

CLINIC MANAGEMENT SYSTEM WITH NOTIFICATION USING GSM MODEM

CHAPTER 1

INTRODUCTION

1.1 Introduction

Clinic is an organization that is responsible in providing a health medication and treatment for all types of peoples. Surely, everyday there are people that need to use the clinic services. But how can clinic provide a faster and efficient services if they are still using the traditional method on their daily operation? The traditional method means the customers need to fill in their detail in registration form manually and the information will only keep in files. After the registration, the files will be place in the rack and this will cause problems like taking a longer time to retrieve the information, make mistakes during writing or misplaced the files.

As a result, one system called Clinic Management System with Notification using GSM Modem will be develop to resolve all the current problems at clinic. Clinic Management System with Notification using GSM Modem is specially designed to let the clinic staff has a high efficiency management tools, computerized and systematic patients record, and detail of treatment records. This system also provide appointment feature, which allow staffs to view the appointment that already made by doctors and

process it by sending a notification to patients. Patients will receive the notification about their appointment details on their mobile phone.

This new system will replace the current system that is used in clinic and surely this system will improve the clinic services and make their daily operation running smoothly.

1.2 Problem Statements

- a) Traditional method, which is the information about patients that is kept on file and back into the rack, has caused problems for the clinic staff to retrieve the information and this might take a longer time.
- b) The traditional method indeed caused too many usage of paper. For that reason, inventing an Eco-friendly product is necessary to save the natural resources.
- c) Patient tends to forget their appointment with the doctor, as there is no reminder from the clinic itself.

1.3 Objectives

- a) To computerized and centralized all the information in order to reduce the time in retrieving all the data and information.
- b) To promote Eco-friendly software that will reduce the usage of paper.
- c) To facilitate patients, so that we can notify the patients using SMS notification, so they can be on time for their appointment.

1.4 Scope

- a) This system will replace the old system that is currently used in most clinic in Malaysia.
- b) This environment of this system is based on Java programming language.
- c) This system will divide to three users, which are for the clinic staff, doctors and administrator. Each of these users has their own permitted area in order to access this system.

1.5 Thesis Organization

This thesis consists of six (6) chapters.

Chapter 1 is an introduction of the system. This introduction consists of system overview. Problem statement has been discussed on the problem that faced by the current system. As for the objectives, the reasons of the development of the project are listed. Scope of the project is discussed on project and user limitation.

Chapter 2 is the literature review, which consists of the current system and the technique or software that is used on it.

Chapter 3 is about the system methodology. It will be on the method that is used to develop the system and project planning. On this chapter, there will be an overview of the project planning such as the creating of the software and the device that helps to develop the system.

Chapter 4 is the elaboration of project implementation. This chapter is more or less on the design of the project development.

Chapter 5 will be based on the discussion and result that was received from the data and data analysis, project constrain, and fix and suggestion of the system. Project analysis is the discourse on the project objective, which is the continuation of the project problem.

Chapter 6 is the conclusion of the project. This includes the conclusion of the data that were received, the methodology, and the used research implementation.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will focus on the literature review. It will cover a period of 1997 to 2011 and will discuss about the concept of the management system, which is the most common problem relating to the system, techniques and basic requirement for this system.

This chapter introduces the definition of computerized system, the GSM modem and also factors that cause the management systems to fail and explain the similar systems.

The developed system is Clinic Management System with Notification Using GSM Modem. These systems are responsible to store patients' data and notify them for their appointment. Before this, most clinics usually used the traditional methods that are quite unsatisfactory. The traditional system used by the staffs is exposed to common mistakes while writing and the probability of having lost document or being misplaced is quite high. Knowing that the document cannot keep as many data as they could about the patient, thus the other important information about them may not be included in that form. Besides that, the patient may have forgotten their appointment with the doctor.

2.2 Definition Management System

Management system actually has been used long time ago. Every organization needs a system that can manage their data and process. Normally they used a conventional method to manage and store their data.

Management system is management documented and tested step-by-step method aimed at smooth functioning through standard practices. Used primarily in franchising industry, management systems generally include detailed information on topics such as ("Businessdictionary.com - online,")

- i. organizing an enterprise,
- ii. setting and implementing corporate policies,
- iii. establishing accounts, monitoring, and quality control procedures,
- iv. choosing and training employees,
- v. choosing suppliers and getting best value from them, and
- vi. marketing and distribution.

2.3 Advantages Computerized System Over The Manual System

A system is an arrangement of elements that when it is put together it becomes an organized and established procedure. A system typically consists of components connected together in order to facilitate the flow of information, matter or energy. A computer system consists of a set of hardware and software, which processes data in a meaningful way.

In every company, keeping record are very important. For the clinic, it is very important to keep the patient record for any reference. There is some method in keeping the record such as using the manual method or the computerized method. The computerized system is better than manual system in keeping record (Egwunyenga, 2009) of the patients. Hence, using the computerized system has so many advantages than the manual system.

One of the advantages using a computerized system is that it is not only easy, but it also saves the time to search the patient record. If they use the manual keeping

record, they have a hard time to find for it. The computerized system will give the opportunity for the companies to do work more effective and efficiently if the company use it (Dalcı & Tanış).

The next advantage is that the staff can update the patient record easily. If the costumers come to the same clinic more than a time, the staffs could find the patient record without any difficulty. If the searching record is easy, the update task is easy as well. The update task is faster and more efficient compared to the manual system.

Another advantage is having this computerized keeping record system, information for a particular period of time can be compiled quickly. With the manual system, it takes time to locate the information from each file and compile it into a report.

Besides that, computerized system can save paper and space. If the clinic is using the manual system, at least a few papers from each file will be used for the keeping record for individual patient. If there are thousands of patients in a clinic, obviously it will need as many papers and files as they could in keeping their record. Doubtlessly, the clinic needs more space to keep the entire file in place. Thus, by using the computerized system, the staffs can store as much details of the patient information in the database given. From this statement, the computerized system also helps in saving cost from buying papers and files for the documentation of patients. By using the computerized system, the target is to create a paperless office, which will turn into reality (Dalcı & Tanış). Obviously the computerized system is better than the manual ones.

2.4 Technique

This section is the review on the current technique on the programming language, in-system programming, database language and methodology.

2.4.1 Programming Language

There are many tools can be used to develop dynamic and interactive system. Java and Visual Basic are the most popular programming tools for graphical user interface (GUI).

a) Java

The Java programming language has been widely accepted as a general purpose language for developing portable applications, toolkits, and applets (Ritchie, 1997).

Java is a programming language originally developed by James Gosling at Sun Microsystems (now part of Oracle Corporation) and released in 1995 as a core component of Sun Microsystems' Java platform. The language derives much of its syntax from C and C++ but has a simpler object model and fewer low-level facilities. Java is currently one of the most popular programming languages in use, particularly for client-server web applications (Wikipedia).

Programs written in Java have a reputation for being slower and requiring more memory than those written in C(Dejan). However, Java programs' execution speed has improved significantly with the introduction of Java 2.0 code has approximately half the performance of C code.

b) Visual Basic (VB)

Visual Basic (VB) is the third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model. Visual Basic is designed to be relatively easy to learn and use (Wikipedia).

Microsoft claims that Visual Basic is the quickest and easiest way to create applications for Microsoft Windows [Microsoft 921. Microsoft Windows is one of the fastest selling software packages in history: 3,000,000 copies were sold in the first nine months (Dukovic & Joyce, 1995).

Microsoft Visual Basic is designed for graphical user interface (GUI) programming. It is not a general purpose programming language.

2.4.2 GSM Modem

In cellular service there are two main competing network technologies, it's Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) (Constantin, 2011). Since it started in the '80s, GSM telephone system was developed using cell concept for the network topology. Each cell corresponds to a specific antenna (base station), which is placed on towers or tall buildings. The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators.

GSM also has low-cost implementation of the short message services (SMS), also called astext messaging, which has been supported on other mobile phone standards as well. In view of the fact that there is huge coverage of distance, the GSM infrastructure can be an alternative to transmit or receive data from or to a device like sensor, actuator and complex device near or remotely. Compared to analogue transmission systems, GSM system provides narrowest bandwidth for the channel, through the use of voice compression algorithm; improving the quality of transmission by using detection and correction codes of errors; digital signal encryption to ensure security and protection against unwanted interception.

2.4.2.1 Architecture of the GSM network

A GSM network is composed of several functional entities, whose functions and interfaces are specified. Figure 1 shows the layout of a generic GSM network. The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber. The Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users.

The MSC also handles the mobility management operations. Not shown is the Operations and Maintenance Center, which oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the Um interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile services Switching Center across the A interface.

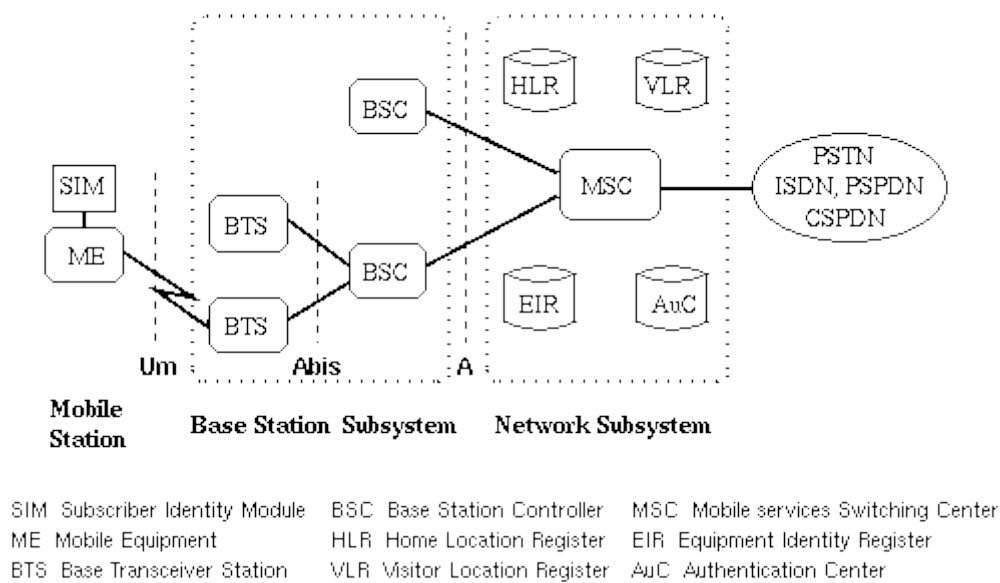


Figure 1.1 General architecture of a GSM network

Source: "Information on mobile"

2.4.3 Similar System

Nowadays, there are many systems that similar to the Clinic Management System with Notification Using GSM Modem.

Based on the research that has done, the developer found the differences and similarities between the three of existing system with the system that will be developing later. Besides the differences and similarities, the research about existing system also was helping the developer to get more idea to develop the system. This table below will explain about all the differences between all the systems.

Description	Generic Notification System for Internet Information	Web based Long-Distance Appointment Registered System	Clinic Management System with Notification Using GSM Modem.
Purpose	To provide a mechanism of delivering a notification messages to a single or multiple recipients based on request by the recipients.	To provide a system for hospital management that allow user to make online appointment.	To computerize and centralized the system of with the addition of appointment elements.
Module	Available to anyone that are browsing the internet.	Consist four layer of module: management view, medical management, patients view and data management view.	Three layer of module: Doctor view, clinic staff view and administrator view.
Implementation	This system by combination of Internet browser, dynamic HTML and GSM modem and XML document.	The implementation of this system by using the ASP programming language with addition of remote registration system.	The implementation of this system by using a Java programming language. Besides that, using the GSM modem.
Database design	The database of this system was	The database of this system based on the	The databases for this system will be

	designed based on generally, which means there use the internet browser database and the user information.	information of the patient, doctor and reservation tables.	designed based on the criteria of patient, appointment and other else.
Advantages		This system allow user to make an appointment without come to hospital, cancel and update their information and appointment.	Can computerize the patient information and user will get the notification about their appointment through mobile phone.
Limitation	The system limitation was found that the environment of this system is still restricted for some types of basic notifications.	Before the user want use this system, they must register manually with hospital and deposit money. If not, they not allowed to using this system.	The limitation might be in this system is the user cannot make the appointment by online.
Availability of user	Large scale of user.	User consists of patient and doctor at the hospital that implement this system.	User consists of staff and doctor at the clinic that implement this system.

Figure 2.1 Comparison between existing systems

2.4.3 Base64 Encoding

This system Base64 content-transfer-encoding or called Base64 encoding, is defined in RFC 2045 .It is a method designed to represent an

arbitrary sequence of octets (8-bit) in a printable text form that allows passing binary data through channels that are designed for flat ASCII text such as SMTP(Postel, 1982). It also allows embedding of binary data in media supporting ASCII text only such as XML files.

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Character	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Value	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Character	R	S	T	U	V	W	X	Y	Z	a	b	c	d	e	f	g	h
Value	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Character	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y
Value	51	52	53	54	55	56	57	58	59	60	61	62	63	(pad)			
Character	z	0	1	2	3	4	5	6	7	8	9	+	/	=			

Figure 2.2 Base64 alphabets.

2.4.3.1 Encoding

The process consists in representing groups of 3 octets (24 bits) of input bits as output strings of 4 encoded characters and the input as a linear stream of octets. Arranged from left to right, the input is divided into 24-bit groups, each formed by 3 consecutive octets of the input stream. These 24-bit groups are then treated as groups of 4 concatenated 6-bit groups. Each 6-bit group is a binary number, representing a decimal value between 0 and 63. That value is used as an index into the array of the Base64 alphabet. The corresponding encoded character is placed in the output string.

2.4.3.2 Padding

The input ends with a whole 24-bit group. The output is a multiple of 4 Base64 encoded characters. No special action is needed. The input ends with two octets or a 16-bit group. Two zero bits need to be added to form a whole 3 6-bit group, which translates into 3 Base64 encoded characters. A padding character '=' is needed to make the output a multiple of 4 characters. The input ends with an octet or an 8-bit group. Four zero bits need to be added to have 2 encoded characters. And two padding characters are added.

2.4.3.3 Decoding

The process of decoding works in opposite to the encoding process. That is 24-bit groups of 4 6-bit groups are translated into groups of 3 octets. All line breaks or other characters not in the Base64 alphabet are to be ignored by the

decoding software and also any illegal sequences of characters in the Base64 encoding, such as "====".

2.5 Summary

Clinic Management System was developed using Netbeans that used Java as the main language. This system also used MySQL as their database that store all the information and data.

CHAPTER 3

METHODOLOGY

In this chapter will discuss about the methodology that will be using in the development of Clinic Management System with Notification Using GSM Modem. The fundamental for this project is to develop a management system that can be implemented and integrated in clinics. This project will be conducted based on the Iterative and Incremental Development method. From the beginning, this project will be developed based on the methodology choose.

3.1 Introduction

Iterative and Incremental development is at the liver of a cyclic software development process developed in response to the weaknesses of the waterfall model. It starts with an initial planning and ends with deployment with the cyclic interactions in between (Wikipedia). Iterative or incremental methodologies provide a cyclical approach to software development, which is especially useful for environments where requirements change often and response need to be quick.

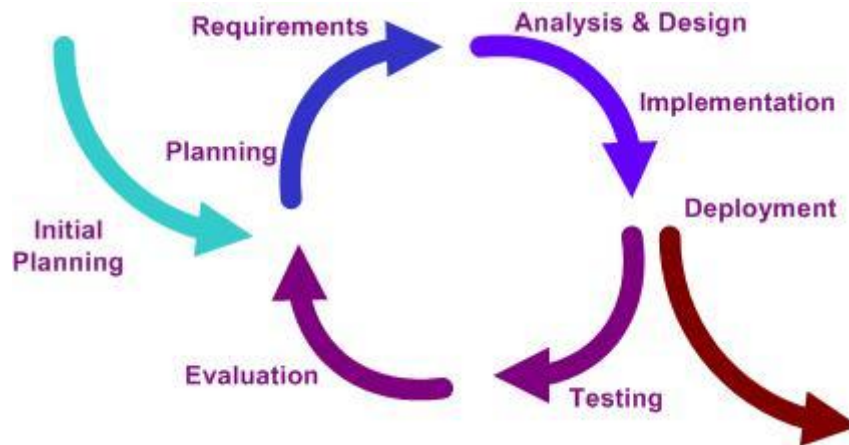


Figure 3.1 Iterative and Incremental Development Method

3.1.1 The Justification of Iterative and Incremental Development Methodology

There are many reasons why we use Iterative and Incremental Development Method for this project. Iterative and Incremental Development Method is very efficient to deal with a project that change often and response need to be quick. It also can deal with a project that the budget didn't cover the costs of the project because change control procedures gobbled up additional funds (Steigjer, 2008). When using Iterative and Incremental Development Method, the development cost of change is more efficient than conventional software development process.

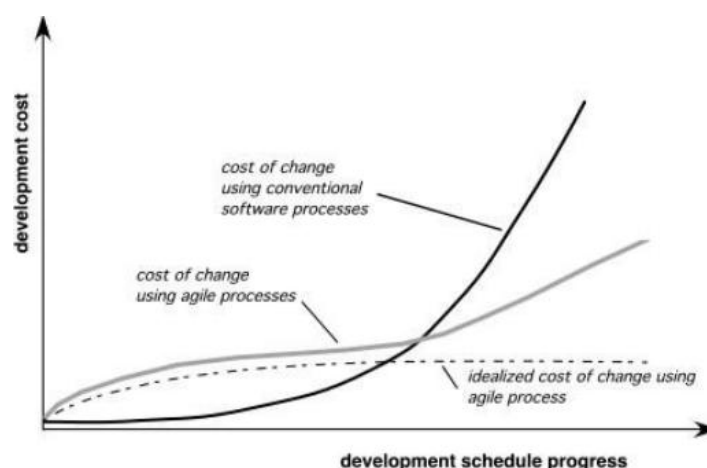


Figure 3.2 Comparison Iterative and Incremental Development Method

Source: Pressman, 2010

3.2 Iterative and Incremental Development Method

The model or approach here are used in developing this project

3.2.1 Planning Stage

In this phase, the most important business function or the goal is identified. Through the process of gathering requirement, it is found out that the system will be develop using NetBeans IDE 6.9.1 technology and interact with My SQL Database Server. The following figure 3.2 is the system's context diagram which shows flow of data between the users and the system.

The scopes of project are specified and a schedule has been design as guidance throughout the system development process to make sure the delivery of it on timely mannered. This has been done with the help of Gantt chart produced through Microsoft Project.

3.2.2 System Requirement

One of the most important tasks in the development of software using the Iterative and Incremental Development Method is gathering and defining the requirements for the project. In order to arrange requirement to develop management system, a research and analysis on existing system has been done. Information gathered during the research gives clearer overview on the flow of the process while answering the question on how to achieve the main goal of the system which is to reengineering the current system with the addition of GSM Modem for notification.

Then from the data, I need to analysis it and choose the all of the requirement that I need to include in the software. I need to understand the flow of management system.

The outcomes from requirement phase are:

- A vision document as general vision of the core project's
- Requirements, key features and main constraints.

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- A project plan, showing phases, iterations and major milestones.
- An initial use-case model

3.2.3 Hardware Requirements

The hardware requirement here are used in developing this project

I. Workstation

In this system development, a workstation is the most important hardware.

Table below explain the minimum requirements

Table 3.1 Workstation requirements

Hardware	Minimum Specification
Central Processing Unit (CPU)	Intel Pentium IV or higher
Memory Cache	3MB
Random Access Memory (RAM)	1GB
Hard Disk Space	80GB
Network Transmission Speed	100Mbps

II. GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages (NowSMS | SMS Gateway, SMS Server Software, MMS Gateway & MMSC).

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities

3.2.4 Software Requirements

The development tool specified here is software to use in developing this project.

a. NetBeans IDE 6.9.1

NetBeans refers to both a platform framework for Java desktop applications, and an integrated development environment (IDE) for developing with Java, JavaScript, PHP, Python, Groovy, C, C++, Scala, Clojure, and others. The NetBeans IDE is written in Java and can run anywhere a compatible JVM is installed, including Windows, Mac OS, Linux, and Solaris.

b. Java Runtime Environment

The Java Runtime Environment (JRE) provides the libraries, the Java Virtual Machine, and other components to run applets and applications written in the Java programming language. A Java virtual machine (JVM) is a virtual machine that can execute Java bytecode. It is the code execution component of the Java software platform.

c. My SQL Database System

MySQL nowadays widely use as database platform. There are many reasons why we choose MySQL. This is some of the reason:

- Speed.
MySQL is fast compared to others.
- Ease of use.
MySQL is a high-performance but relatively simple database system and is much less complex to set up and administer than larger systems.
- Query language support

It also understands SQL (Structured Query Language), the standard language of choice for all modern database systems.

- **Capability.**

The MySQL server is multi-threaded; so many clients can connect to it at the same time. Each client can use multiple databases simultaneously.

- **Connectivity and security**

Besides that, it is fully networked, and databases can be accessed from anywhere on the Internet, so user can share your data with anyone, anywhere. But MySQL has access control so that one person who shouldn't see another's data cannot. To provide additional security, MySQL supports encrypted connections using the Secure Sockets Layer (SSL) protocol. This will provide to the administrator of this system later.

- **Availability and cost.**

MySQL is an Open Source project with dual licensing. First, it is available under the terms of the GNU General Public License (GPL). This means that MySQL is available without cost for most in-house uses. Second, for organizations that prefer or require formal arrangements or that do not want to be bound by the conditions of the GPL, commercial licenses are available.

3.3 Analysis and Design

In this system analysis phase, I need to define the requirement from previous phase. Process analysis can be by observation, interview and many more. For Clinic Management System with Notification Using GSM Modem, I decided to observe and analysis of the similar system. By this I can get most recent and updated problem in existing system. So I can avoid the same problem.

The important thing for make sure my project running smoothly is study for the current process because the system must follow the requirements .The problems and

constraints also defined by me in this phase. The new system must overcome a problem in current system.

3.3.1 Flowchart

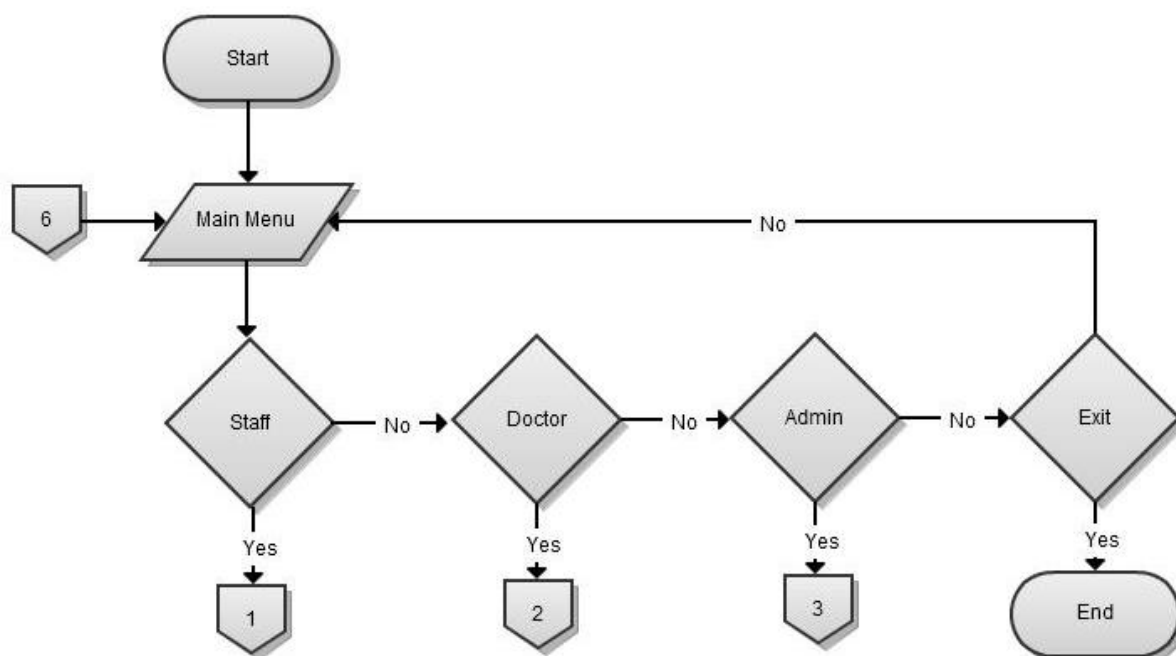


Figure 3.3 Flowchart in the Main Menu

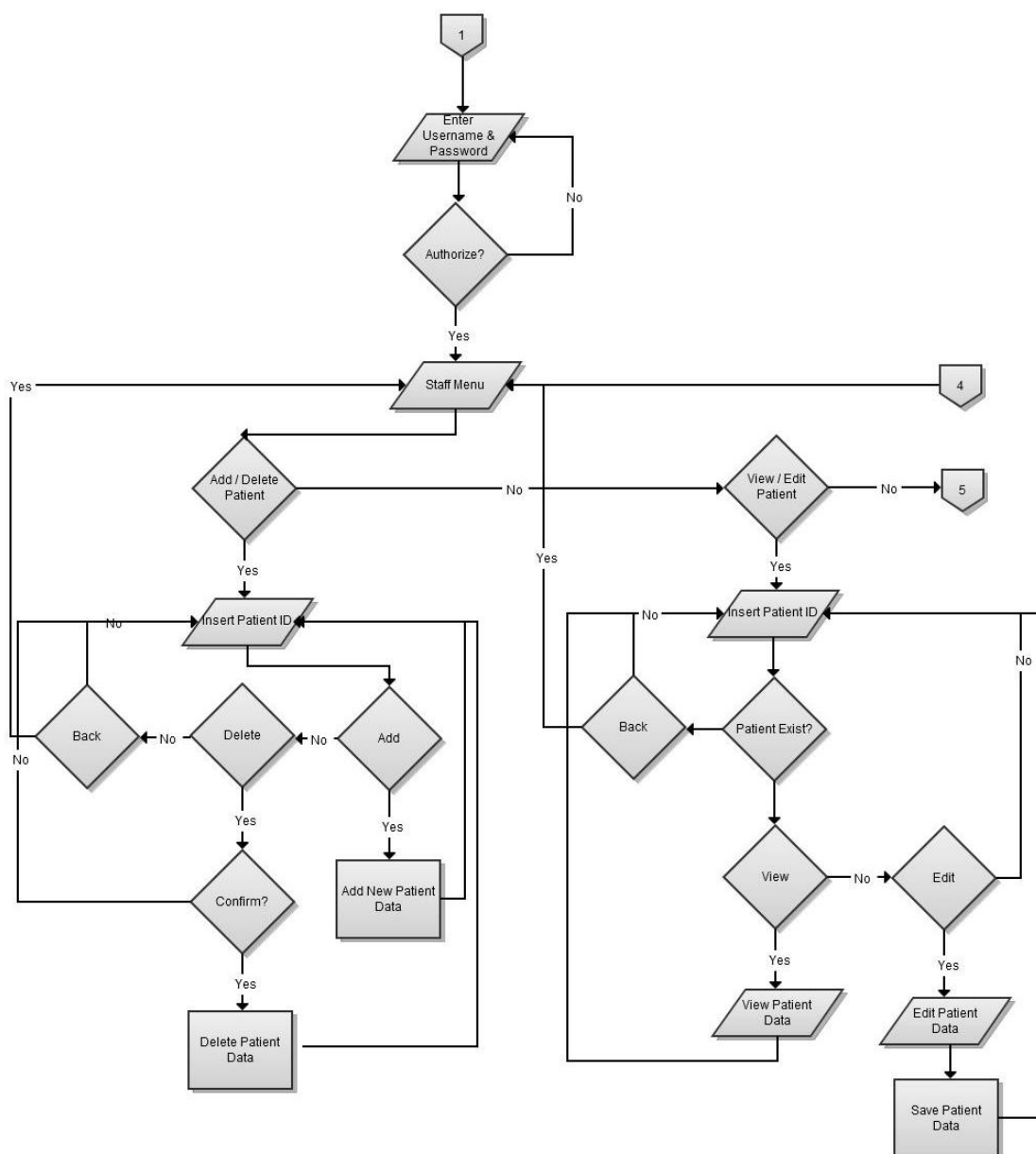


Figure 3.4 Flowchart in the Staff Menu

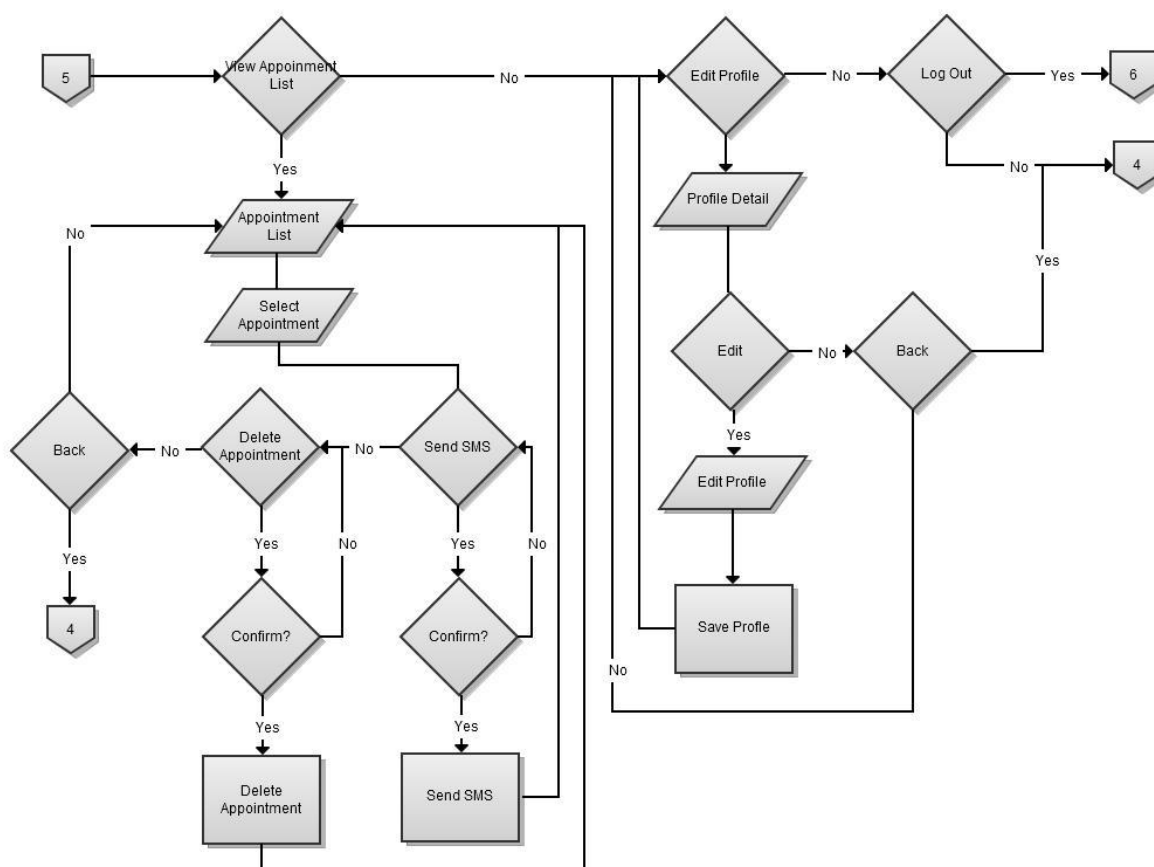


Figure 3.5 Flowchart in the Staff Menu (Continue)

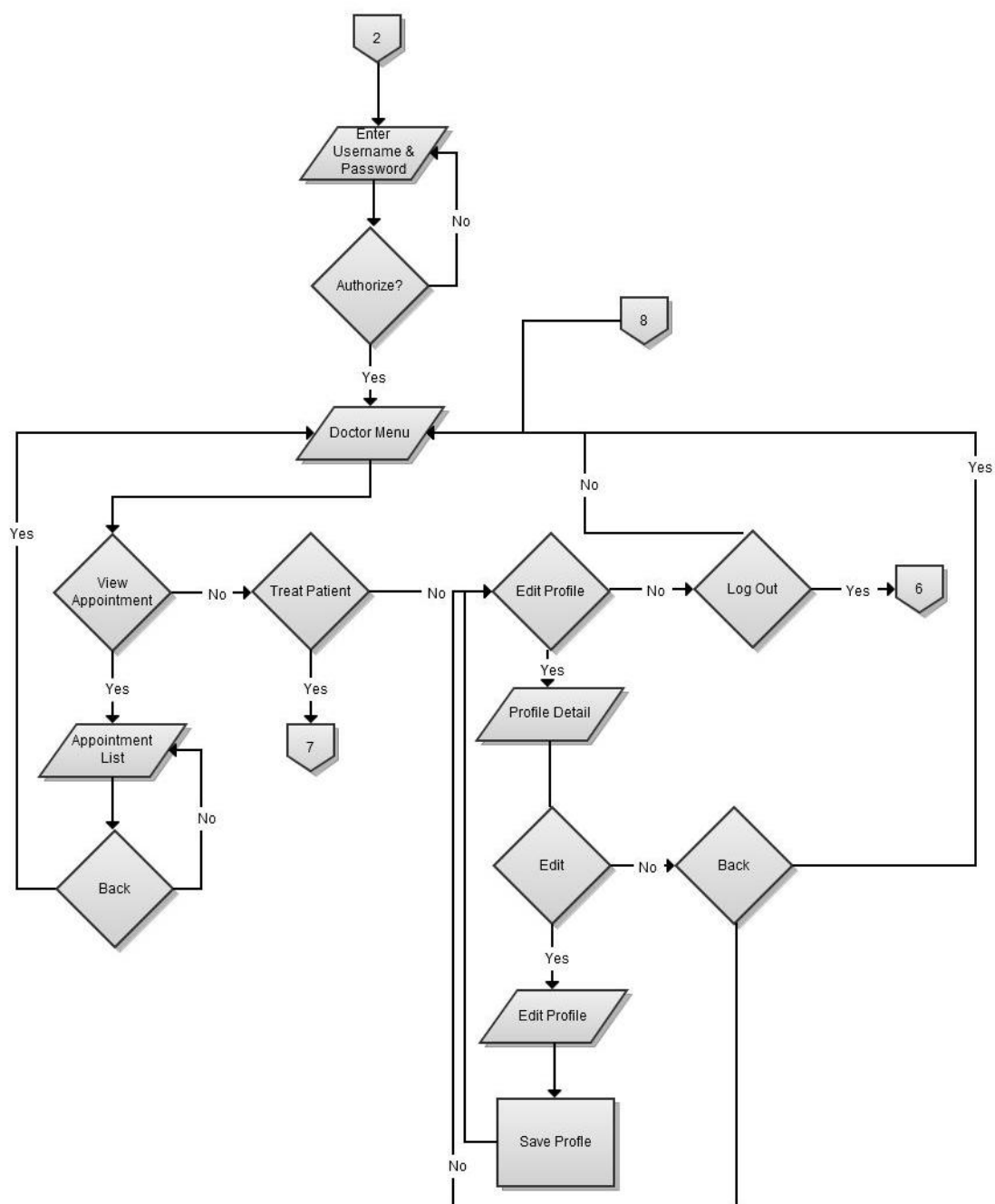


Figure 3.6 Flowchart in the Doctor Menu

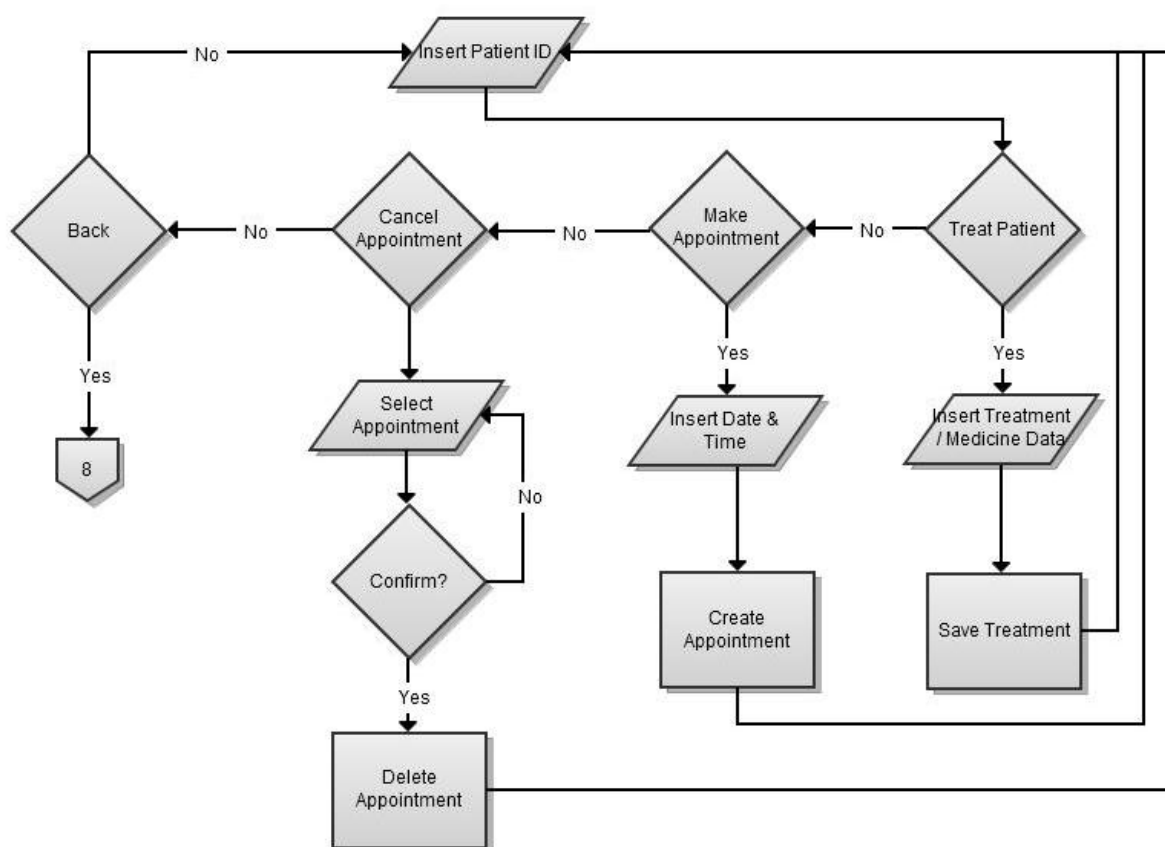


Figure 3.7 Flowchart in the Doctor Menu (Continue)