CERTIFICATION OF APPROVAL

Real-time Clinical System

by

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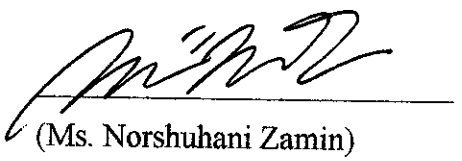
Approved by,



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UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in the project, that the originality work is my own expect as specified in the references and acknowledgements and that the original work contain herein have not been undertaken or done by unspecified sources or persons.

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AZWA ZURAINI BINTI YUSOF

ABSTRACT

The objective of the study is to develop a system that can help the users, in this context, the doctors, attendant and also the patient, to manage the data effectively, communicate efficiently, save time and also, most important is cost. Besides that, it is to apply LAN technology into clinical system, allow communication between two or more parties and sharing information in the organization. The methodology will be divided into two major parts, research methodology and design methodology. For the research methodology, questionnaire and observation will be used as tools. Meanwhile, for design methodology, 'Waterfall' methodology that consists of five different stages which are analysis, design, development, testing and evaluation will be implemented. In order to have full understanding of this project, two main areas need to be covered first, real-time communication and clinical management system. This is necessary in order to develop a good clinical system. As a conclusion, Real – time Clinical System is a new way to the users, patient especially to get better service and improved the management at the clinics. And I hope this product will be used in the clinics and it will contribute something good to the society in advance future.

ACKNOWLEDGEMENT

Alhamdullilah, praise to Allah SWT as I manage to finish this Final Year Project successfully. This project has certainly brought great and priceless experiences which have never been encountered before. It had become the opportunity for me to enhance my skills in solving problems independently and it has brought chances for me to apply my knowledge and expanding my thought in order to complete this project.

First of all, I would like to thank my supervisor, Ms. Norshuhani Zamin for supervising me and for all the time she spent to facilitate me. Without her, I don't think the project will be completed as it is. I also would like to dedicate this acknowledgement to all FYP coordinators and UTP lecturers for their cooperation and advices. Without their kind cooperation and help, my project would never completed this far and it would never be a fruitful and enjoyable experience. All of these wonderful people had continuously given their hand in making the harvesting of the vast experience and knowledge at its maximum capacity.

To my family who always been there when I need them the most, I could never repay you. To my friends, that always encouraging and believing in me and mentioning that I can carry out this idea to the completion, thank you and I will always remember you guys. Last but not least, to those who has helped me through thick and thin either directly or indirectly, I owe all of you a debt of gratitude beyond measure. Thank you very much.

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ABBREVIATIONS

KE Knowledge Engineer

LAN Local Area Network

UTP University Technology of Petronas

IRC Internet Relay Chat

IT Information Technology

IEEE Institute of Electrical and Electronic Engineers

CHAPTER 1
INTRODUCTION

1.0 OVERVIEW

When we go to clinic, our first impression is, there is so many work that the attendant should do. They need to deal with the patient, ask them whether they already register or not with the clinic, put the patient in the queue list and then call the patient when the time is ready to see the doctor. Then, the doctor will call the attendant to give patient the medicine. In order to lessen their burden, Real-time Clinical System is proposed.

1.1. Background of Study

Clinical System is widely used in the specialist hospital and also clinics throughout the world. However, in our country, basically the clinics and hospitals are still using the old manual system to manage all their daily works and also the clinic's management. For example, the attendants need back and forth from his or her place to the doctor's office just to get the information needed. They also need to manage all the data, from inventory's data to patient's data.

Since the clinic is basically just a small organization, they intend to do it manually. However, the small organization's management may become a hustle when all the data is unorganized. This will make the data is very difficult to find when they need to use it.

The communication between the doctors and the attendant at the clinic, basically they just use the telephone or in certain places, there is no communication medium. The doctor will call the attendant which is just outside his or her room when they need something. Besides that, the patients need to wait for a while to register their name.

1.2. Problem Statement

1.2.1. Problem Identification

The problems arose because of the communication between the doctor and the attendant. It is difficult when there are no specific medium for them to use. It is easily mistaken by the attendants, which will results giving the wrong information. Besides that, it is become more hustle to the attendant when need to go back and forth between his or her place and the doctor's room just to get info needed.

Other than that, when the doctor's issue a medical prescription or in other words, the type of medicine the patient's need, the attendant will always have a difficulties to read the doctor's handwriting. There are some cases happen when the attendant gives the wrong medicine to the patient. This results the patient will become sicker than before and even worse, the patient cannot be helped and die.

Unorganized data will also become a problem when the doctors as well as the attendant need to find the information. They have to find the needed data from rack to rack because of unorganized data.

As a patient, when they come in to register their name, they need to wait for a while until the attendant find their documents. Then they also have to wait to see the doctor. Again, when they finish with the doctor, they need to wait to get their medicine. From here comes the idea of Real-time Clinical System. The system is to fulfill the need of the doctor, attendant as well as the patient thus reducing the patient's waiting time.

1.2.2. Significant of the Project

The final product of this project is able to manage the clinical system which before this only being done manually. Besides that, the project will also allow better communication between doctor and attendant to overcome misunderstanding problems. To the patient, this system will eventually help them to minimize waiting time and also lessen the attendant's and the doctor's burden. Patient record as well as

the inventories record will also can be more organized and easy to manage. Besides that, this system will automatically calculate the bills of the patient and generate medical certificates if required.

1.3. Objectives and Scopes of Study

1.3.1 Objectives

The objectives of this study are as follows

- To apply LAN technology into clinical system, allow communication between two or more parties and sharing information in the organization.
- To speed up the clinical and management process effectively.
- To promote paperless environment.

1.3.2. Scopes of Study

- Focusing on real-time communication on clinical system. The potential clinic is Ar-Ridzuan Clinic which is situated in UTP campus.
- The final product (prototype) development will include communication between both parties; the doctors and the attendant, managing patient's data, calculate patient's bills and issue receipt.

CHAPTER 2
LITERATURE REVIEW

2.0 OVERVIEW

Few days has been spent on this literature review part, gathering and collecting information from various resources. To understand what real-time clinical system is, this part has been divided into two general areas, real-time communication system and clinical system itself. Later these two elements will be combined as one, which is real-time clinical system.

2.1. Real-time system

Real – time system describes an application which requires a program to respond to stimuli within some small upper limit of response time (typically milli- or microseconds). Process control at a chemical plant is the classic example. Such applications often require special operating systems (because everything else must take a back seat to response time) and speed-tuned hardware [1]. Real time is also a level of computer responsiveness that a user senses as sufficiently immediate or that enables the computer to keep up with some external process (for example, to present visualizations of the weather as it constantly changes). Real-time is an adjective pertaining to computers or processes that operate in real time. Real time describes a human rather than a machine sense of time [2].

A distinction can be made between those systems which will suffer a critical failure if time constraints are violated (**hard** or **immediate real-time**), and those which will not (**soft real-time**) [3].

Hard real-time systems are typically found interacting at a low level with physical hardware, in embedded systems. For example, a car engine control system is a hard

real-time system because a delayed signal may cause engine failure or damage. Soft real-time systems are typically those used where there is some issue of concurrent access and the need to keep a number of connected systems up to date with changing situations. Live audio-video systems are usually soft real-time; violation of constraints results in degraded quality, but the system can continue to operate.

Real-time Clinical System will fall under the soft real-time system, this is because in the communication between the doctor and the attendant, there will be only a slight delayed between the two. The system or the other function in the system can continue operate if there is some delay in the system.

2.1.1 Real-time Communication Revolution

Each new communication medium, as it adopted by society, changes both the nature of discourse and the way people and groups organize themselves. As new media arise, older ones decline or are repurposed. Real-time communication media are now becoming commonplace, in particular web conferencing and instant messaging technologies are rapidly being adopted throughout the business community. And as they are being adopted, they are just as rapidly becoming integrated – with each other, and in very near term, with existing technologies that have served as core communication media through which businesses operate.

This rapid adoption is being driven by the value that real-time collaboration offers to business, and just as occurred with earlier innovative media, like telephone, television, radio and hand phones.

We often say that real-time communication is changing the way we interact, do business, and ultimately, how we perceive the world. But in concrete terms, how does that happen? In what specific ways does real-time interaction change things?

The first generation is non-real-time collaboration, such as email and conventional groupware. Email is becoming hellishly inefficient as well, as the result of ever increasing numbers of emails, both legitimate business communications and the

infection of spam. When email was first introduced into the business context, it swept through the business like a strong wind, changing the face of business forever. Email rapidly revamped inter- and intra-business communication paths, opening the way for reengineering and downsizing the organization and eliminating the hierarchical, command-and-control model that had been in place since the start of the industrial revolution [4].

In a recent essay, Bill French asserts that "email is the place that knowledge goes to die." Without the addition of extrinsic analysis and content mining, email is simply the wrong sort of storage mechanism for a company's most critical and timely information [4].

The solution to the email problem is not to develop better email systems, but to look for ways to improve communication so that delay and wasted time is can be solved. The transition from slow-time communication to real-time communication will have similar social impacts. Business culture has been evolving in this direction for some years, but we are shifting to a revolutionary period, driven by the direct cost savings inherent in real-time collaboration, especially web conferencing and instant messaging. But it is not the first order cost savings – doing things more cheaply – that matter in the long run; it is the second order benefits – doing new things – that will characterize the world of business a few years hence.

2.1.2 Real-time Communication

There are few types of real-time communication. Four types of servers comprise our real-time communication category:

- Chat servers enable a large number of users to exchange information in an environment similar to an Internet newsgroups but with real-time discussion capabilities.
- IRC, or Internet Relay Chat servers, are a collection of server networks (or 'nets') that allow users to connect to each other via an IRC network.

- Instant messaging servers, like chat, facilitate communication in real time. However, while a chat room environment typically handles two or people involved in one or many discussions, instant messaging generally involves one conversation between two people.
- Instant messaging gateway servers act as the intermediary between consumer instant messaging networks and internal corporate networks. The server overlays IT management, compliance, and security features onto plain-text, unencrypted and anonymous public instant messaging clients.

These are some of the examples of the application of real-time communication:

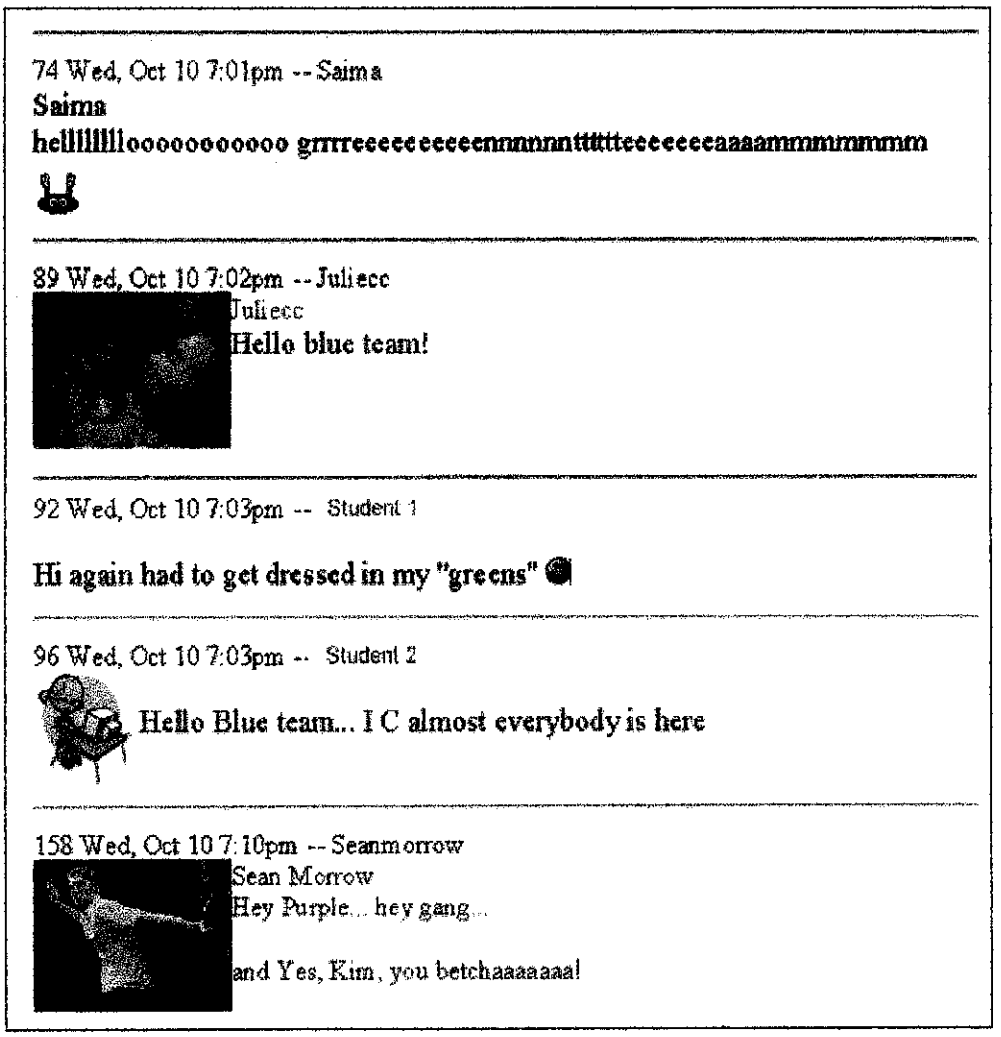


Figure 2.1 Member of small groups greeting each other in the main room to the exclusion of the rest of the group.

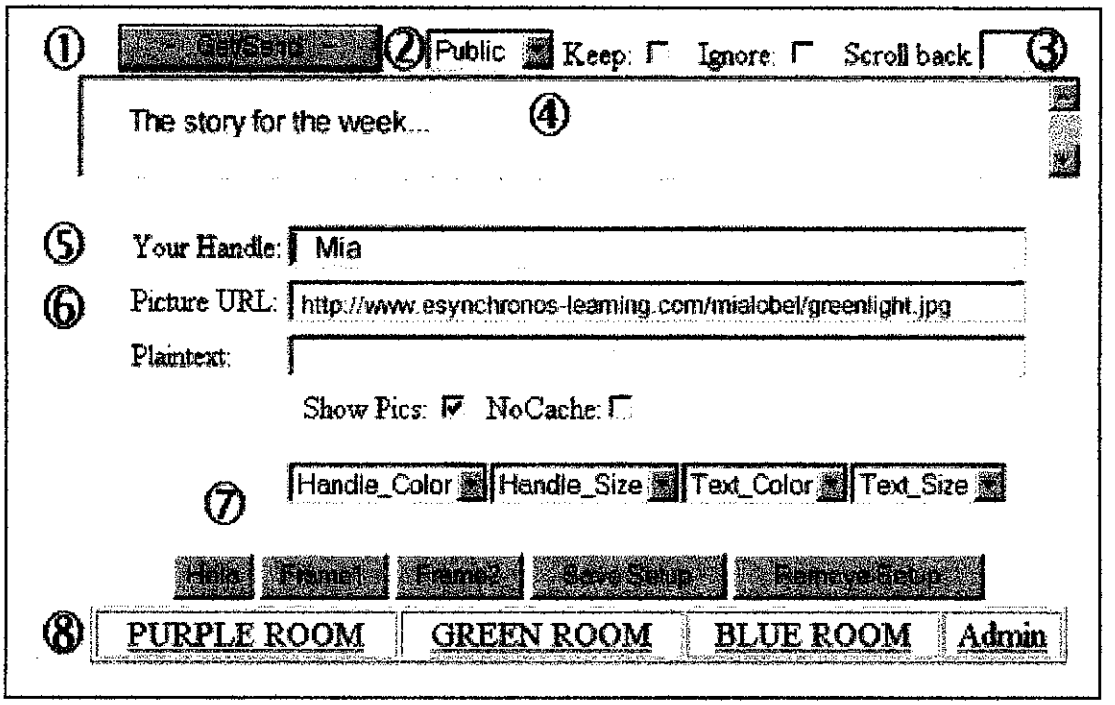


Figure 2.2 Example of Real-time communication application

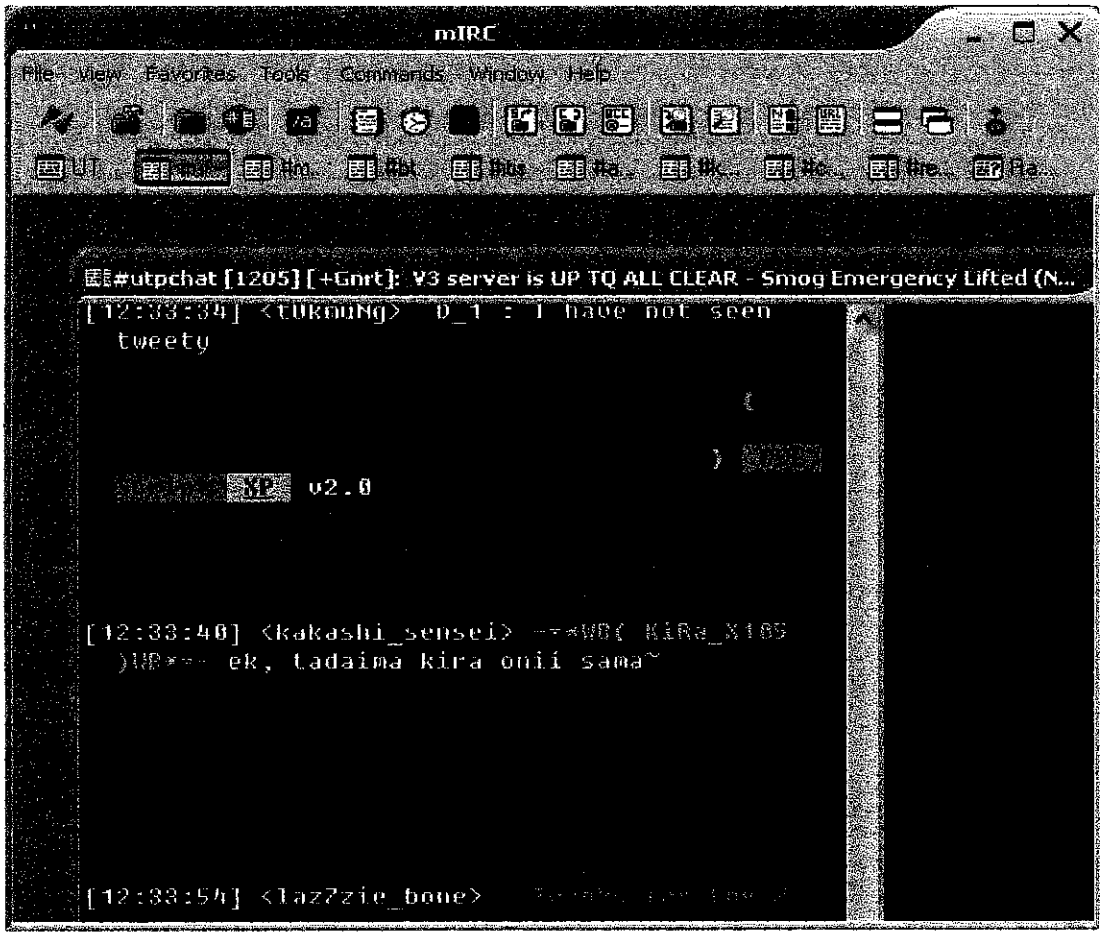


Figure 2.3 Example of using Internet Relay Chat (IRC)

2.2 Clinical System

The clinical system offers physicians a rich working environment that is based on a clinical service line model. A clinical service line gathers information from the patient at every clinical contact. For example, at an initial visit the receptionist gathers demographic data, a nurse gathers clinically significant data like allergies and adverse reaction, medication lists, etc., and finally the physician completes the medical record by entering the diagnosis. All the data gathered at the various patient encounters is automatically combined to efficiently create a complete and dynamic medical record. This eliminates redundant data collection while improving the clinical experience for the patients [6].

Basically, the software produces an electronic medical record, a clinical summary, and a treatment timeline for each patient. The electronic medical record includes the following information typically collected at each clinical encounter: history of present psychiatric illness, past psychiatric history, medical history, substance-related history, medications list, allergies list, social history, family psychiatric history, review of systems, physical exam, laboratory values, imaging data, mental status exam and progress note.

Some of the clinical system that has been produced has an automated report generation capability in which stored data elements and free text are combined to produce clinical reports instantly. Examples include an initial evaluation with a history and physical, demographics, progress notes, medication lists, and clinical summary.

2.3 Real-time Clinical System

Real – time clinical system basically is a combination of two different types of programs; real-time communication and also clinical system. This system basically is not widely used in the clinical area at present. With the recent spate of articles proclaiming significant improvements in the delivery of high-quality health care achieved by using real-time clinical systems, many health care organizations are either trying to buy or build such capabilities. Whichever they decide to do, the

following five elements are prerequisites: an integrated, real-time patient database, a data-drive mechanism, a time-drive mechanism, a knowledge engineer, and a long-term data repository. The following paragraphs describe each of these key elements and give examples of their utility.

- Integrated, real-time patient database.

A database that integrates data under a common patient identifier from a variety of clinical and administrative sources including the pharmacy, clinical laboratory, admissions, discharges, transfers, nursing notes, and radiology reports. It stores and updates all data as soon as laboratory results are available.

- Data-driven mechanism.

A data-drive mechanism in a computer system enables a knowledge engineer to set a flag so that a program can be activated when a particular type of data or data item (e.g., clinical laboratory results or a chest radiograph report) is stored in the database. Such a "triggering" event enables a KE to create automatic, real-time, asynchronous, clinical systems.

- Knowledge Engineer

The knowledge engineer (KE) is an informatics expert who is responsible for extracting and then translating the clinical knowledge into machine executable logic. The KE must have in-depth knowledge of the structure and meaning of the data recorded in the patient's electronic medical record, a thorough understanding of the various knowledge representation schemes, and the analytical and social ability to discuss and help others choose between complex options in clinical and patient care scenarios. It is not necessary that the KE be a clinician or a computer programmer, although either skill set would be useful.

- Time-driven mechanism

The time-drive mechanism on a computer allows the knowledge engineer to develop programs that will be executed automatically at a specific time in the future (e.g., 2am). By running a program based on time, the knowledge engineer can create logic

to remind clinicians to perform specific activities or to check that the appropriate action has been performed.

- Long-term clinical data repository.

The long-term clinical data repository contains patient-specific data from a variety of clinical sources collected over a period of several years. It allows the knowledge engineer, in conjunction with the clinical advisory group, to develop reliable statistical predictors of specific events. For example, one could develop a logistic regression equation that identifies the pathogen most likely to be found in a particular specimen and recommends the least expensive antibiotic.

2.4 Similar System in Market

A research has been made, there are a few medical institution have already develop a clinical system which is quite similar with this project. For example, Duke University Medical Center's Department of Psychiatry [7] is creating an electronic record for a regional clinical care and clinical outcomes network. The electronic record called CRIS functions in multiple arenas and platforms including a client/server, standalone, briefcase, and thin-client. This multi-platform model facilitates distributed data collection in the clinical setting with data processing and analysis performed through the departments' central data repository.

The CRIS Emergency Module is operating seven days a week, 24 hours a day, in the Duke University Medical Center's Emergency room to help the emergency room physician accurately and efficiently assess and record all emergency room visits as they come in.

However, in Malaysia, the clinical systems are basically and widely use in private medical institution only. The small clinics, such as Ar-Ridzuan, the staffs still using the manual system to manage their daily work. From this research it is proven that the system is very beneficial to the attendants and also the doctors.

CHAPTER 3
METHODOLOGY

3.0 OVERVIEW

This chapter will be focusing on the methodology that is going to be implemented along developing this project. The methodology part, it will be divided into two main sections, which are Research Methodology and Design Methodology. The research methodology is on how the data collected and turned into useful information for the study. The design methodology is about the development of final product. Both sections need to be combined to ensure the successfulness of the project.

3.1. Research Methodology

The main tool to gather information is interview. The interview will be constructed between the potential users such as the clinic's attendant and the doctor itself. It will then be supported with observations and surveys. It will be conducted throughout the research process. Besides that, internet research, journals, articles and as well as books will also be the reference in this study.

3.1.1. Interview

The main advantage of using interview is simplicity, which saves a lot of time. Besides that, interview can be easily conducted with the potential users and they will answer the question on the spot, which can ensure the information is correct.

3.1.2. Observations and Surveys

As support, observations and surveys are conducted throughout the research process. The need of observation and survey arose when not all of the respondents willingly being honest and giving correct information.

3.2. Design Methodology

The waterfall model takes the fundamental process activities of specification, development, validation, and evolution and represents them as separate process phase such as requirements specification, software design, implementation, testing and maintenance. The system is developed during the design and development stage. Testing is done regularly to check whether the system runs as expected. Finally, conduct evaluation phase in order to analyze the system performance whether it is meet the user's requirements. The methodology was adopted because it provides systematic and orderly approach in solving software problem.

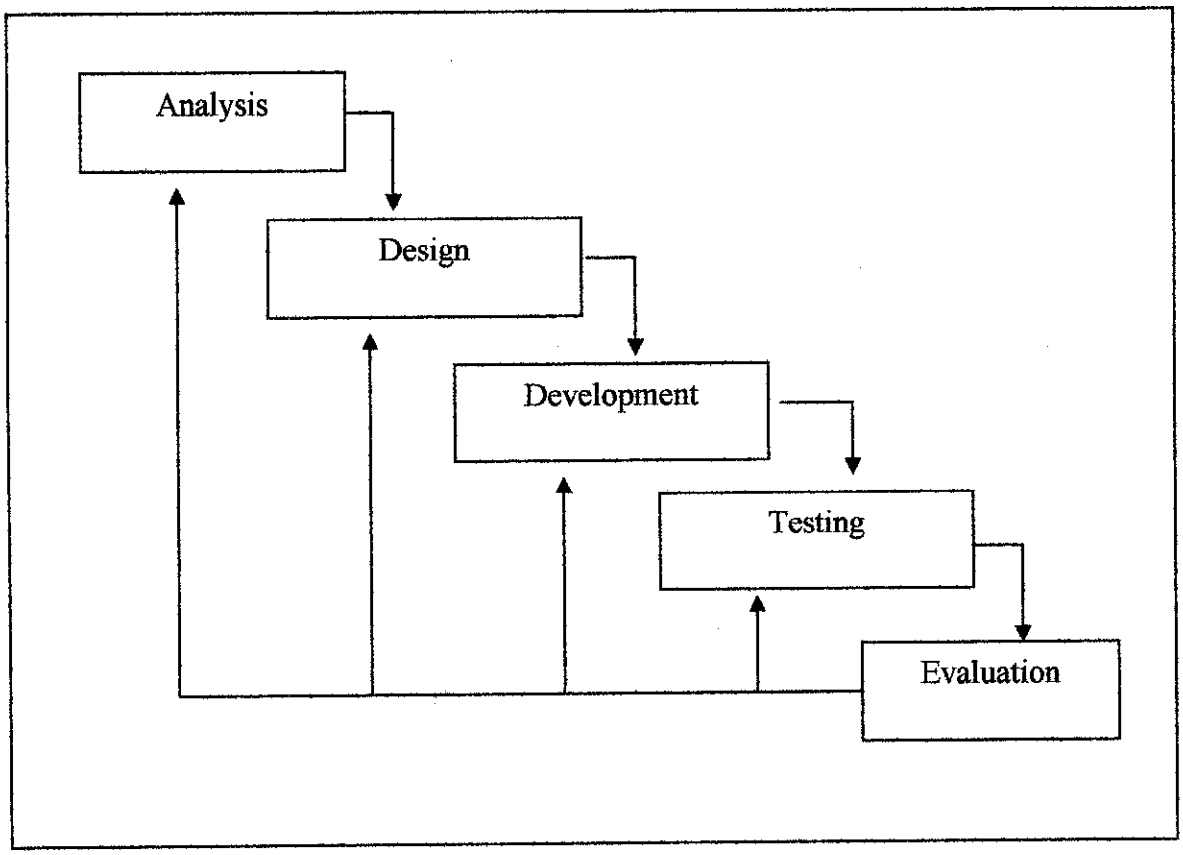


Figure 3.1: Phased involved in creating A Real-time Clinical System

3.2.1 Analysis

The first phase of beginning the project is analysis. It involves defining the problem statement, objectives and scope of study. In addition, information gathering that related to the project through research on internet site such as IEEE search, reading and interview are also conducted. Next, user requirement analysis and as well as defining the methodology and tools used for completing project development. Finally would be the plan project timeline and prepare Gantt chart so that the project could be completed in the given time period.

3.2.2 Design

In the design phase, it involves designing the interfaces and also designing the workflow. The system design process partitions the requirements to either hardware or software systems. It establishes overall system architecture. Software design involves identifying and describing the fundamental software system abstraction and their relationships.

3.2.3 Development

Basically, it is same goes to the design phase. This is the important phase where the design part such as the interface is being transferred into coding to make the interfaces function correctly. Detailed documentation from the design phase can significantly reduce the coding effort in the development phase.

3.2.4 Testing

The individual program units or programs are integrated and tested as a complete system to ensure that the software requirements have been met. Among of the tasks that would be carried on is reviewing, validating and testing the modules created in the system iteratively in order to ensure the system runs as expected. Other than that,

it would be best if the user try out the system and for see the weaknesses of the system that could be improved. Besides tested by the author of the system, it is also needed to be tested by the potential user of the system. The example of the testing part includes the functionality of the system, the interfaces, and the navigation.

3.2.5 Evaluation

Normally (although not necessarily) this is the longest life-cycle phase. The system is put into practical use. Evaluation is the process of determining the value and efficiency of the project. In this phase, evaluation is performed to the module of the system in order to define the performance of the whole system. The evaluation is done on the functionality of the system, security, the content, the interactivity and the user friendliness of the system. Basically, the final evaluation will be evaluated by the target audience because they are the one that will be using the system. For this software, the evaluators are the attendants and also the doctor.

3.3. Tools required

3.3.1 Software

Software	Reasons
Visual Basic. NET	Visual Basic.NET is the most user friendly language and easy to construct and manage.
Microsoft Access as database	Microsoft Access is a program that is compatible with the Visual Basic.NET as a database.

Table 3.1 Software

3.3.2 Hardware

Hardware	Reasons
Personal computer	Most suitable platform to develop a system
Network Interface Card (NIC)	Used to enable the computer to connected to the network
Network hub or router	Connection point for devices in a network and used to connect segments of a LAN.
Cable	Used to connect the computer and the hub.

Table 3.2 Hardware

CHAPTER 4
RESULTS AND DISCUSSION

4.0 OVERVIEW

At the beginning of the research process, it seems that we need to identify and get some information from the patient at the clinic. But during the research phase, I found out that it is not really necessary to gain information from the patient itself. However, it is very crucial to gain information from the attendants and also the doctors at the clinic. Here, are some of the details that are used during the implementation of the project.

4.1. Results and Findings

After doing some interviews with the attendant and the doctor at the clinic, finally I gain some useful information.

4.1.1 Required data

There are few details that the attendant will complete when the patient come to the clinic such as, their names, age, I.C No, occupation, address and also telephone number (Appendix A). A different form need to be filled by the doctor after he checked the patient (Appendix B). In this form the doctor will fill in the date he checked the patient, the problems and what type of medicine that the attendant need to give to the patient. After some interview (Appendix C) with the attendant and the doctor, I found out, the problems may arise at this stage, where the doctor fill in the form and the attendant having a problem to understand what actually the doctor wrote. They need to come again to the doctor to ask for the right medicine.

4.1.2 The patient

From the interview and the observation that have been done with the attendant and also the doctor, Dr. Zulkifli bin. Mohamed Sharif the potential patient to come to the clinic such as the student (almost 50%), the other 40% is the lecturer and also the UTP staffs. People from outside UTP also come to the clinic. About 10% from the patients are the people from UTP surroundings. In a day, there are about 40 – 50 patient who came in, but there are more coming in when there are some disease and infection season. Some of them were come repetitively because they were still infected by the disease.

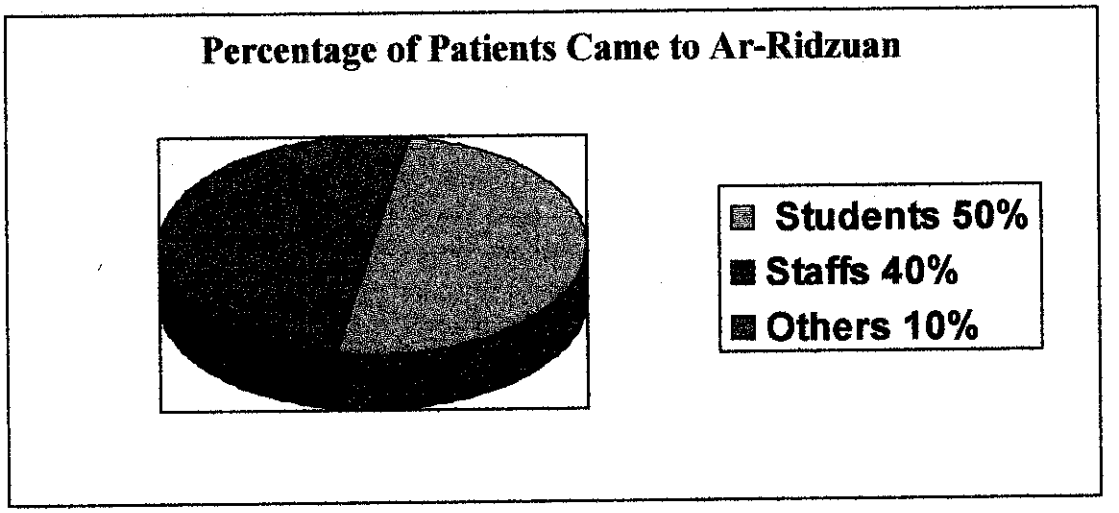


Figure 4.1 Percentage of patient came to Ar-Ridzuan clinic

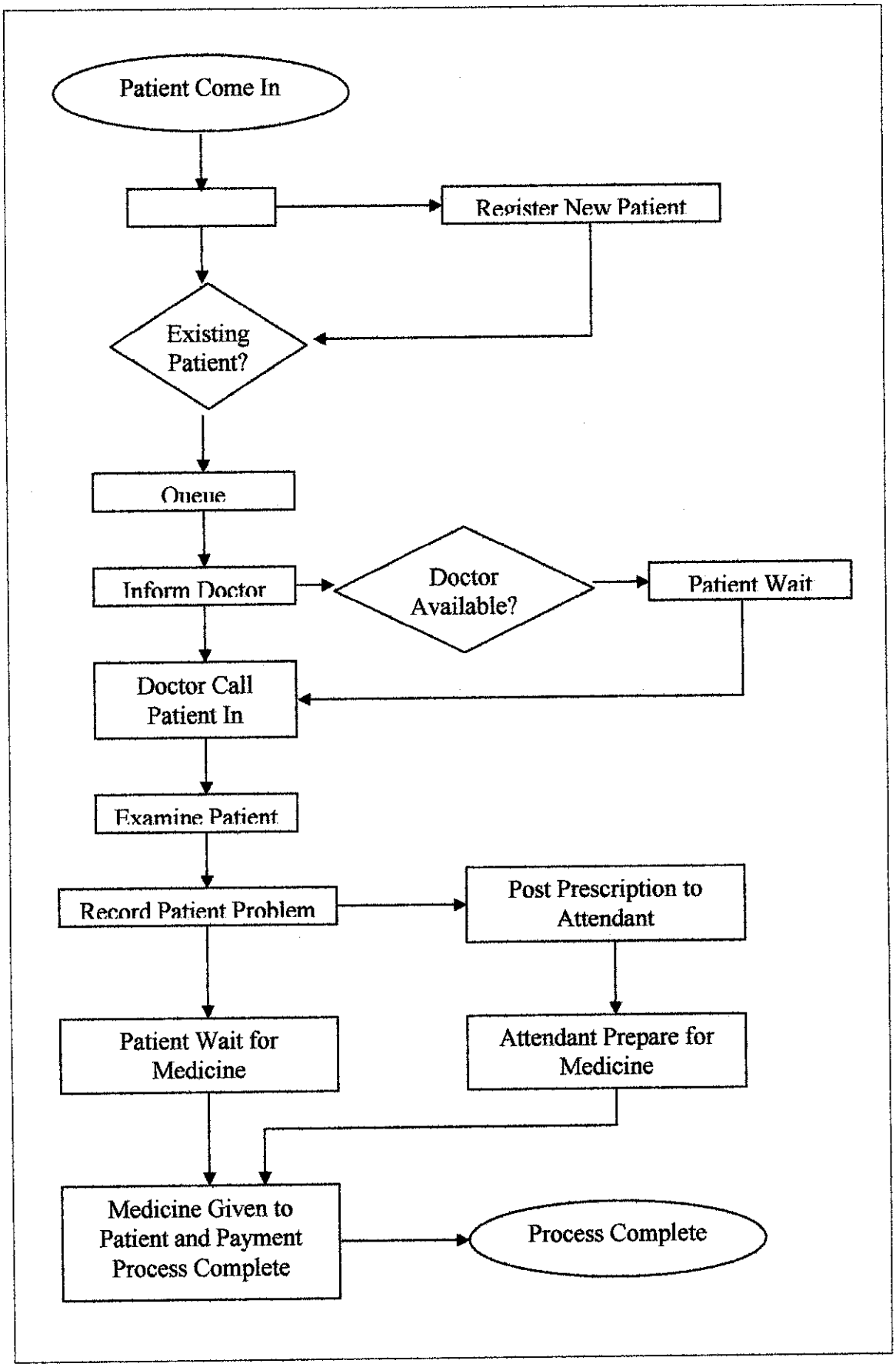
4.1.3 The 'famous' sickness

To make sure the process of the implementation run very well, I also asked the doctor the most 'famous' sickness that he may found in his clinic. There are a few sicknesses such as, fever, flue, headache, diarrhea, small injury in accident, sore throat and others. This question need to be asked as I need to identify what kind of disease always happened and what type of medicine need to give to the patient. In the system, simple check boxes are added in order to make sure the doctor will lessen his handwriting and with only few clicks a full prescription of the medicine is ready for the attendant.

Patient Per Day	Problems
7	Acute Tonsilitis
6	Urinary Tract Infection
8	Diarrhea
5	Oritis Externa
5	Conjunctlivitis
6	Mouth Ulcer
3	Lower Back Pain
4	Tirea Vesicolor

Table 4.1 Famous sickness

4.2 Process Flow



4.3 Real-time Clinical System

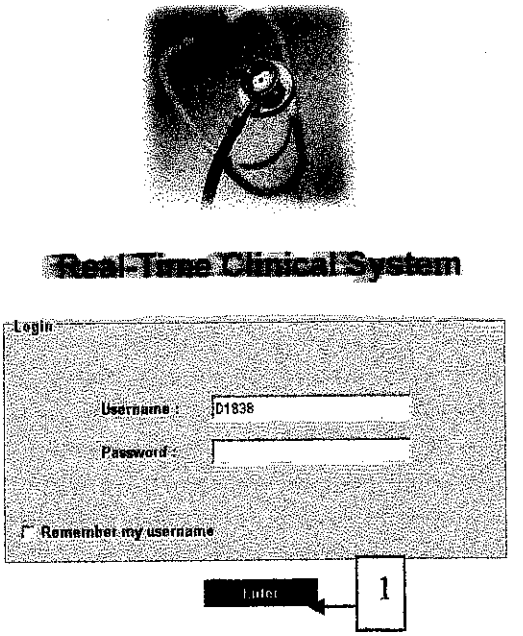


Figure 4.2 Login Page

1. In the login page, user will need to enter username and the correct password to enter the system with the correct function based on the job, whether it is the attendant or the doctor.

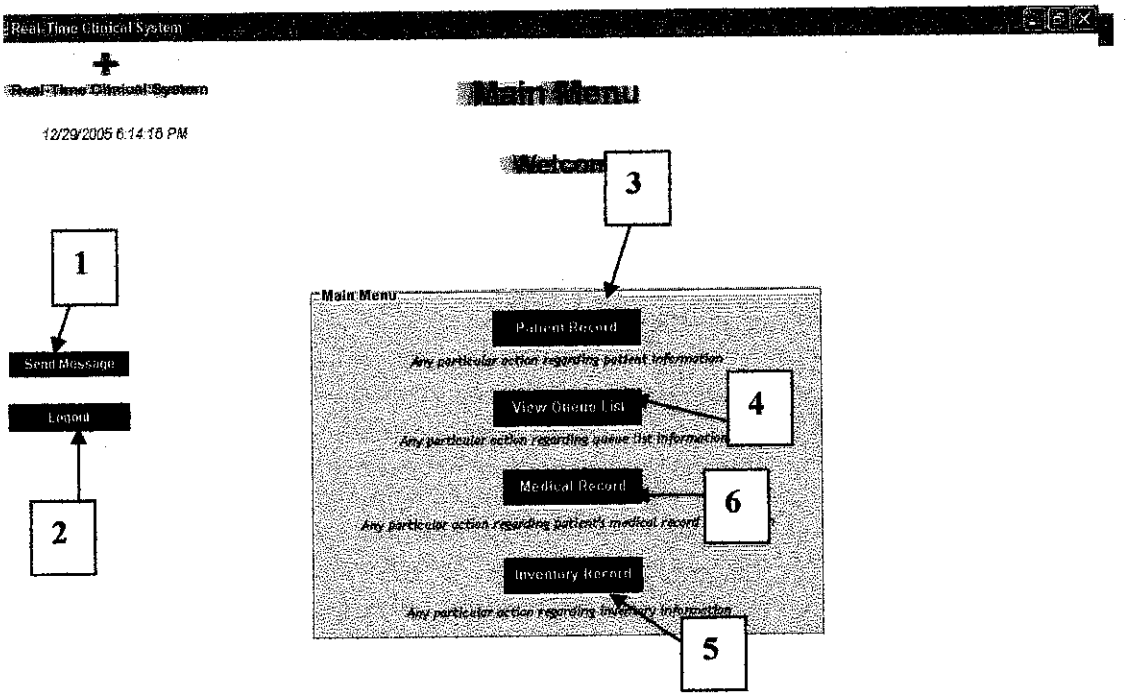


Figure 4.3 Main Page

There are few buttons which lead to the main function in this system:

1. Send Message: Allow user to send message to others.
2. Logout: Function for user to logout from the system.
3. Patient Record: Allow user to add new, delete and edit patient record.
4. View Queue List: Allow the attendant and the doctor the patients queue list.
5. Inventory Record: Allow management of the inventory such as the medicines in stock.
6. Medical Record: Allows only doctor to add and view record of the patient.

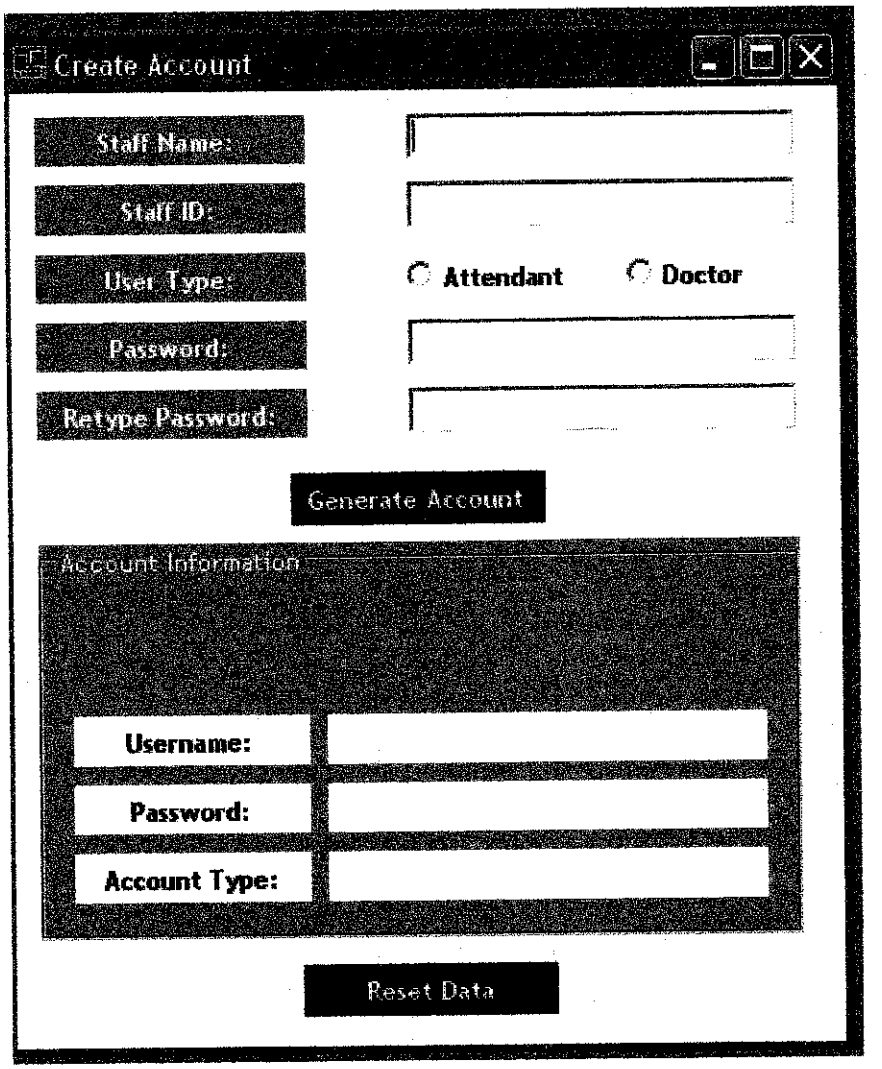


Figure 4.4 Generate Account

This form will allow the attendant to generate new account for the user. Account for the attendant and the doctor will be different because of the function that they can access is different.

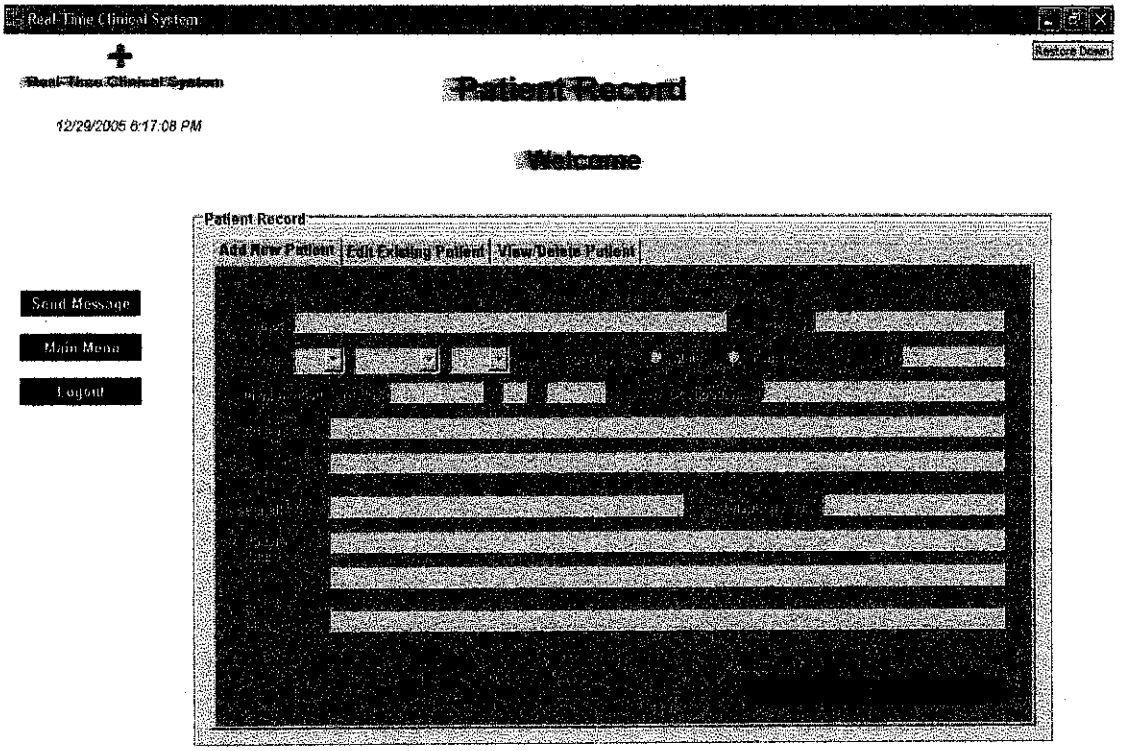


Figure 4.5 Patient Record

This form will allow user to view, add new record, edit and also delete the existing record of the patient. Only the attendant can add new record, edit and also delete the existing record. The doctor can only view the patients' record.

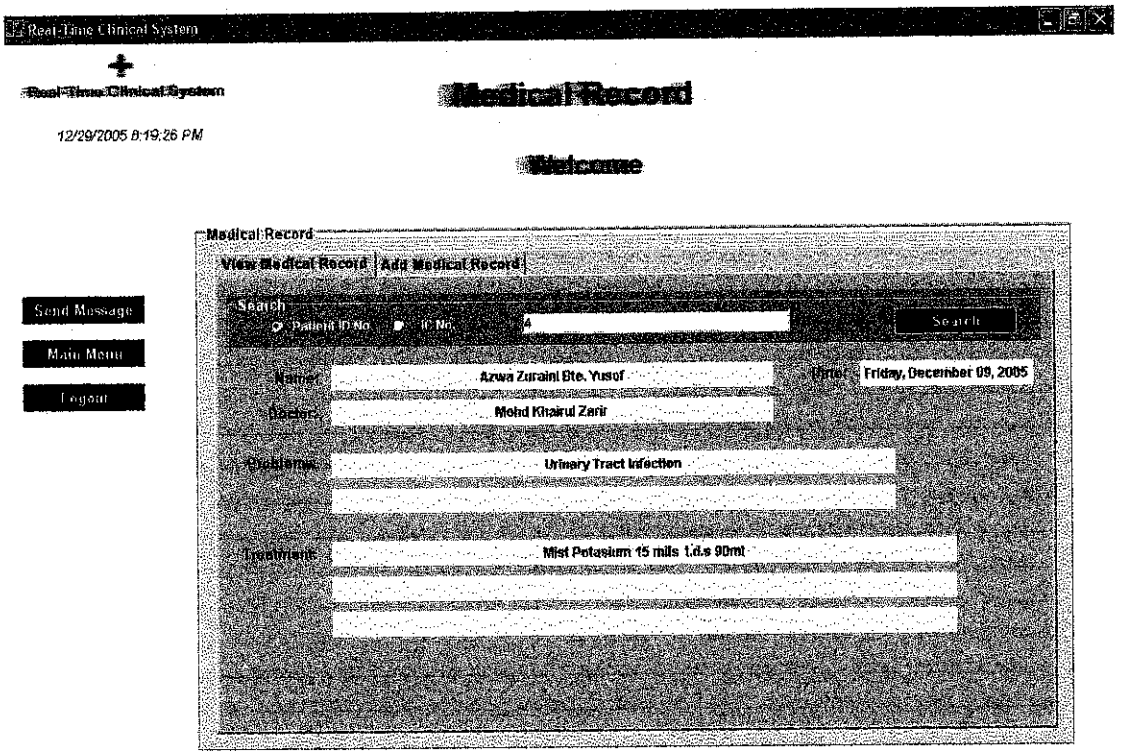


Figure 4.6 Patient Medical Records

This form will allow user to view and add new record. There are no edit and delete the existing record of the patient. Only the doctor can add new record and the doctor can only add record.

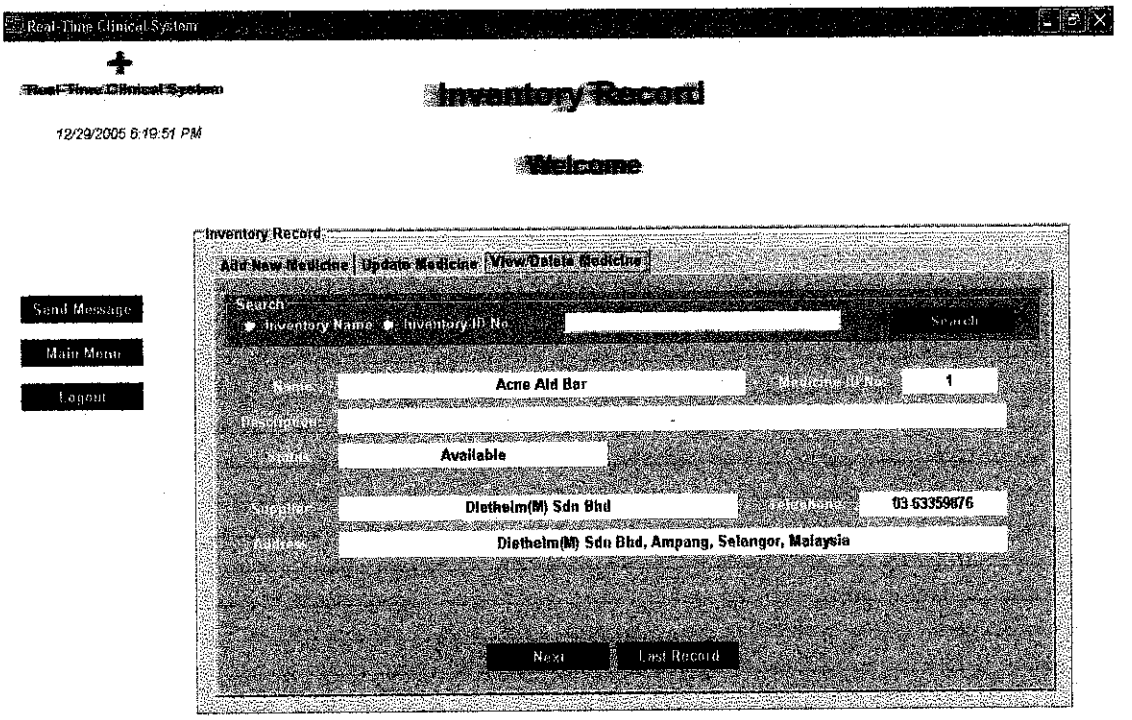


Figure 4.7 Inventory Records

This form will allow user to view, add new record, edit and also delete the existing record of the inventory. Only the attendant can add new record, edit and also delete the existing record. The doctor can only view the medical record.

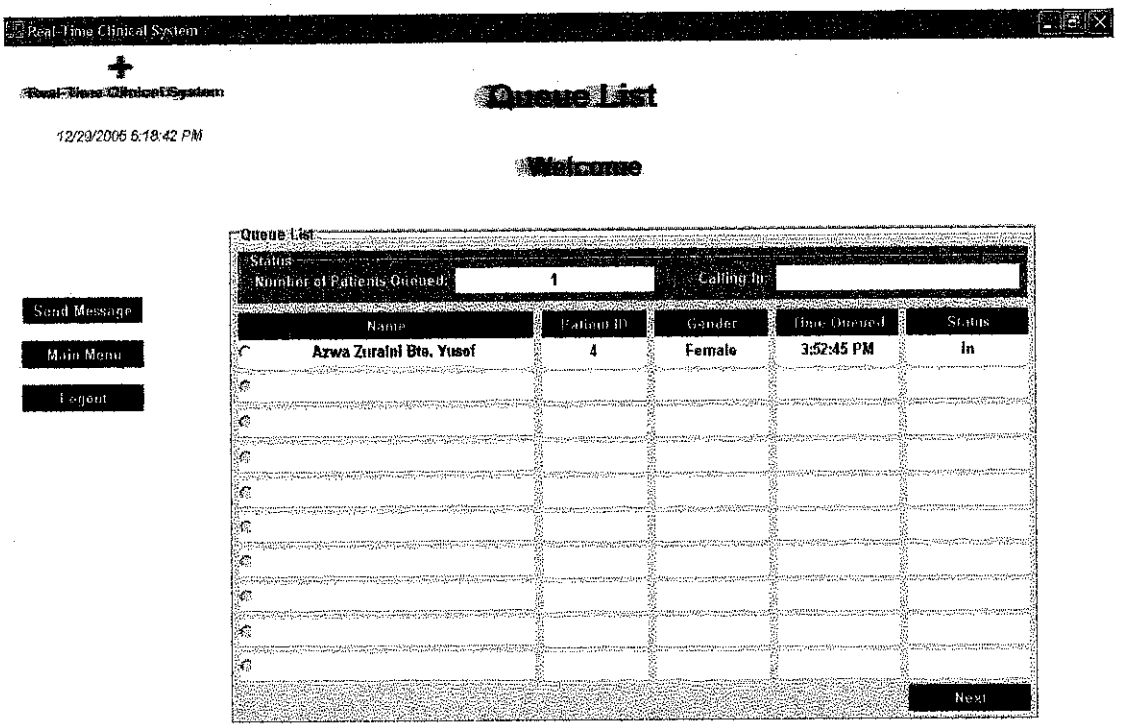


Figure 4.7 Queue List

This the form where both the doctor and the attendant can communicate and view the patients who already in the queue list.

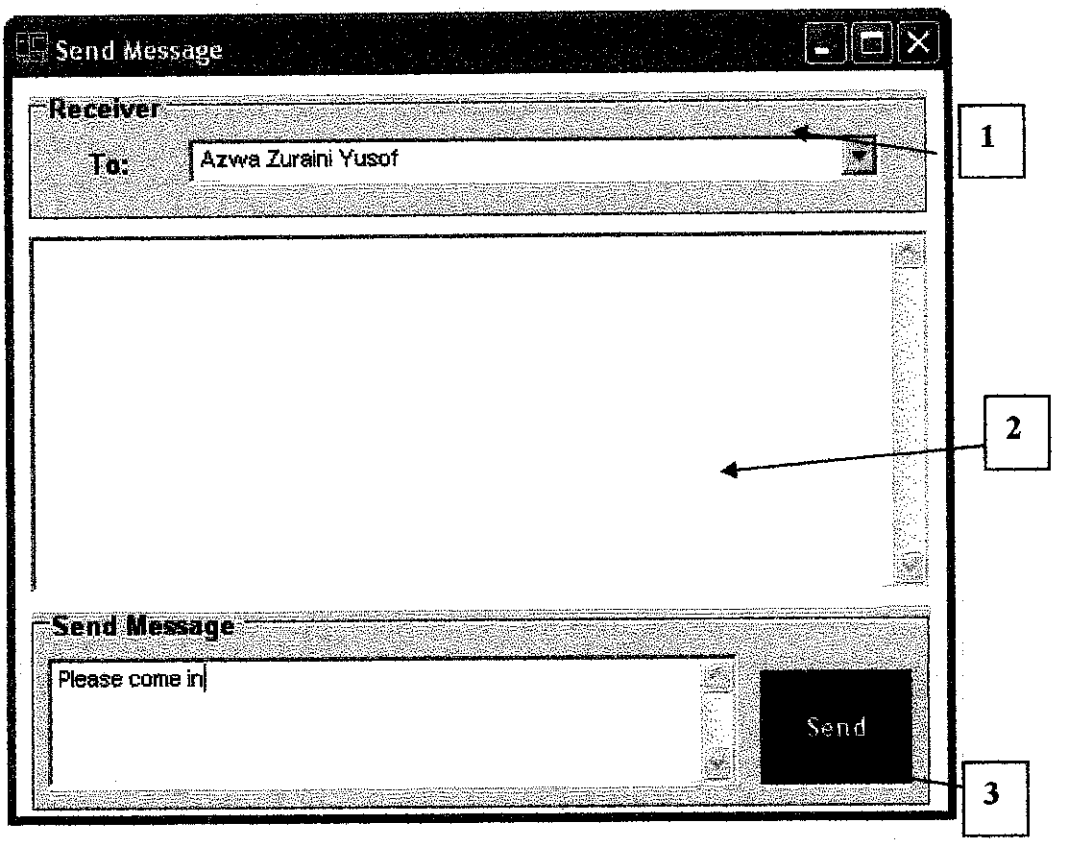


Figure 4.9 Chat System

In this form, user will be able to communicate between them.

1. User can choose with who they want to communicate.
2. All the messages will be shown in this box
3. Button send will allow user to send their message based on who they want to send the message.

4.4 Testing results

After completing the project, the testing phase is conducted. The testing was conducted by the author of the system and also the potential user of the system; the doctor and also the attendant. It is to make sure all the plans of the system are implemented effectively. Basically it involved reviewing, validating and testing the modules created in the system. To be specific, the system is tested on its interfaces, functionality and the easiness of navigation. A sample of the testing form is available in Appendix. Below is the result of the testing phase.

Rating: 1=Worst 5=Excellent					
Attributes	**1**	**2**	**3**	**4**	**5**
Interfaces Design				**X**	
Smoothness of Navigation				**X**	
Functionality					**X**

Table 4.2: Testing results

Based on the result, we could see that the product is quite successfully designed, whereby all the necessary attributes is placed at the right position. Good design of an interface would encourage user to continue navigating the website. The smoothness of navigation process is interpreted when the user do not face any type of error while navigating. From the testing result, it shows that the system is successfully created and could be further to the next step which is evaluation by the user.

4.5 Evaluation result

The evaluation part is performed after the testing phase. It is implemented to the potential user that has not been involved in the development of the system. It is crucial in order to make sure that the system is acceptable to the user and meet the user expectation. Three users including the author of the system, the doctor and also the attendant have been evaluating the system and this is the result of evaluation phase.

Elements / Criteria	Meets all Standards	Adequate	Fails to Meet Standards
Functionality	2	1	-
Accuracy	2	1	-
Interactivity	3	-	-
User-Friendliness	2	1	-

Table 4.3: Evaluation results

As we could see from the table above, the doctor and also the attendant basically satisfied with the product. However there are some amendments should be made in the future. The smoothness of the navigation and user-friendliness of the system should be improved in the future. On the other hand, the potential users, they like the interface design of the system.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, there is a significant need for Real – time Clinical System as from past experiences and observations, it is very crucial to have this kind of system in order to have an effective and efficient way of managing the clinical system. Internet is an advantage in these days as we all moving to the new era of technologies. Besides having so much benefit to the human, such as saving time, we also can promote paperless environment which will lead to a better environment.

The automated system is able to manage the clinical system thus replacing the manual system. Besides that, the project will allow better communication between doctor and attendant to overcome misunderstanding problems. To the patient, this system will eventually help them to minimize waiting time and also lessen the attendant's and the doctor's burden. Patient record as well as the inventories record will also can be more organized and easy to manage plus this system will automatically calculate the bills of the patient

The development of this project is divided into two phases which are the research part and the design part. Waterfall methodology has five sequence stages and it is applied in the design phase as it is well structured approach. Hence, it is hope that the project will reach its goals and the community especially the clinics' staffs will accept this project and apply it in their daily lives as it is very beneficial to them.

5.2 Recommendations

For the recommendations part there are few things that need to be improve in the future. First one is the security. Security is one of the important elements in every system. For Real-time Clinical System, the security is important to avoid hackers, viruses etc that can penetrate into the system and destroy the original data. Currently, the system has a security function which is the use of passwords to enter the system is vital to ensure that only authorized persons is enabled to view and controlled the system. However, it is very important to have more reliable security system to ensure the system is safe from hackers and also viruses' threat.

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APPENDICES

APPENDIX A

APPENDIX B

APPENDIX C

Interview Questions

1. What is your name?
2. What is your position in this clinic?
3. Please describe your working hours.

For attendant:

1. Please describe your daily work.
2. How would you categorize your workload? Heavy, Medium or Easy?
3. How many patients come in to the clinic per day?
4. Did the patient need to wait for long time to see the doctor?
5. Do they come to have a consultation with the doctor or want to buy the product?
6. Please describe the procedure for the patient need to follow when they come to the clinic.
7. Please describe all the problems that may occur during the process.
8. How about the inventory management? Please describe in details.
9. Is it difficult to communicate between you and the doctor?
10. Is it tedious the all work that you need to do?

For doctor:

1. Please describe your daily work.
2. How would you categorize your workload? Heavy, Medium or Easy?
3. How many patients come in to the clinic per day?
4. Please describe the type of sickness that always attacks the patient.
5. Can you please describe the type of sickness and the medication for the patients?
6. Is it difficult to communicate between you and the attendant?
7. Please describe the process you need to do in order to give instruction to the attendant.