diagram for patient log in ....................................................... | 44 |
| Figure 5-4  | Use case diagram for doctor log in ....................................................... | 45 |
| Figure 5-5  | Home page of the system .......................................................................... | 47 |
| Figure 5-6  | Home page with the user name and password ......................................... | 48 |
| Figure 5-7  | Data flow diagram for the entire system structure .................................... | 49 |
| Figure 5-8  | A public page link for available doctors in the specific hospital ............. | 50 |
| Figure 5-9  | Create new account page ........................................................................... | 51 |
| Figure 5-10 | Create new account page including the account details ............................ | 52 |
| Figure 5-11 | Congratulation message for successful registration ................................... | 53 |
| Figure 5-12 | Patient Member Login page ....................................................................... | 54 |
| Figure 5-13 | Member ‘s page .......................................................................................... | 55 |
| Figure 5-14 | Login to administrator account .................................................................. | 56 |
| Figure 5-15 | Login as a Doctor ...................................................................................... | 57 |
| Figure 5-16 | Doctor’s page ............................................................................................. | 58 |
| Figure 5-17 | Administrator prerogative to add or delete medical units .......................... | 59 |
| Figure 5-18 | Editing one of the medical unit by the administrator ............................... | 60 |
| Figure 5-19 | Editing (add/delete) of doctors in the system ........................................... | 61 |
Figure 5-20  Doctors information as shown including the user rate..................62
Figure 5-21  Patient list shown. ..................................................................63
Figure 5-22  Adding news to the hospital website by the administrator. .....64
Figure 5-23  A simple organizer for the doctor. ........................................65
Figure 5-24  Doctors page to edit. ...............................................................67
Figure 5-25  Doctor Profile editor, part time or full time. .........................68
Figure 5-26  Successfully purchased 110 H-Points. ....................................69
Figure 5-27  Make Appointment page. .........................................................70
Figure 5-28  Outdated appointment with a particular doctor.........................72
Figure 5-29  Insufficient H-Points message after making an appointment. ....73
Figure 5-30  An appointment date is available. .............................................74
Figure 5-31  Appointment confirmed. .........................................................75
Figure 5-32  Appointment completed. ..........................................................76
Figure 6-1    Gender..................................................................................81
Figure 6-2    Age.....................................................................................82
Figure 6-3    Monthly Income. .................................................................83
Figure 6-4    Education..............................................................................84
Figure 6-5    Browsing/month. .................................................................85
Figure 6-6    Internet use. ........................................................................86
Figure 6-7    User level. ............................................................................88
Figure 6-8    Attitude................................................................................89
Figure 6-9    Usefulness. ...........................................................................90
Figure 6-10   Ease of use...........................................................................91
Figure 6-11   Overall system.....................................................................92
Figure 6-12   Items with highest mean value..............................................93
Figure 6-13  Items with lowest mean value.
List of Tables

Table 4-1  Interview demographics. ................................................................. 35
Table 6-1  Overall Demographical Information of the study. ......................... 80
Table 6-2  Question items and groups studied. ............................................. 86
Table 6-3  Profile of the study. ................................................................. 91
Dedication

To

My wife

And

My children
Acknowledgement

I would like to take this opportunity to express my deep sense of gratitude and profound feeling of admiration to my thesis supervisor. Thanks to all those who helped me in this work.
Definitions Specific to Thesis

This Thesis has been prepared with full compliance to the University of Malaya requirement.
1. CHAPTER ONE: INTRODUCTION

1.1. Research Motivation

Healthcare appointment system solution tool is a technique to create a better health service for the hospitals in Malaysia. For example, maintaining the information of the hospital staff, patients, medicines and others in many government or private hospitals might involve a huge amount of documentation, resulting in a lot of overheads and inefficiency. In addition to this, in Malaysia, there is also a high level of interest to use the web based technology to promote healthcare as a matter of policy.

Healthcare is one of the seven pillars of Multimedia Super Corridors which is designed as the catalyst towards achieving Vision 2020. Under the flagship application, healthcare is recognized as ‘Telehealth’ which is designed to provide a more thorough and a faster rate of healthcare service to the public. This is planned to be achieved through connecting the healthcare service providers through a strong medical information database. The aim of ‘Telehealth’ is to provide a high quality of service, regardless of their location in the country.

The Vision 2020 envisages Malaysia to be recognized as a fully developed nation economically, culturally, politically, spiritually and psychologically. As such this proposed study by the researcher is in line with the government policy.
The Healthcare Industry is one of the main sector of all developed countries and investment in the ‘Telehealth’ application, is only a natural step forward for a better Healthcare Industry.

The system that the researcher proposes to develop, is a management tool designed specially to implement efficiency at hospitals. The main purpose of this system is to manage all the data information of the hospital in a secure way. This system is a web based database. By using this system; the administrator and staff can view, add, edit, delete and update the information easily.

Based on the motivations elaborated in the foregoing paragraphs the proposition behind this research is that there are different designs of appointment system depending on the user. The main reception desk of the hospital is the first point of contact for a patient. If the patient has an appointment in the outpatient department, he/she is directed to the outpatient reception. If he/she is to be admitted as an inpatient, the patient is directed to the admission office.

Usually the input of a reception is as follows:

- Patient PIN /OPD number/registration number + appointment number
- Reporting time at the Reception.
- Entry time of patient to the clinic.
• Exit time of patient from the clinic.

These are the main information entered by the staff at the reception desk, whenever a patient comes for consultation or treatment. Patient information would be entered every time a patient comes in for consultation or treatment and this is repeated every time, all the time.

However the proposed system in this study should be user friendly that the Receptionist shall not enter any data. The receptionist will select the patient from the "Appointment of the day list" and will just click on the boxes, provided for patient's "Entry", at Reception and Consultant's Clinic and "Exit" from the consultant's Clinic. System shall capture the system time the moment these boxes are clicked. The moment "Exit" box is clicked; system shall immediately display the next patient in the queue.

The business scenario map is designed for the healthcare industry. It shows how all the relevant parties – a patient, a doctor, and a hospital – can use the internet to exchange information which makes it possible to book appointments. The use of such a system encourages collaboration among the user, hospital and experts. Further, increased transparency and customer service are achieved. These benefits, among others, save time and money.

The internet–enabled transaction for appointment makes it possible to post appointments to available time slots from outside the hospital. External physicians, for example, can then book an appointment directly for their patients in the
management system. This transaction is a simplified version of the regular transaction used within the outpatient management function. The internet application is connected directly with the patient management system and the desired appointment is booked through the internet. The quantity of appointments that are booked can be controlled through the internet by marking the supplied time slots in the day program of the respective planning object as "externally bookable". In this way an external doctor can access the booking system over the web, choose the appropriate medical department, the earliest possible date, and enter a specific time for the appointment.

The resulting list provides free time slots that can be interactively chosen. To book, the appointment, some rudimentary data of the patient needs to be entered online. After confirmation (by the doctor and/or patient), an appointment will be created in the SAP system. Confirmation of the booked appointment is generated and sent to the patient as a printout and a reminder, detailing the location of his/her appointment.

1.2. Problem Statement

A significant effort and time are made by the patient to make an appointment, yet these may be wasted as clash may occur with other consultation time or unavailability of the specialist.

The research problem is concerned about the patient. Currently it takes a long time for the patient to make an appointment with a doctor who might not be available. A new
scheme is proposed in this research to reduce the time and effort spent by the patient to secure an appointment with the consultant.

1.3. Research Questions

The researcher has set out four research questions at the outset of this study. The researcher will attempt to answer these questions from the self administered questionnaire conducted in the course of this study. The questions are formulated as follows:

i. What are the criteria of interest for an enhanced Appointment System?

ii. What type of enhanced Information system can focus on Online Appointment System?

iii. What is the prototype of Online Appointment System?

iv. What is the users’ perceptions of the Online Appointment System?

1.4. Research Objectives

The previous sections have addressed the research motivation, background of the study and highlighted the research questions. The research motivation and questions led to the specification of the following research objectives, which were identified through the extensive literature review conducted as part of this study.
1. To ascertain features that should be included in an Online Appointment System.

2. To propose a new Hospital Information System which focuses on Online Appointment System.

3. To develop a working prototype for the Online Appointment System.

4. To evaluate users’ perceptions of the Online Appointment System.

1.5. Scope and Limitation of the study

The scope of this study and its limitations are identified as follows:

The scope of the study evaluates the acceptance of a proposed Online Appointment System in Malaysia. This has specific reference to the Klang Valley only. The study focuses on two selected public hospitals in relation to the Hospital Appointment System.

1.6. Assumption

In this study the researcher assumes that all appointments are genuine and that some security validation like the National Identity Card Number or the Passport Number is sufficient.

The researcher assumes that the Hospital Appointment System examined in this study would be “a fit for all” system, for the purpose of this study. Of course there will be some formatting and cultural issue differences from one hospital to another, but that will be left out for customization at a later stage which is not within the scope of this study.
1.7. Contribution of the study

The benefits of this study are twofold as discussed below:

1. The proposed Hospital Information System is using web based technology to facilitate patient appointment system. This will benefit hospitals as well as the clinics. The scheduling system can be used to perform at the optimized level which reduces wastage of time, energy and resources. The proposed system will complement and enhance the current hospital information system, being practiced by the hospitals for patient appointments.

2. The patient can be more comfortable dealing with his/her assigned medical experts like the specialists, doctors, clinicians, laboratories, pharmacists, dietician, physiotherapists and the whole range of consultants as the proposed system allows the user to have better control of their time through the new appointment system.

3. The patient can be more-comfortable in dealing with his/her assigned doctor as the proposed system attempts to incorporate all the user needs into the proposed system.

4. The expected outcome of this study is a web based appointment system that could be used for medical organizations for patient appointments. The system can be used as a means of conveying messages from the hospital to the general
public and also the selected customers of the hospital. These functions will be tested and evaluated using TAM model.

1.8. Conclusion

In this introductory chapter the researcher discussed all the pertinent background details of the study including the problem statement, research questions, objectives, scope and limitations of the study, contribution of the study and arrangement of the thesis as part of the general details to the reader.

The researcher believes that this will give all readers a general understanding of the study undertaken by the researcher.
2. CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

In this chapter the researcher attempts to review the relevant literature that has been done in the patient appointment system in general and the studies revolving around the Hospital Information System.

This chapter discusses the appointment system in the health industry to assess the relevance and applicability of the system to the healthcare sector. This becomes necessary as there is not much work done in the hospital appointment system (Fone et al., 2003).

2.2. Role of Information Communications Technology (ICT)

Information Communications technology (ICT) is one of the driving forces in the information society. Current trends indicate that computers will soon be integrated into many devices and that there is virtually no limit of inter-networking of all kinds of computers and services (Dev and Olsen, 2000).

Discussed the role of information technology (IT) and suggested that the Internet will provide great opportunities for future sales. Rayman stated that information and computer technology, especially the Internet, have changed the
socioeconomic context of the world and the way, businesses are conducted in the world including both the manufacturing and service sectors (Rayman-Bacchus and Molina, 2001). Furthermore, the authors are of the strong opinion that it will stimulate further changes (Visuvalingam, 2007).

### 2.3. Benefits of ICT

Weber and team conducted a study on travel information and travel services. The researcher is of the opinion that the above study is equally applicable for this study as this is also service oriented (Weber and Roehl, 1999). The study provided a profile of people who used the Internet to search for information or to purchase services on the internet. Their study found that the respondents who searched for information or who purchased services or products online are of higher incomes, higher status occupations, and have more years of experience with the Internet than those who did not search or purchase online. The findings of these studies suggest that managers of hospitality organizations should understand the differences between socio-demographics and behavioral characteristics between online and non-online customers before implementing their promotion strategies.

### 2.4. ICT in Healthcare

When someone seeks help for a health related problem or question, the service provider, usually the medical expert, has to navigate a complex system where health services are distributed across multiple clinicians in a variety of specializations and institutions, even within the same hospital let alone cross geographical boundaries (Fu et al., 2006).
Within the healthcare system, efforts to reduce costs have limited the time clinicians and medical experts are able to spend with patients. For this reason the Information Communications Technology enables a high level and efficient Personal Health Information Management which in turn enables unprecedented advantage to numerous patients. ICT systems bring the patient and doctor closer to the goal of helping all patients be informed, becoming active participants, increasing the quality of their own care without disregarding important aspects of their personal and professional lives (Pratt et al., 2006).

2.5. Health Information System

2.5.1. Definition

Health informatics or medical informatics is the intersection of information science, computer science, and health care. It deals with the resources, devices, and methods required for optimizing the acquisition, storage, retrieval, and use of information in health and biomedicine. Health informatics tools include not only computers but also clinical guidelines, formal medical terminologies, and information and communication systems (Haux, 2006).

Sub-domains of (bio) medical or health care informatics include: clinical informatics, nursing informatics, imaging informatics, consumer health informatics, public health informatics, dental informatics, clinical research informatics, bioinformatics, veterinary informatics, pharmacy informatics and healthcare management informatics.
2.6. Health Information Process

Tylor describes that there are three parts of the information process. The three parts are essentially the user, the interface, and the system (Taylor and Voigt, 1986).

The earliest use of computation for medicine was for dental projects in the 1950s at the United States National Bureau of Standards by Robert Ledley. The next step in the mid 1950s were the development of expert systems such as MYCIN and INTERNIST-I. In 1961, a major career change occurred when (Collen, 1987), abruptly went from medical practice into medical computing. The primary goal was to develop a comprehensive health care information system to provide an integrated, continuing patient medical record (Collen, 1987). In 1965, Dr. Sidney Garfield decided that, the National Library of Medicine should use MEDLINE and MEDLARS. At this time, Neil Pappalardo, Curtis Marble, and Robert Greenes developed MUMPS (Massachusetts General Hospital Utility Multi-Programming System) in Octo Barnett's Laboratory of Computer Science at Massachusetts General Hospital in Boston. In the 1970s and 1980s, it was the most commonly used programming language for clinical applications. The MUMPS operating system was used to support MUMPS language specifications. As of 2004, a descendent of this system is being used in the United States Veterans Affairs hospital system. The VA has the largest enterprise-wide health information system that includes an electronic medical record, known as the Veterans Health Information Systems and Technology Architecture or Vista. A graphical user interface known as the Computerized Patient Record System (CPRS) allows health
care providers to review and update a patient’s electronic medical record at any of the VA’s over 1,000 health care facilities.

In the 1970s a growing number of commercial vendors began to market practice management and electronic medical records systems. Although many products existed, only a small number of health practitioners used fully featured electronic health care records systems. Homer R. Warner, one of the Fathers of Medical Informatics, founded the Department of Medical Informatics at the University of Utah in 1968, and the American Medical Informatics Association (AMIA) has an award named after him on application of informatics to medicine in the Hall of Fame of Utah Technology Council (Jeong and Lambert, 2001).

The US HIPAA of 1996, regulating privacy and medical record transmission, created the impetus for large numbers of physicians to move towards using (Electronic Medical Record) EMR software, primarily for the purpose of secure medical billing. The US is making progress towards a standardized health information infrastructure. In 2004 the US Department of Health and Human Services (HHS) formed the Office of the National Coordinator for Health Information Technology (ONCHIT), headed by David J. Brailer, M.D., Ph.D. The mission of this office is widespread adoption of interoperable electronic health records (EHRs) in the US within 10 years.(See quality improvement organizations for more information on federal initiatives in this area). Brailer resigned from the post in April, 2006.

The Certification Commission for Healthcare Information Technology (CCHIT), a private nonprofit group, was founded in 2005/7 by the U.S. Department of Health and
Human Services to develop a set of standards for electronic health records (EHR) and supporting networks, and certify vendors who meet them. In July, 2006 CCHIT released its first list of 22 certified ambulatory EHR products, in two different announcement(Legris et al., 2003).

In Hong Kong a computerized patient record system called the Clinical Management System (CMS) has been developed by the Hospital Authority since 1994. This system has been deployed at all the sites of the Authority (40 hospitals and 120 clinics), and is used by all 30,000 clinical staff on a daily basis, with a daily transaction of up to 2 million. The comprehensive records of 7 million patients are available on-line in the Electronic Patient Record (ePR), with data integrated from all sites. Since 2004 radiology image viewing has been added to the ePR, with radiography images from any HA site being available as part of the ePR.

Another study (Loula Pekka and Hannu, 1996) discussed the concept of virtual hospital and telemedicine as a part of daily hospital operations. The concept of the virtual hospital is analyzed by using business, application and technology point of views.

(Lee et al., 2005b) proposed a system for patient scheduling in a department of nuclear medicine. Regarding Ambulatory Care, (Lovell et al., 2001).

From Australia developed a user – friendly, database-driven system accessible via internet, which replaced the current paper-based system.
(Goradia, 2006) discussed about an integrated system containing medical information providing system, hospital reception method, medical information database and computer unit for patient reception at hospital. The study further reports that the documentation affects patient care, physician efficiency, and ultimately affects the accuracy of coding.

2.7. Hospital Information System

Hospital information system is defined as “The application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making”. This definition includes such applications as: electronic health record, electronic billing, electronic discharging and telemedicine (Yusof et al., 2007). For instance, by implementing the electronic health record, hospitals can save expense associated with record keeping, improved workflows, practice management and billing including one-time electronic order entry and the elimination of transcription (Nakamura et al., 2007). Early IT implementations started between 1991 and 1995, and were designed to handle administrative tasks, drug inventory management, finance and health management information reporting. Hospital Selayang was opened in 1998, with capacity of 900 beds. Selayang is the best example of effective implementation of a hospital information system. Even ambulance drivers are involved. Once a driver has sent a patient to the hospital, he has to log into the system to record the route and traffic information.
Learning from the experience at Selayang, the country’s second paperless and filmless hospital, the 300-bed Putra Jaya Hospital, adopted the same system. Overall, the two hospitals have been successful and the government decided to make IT, part of the planning for all future hospitals. (Hadis and Hashim, 2004, Hassan, 2004).

In Malaysia, hospitals across the country are continually searching for ways to ensure patient safety and improve the quality of care. Important factors needed for successful implementation of information systems for a hospital, include a culture of safety, attraction and retaining key personnel, revision and continually updating quality improvement processes, and giving the staff tools to excel (Naing et al., 2008) In addition, an internal environment that constantly focuses on quality and a set of practical tools that promote good outcomes and quality improvement on a daily basis also form success factors of information system adoption in hospitals (Pavlopoulos et al., 2002).

A Basic Health Information System (BHIS) includes a Patient Management System, simple Clinical Information System and financials; an Intermediate Health Information System (IHIS) integrates what a BHIS would encompass with laboratory and pharmacy information systems. And a more costly Total Health Information System (THIS) also includes more advanced modules such as RIS/PACS and Case Mix (Wu et al., 2008).

The factors influencing the adoption of information system (IS) at hospitals in Malaysia. are: innovation, relative advantage, competitive edge, patients’/customers’ pressure, top management support, size of hospital, and employees’ knowledge.
Based on these factors, I intend to design my proposed prototype system development, to better equip the Malaysian hospitals (Naing et al., 2008).

2.8. Current state of Hospital Information System in Malaysia

Malaysia has been experiencing changing disease patterns with increased cost of medical care. Therefore, in its Vision 2020 PLAN, Malaysia aims to be a nation of healthy individuals, families, and Communities (MMA, 1999) Malaysia’s Ministry of Health, has called for a change in the role of healthcare professionals and a delivery interface between the consumers and health system.

Thus healthcare strategy has had to shift from making traditional health and hygiene improvements to promoting healthier lifestyles and providing quality care.

One of major means to achieve this vision is to set an up to date health information system that is affordable, accessible, efficient, and technologically appropriate, with emphasis on quality (Mohd and Mohamad, 2005).

My attempt for an extensive literature review about the status of the online hospital appointment system in the local setting of Malaysia did not show any results. This is still another motive to pursue the idea of establishing such a system, in addition to the afore-mentioned objectives.
2.9. Definition of Appointment System

Many researchers have examined what current and potential online customers like to see from hospitality and travel websites. Murphy found that there were 32 common features in the hotel reservation/booking sites (Murphy et al., 1996). These features were found through search engines. A further scrutiny reveals that the 32 identified features were then divided into four major categories. The categories identified as relevant for an online appointment system are promotion, service, interactivity, and management.

In view of the above, the researcher hypothesized that a system for a hospital use will serve better than traditional method of making an appointment. A better system in terms of ease of use, reducing time and efforts is needed for making the appointment and at the same time it should be friendly and accessible from different locations as it is an internet based one. The development of the system will be based on opinion gathered from different groups involved in the appointment of a patient, Viz, doctors, hospital staff and the patient himself. Opinion sought is about the need of a system which will serve better than the traditional method in the context of the features mentioned above. Based on the supporting opinion from the target groups, the researcher proceeded to design the system and test it with the same target groups and get their reflections as an evaluation process.

2.10. Definition of Web based Hospital Information System

The web based Hospital Information System is to have features such as medical history list, data security and integrity, authorized access, remote multi-access,
medical examinations and tests, links to medical databases, etc., in a web-based or
computer-based record system. In addition, some other information should also be
included in the system, like personal data including demographic and administrative
data. The aim of this web based Hospital Information System is to improve the quality
of health care provision, to minimize the Institution’s costs, to ameliorate time
management, to increase training capabilities and to improve remote patient record
access. (Connolly et al., 1998). Broadly speaking, outpatient appointment scheduling
literature can be classified in to two groups: those that evaluated schedules and those
that evaluated algorithms to uncover improve schedules (Kaandorp and Koole, 2007).
In case of the former type of study, simulations were used whereas the Latter mostly
applied analytical methods. A comprehensive review of the literature on AS can be
found (Cayirli and Veral, 2003). The prevailing ASs range from single-block
appointments on one extreme to individual appointments on the other side. Most of
the appointment systems have concentrated on modification and combination of these
two systems.

Any combination in the appointment interval such as a block size or an initial block
create an AS rule. The single-block system assigns all patients to arrive in a block at
the beginning of the clinic session, allocating a “date” rather than an exact
appointment time. As expected, this system creates long waiting times for patients but
shortens idle time for the doctors. The individual-block/fixed-interval system calls
patients individually at intervals equal to the mean consultation time. The individual-
block/fixed-interval with an initial block system is similar, but the number of patients
assigned to the initial block is greater than one. Wahban cited different method of
appointment system in Malaysian hospital within the above mentioned context
examining the role of SMS in making hospital appointment (WAHAB, M. et al 2010).

2.11. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is a well known model developed by (Davis, 1989). The model consists of Perceived ease of use, perceived usefulness, attitude toward usage, behavioral intention to use and actual system use (Yang and Yoo, 2004, Venkatesh and Davis, 2000).

2.12. The objective of TAM

The objective of TAM is to provide an explanation for the determinants of computer acceptance, an explanation that, in general, is capable of explaining user behavior across a broad range of end-user computing technologies and user populations (Davies, 1989,Bertrand and Bouchard, 2008).

2.13. TAM in Hospital Information System

In Malaysia, the rapid development of information technology, and with the growing population of Internet users, e-services have become widely accepted among enterprises and the trend is not only dominant in high tech and traditional industries, but also in medical industries. The medical industry is a capital-intensive, labor-
intensive and information-intensive one; therefore, the large amounts of information exchange in the medical industry are attracting the attention of medical managers. If hospitals do not adapt management information systems, they will be inefficient and lose the trust of their patients (Lu et al., 2005, Scott, 2007).

Hospital information systems (HIS) have gradually taken over traditional hospital operation procedures. The infrastructure of medical industry management information systems is a high technology oriented field, one that is changing quickly. Ideally, hospital information systems should be linked with each other, and be able to share databases (Kwon and Chidambaram, 2002).

The technology acceptance model has received significant attention from scholars. According to the technology acceptance model, system usage behavior is determined by the intention to use a particular system, which in turn, is determined by its perceived usefulness and ease of use (Davis, 1986) and (Hesse et al., 2005). However, medical professionals who use the electronic logistics information system are a specific user group. Thus, existing variables of technology acceptance model cannot fully reflect users’ motives, and therefore require a search for additional intrinsic motivational factors. Prior research has found that perceived financial cost has a great influence on IT users’ behavior (Tung et al., 2008).

Factors that affect TAM in HIS implementation include: diffusion of innovation (explained by the theory), belief construct (trust), external variable (perceived financial cost), perceived usefulness and perceived ease of use. (Agarwal and Karahanna, 2000, Moore and Benbasat, 1991, Mathieson et al., 2001).
TAM provides the basis for the study of technology acceptance and has become a widely used model in IS research. For example, (Lee et al., 2005a).

Investigate students’ acceptance of an Internet-based learning medium (ILM). They integrated a motivational perspective into the technology acceptance model (Davis et al., 1989). Their results showed that not only perceived usefulness but also perceived enjoyment significantly directly impacted their intention to use ILM, but on the other hand, perceived ease of use did not significantly impact on student attitude or intention towards ILM usage. Porter integrated TAM and TPB to discuss the factors that affecting the taxpayers’ intention to adopt a particular tax-filing method from manual, two-dimensional barcode, or Internet (Porter and Donthu, 2006). Results showed that taxpayers tend to concentrate on the usefulness of a tax-filing method. Published studies have documented that performance expectancy, effort expectancy, social influence and facilitating condition will influence the intension to use. While Gender, age, experience, and voluntariness of use are the control variables (Saadé and Bahli, 2005, Pratt et al., 2006).


The developed prototype needs to be evaluated and tested. The researcher selected Technology Acceptance Model to evaluate and test the newly developed prototype system.

2.15. Conclusion

From the overall conclusion of the literature review conducted, it is clear that online customer decision-making is an important area of study for the hospitality industry.
There is a current body of knowledge in the area of consumer online decision-making. However, the researcher did not find much literature that described the differences in the factors that affect hospital appointment system based on the behavior of the web based and non web based customers.

Towards the end of the literature review, the researcher was able to generate a pool of questions to be tested later in the questionnaire self-administered questionnaire. The pool of questions is used as the basis of the questions adopted by the researcher in the questionnaire self-administered questionnaire.

The extensive literature review has also enabled the researcher to compile the relevant system contents for the prototype system development. The evaluation and test of the developed prototype system is adopted from the well know TAM model discussed here in this chapter.
3. CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

In this chapter the researcher explains in detail the process and procedure of conducting the study from the beginning to the research findings. The main objective of this chapter is to provide a detailed description of research methodology being undertaken by the researcher in this study.

1. This study uses mode of interview based questionnaire to gather user requirement for the system development.

2. This study uses prototype to the system development method.

3. This study uses self administered questionnaire for the system evaluation.

In this chapter the researcher has included the interview questions in a semi structured format.

The entire research methodology, including the study framework, research design, data collection, data analysis together with the instruments used in this study are highlighted in this chapter.

The topics discussed in this chapter includes data needed for this study, primary data used, Research approach, Quantitative Data and Research framework. Sampling,
Research Instrument, Research Implementation and Designing of questionnaire are also discussed herein.

Then the researcher discusses Data Collection, Data Analysis and concludes with the Chapter summary.

3.2. Flow of the Research

A graphical representation of the entire study is given below. The work to be done in this study is presented to the readers through the Figure 3-1 below.
3.3. Research Methods

The researcher considers capitalizing on quantitative methods in this study. In the stage leading to identifying the crucial contents for the proposed system, the researcher uses mainly the quantitative method. Based on the literature review and the
analytical observation the researcher compiled a list of groups to be included in the proposed system.

The works done by his peers and all the work involved in the current state of art is used as a guide for the researcher at this initial stage.

Upon identifying the relevant groups, the researcher was able to develop a prototype to be tested among the potential users of the system through the participation of a selected two hospitals in the Klang Valley region. At this stage the researcher used the quantitative method to identify the responses and feedback of the potential users of the newly developed system.

The questionnaire self administered questionnaire was used by the researcher to extract the feedback from the potential users of the system.

Finally upon identifying the related factors needed to be built in the proposed system the researcher developed the prototype.

The proposed system comprises the information about the hospital and its services in English. The appointment module allows a patient to book online an appointment with the doctor required, at the desired time. A detailed online calendar is available to assist the user. An advanced search engine is implemented to enable quick search for a specific specialization on a specific date.
Finally, the prototype healthcare appointment system evaluation is conducted with a particular focus on the acceptance of the healthcare appointment system. The investigation is to identify the acceptance of the system as a browsing tool as much as an online appointment system in healthcare environment.

3.4. Quantitative Interview

3.4.1 System pre development interview

The researcher has included interview as a part of this study to gather information regarding the suitability of the proposed system. This is best gathered from the doctors, hospital personnel and patients. This section includes the demographic part. The questions raised in this part are as follows: Gender, Job specification, Age, Education, Working experience

**Characteristics of the system**

The researcher questioned the respondents on the following nine questions.

1. What do you think about the accessibility of the system?
2. What do you think about the system efficiency in tracing the number of visits?
3. What do you think about the effect of the system on easiness of finding the number of patients in a waiting list?
4. What do you think about the effect of the system on the time needed for making an appointment?
5. What do you think about the effect of the system on the efforts needed for making an appointment?
6. What do you think about the effect of the system on the cost of making an appointment?

7. What do you think about the effect of the system on perception of patient about the quality of health care?

8. What do you think about usefulness of the system on planning your duties?

9. Please provide your comments about the system.

3.4.2 System evaluation Interview

A questionnaire self administered questionnaire was used in this study to facilitate the investigation by extracting the necessary data from the potential users of the hospital appointment system. This study tries the alternate on-line hospital appointment system and determines the acceptance level of the system. Part of the study is also to find how to improve the appointment system generally. This is in contrast to the current paper based appointment system being practiced by the hospitals.

The questionnaire self administered questionnaire is very much based on the Technology Acceptance Model developed by Davis (1989). The questions have been identified from the literature review and adopted with little modification for the purpose of this investigation.

The questionnaire self administered questionnaire has two parts.

Part A Demographics of the respondents

Part B Questionnaire proper inclusive of User level and three groups with 21 items of questions.
In this study the researcher used face to face questionnaire self administered questionnaire together with electronic mail self administered questionnaire. The researcher conducted the full scale self administered questionnaire as planned from May 18\textsuperscript{th} onwards for 3 weeks.

3.5. Prototyping system Development

Taylor’s Value-Added Model comprises six general user criteria as follows:

- Ease of use, noise reduction, quality, adaptability, time savings, and cost-savings.

According to the author, these add value to an information system. Taylor (1986).

Small (1997) believes that four of these six are particularly relevant to a web site’s quality, which are ease of use, noise reduction, quality and adaptability of the system.

Based on these literature reviews the researcher compiles the potential and relevant contents for the proposed patient appointment system. The list of potential factors identified is shown in Figure 3-2 below.
Figure 3-2  Content Factors of the prototype.

The figure 3.2 shows the main factors considered crucial in developing an effective Hospital Appointment System. Source: Taylor’s Value-Added Model. Taylor (1986).

1. Ease of use: This component includes various aspects that contribute to developing an easy system as follows: browsing the website, orientation to the hospital, making an order and physical accessibility.

2. Noise reduction: it is important to have a system, which does not cause visual or audio disturbances to the user. The factors to be considered are: Item identification, subject description, linkage, indexing, filtering and vocabulary control.

3. Quality: These attributes cover different aspects of system performance; like accuracy, reliability, validity, editing, updating and quality control.

4. Cost saving: one of the main motives to develop such system is to reduce the cost of making an appointment. It includes lower connect time and lower price.
5. Time saving: the system is intended to save time and as such should have the feature of responding quickly by reducing the process time.

6. Adaptability: These are the features that can make the system suitable for use in different situation by different users. The features involve: flexibility, simplicity, data provision, manipulation capabilities and relevance.

3.6. Sampling

For sampling purpose, the population of interest of this study is the mass population of this country. In theory the entire general population in Malaysia can be considered as the population for this purpose. However the researcher narrows the scope of the sample population in the paragraph below. The sampling frame for this study consists of the medical specialists, patients and Hospital administration personnel of the two hospitals in the Klang Valley, mentioned below

1. University Malaya Hospital
2. Hospital Sungai Buloh

3.7. Sample size

The researcher has estimated that a total of 15 subjects are needed to get opinion about features of the system. Another 60 subjects is needed to evaluate the performance of the system. It includes 20 patients, 20 medical specialists and 20 hospital personnel from the 2 hospitals in Klang Valley. The population of 20 patients
of this study is those general patients who visited the selected hospitals in Klang Valley. Random sampling method is used to ensure equal chance of being selected for the participants.

3.8. Conclusion

In this research methodology chapter, the researcher has explained in great detail all the methods used to conduct this study. The system development life cycle and the flow chart are briefly explained. The rating scale used is well described and explained to the readers. The data analysis procedure is also well detailed.

The questionnaire was designed and developed based on the literature review to evaluate the suitability of the proposed appointment system among the potential users.
4. CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.1. Introduction

In the first stage of data collection the researcher complied all the responses received into an excel working sheet. This is treated as the database for all the responses received.

Each respondent is identified as a unique respondent. Each of them is assigned a unique number from Respondent 1 to Respondent 60.

The demographics are then assigned a unique column each for recording the response from the respondents. Likewise the groups are all arranged in sequence based on the question numbering in the questionnaire. These are recorded column wise from left to the right.

4.2. Interview analysis

4.2.1. Demographics

The demographics of the participants are as presented in Table 4-1 below.
Table 4-1    Interview demographics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>15</td>
<td>100%</td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>33.3%</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>66.7%</td>
</tr>
<tr>
<td>Job specification</td>
<td>15</td>
<td>100%</td>
</tr>
<tr>
<td>Doctor</td>
<td>6</td>
<td>40.0%</td>
</tr>
<tr>
<td>Hospital Staff</td>
<td>9</td>
<td>60.0%</td>
</tr>
<tr>
<td>Age</td>
<td>15</td>
<td>100%</td>
</tr>
<tr>
<td>20-30</td>
<td>2</td>
<td>13.3%</td>
</tr>
<tr>
<td>31-40</td>
<td>5</td>
<td>33.3%</td>
</tr>
<tr>
<td>41-50</td>
<td>5</td>
<td>33.3%</td>
</tr>
<tr>
<td>51-60</td>
<td>1</td>
<td>6.7%</td>
</tr>
<tr>
<td>61 and over</td>
<td>2</td>
<td>13.3%</td>
</tr>
<tr>
<td>Education</td>
<td>15</td>
<td>100%</td>
</tr>
<tr>
<td>Degree</td>
<td>6</td>
<td>40.0%</td>
</tr>
<tr>
<td>Master</td>
<td>8</td>
<td>53.3%</td>
</tr>
<tr>
<td>PhD</td>
<td>1</td>
<td>6.7%</td>
</tr>
</tbody>
</table>

4.3. Definition

The set of nine questions referred earlier is a part of a semi-structured interview. The researcher identified the main response of the respondents and as far as possible, grouped them closely as a unified factor, using the affinity concept.

4.4. Accessibility of the system

Among the 15 responses obtained from the interview, 8 participants said “we feel that the system should be easy to use”. Another 4 participants said that they need the system to be fast and 2 respondents reported that they like a system which is friendly and the rest answered “Needs hardware & internet” and that this is a “New method”.

35
4.5. Tracing number of visits

With regard to tracing the number of visits, 5 respondents indicated that “we expect the system to be good”. Another 3 participants said “we wish to find it efficient in tracing the number of visits”. 2 respondents each said “we feel the system is fast and Easy”. 1 respondent said” I found it Nice”.

4.6. Identifying number of patients in waiting list

The next question was “What do you think about the effect of the system on easiness of finding number of patient in a waiting list?”

Majority of respondents (7) said “that system is “Easy to access”. Another 3 respondents answered that “it seems it helps planning”. Two respondents said “it was Convenient “and the rest of respondent said “I found it Effortless, no need to travel and Efficient”.

4.7. Time taken for appointment

Concerning the time, the question was “What do you think about the effect of the system on the time needed for making appointment?”

Among the 15 participants 7 of them said “I think it saves time”. 4 respondents believed “the system help Easier appointment”. 3 respondents said “it was Fast “and only 1 respondent said “it Reduce cost”.

36
4.8. Efforts needed for making appointment

Out of the 15 responses to the question “What do you think about the effect of the system on the efforts needed for making appointment?” 6 respondents said, “It doesn’t require effort”. Another 4 reported, “We feel the system is Faster”. 4 respondents said “I believe the system would be Effective and Helpful”. The other respondent said “if found it Friendly”.

4.9. Cost of making appointment

To explore potential user opinion about the cost of making appointment, the question asked was “What do you think about the effect of the system on the cost of making appointment?”

Out of the 15 respondents, 8 said, “The system will help minimize the cost”. 2 respondents said “I believe it is cheap”. Another 2 of respondents said “the system would ensure low cost”. The rest of the responses are as follow “I found the system “easy and saves time”. “ I feel it will be effective” and “I don’t need to travel to make appointments”

4.10. Perception of Quality of Health Care

With regard to the perception of quality health care, 4 respondents indicated “I need a system which improves quality of health care”. Another 3 respondents said “we felt it improves the quality of care”. 2 respondents each answered saying, “it is new technology, Important and Good perception”. 1 respondent each said “there is no time needed for waiting” and the system is user friendly”.

37
4.11. Helpfulness on Planning Duties

The health professional were targeted with the question “What do you think about the help of the system on planning your duties?”

5 respondents said “it helps me to plan my duties”. Another 4 said “It would Improve my work”. 2 of the respondents reported “it was useful”. 1 respondent indicated “I need Internet access to use the system”. Another one said “I feel it will reduce cost and saves time”.

4.12. Comments

The comments of the respondents. Compiled at the end of the interview are as follows

5 out of the 14 respondents commented “I recommend it to others”. 3 of the respondents said “I found this a good method of cost reduction”. 2 respondents each said “The system is Friendly” and one said “it is time saving”. Another respondent said “it is an organized system” and still another respondent said “if feel it is easily Manageable”.

4.13. Findings related to the System

Suitable design and colors

‘Suitable design and colors’ gets the lowest mean as per a single item in this entire study. This item got 75.6% on the whole.

The researcher recommends more soothing and lighter colors should be used to improve the level of general acceptance.
**Encounter errors**

There seems to be some errors while using the system. The general response in terms of ‘encounter errors’ is 76.4%.

The researcher recommends for further investigation and user tests to be conducted identifying the source of the error and necessary remedial and corrective actions to be taken to reduce the errors.

**Trust and confidence**

This item of ‘trust and confidence’ got 77%.

The researcher recommends that trust and confidence can gain more popularity as the usage increases with promotion by the hospital and users themselves.

**Willingness to use**

The respondents indicated that they were not so willing to use the system. Only 77.6% indicated they are willing to use the system.

The researcher recommends that the system usage must be promoted by the hospital through some campaign and activities. This could include awareness campaign from time to time.

**User-friendly and quick to find information**

These two items secured 78% each. The researcher recommends that each of these items can be improved by making the system more user friendly. System can be made
to offer more information through Frequently Asked Questions and Answer section. More practical information can be incorporated into the system.

4.14. Conclusion

In order to collect the required data for data analysis the researcher has systematically explained the questionnaire designing and the data collection method. The researcher has explained and shared with the readers the entire research methodology applied in this study together with the strategy, research framework and the activities taken in this chapter. In the next chapter the researcher will discuss the prototype development by outlining the approach taken by the researcher in developing the proposed system.
5. CHAPTER FIVE: SYSTEM DESIGN AND IMPLEMENTATION

5.1. Introduction

In this chapter, the researcher details out the proposed system design in a systematic manner. The entire system is explained here in detail. The researcher discusses the development of the Hospital Appointment System prototype. The step by step system prototype development is detailed out by the researcher. The system development comprising of all major activities, design and development of the prototype are listed out here for the benefit of the readers.

5.2. Overview

The web site and the patient appointment system are intended to provide an efficient and flexible substitute to the current paper based appointment system. This is believed to be in line with the progress and development of the use and application of Information Communications Technology in Healthcare sector.

5.3. System framework

Home page

The system starts with a home page. The home page is the introductory page which introduces the doctors and patients to the site and the system. The home page contains links to Doctors, Patients and News.
The page has three static images which appear on the top of the page. Then the page is divided into 6 columns. The 6 columns are dedicated columns for:

Admin Login column, Points column, News column, Patients column
Doctors column, Medical Units column.

Admin Login column
There is an image together with two fields for Username and Password. There is also a Login tab on this column.

H Points column
In this column the researcher has included text details in relation to the HPoints. There is also a hyperlink to more information about the H-Point.

News column
In this column there is News heading. Then the current news is highlighted. It has the current date on the page together with a Read More hyperlink.

5.4. System workflow

The researcher developed a systems workflow for the benefit of the readers. The workflow is as shown in Figure 5-1 below.
Figure 5-1  System workflow.

5.5. Overall System use case diagram

5.5.1. The administrator log in

The administrator log is summarized as shown in Figure 5-2 below.
5.5.2. Patient log in

The patient log in is summarized as shown in Figure 5-3 below.
5.5.3. Doctor log in

The doctor log in is summarized as shown in Figure 5-4 below.

![Use case diagram for doctor log in](image)

Figure 5-4 use case diagram for doctor log in.

The participating hospitals can announce the launching of new services on line including this hospital appointment system that help reduce waste of time and effort in an attempt not only to save money but also to provide greater convenience for the users.

Patient’s column

In the Patients column there are detailed text information on Create your account, Make appointment online and Get Free online support.

Together with these there are three hyperlinks on this column. The three hyperlinks are on:
Browse for Doctors; Create your Account, Registered Members.

Doctor’s column
In the Doctors column the researcher included some four lines of text details. Apart from that there is a drop down menu for the Title and another field for name. This is followed by Search and Reset buttons.

Medical Units column
In the Medical Units column the researcher has provided hyperlink to all the Medical Units registered in the hospital appointment system. A click on the hyperlink will take the users to the respective medical unit.

The screen sample of the home page is as shown in the Figure 5-5 below.
In order to use the system, a registered user need to log in with the given username and password into the system. A sample of the screen is shown in Figure 5-6 below.
5.6. Data Flow diagram

The appointment system data flow diagram is represented as shown in Figure 5-7 below. The flow chart below explains the user activities for all the different type of users; administrator, patient and doctors.
5.7. Description of system modules and functionality

The system uses a public link page, to enable the users to identify the medical units available in a given hospital. The example of the medical units and the available specialist doctors are highlighted in this public link page. A screen sample of the page is as shown in Figure 5-8 below.
A public page link for available doctors in the specific hospital.

5.7.1. Create a new account

New account creation is managed from the New User Account page. The new user has to key in the email, full name, phone number and address to facilitate the account creation. There are four fields for the users to key in the respective values for registration.
Before registration the new user has to select a password and confirm it again with the Re-type Password. This is submitted to the system administrator with the Register button. With details supplied to the system the system will register the user as a new user account. A sample of the page is shown as Figure 5-9 below.

![New User Account Form](image)

**Figure 5-9** Create new account page.

### 5.7.2. Account details

The new user account page requires the new user to fill in the required fields of information for registration purposes. A sample page with the details is shown in Figure 5-10 below.
5.7.3. Successful registration of account

Upon filling in the registration details in to the system the user submits the information page to the system through the Register button. The system generates congratulations message for the successful user registration.

The message is displayed on top of the page together with a hyperlink to Login to your account. The new User Account is rewarded with 10 HPoints. There is a note to this effect.
The page is shown as Figure 5-11 below.

Figure 5-11  Congratulation message for successful registration.

5.8.  User Manual

5.8.1.  Log in

Log in is applicable for all those who are registered with the system. Currently the prototype allows three different types of log in as shown below:

Patient member, Doctors, Administrator
5.8.2. Patient member login

The patient member needs to enter the email id and the password to be given the access to the system. The patient member log in page is as shown in Figure 5-12 below.

![Patient Member Login page](image)

Figure 5-12 Patient Member Login page.

Upon successful login into the system the member patient is taken to the member’s page.

The page has a control panel which contains 4 hyperlinks as follows:

- Browse Doctors
- Make Appointments
- My Credit
- My Appointments

The members’ page is shown in Figure 5-13 below.
The administrator of the system logs in similarly like the member patient. Once logged in the administrator has the following hyperlinks which the administrator can edit at all times:

- Medical Units
- Doctors
- Patients
- Public News Feed

The administrator page is as shown in Figure 5-14 below.
Doctors log in to the system through the doctor log in page. The doctor id and password are the required fields for log in. The sample page is as shown in Figure 5-15 below.
The doctor logs in similarly like the member patient and the administrator. Once logged in the doctor has a control panel containing the following for editing purposes:

My Profile, My Unit, My Organizer, Organizer Filter

The doctor page is as shown in Figure 5-16 below.
5.8.5. Administrator

The administrator page is divided into two halves. The column on the left has a List of Active Medical Units. The list has the names of the unit together with an Edit button for editing purpose. The telephone numbers and email address of the contact person in the medical unit is also included.

The column on the right is for the administrator to Add New Medical Unit. There are four fields in this column. The fields are discussed under Administrator prerogative below.
5.8.6. Administrator prerogative

Add New Medical Unit the administrator has the four following fields:

Code, Title, Email, Phone

The administrator can add or delete new medical units by submitting Add Unit button.

The page is as shown in Figure 5-17 below.

![Administrator prerogative to add or delete medical units.](image)

5.8.7. Editing of medical units

The contents of this page are:
Image upload, View Unit, Unit Home, Add a short description for the unit (max 150 characters)

Add a short tail paragraph for this unit (max 150 characters).

The Unit Doctors are in display in this page. The doctor names and the coded unique numbers are displayed on the right hand side of the page. The contact numbers of the doctors together with their respective Email ids are also displayed in the page.

Figure 5-18 Editing one of the medical unit by the administrator.
5.8.8. Editing of doctors

In this page the administrator is able to add prospective doctors as and when they are available to render their services and consultancy. This is done through an Add Id field in the page. Once a name is added it is displayed in the list of prospective doctors. The names are displayed together with their telephone contact details together with their email id. As much as the administrator can add new prospective doctors, the administrator can also delete the names of doctors when their service is not available. This page has direct link to Home, Units, Patients and News. The details of this page can be seen in Figure 5-19 below.

![Editing of doctors](image-url)

**Figure 5-19** Editing (add/delete) of doctors in the system.
5.8.9. Doctors information

In this page the details of a particular doctor is displayed. The fields displayed are:

Name, Email, Phone and Certificate,

A User rating field is also displayed to see the rating by the users. The user rating is modeled through a display of 5 stars. These stars are dim in its general position. However as the rating increases the stars are displayed in strong yellow color. The rating increases with more stars in yellow color. The detail of the page is as shown in Figure 5-20 below.

![Doctors information as shown including the user rate.](image)
5.8.10. Patients Page

In the Patients Page a list of the patients is displayed. The name, email id, telephone number, address and the remaining H-Points is displayed in different columns of the page. The page has direct link to Home, Units, Doctors and News pages. The detail of this page is reflected in Figure 5-21 below.

![Patient list shown.](image)

5.8.11. Adding news

In this News page the user can see Recent News. The editing fields are:

i. Title and

ii. Body.
There is also a check box to add image. The title and body is submitted through the Create News tab which is shown in Figure 5-22 below.

There is direct link to Home, Units, Doctors, Patients pages and Logout from this page.

Figure 5-22  Adding news to the hospital website by the administrator.

5.8.12. Doctors

The doctor’s organizer is divided into 2 sections. The first one is Today’s Appointments. In Today’s Appointment there are 4 columns. The columns are Time Slot, Patient Address, Date and Registered detail.
The next section is Monthly Digest. In this section there are 4 columns. The columns are Date, Slot, Patient Address and Registered details.

In order to manage this organizer there are 2 fields. The first field is the Month field which has a drop down menu to select the months from January to December. The next drop down menu is the year menu.

This Organizer page has direct link to Home, Profile, Unit pages and Logout link. The detail of this page is as shown in Figure 5-23 below.

![A simple organizer for the doctor.](image-url)
5.8.12.1. Managing Doctor’s page

In the Profile page the doctor can manage the following:

i. My Profile

which is used to add, edit and manage the doctor’s personal info and create a public page.

ii. My Unit

Which is used to view the doctors Unit page and follow updates?

iii. My Organizer

Which is used to view the daily and monthly appointments digest and contact the patients and

iv. Organizer Filter

Which is used to remove outdated appointments and refresh the organizer?

The details of this page can be seen in Figure 5-24 below.
5.8.12.2. Managing Doctor’s profile

The doctors may choose the mode of his services, he/she may choose between part time or full time appointment. The part time appointment have three time slots for appointment scheduling while full time have six time slots for appointment.

The fields in this page are Full Name, Email and Phone for user keying in. There is 2 drop down menus for Medical Unit and Service Mode. There is a drop down menu for these two fields. Next the doctor can update the qualification through the Certificate field which is managed through the Update button.
This page is directly linked to Home, Unit, Organizer pages and Logout link.

The sample page is shown in Figure 5-25 below

![Doctor Profile editor, part time or full time.](image)

**Figure 5-25** Doctor Profile editor, part time or full time.

### 5.8.13. Purchase of credit

This is an H-Points credit purchase page. Purchase of H-Points credit can be done through MasterCard, Visa, Paypal, CIMB Bank, Maybank and Citibank.

There is two drop down menus in this page. One is to Select H-Points and the other is the Payment Method. There is a Buy button for the user to submit the purchase.
The My HPoints page has direct link to Home, Doctors, Appointment pages and Logout link. The page is as shown in Figure 5-26 below.

Figure 5-26 successfully purchased 110 H-Points.

5.8.14. Making an appointment

In the Doctors page there is a list of all the available doctors grouped under their medical unit.

The list is further supported with the user Star rating of the doctors together with their name, phone and email. Each one of the doctors in the list is provided two links. One is to view the doctor’s profile and another is make appointment.
The Doctors page has direct link to Home, My HPoints and Appointments pages. There is also the Logout link in this page. The detailed page sample is shown in Figure 5-27 below.

![Image of Doctors page]

**Figure 5-27** Make Appointment page for patient.
5.8.15. Outdated appointment

In the Doctors page there is an appointment page which shows the user is about to make an appointment with the selected doctor. In this page the costs of the appointment with the selected doctor and the current balance HPoints is highlighted before making the appointment.

There are three fields for Date, Month and Year for the users to select the appointment date. These three fields are drop down menus. Once the dates are selected the user can Check Availability by clicking a button next to the drop down menus.

This page has direct link to Home, My HPoints and Appointment pages and the Logout link. The detailed page is shown in Figure 5-28 below.
In the event the user has less or insufficient HPoints the system prompts the user to purchase more H-Points. The system indicates an appointment with a particular doctor costs a certain amount of HPoints and that the user has so much less HPoints in the account. A note saying “You do not have sufficient H-Points to make this appointment. Please purchase more H-Points.” The Please purchase more H-Points is hyperlinked to the page where the user can purchase the H-Points.

This page has direct links to Home, My HPoints, Appointments pages and Logout link. The page details are as shown in Figure 5-29 below.
Figure 5-29 Insufficient H-Points message after making an appointment.
5.8.17. Appointment date is available

Assuming the user has sufficient HPoints in the account one can proceed to make an appointment with the respective doctor. Once the date, month and year has been selected from the drop down menus, the user can proceed to Check Availability.

A note “Success. The doctor has empty slots on the date you selected. Please choose a slot from the list below” appears once the HPoints is deducted. The details of this page can be seen in Figure 5-30 below.

Figure 5-30  An appointment date is available.
5.8.18. Appointment confirmed

Upon successful payment through the H-Points and the selection of appointment date the system calls for a confirmation from the user.

The name of the doctor, date and the H-Points charged is displayed on the screen. With these details there are two links. One is to Confirm Appointment and the other Cancel. The user action either to Confirm Appointment or Cancel is called for. Once the user chooses to confirm the appointment one would not be able to cancel the appointment. In order to change the date, the user may cancel his/her first appointment and book for another appointment, there will be no extra charges from the HPoints in this case.

Figure 5-31 Appointment confirmed.
5.8.19. Appointment completed

The system will then fix the appointment. The system will then indicate the date, time, doctor and register appointment.

The details are as shown in Figure 5-32 below.

![Appointment completed](image)

Figure 5-32 Appointment completed.

5.9. Conclusion

The researcher discussed about the prototype system in great detail in this chapter. The researcher attempted to show how the prototype system was developed together with the detail of workings of the system towards managing the patient appointment system. All the different users and their respective functions were discussed in
relation to the prototype system. The entire content of the prototype system was explained in detail in this chapter for the readers benefit. The look and feel together with the functionalities of the prototype system was highlighted for the ease of understanding the proposed hospital appointment system. The details were supported by images from the prototype system.
6. CHAPTER SIX: SYSTEM TESTING AND EVALUATION

6.1 Introduction

In this chapter, the researcher discusses the data collected from the questionnaire self administered questionnaire. The data collected are analyzed using different tools and techniques. In this chapter, the researcher attempts to convert the collective data into meaningful piece of information. Furthermore the researcher attempts to relate the data and information derived from the analysis in this chapter as a link and means to answer the research questions raised in this study.

The data analysis output is presented in graphs and figures.

Raw data is presented in a raw format and also in a summary format in Tables.

6.1. Objective

The objective of the proposed system is to develop a system which offers the most flexible and convenient ways for the user to fix an appointment with the selected medical specialists. Further to that, the web site is also intended to provide in depth, information about the illness and complications and, the type of services being provided by the medical specialists.
6.2. System Testing

The prototype system testing is necessary for the purpose of testing and debugging the system functionality and that it does what the system is intended to do and behave like. The system is tested against the system application protocols like TCP/IP, Http etc. The researcher also tested the user interfaces with the different levels of infrastructure. No major defect or irregularities are found. Some minor debugging was done prior to the usage for prototype implementation in the hospitals.

6.3. Self administered questionnaire - Part A -Demography

As part of this investigation the researcher asked 7 demographic questions in the study. The 7 demographic variables are as follows:

Gender, Age, Monthly Income, Education, Browsing/month, Internet use,
Respondents

It is a point to note that there are 60 respondents in this study and that represents 100% respondents of this study.

The demography raw data obtained in this investigation is presented in Table 6-1 below.
The summary data for the entire demographics obtained in this investigation is presented in a tabular format. The overall summary data compiled for demographics is shown in Table 6-1 below.

Most of the demographics data are presented in both frequency and percentage.

Table 6-1  Overall Demographical Information of the study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
<td>38.3%</td>
</tr>
<tr>
<td>Male</td>
<td>37</td>
<td>61.7%</td>
</tr>
<tr>
<td>Age</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>20-30</td>
<td>23</td>
<td>38.3%</td>
</tr>
<tr>
<td>31-40</td>
<td>18</td>
<td>30.0%</td>
</tr>
<tr>
<td>41-50</td>
<td>12</td>
<td>20.0%</td>
</tr>
<tr>
<td>51-60</td>
<td>4</td>
<td>6.7%</td>
</tr>
<tr>
<td>61 and over</td>
<td>3</td>
<td>5.0%</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>RM1000-2000</td>
<td>5</td>
<td>8.3%</td>
</tr>
<tr>
<td>RM2001-3000</td>
<td>16</td>
<td>26.7%</td>
</tr>
<tr>
<td>RM3001-4000</td>
<td>18</td>
<td>30.0%</td>
</tr>
<tr>
<td>RM4001-5000</td>
<td>14</td>
<td>23.3%</td>
</tr>
<tr>
<td>RM5001 and over</td>
<td>7</td>
<td>11.7%</td>
</tr>
<tr>
<td>Education</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>Degree</td>
<td>21</td>
<td>35.0%</td>
</tr>
<tr>
<td>Diploma</td>
<td>14</td>
<td>23.3%</td>
</tr>
<tr>
<td>Master</td>
<td>12</td>
<td>20.0%</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>8.3%</td>
</tr>
<tr>
<td>PhD</td>
<td>8</td>
<td>13.3%</td>
</tr>
<tr>
<td>Browsing/month</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>&gt; 25 times</td>
<td>42</td>
<td>70.0%</td>
</tr>
<tr>
<td>16-25 times</td>
<td>12</td>
<td>20.0%</td>
</tr>
<tr>
<td>9-15 times</td>
<td>5</td>
<td>8.3%</td>
</tr>
<tr>
<td>Click here</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td>Internet use</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>&lt; One year</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td>&gt; 4 years</td>
<td>43</td>
<td>71.7%</td>
</tr>
<tr>
<td>2-3 years</td>
<td>4</td>
<td>6.7%</td>
</tr>
<tr>
<td>3-4 years</td>
<td>11</td>
<td>18.3%</td>
</tr>
<tr>
<td>Click here</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td>Respondents</td>
<td>60</td>
<td>100%</td>
</tr>
<tr>
<td>Doctor</td>
<td>20</td>
<td>33.3%</td>
</tr>
<tr>
<td>Hospital Staff</td>
<td>20</td>
<td>33.3%</td>
</tr>
</tbody>
</table>
6.3.1. Gender

First item studied in this self administered questionnaire is the gender. In this study there are 23 Female respondents compared to 37 Males. The groups make up 38.3% and 61.7% of the total respondents respectively. The details are as shown in the Figure 6-1 below.

![Gender Pie Chart]

Figure 6-1 Gender.

6.3.2. Age

Age is the next item investigated in this study. The 20-30 age group has 23 respondents accounting to 38.3% in this study. 18 respondents are in the 31-40 forming 30.0% of the respondents. The next age group of 41-59 has respondents forming 20.0%. 51-60 age group has 4 respondents forming 6.7%. 61 and over has 3
respondents with 5.0% of the total percentage of this study. The detail of the finding is shown in Figure 6-2 below.

![Age Distribution Chart](image)

Figure 6-2  Age.

6.3.3. Monthly Income

Monthly Income or earning capacity is the next item investigated by the researcher. In this study the respondents are mostly from the RM3001-4000 monthly income group. There are 18 respondents in this group accounting for 30.0%. 16 respondents are from the RM2001-3000 income group. This group has 16 or 26.7% of the total respondents. Close to this there are 14 respondents in the RM4001-5000 income group forming 23.3%. 11.7% with 7 respondents earned RM5001 and over. Next is the RM1000-2000 income group with 5 respondents accounting for 8.3% of the total percentage. The detail is highlighted in Figure 6-3 below.
6.3.4. Education

In this study, the researcher interviewed 21 Degree holders in the course of the investigation. This group accounts for 35.0% of the total respondents. 14 Diploma holders accounts for 23.3% of the total respondents. 20.0% or 12 of the respondents has Masters Qualification. PhD holders are 8 or 13.3% as a whole while Others account for 8.3% with 5 respondents. The detail is shown in Figure 6-4 below.
6.3.5. Browsing per month

The researcher also investigates the browsing habit of the respondents. This is determined through the frequency of browsing per month. 42 respondents stated that they browse more than 25 times per month. This accounts for 70.0%. The next group browses 16-25 times per month and accounts for 20.0% with their 12 respondents. 8.3% or 5 respondents browse 9-15 times per month. One respondent did not answer this question and that accounted for 1.7% of the total respondents. The detail is as shown in Figure 6-5 below.
6.3.6. Internet use

Internet usage among the respondents is also investigated by the researcher. 43 respondents are using the internet for more than 4 years accounting for 71.7%. 18.3% or 11 respondents has been using the internet for 3-4 years. Some 4 respondents are using the internet for 2-3 years forming 6.7% from the total internet using respondents. Both less than 1 year and click here has 1 respondent each. This accounts for 1.7% respectively. This is well reflected in the Figure 6-6 below.
6.4. Part B Data collected

In this study, the researcher investigated 4 major areas of the prototype system. The areas are mainly:

i. User level,

ii. Attitude,

iii. Usefulness and

iv. Ease of Use.

The detailed question items and the group categorization are summarized in Table 6-2 below.

Table 6-2  Question items and groups studied.
<table>
<thead>
<tr>
<th>Q. No</th>
<th>Question</th>
<th>Mean</th>
<th>Domains</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>User Level</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>How do you rate the/your level of trust and confidence of the system?</td>
<td>3.85</td>
<td>Attitude</td>
<td>4.03</td>
</tr>
<tr>
<td>3</td>
<td>How do you agree to have a management support to the system for maintaining the system success?</td>
<td>4.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Registration process should easy and free of negative consequences</td>
<td>4.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The system does reduce the cost?</td>
<td>4.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I am willing/intending/enthusiastic to use the system</td>
<td>3.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The system is useful in the perspective of enhancing the performance of a particular task?</td>
<td>3.97</td>
<td>Usefulness</td>
<td>4.09</td>
</tr>
<tr>
<td>8</td>
<td>The system is useful and effective as timely consuming?</td>
<td>4.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The system is reliable?</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The system is useful in perspective of the H-Points concept?</td>
<td>4.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The system is attractive to users?</td>
<td>4.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I find <a href="http://www.healthcare.com">www.healthcare.com</a> website primarily a useful site?</td>
<td>4.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I find this a site that adds value?</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The system is suitable for long term usage in an effortless way?</td>
<td>4.12</td>
<td>Ease of Use</td>
<td>4.04</td>
</tr>
<tr>
<td>15</td>
<td>How do you rate the provided interfaces in displaying all the available functionality?</td>
<td>4.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The system is culturally accepted?</td>
<td>4.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The system is user-friendly?</td>
<td>3.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The design and colors used in the system are suitable</td>
<td>3.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>How often did you encounter errors while using the system?</td>
<td>3.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>It is easy to navigate around the system</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I can quickly find the information that I need?</td>
<td>3.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.4.1. Category 1: User Level

There are 60 respondents in total forming 100%. Out of this there are 20 Doctor, Hospital Staff and Patient. Each of this group accounted for 33.3% of the total respondents each. The breakdown of the respondents is shown in Figure 6-7 below.
Figure 6-7  User level.

6.4.2. Category 2: Attitude

There are 4 questions in this group. ‘Reducing the cost’ gets the highest mean of 4.17. This is followed by ‘easy and free of negative consequences’ with a mean of 4.08. ‘Management support’ gets 4.02 while ‘Trust and confidence’ secures a mean of 3.85. The result is highlighted in Figure 6-8 below.
6.4.3. Category 3: Usefulness

There are 8 items investigated in this group. ‘Adds value’ gets the highest mean value of 4.25. ‘Attractive to users’ gets an average 4.22. This is followed by ‘Reliable’ with a mean of 4.13. Next to this is ‘useful and effective’ with a mean of 4.12. The H-Points concept secures a mean of 4.10. ‘Website primarily useful’ is next with a mean of 4.07. This is followed by ‘enhancing the performance’ with a mean of 3.97 and finally the lowest in the group is ‘Willing to use’ which gets a mean of 3.88. The detail is shown in Figure 6-9 below.
6.4.4. Category 4: Ease of Use

There are 8 items studied in this group. ‘Culturally accepted’ obtains the highest mean value of 4.35. Functionality has a mean of 4.30. ‘Easy to navigate’ accumulated the mean of 4.13. Next to this was ‘Suitable for long term usage’ which secures an average of 4.12. ‘Quick to find information’ follows with a mean of 3.90. ‘User-friendly’ gets an average of 3.90. This is followed by ‘Encounter errors’ with an average of 3.82. ‘Suitable design and colors’ gets an average of 3.78. The detail of the finding is shown in Figure 6-10 below.
6.5. Profiling of the Demographics

As a summary of the study the researcher is able to conclude that the profile of the study is Male respondents within the age range of 20-30 years, earning between RM3001-4000 per month. Typically the respondents are degree holders who browse internet more than 25 times in a month with an internet usage experience of more than 4 years. The respondents are equally divided into Doctors, Hospital Staffs and Patients. The detail of the profiling is shown in Table 6-3 below.

Table 6-3 Profile of the study.

<table>
<thead>
<tr>
<th>No</th>
<th>Variable</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gender</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2.</td>
<td>Age</td>
<td>20-30 years</td>
</tr>
<tr>
<td>3.</td>
<td>Monthly income</td>
<td>RM3001-4000</td>
</tr>
<tr>
<td>4.</td>
<td>Level of education</td>
<td>Degree</td>
</tr>
<tr>
<td>5.</td>
<td>Browsing per month</td>
<td>&gt; 25 times a month</td>
</tr>
<tr>
<td>6.</td>
<td>Internet use</td>
<td>&gt; 4 years</td>
</tr>
</tbody>
</table>

6.6. Data analysis

6.6.1. Overall System Analysis

The overall finding of this study indicates that the prototype system is regarded as a Useful system as the mean of 4.09 indicates. This is followed by Ease of Use with a mean of 4.04. Attitude accumulates a mean of 4.03 as shown in the Figure 6-11 below.

![Figure 6-11](image)

Figure 6-11  Overall system.
6.6.2. Highest Mean

The item with the highest mean is ‘Culturally accepted’ with a mean of 4.35. Next is ‘Functionality’ which gets an average of 4.30. Adds value secures 4.25. Attractive to users is the next with an average of 4.22. Reduce the cost gets an average of 4.17 as shown in Figure 6-12 below.

![Items with highest mean](image)

Figure 6-12 Items with highest mean value.

6.6.3. Lowest Mean

Suitable design and colors gets an average value of 3.78. Encounter errors is the next with an average of 3.82. This is followed by Trust and confidence with a mean value of 3.85. Willing to use gets a mean of 3.88. Two items, User-friendly and Quick to find information get a similar mean value of 3.90. The detail is shown in Figure 6-13 below.
Figure 6-13  Items with lowest mean value.

6.7.  Research Question

The questionnaire self administered questionnaire is conducted with Liker Scale of 5 points. The responses are in the form of a scale of 1 to 5. The mean is calculated to reflect the responses. However, for ease of reference to the readers, the mean is translated to percentage.

6.7.1.  Question 1

What is the user's attitude in respect to enter the full name and full information on the online system?
The average mean for Attitude is taken to answer this question. The mean of 4.03 for attitude is reflected as 80.6%. This indicates that 80.6% of the respondents are willing to give their full name and full information on the online system.

6.7.2. Question 2

What is the level of trust and confidence of the proposed system?

The researcher uses question no. 2 in the questionnaire self administered questionnaire to answer this question. The response obtained from the self administered questionnaire is a low mean of 3.85. This, when translated into percentage is equivalent to 77%. The researcher can safely conclude that the level of trust and confidence of the proposed system is 77%.

6.7.3. Question 3

Is the proposed system reliable?

In order to answer this question, the researcher uses question no. 9 in the questionnaire self administered questionnaire. The response obtained for this item is 4.13. In other words. This is amounting to 82.6%. Based on this data the researcher can conclude that the proposed system is perceived as reliable by 82.6% of those self administered questionnaire.

6.7.4. Question 4

Does the proposed system reduce cost of fixing appointments?
To answer this question, the researcher depends on question no. 5 of the questionnaire self administered questionnaire. The response received shows the mean response for this question item is 4.17. That is equivalent to 83.4%. With this data emerging from the data analysis, the researcher can safely conclude that 83.4% of the respondents perceive that the system reduces the cost of appointment.

6.7.5. Question 5

What is the level of usefulness of the proposed system?

In order to answer this particular question, the researcher depends on the eight questions in the usefulness group. The mean of the usefulness group is taken as the right answer for this question. The usefulness group secures an overall mean of 4.09. This, when translated into percentage turns out to be 81.8%. Using this as the basis for further description, the researcher can positively affirm that 81.8% of the respondents perceived the system as useful.

6.8. Conclusion

The researcher capitalizes on the facts and figures obtained in the self administered questionnaire to highlight the findings in this chapter. This chapter contains the detailed results of the investigation conducted by the researcher as a part of this study. The researcher uses graphical tools including charts, graphs, figures and tables to present the findings of this study.
7. **CHAPTER SEVEN: CONCLUSION**

7.1. **Introduction**

In this chapter the researcher affirms the main findings of this study.

7.2. **Concluding Discussion**

For the benefit of the readers, the researcher converts the mean values obtained in the investigation into percentage as many can easily recognize and appreciate the percentage value rather than the mean value.

The three groups took part in the study, are not very far different from each other in terms of the mean values obtained. However the result clearly shows that the system is very useful.

The research objectives of this study are successfully achieved. The objectives of the study are as follows:

1. To study the current state of Health Information System in Malaysia.
   
   Most of the Malaysian hospitals are using HIS which is incorporated into the different settings of the hospital. HIS helps to improve patient care, where it is used for filing records, billing and other services. None of the Malaysian hospitals are using Online Appointment System.
2. To propose a new enhanced Hospital Information System which focus on Online Appointment System?
   An enhanced HIS with Online Appointment system is an optimal setting system to help doctors to better plan for his/her activities and to know the patients waiting for consultation. The system reduces the cost and effort needed to make appointments by the patient.

3. To develop a working prototype Online Appointment System.
   The Online Appointment System is conceived and expected to have an attractive interface, to be user friendly and easy to use system. It also proves to be culturally acceptable, and easily accessible from different locality by different users.

4. To evaluate user application of the prototype using TAM.
   We can conclude that TAM is an optimal setting to develop the Online Appointment System. In the era of internet availability and accessibility, most of the target population have a good perception about usefulness and ease of use of technology based system.

   7.2.1. Attitude

   Based on the interview results, 80.6% of the respondents are of the opinion that the system is useful and widely accepted.

   Very clearly, the cost reduction has attained the highest value among the respondents which suggests that most of the respondents are keen on the system as they see it as a means to reduce costs. However on the other hand the trust and confidence seems to
be the lowest. This is only natural because the users are worried about violation of their privacy, including the details of their illness.

7.2.2. Usefulness

The study shows that many respondents believe the system is a useful one. 81.8% of the respondents indicate and agree that this is a useful system.

In this group the users are very firm in believing that the system not only adds value but also attractive to them. Apart from that the users are of the opinion that the system is reliable, useful and effective. However one alarming finding is that the users’ willingness to use the system is at the lowest.

Even when the system is regarded as useful, adds value and reliable among others, the users are not willing to use it. The researcher addresses this issue in the recommendations section of this study.

7.2.3. Ease of Use

80.8% of the respondents are of the opinion that the system is easy to use.

The respondents are clear in saying that the system is culturally accepted, has good functionality and easy to navigate. However, in contrast the users are certain that the system does not have suitable design and colors. Further to that, the users also indicate that they encounter errors and that the system is not so user friendly.
The researcher welcomes these feedbacks from the users and suggests improvement in the form of recommendations in this study.

7.3. Contribution

This study has been instrumental for the researcher to identify the factors which affects the acceptance of the hospital appointment system. The questionnaire self administered questionnaire helped to positively identify the group of items which encourage the use of the system and also that discourages the acceptance of the proposed system.

Items of obstacle with the low mean values are identified for improvement which is incorporated in the recommendation section of this study.

7.4. Limitation

A number of limitations are acknowledged by the researcher towards the end of this study. The participating hospitals are very limited, only two hospitals in the Klang Valley.

The number of respondents is too small. The researcher believes that participation of more number of respondents in the questionnaire self administered questionnaire would provide a better cross representation view of the population.
Upon completing the investigation the researcher realizes that the study could have incorporated a particular question on their satisfaction level so that the researcher would have been able to do an analysis on the satisfaction level of the users of the hospital appointment system. The lack of a particular question on the satisfaction level of the user in this study prevents the researcher from being able to affirmatively determine the customer satisfaction level.

7.5. Future Work

At the end of the investigation the researcher is of the opinion that a number of areas can be considered for future studies to further enhance the area of hospital appointment system developed in this study.

Future studies could include hospitals in other geographical location covering a broader area spanning the country in entirety inclusive of east Malaysia. This could desirably include both rural and urban Malaysian cities.

Another suggestion for future studies is to conduct a two sided self administered questionnaire which investigates the Expectation and Satisfaction level of the users. This can be based on the Service Quality (ServQual) or any other suitable model. By doing this the researcher could also include an overall question to evaluate the satisfaction level in using the online hospital appointment system.

Other studies could look at developing an Index for the usage of online hospital appointment system while others can study the satisfaction level of the users.
A comparison study among the private and public hospitals can help to understand the acceptance level of the online hospital appointment system among the public and private hospitals.

Others could also include a study on the specific groups of the evaluation and test for the system acceptance.

7.6. Future directions of the prototype system

Future work can include the following areas:

1. The patient to be able to request for the record of his/her visits.
2. May be developed to suit other task relating to get the results of investigation before the next appointment for medical briefing.
3. Able to do cancellation or changes to the date or time of appointments

7.7. Recommendation for Improvement of the System

Attitude

In an attempt to increase the overall attitude of the users in relation to the hospital appointment system the researcher proposes the following:

i. To conduct some awareness campaign both in the hospital and also outside the hospital
ii. To conduct road shows, forum and tea-talks

Usefulness

In order to improve on the general usefulness of the system to the users, the researcher proposes that the hospitals:

i. provide some incentives to the users

ii. assure that the confidentiality is secured and protected

Ease of Use

The easiest task for a general improvement of the hospital appointment system is in this ease of use group. The services of professional designers and programmers can be readily used to offset the shortfall of this group in general. The skills and expertise of professional designers and programmers can certainly add value to the ease of use of this system.

7.8. Benefits

In the era of advancing technology and internet accessibility, the system is considered to be a very convenient means to achieve maximum utilization of technology and to help rapid and easy accessibility to hospital care.

The idea of introducing the credit point is so interesting; it applies the marketing concept in attracting the customer, in which the regular patient of the hospital will get
the dual benefit of the system; easy, rapid and assured appointment and rebate credits as a promotion for the hospital to help ensure patient loyalty.

7.9. Significance of the study

The researcher believes that this study has contributed to the Health sector in many dimensions. The significance can be seen from two main angles:

i. For the researcher

ii. For the Healthcare industry

7.9.1. For the researcher

This study allowed the researcher to acquire new knowledge in terms of developing a useful system. The experiences and lessons obtained from the study can never be substituted with text book reading. The researcher was able to acquire hands on experience in planning, designing, developing and testing a system.

7.9.2. Healthcare industry

The healthcare industry benefited from this study as the researcher introduced and tested an online hospital appointment system. This greatly reduces physical traveling and costs. With this, time can be saved for many of the users who can now make and manage their hospital appointments from their own convenient place supported by the internet connection.
Upon completing the investigation, the researcher is able to positively summarize that the research aim and objectives together with the research questions are all systematically achieved and answered.

As a conclusion, the researcher is able to say that Information Communications Technology complements Healthcare sector very well. The health care sector can be developed with the aid of ICT to provide better services to the people. In the current growing trends of technology there is little doubt that ICT can act as a catalyst to bring about higher level of service satisfaction to the mass, particularly those who seek support in the healthcare sector.

By implementing the recommendations in this study, the researcher believes that the prototype can further be improved to enable the hospital appointment system to be fully implemented in private hospitals as an ongoing development.

As for the public hospitals, the system can be implemented with some modifications and customization as there are no charges to the users or the users are charged a nominal fee only. The web based technology is well suited for this purpose. The web based technology might just be the solution for public hospitals as cost can be very minimal as the administration can be centralized.

The researcher believes, this study will help and support the healthcare sector to move forward by providing not only advanced medical care to their customers, but also a much simpler and efficient appointment system by implementing the system developed by the researcher.
In nutshell

User acceptance is a pivotal factor determining the success or failure of an information system product. The present research used TAM to address why user accept or reject IT and how user acceptance influenced by system characteristics. From practical standpoint we are interested not only in explaining why a system is unacceptable to a set of user but also in understanding how to improve user acceptance through the design of the system. The choice of functional and interface characteristics of a new system are largely under the control of information designers, developers, selectors and managers. Needed is a model of how such design choices affect user acceptance in similar environment.

Overall, TAM provides an informative representation of the mechanism by which design choices influence user acceptance, and should therefore be helpful in applied contexts of forecasting and evaluating user acceptance of IT.
REFERENCES


COUNTRYMAN, C. C. Year. Content analysis of state tourism web sites and the application of marketing concept. In: Fourth annual conference on graduate education/graduate student research in hospitality & tourism 1999 Las Vegas, Nev. USA., 210–218.

DAVIS, F. D. 1986. A technology acceptance model for empirically testing new end-user information systems: theory and results.


Greetings,

My name is Ali, I am a masters student at FSKTM. I am currently working on my research titled: “Online Appointment System for Modern Healthcare Systems”. I am developing a system that enables patients to make online appointments and access doctors’ timetables aiming to reduce cost and effort accompanied with physically conduct appointments. I would be thankful if you can give this questionnaire a few minutes of your time to help me evaluate the significance of my system.

H-Points

In my system, I have introduced a new concept named: “H-Points”. H-Points are conventional credit points maintained in conventional user accounts at a hospital’s online system. Users can purchase H-Points at a specific price imposed by the hospital management. H-Points can be purchased by credit cards or by cash at the hospital reception desk. Patients can use their H-Points to make appointment and purchase any other online service provided by the system.
### Advantages to Users

<table>
<thead>
<tr>
<th>Advantages to Users</th>
<th>Advantages to Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the chance of exposing credit card information online</td>
<td>Encourages users to pay more in advance</td>
</tr>
<tr>
<td>Can earn discounts according to hospital offers and promotions</td>
<td>Can increase income by arranging strategic discounts and promotions</td>
</tr>
<tr>
<td>Reduce the psychological impact of dealing with large amounts of credit</td>
<td>Simplify the process of changing pricing by only changing the (H-Points to Money) exchange rate.</td>
</tr>
</tbody>
</table>

---

### Self administered questionnaire System Evaluation By User

There are two (2) parts in this self administered questionnaire:

1. Demography - Part A
2. Questionnaire - Part B

Please Answer Both Parts.

---

### Part A: Demography

This part collects basic demographic information about you. These information are important in weighing your answers in part B. Thank you for cooperating.

1. Gender:  
   - [ ] Male.  
   - [ ] Female.

2. Age:  
   - [ ] 20-30.  
   - [ ] 31-40.  
   - [ ] 41-50.  
   - [ ] 51-60.  
   - [ ] 61 and over.

3. Monthly Income:  
   - [ ] RM 1000 – 2000.  
   - [ ] RM 2001-3000  
   - [ ] RM 3001-4000.  
   - [ ] RM 4001-5000  
   - [ ] RM 5001 and over.
4. Education:  
- ○ Degree.  
- ○ Diploma  
- ○ Master.  
- ○ PHD.  
- Others. (Please specify: ………………………..)  

5. Browsing per month:  
- ○ Less than 2 times.  
- ○ 2-8 times.  
- ○ 9-15 times.  
- ○ 16-25 times.  
- ○ More than 25times.  

6. Internet use: (How long have you used the internet).  
- ○ Less than one year.  
- ○ 1-2 years.  
- ○ 2-3 years.  
- ○ 3-4 years.  
- ○ More than 4 years.  

Part B: System Questionnaire  
This part collects your evaluation of the system. Before answering this part, please make sure the system is demonstrated to you briefly.  

Category 1: User Level  
1. I am testing and evaluating this system as:  
   - ○ Patient.  
   - ○ Doctor  
   - ○ Hospital Staff  

Category 2: Attitude  
Read the following questions and indicate your answer/response in scale of 1-5 as shown below
2. How do you rate the/your level of trust and confidence of the system?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

3. How do you agree to have a management support to the system for maintaining the system success?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

4. Registration process should be easy and free of negative consequences

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

5. The system does reduce the cost?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

Category 3: Usefulness

6. I am willing/intending/enthusiastic to use the system

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

7. The system is useful in the perspective of enhancing the performance of a particular task?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

8. The system is useful and effective as timely consuming?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

9 The system is reliable?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

10. The system is useful in perspective of the H-Points concept?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.

11. The system is attractive to users?

☐ 1. STRONGLY DISAGREE. ☐ 2. DISAGREE. ☐ 3. NEUTRAL. ☐ 4. AGREE. ☐ 5. STRONGLY AGREE.
12. I find www.healthcare.com website primarily a useful site?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

13. I find this a site that adds value?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

Category 4: Ease of Use

14. The system is suitable for long term usage in an effortless way?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

15. How do you rate the provided interfaces in displaying all the available functionality?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

16. The system is culturally accepted?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

17. The system is user-friendly?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

18. The design and colors used in the system are suitable
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

19. How often did you encounter errors while using the system?

20. It is easy to navigate around the system.
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

21. I can quickly find the information that I need?
1. STRONGLY DISAGREE. 2. DISAGREE. 3. NEUTRAL. 4. AGREE. 5. STRONGLY AGREE.

“For any inquiry please don’t hesitate to contact me via:

Ali80_82@yahoo.com”

118
Thank you for your cooperation
Interview: System Requirement before Development

Dear respondent

With the advanced technology and increased diversity and volume of knowledge in medical care, the hospitals should adopt new approaches to provide quality health care.

I am Ali, a master’s student at FSKTM currently working on a project to design a new Information Technology based appointment system, I would like to have your opinion about the characteristics of an effective system that help to improve the quality of care and reduce the burden on the patient’s. I will be thankful if you can give this questionnaire a few minutes of your time to help me exploring your opinion.

Part A: Demography

This part collects basic demographic information about you. This information is important in weighing your answers in part B. Thank you for cooperating

1. Gender: ☐ Male ☐ Female
2. Job specification: ☐ Doctor ☐ Hospital Staff
3. Age: ☐ 20-30 ☐ 31-40 ☐ 41-50
   ☐ 51-60 ☐ 61 and over
4. Education: ☐ Degree ☐ Diploma
   ☐ Master ☐ PHD
   Others (Please specify: ……………………………)
5. Working experience: ………………… years
Part B: Characteristics of Appointment System Questionnaire

This part about your opinion regarding the characteristics of the system

1. What you think about accessibility of the system?

2. What you think about system efficiency in tracing number of visits?

3. What you think about the effect of the system on easiness of finding number of patient in a waiting list?

4. What you think about the effect of the system on the time needed for making appointment?

5. What you think about the effect of the system on the efforts needed for making appointment?

6. What you think effect of the system on the cost of making appointment?

7. What you think effect of the system on perception of patient about quality of health care?

8. What you think about helpness of the system on planning your duties?

Do you have any other comments?

........................................................................................................................................................................
........................................................................................................................................................................
........................................................................................................................................................................
........................................................................................................................................................................

Thank you for your cooperation