CHAPTER 3: RESEARCH METHODOLOGY
3.1 Introduction

This chapter outlines the research design for this exploratory study and the manner in which the research was conducted. This chapter will cover the research sample, research method, research instrument, method of distribution and data analysis techniques. In this chapter also cover the system development methodology and the adoption of genetic algorithm in the timetable engine development.

3.2 The Research Sample

The targeted audience of this research is any Universities and students in Malaysia who is using the manual or automated timetable system. The targeted subjects are likely to have knowledge or experience in doing or using the timetable system. Survey instrument packages consisting of a cover letter, a questionnaire and a stamped reply envelope were mailed to the 2 universities and 10 respondents from each university.

3.3 Research Method

It was decided that the research method to be utilised would be mail surveys (distribution of questionnaires), e-mail surveys (distribution of questionnaires) and personal interviews. Data will be collected from targeted samples through interview or questionnaire.

Mail survey is where the questionnaire is distributed to each individual in the sample by mail, with a request that it be completed and then returned by a given date. Besides that, the researcher will also conduct face-to-face interviews with the selected respondent.

3.4 Research Instrument

The survey instrument used two sets of questionnaires. The first set of questionnaire consists of 4 sections designed for the student who is using the timetable in their
The first set of questionnaire is developed for students and is divided into four main sections. The first section requested general information about the respondent. The objective is to know the background of the respondent. The second section is about the respondents’ perception of using the timetable system for their registration subject of every semester. The objective of this section is to know how user friendly of the system. The third section is about the functionality of the timetable system and the objective is to get information on how the system is function. The final section is for the respondents to give opinion or suggestion on their timetable. The objective of this section is to get feedback from the respondents using the system; this is an important section which will be included in development of Timetable Management System.

The second set of questionnaire is developed for the administrator or the person in charge of the timetable of their university and is divided into six main sections. The first section requested general information about the respondent. The objective is to know the background of the respondent. The second section is about the system itself. The objective is to get information on what programming languages were used and the interface of the system. The third section enquired about the process of doing the timetable. The objective is to get information on how the process is implemented. The
fourth is the functionality of the system. The objective is to know how the timetable caters for the clashing of the subjects and how friendly the system is. The fifth section enquired about the procedure in handling the clashing of timetable. The objective is to get information on how every of universities handle the situation when they have the problem. The final section is regarding the respondent’s perception on how to improve or suggestion for their timetable system. The objective is to get feedback from the respondents using the system. (Refer to Appendix G for the questionnaire).

3.5 Questionnaire Distribution and Return

Three methods of distribution were used for the questionnaire:

- Fax
- E-mail
- By hand (Personal)

All students with e-mail addresses received the questionnaires via this medium. Alternatively, questionnaires were faxed or posted. Most of the response received are via fax and email.

3.6 Data Analysis Techniques

The results from the questionnaires were initially entered into a Microsoft Excel spreadsheet to allow for the easy generation of graphs and tables. Other software such as SPSS was not used since all the data collected were descriptive data.

3.7 System Development Methodology

Rapid Application Development (RAD) will be used primarily in this project as the system development methodology. This is because RAD provides the abilities to
quickly develop an application and to make modifications when needed without leading to an iterative development environment. Solutions can be provided quickly that meets the major objectives of this project and gets things started. Later on, modifications and improvements can successively be added as features and functionality. This means a prototype can be produced and running in a short period of time, thus meeting the limited time constraints provided for this project.

RAD emerged in the 1990s and attempts to address both weaknesses of the structured development methodologies: long development times and the difficulty in understanding a system from a paper-based description Dennis et al (2000). Martin (1991) had defined RAD as:

“a development life cycle designed to give much faster development and higher quality results than the traditional life cycle”.

RAD comprises of software development stages that mimic the traditional waterfall model. It compresses the steps in the waterfall model into fewer steps that form a cycle of iteration in development instead of the former linear and structured approach. RAD also provides a development environment that puts more effort on analysis and design stages. There are three RAD categories, which include Phased Development Methodology, Prototyping Methodology and Throwaway Prototyping Methodology. For this project, prototyping methodology will be used because this methodology emphasizes on smaller modules and the use of evolutionary prototypes with critical time limits for software development.

Prototyping methodology performs the analysis, design, and implementation phases concurrently, and all three phases are performed repeatedly in a cycle until the system is completed Dennis et al (2000). The major benefit of this methodology is changes can be made to the prototype and that is how the prototype is evolved into a working system.
Figure 3.1 below illustrates the prototyping methodology that is used in this project. It consists of steps that exhibit highly iterative behaviour in order to allow maximum flexibility in making further changes or refinements of system requirements whenever necessary.

![Figure 3.1: Prototyping Methodology (Source: Dennis et al 2000)](image)

With this prototyping approach, the basics of analysis and design are performed, and work immediately begins on a system prototype, which provides a minimal amount of features. The first prototype is the user interface of the web portal. Following that, the project sponsors provide comments, which are then used to re-analyze, redesign, and re-implement a second prototype that provides a few more features. This process continues in a cycle until the analysts, users, and sponsors agree that the prototype provides enough functionality to be installed and used in the organization. After the prototype (now called “system”) is installed, refinement occurs until it is accepted as the new system.

### 3.8 Adoption of Genetic Algorithm in the Timetable Engine Development

#### 3.8.1 Web Server

A web server is a software application that uses the Hypertext Transfer Protocol and usually runs on a computer that is connected to the Internet. There are many web server software applications, including public domain software from Apache, and commercial
applications from Microsoft, Oracle and others. A web server may host or provide access to content and responds to request received from Web browsers.

### 3.8.2 Apache Web Server

The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows NT. The goal of the Apache Server is to provide a secure, efficient and extensible server that provides HTTP services in synchronization with the current HTTP standards. Apache Web Server has been chosen for this project because it is a well-known, free web server, which exists to provide a robust and commercial-grade reference implementation of the HTTP protocol.

### 3.9 Conclusion

There is a long process to do the timetable system. A number of factors influence the preparation of the timetable. These are the results of the researchers perception on using or doing the timetable system, the functionality of the system, handling the clash of the subjects, classes and times. The RAD is used as a system development methodology because RAD provides the abilities to quickly develop an application and to make modifications when needed without leading to an iterative development environment. By having the timetable system, there are benefits to all level of user such as students, lecturers and administrators.