EXPERT SYSTEM FOR SELECTION OF ACADEMIC PROGRAMME (ESSAP)

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EXPERT SYSTEM FOR SELECTION OF ACADEMIC PROGRAMME (ESSAP)

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LIST OF TABLE

ABSTRAK

Sistem pakar adalah salah satu applikasi penting yang berasaskan cabang-cabang Kepintaran Buatan. Pada permulaan pembangunan sistem pakar dalam pendidikan, bidang yang dipilih adalah applikasi untuk pemilihan program akademik. ESSAP merupakan sebuah sistem berasaskan web yang berbeza daripada program komputer konvensional yang mana ia mampu menyelesaikan masalah dengan meniru.mimik proses penaakulan manusia, bergantung kepada logik, keyakinan, "rules of thumbs", pandangan dan pengalaman. Sistem ini menyediakan program akademik bagi Sekolah Sains Maklumat & Kejuruteraan (SISE) di Kolej Universiti Teknologi & Pengurusan Malaysia (KUTPM). Bahasa-bahasa pengaturcaraan web yang digunakan adalah PHP, Javascript dan CSS. Pangkalan pengetahuan adalah menggunakan pelayan pangkalan data MySQL. Sistem ESSAP menyediakan cadangan dan nasihat bagi program akademik kepada para pelajar berdasarkan minat dan juga kelayakan akademik mereka. Daripada minat, sistem akan mengenalpasti jenis personaliti pelajar mengikut theori Holland J.

ABSTRACT

Expert system is one of the important application oriented branches of Artificial Intelligence. At the beginning of development expert systems in education, the area selected is application to selection of academic programme. ESSAP is a web-based system that are different from conventional computer programs as they can solve problems by mimicking human reasoning processes, relying on logic, belief, rules of thumb, opinion and experience. This system provides academic programme for School of Information Sciences & Engineering (SISE) at University College of Technology & Management Malaysia (KUTPM). The web programming languages of system implementation are PHP, JavaScript, and CSS. The knowledge base was created using MySQL database server. ESSAP system provides advisory and recommendation for academic programme for the students based on their qualification and interests. The system would determine type of student's personalities from their interest, using Holland J. Theory.

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TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Overview

Many college students do not know what they wish to study in. Effective academic program advising is important because students who are clear of their needs and the institution's offering (academic programme) and resources are (a) more likely to enrol, (b) less likely to take classes that do not contribute toward graduation, (c) more likely to enjoy college, and (d) more likely to graduate. Academic advising is labour intensive, because it generally requires at least one hour of counselling session for each student and often several sessions are required. Academic advising is important because it educates students to select academic programmes and identifies appropriate majoring.

According to Oliveras (2002) advisory systems are in the fields of expert systems and artificial intelligence (human cognitive science). Expert systems can be developed for two purposes: either to replace a human decision-maker or to support a human decision-maker. In the former case, the expert system can be regarded as a part which is liaising within a complex control system and hence being a part of the control system. In the latter case, an expert system is designed to obtain advice with the aim to support and improve decision-making effectiveness for human users. It is in this case that an expert system is regarded as an advisory system.

Artificial Intelligence (AI) is a field of study in computer science that pursues the goal of making a computer reason in manner similar to humans. In the simplest sense, AI is the study of developing computer programs that exhibit human-like intelligence. From the practical standpoint, the goal of AI is to make computers more useful for humans. This can be achieved by producing computer programs that assist human in decision making, intelligent information search, or simply by making computers easier to use with natural language interfaces (Durkin, 1998).

According to Giarratano & Riley (2005), expert system is one of the areas of AI and it was a very successful approximate solution to the classic AI problem of programming intelligence. Expert systems function very well in their restricted domains and many successful applications of expert systems today are in business, medicine, education, science and engineering. In this study, expert systems will be used for selection of academic programmes at School of Information Sciences and Engineering (SISE) in Kolej Universiti Teknologi & Pengurusan Malaysia (KUTPM), Shah Alam.

1.2 Problem Statement

SISE students choose their suitable academic programme based on their qualification and interest. Problems arose when they choose the wrong and unsuitable academic programme for themselves. Some students choose academic programme based on their friends influence.

Parents also play a part in determining student's choice of study. Some parents tend to pressure their children to take up certain choice of courses. For example, currently the Biotechnology and Medical fields are flourishing and a lot of parents prefer to have

their children involved in these fields, thus disregarding their children's interest in other field of studies.

Another factor that influences student's choice of academic programme is their inability to make decision based on their interest and capability. These students tend to enrol in a course that they think will help them open up doors to employment in the future. They might not perform well in courses that they have no interest at or are not good at. Hence, their gradual declining grades will not help them much in getting a job related to their studies.

There are a lot of expert system applications in academic advisory however these applications lack the use of human personality types to determine the best academic programme for the student. These systems still have limited functions such as lack of explanation to the solution of the problem. Most of these applications are using students academic in consulting the students and normally focus on the selected courses.

1.3 Objectives

The objective of the study is to develop a web based expert system for academic advisory. The system can be used to assist students in making decisions in choosing the right and suitable academic programmes that match with their qualification and interest (based on Holland J. Theory).

1.4 Scope of the Project

Expert System for Selection of Academic Programme (ESSAP) was developed using PHP: Hypertext Preprocessor for web development and is embedded into HTML, while MySQL is used as the Knowledge-Base (database server). The scope of this system is into two (2) categories which are scope of user and scope of system.

1.4.1 Scope of User

a) Potential Student

Students of Diploma from KUTPM or other colleges, Matriculation and STPM (Sijil Tinggi Pelajaran Malaysia) that wanted to do diploma or bachelor degree in KUTPM especially in the field of technology, computer engineering and computer study.

b) KUTPM Lecturers or Counsellors

Lecturers and counsellors can use ESSAP as a tool to help the student in academic consultation or give them advices in choosing their majors.

1.4.2 Scope of System

This ESSAP focuses on two (2) main academic programmes offered by SISE which are eight (8) Diploma programme and seven (7) Bachelor programmes.

a) Diploma Programme

i) Diploma in Information Technology (DIT)

ii) Diploma in Electronic and Engineering (DEE)

iii) Diploma in Multimedia (DMM)

iv) Diploma in Computer Engineering (DCE)

v) Diploma in Business Computing (DBC)

vi) Diploma in Industrial Computing (DIDC)

vii) Diploma in Automation Engineering (DAE)

viii) Diploma in Mechatronic Engineering (DME)

b) Bachelor Degree Programme (Honours)

i) Bachelor in Information and Communication Technology (BICT)

ii) Bachelor in Computer Science (BCS)

iii) Bachelor in Computer Engineering (BCE)

iv) Bachelor in Business Computing (BBC)

v) Bachelor in Game Art & Animation (BGA)

vi) Bachelor in Instructional Multimedia (BISM)

vii) Bachelor in Computer Systems Auditing (BCSA)

The sources of knowledge are knowledge that acquired from books, magazines and knowledgeable people from the education environment. ESSAP used the multiple expertise which multiple experts can be made available to work simultaneously and continuously on a problem at any time. The level of expertise combined from several experts may exceed that of a single human expert. This project focuses on academic programme for the SISE and it will be designed as an expert system tool to determine the suitable academic programme for students.

This system applied the Holland Theory to help in solving the student's problems in academic programme through the use of expert system concept. ESSAP explained in

detail the reasoning that led to a conclusion. A human may be too tired, unwilling, or unable to do this all the time. This increases the confidence that the correct decision is made. This system also applied the methods of reasoning under uncertainty using probability theory (certainty factor). According to Giarratano and Riley (2005), the strength of an expert system is its ability to handle uncertainty just like a real person.

1.5 Significance of the Project

Expert System for Selection of Academic Programme (ESSAP) is a web-based application that can assist students to choosing the suitable academic programme offered by School of Information Sciences and Engineering (SISE) in KUTPM.

This ESSAP system can efficiently reduce the time advisors or lecturers spend with students by having the computers do the work of assembling base information, and in return allowing advisors or lecturers to counsel students later in greater depth.

The benefits realizable from implementation of the ESSAP system include: (a) improved enrolment marketing by having full-time recruiter or advisor on the Internet in 24 hours a day, every day, (b) increased retention of students by enhancing the likelihood that students select an appropriate academic programme or major, and (c) consolidation of KUTPM knowledge an academic advising.

Besides that, ESSAP has additional pieces of information such as, the departmental details of an academic programme or major, the catalogue entries for the academic programme or major, registration information and so forth. It also has explanation facility that can explain its reasoning so that its reasoning can be checked by the user.

1.6 Organization of Report

In this report, the fundamental about artificial intelligence, expert system, Holland J. theory and expert system applications in previous work are described in Chapter 2. In Chapter 3, a brief explanation of current system in KUTPM highlighted. The conventional methods to determine student's personality that guide them to career paths are described.

Chapter 4 discusses the methodology in development of Expert System for Selection of Academic Programme (ESSAP). It including the chosen of experts, knowledge design such as production rules, semantic network and other related works. In Chapter 5, the system implementation has been discussed including system analysis, system design, and system architecture. In Chapter 6, the results and findings were analyzed. Finally, Chapter 7 stated the limitation of ESSAP system and further recommendation of this study.

CHAPTER 2
LITERATURE REVIEW

This chapter starts with an introduction to artificial intelligence. Section 2.1 describes the introduction of Artificial Intelligence (AI). All about Expert System (ES) is discussed in Section 2.2. Section 2.3 describes the web-based ES followed by Holland J. Theory in Section 2.4, and several previous research works is briefly discussed in Section 2.5.

2.1 Introduction to Artificial Intelligence

Artificial Intelligence (AI) may be defined as the branch of computer science that is concerned with the automation of intelligent behaviour (Luger, 2002). Artificial Intelligence has several areas of interest, such as robotics, vision, natural language understanding and semantic modelling, speech artificial neural systems and parallel processing, automated reasoning and theorem proving, expert system, game playing and human performance modelling. One of the major roots of the expert systems is in cognitive science: the way human's process information (the way they think and solve problems).

2.2 Introduction to Expert System

Expert systems were developed as research tools in the 1960s as a special type of AI to successfully deal with complex problems in a narrow domain such as medical disease diagnosis. Expert systems have greatly increased in popularity since their commercial introduction in the early 1980s. Today, expert systems are used in

business, science, engineering, manufacturing, and many others fields in which there exists a well-defined problem domain (Giarratano & Riley (2005).

2.2.1 Definitions of Expert Systems

An expert system is a computer program that represents and reasons with knowledge of specialist subject with a view to solving problems or giving advice (Jackson, 1998). Expert systems are suitable for solving the ill-structured (or not entirely defined) type problems, which are usually difficult or impossible to solve by conventional methods as example procedural programming (Noran, 2000).

According to acquire.com (2005), an expert system is a computer program that provides expert advice (decisions, recommendations or solutions) as if a real person had been consulted. These systems capture and deliver knowledge that is not easily represented using traditional computing approaches. They can retain the knowledge and experience of anyone in an organization (including people who are retiring), pre-process information to increase an expert's productivity, or allow someone with less training to perform functions at a higher level. Expert systems can be used to gain access to expertise immediately, around the clock, by many people at the same time.

In addition to the nature of the task that expert systems are suited for, the actual structure or architecture of expert systems differs from traditional software. An expert system is composed of two independent parts which are an inference engine and a knowledge base. The inference engine is the control structure of the program that implements the knowledge represented in the knowledge base. The

knowledge base is where the real power of the expert system resides: the coded pool of rules, insights and knowledge that the person doing that task brings to bear on it. This two part structure results in two important features of expert systems:

a) It allows the system to be modified, updated and expanded more readily than traditional programs making it easier to keep the system current with changes in the field, or with changes in users' requirements, and

b) It allows the system to provide an explanation of the reasoning behind it's conclusions which is necessary to provide the credibility and confidence that people require before routinely accepting it's advice.

Figure 2.1 below the concept of a knowledge-based expert system (Giarratano & Riley, 2005). The expert system receives facts from the user and provides expertise in return. The main components of the expert system (invisible from the outside) are the knowledge base and the inference engine. The inference engine may infer conclusions (solutions) from the knowledge base, based on the facts supplied by the user.

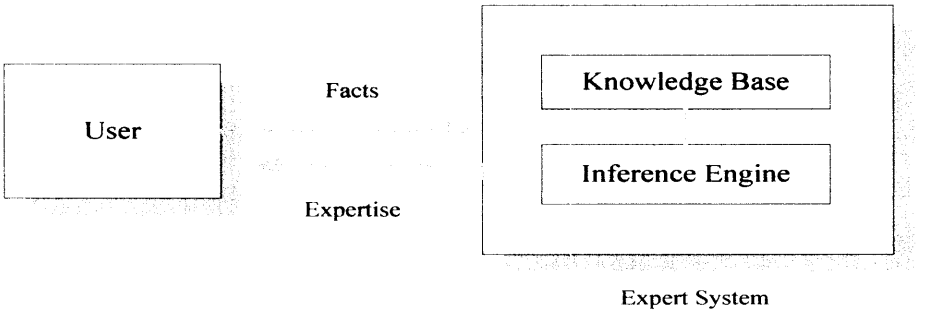


Figure 2.1: Basic Function of an Expert System

Engelmore & Feigenbaum (1993), stated that an expert system consists primarily of a knowledge base and an inference engine, and a couple of other features

worth mentioning: reasoning with uncertainty, and explanation of the line of reasoning. To deal with uncertain knowledge, a rule may have associated with it as a confidence factor or a weight. The set of methods for using uncertain knowledge in combination with uncertain data in the reasoning process is called reasoning with uncertainty. Because an expert system uses uncertain or heuristic knowledge (as we humans do) its credibility is often in question (as is the case with humans). When an answer to a problem is questionable, they tend to want to know the rationale. If the rationale seems plausible, they tend to believe the answer. So it is with expert systems. Most expert systems have the ability to answer questions of the form: "Why is the answer X?" Explanations can be generated by tracing the line of reasoning used by the inference engine.

2.2.2 Expert Systems Applications

According to acquire.com (2005), in operation, expert systems can fill a number of functions such as in Table 2.1 below:

Table 2.1: The Functions of Expert Systems

as a librarian	Helping people find, organize and interpret information required to carry out a task;
as an advisor	**Embodying and sharing specialized expertise needed by others;**
as an instructor	Helping others to learn a task;
as an assistant	Taking care of routine tasks to free up time for more interesting and demanding aspects of the work.

Durkin (1998) has categorized applications of expert systems by problem areas and problem-solving paradigms. The examples of the problem areas are shown in Table 2.2 and Table 2.3 shows the eleven (11) examples of problem-solving paradigms.

Table 2.2: Major Application Areas of Expert Systems			
Agriculture	Business	Chemistry	Communications
Computer Systems	**Education**	Electronics	Engineering
Environment	Geology	Image Processing	Information Management
Law	Manufacturing	Mathematics	Medicine
Meteorology	Military	Mining	Power Systems
Science	Space Technology	Transportation	

Table 2.3: Types of Problem Solved by Expert Systems	
Problem-Solving Paradigm	**Description**
Control	Governing system behaviour to meet specifications
Design	Configuring objects under constraint
Diagnosis	Inferring system malfunctions from observables
Instruction	Diagnosing, debugging, and repairing student behaviour
Interpretation	Inferring situation description from data
Monitoring	Comparing observations to expectations
Planning	Designing actions
Prediction	Inferring likely consequences of given situations
Prescription	Recommending solution to system malfunction
Selection	**Identifying best choice from a list of possibilities**
Simulation	Modelling the interaction between systems components

Based on Table 2.1 this project functions ***as an advisor*** and based on Table 2.2, the focus area is **Education**. The problem-solving paradigm that has been used for this project is **Selection** as shown in Table 2.3.

Selection systems identify the best choice from a list of possibilities. It work from problem specifications defined by the user and attempt to find a solution that most closely matches these applications. These systems usually employ an inexact reasoning technique or a matching evaluation function when forming their selections (Durkin (1998).

2.2.3 Expert System versus Computer-based Advising Methods

According to expertise2go.com (2005), expert systems are often more effective than other computer-based advising methods because they are:

a) *Goal oriented*

Expert systems deliver answers to very specific questions that represent the goals of the interview: it is not focused on abstract or theoretical information.

b) *Efficient*

Requests for new information are based on user earlier responses -- user do not waste time providing irrelevant input.

c) *Adaptive*

If user does not know the answers to all of the questions, alternate paths through the knowledge base might allow deduction of sufficient facts to provide useful advice.

d) *Able to deal with uncertainty*

Expert systems can process user uncertain responses and, by combining several pieces of uncertain information, may still be able to make strong recommendations.

e) *Able to explain their information requests and suggestions*

Justification for each question that user asked along with a detailed explanation of the reasoning that led to any recommendations is available as

user work. User gets to see how the expert system used rules from its knowledge base to convert their input into advice.

2.3 Web-based Expert Systems

According to expertise2go.com (2005), web-based expert systems deliver advice online to support product selection and other decisions.

In recent study of an intelligent dialogue for online rule based expert systems (Mertens, Rosu & Erdani, 2004), it describes a concept for creating free configurable, intelligent behaving web dialogues for rule based expert systems. Free configurable is meant to indicate, that the dialogue module developed with this concept is domain independent and being configurable without needing means of programming. Intelligence means that it in spite of this independency, it can behave in accordance to expert system's knowledge and the received user inputs. As dialogue and reasoning engine only communicate by exchanging facts, it can be used with any expert shell or reasoning tool that can be adapted to provide simple knowledge interchange functions. The dialogue itself can be realized in any language that supports server-sided dynamic creation of HTML pages.

This concept has been successfully implemented within a knowledge based online student consultation system, realized with Active Server Pages, a mySQL database and a self-written reasoning engine. Being part of this system, the interview dialogue has proved its power to be quickly configurable to provide any needed dialogue elements. The actual quality of the dialogue naturally depends on the amount and

quality of the knowledge – the interview can only be as intelligent as the facts and rules that control it.

2.4 Holland J. Theory

Holland's typological theory (Holland, 1997) specifies a theoretical connection between personality and environment that makes it possible to use the same RIASEC classification system for both persons and fields of study or occupations. Many inventories and career assessment tools use the typology to enable individuals to categorize their interests and personal characteristics in terms of combinations of the six types: Realistic, Investigative, Artistic, Social, Enterprising, or Conventional. These six types are briefly defined in Table 2.4 below.

Table 2.4: The Summary of Holland Types

Type	Examples of Occupations/Fields	Typical Traits
Realistic	computer engineering, forestry, surveyor, poultry science, and farmer	mechanical and athletic abilities, likes to work outdoors and with tools and machines, and might be described as conforming, frank, hard-headed, honest, humble, materialistic, natural, normal, persistent, practical, shy, and thrifty
Investigative	biology, chemist, physicist, geologist, anthropologist, laboratory assistant, and medical technician	math and science abilities, and likes to work alone and to solve problems; might be described as analytical, complex, critical, curious, independent, intellectual, introverted, pessimistic, precise, and rational
Artistic	composer, musician, stage director, dancer, interior decorator, actor, and writer	artistic skills, enjoys creating original work, and has a good imagination; may be described as complicated, disorderly, emotional, idealistic, imaginative, impulsive, independent, introspective, nonconforming, and original
Social	teacher, speech therapist, religious worker, counsellor, clinical psychologist, and nurse	likes to help, teach, and counsel people, and may be described as cooperative, friendly, generous, helpful, idealistic, kind, responsible, sympathetic, tactful, understanding, and warm
Enterprising	buyer, sports promoter, television producer, business executive,	leadership and public speaking abilities, is interested in money and politics, and likes to influence people; described as acquisitive,

	salesperson, travel agent, supervisor, and manager	agreeable, ambitious, attention getting, domineering, energetic, extroverted, impulsive, optimistic, self-confident, and sociable
Conventional	bookkeeper, financial analyst, banker, tax expert, and medical laboratory assistant	clerical and math abilities, likes to work indoors and to organize things; described as conforming, careful, efficient, obedient, orderly, persistent, practical, thrifty, and unimaginative

According to RIASEC theory, if a person and an environment have the same or similar codes, for example, Investigative person in an Investigative environment, then the person will likely be satisfied and persist in that environment (Holland, 1997). This satisfaction will result from individuals being able to express their personality in an environment that is supportive and includes other persons who have the same or similar personality traits. It should be noted that neither people nor environments are exclusively one type but rather combinations of all six types. Their dominant type is an approximation of an ideal, modal type.

The profile of the six types can be described in terms of the degree of differentiation (flat or uneven profile), consistency (level of similarity of interests or characteristics on the RIASEC hexagon for the first two letters of a three-letter Holland code), or identity (stability characteristics of the type). The John Holland's hexagon is shown in Figure 2.2 below (FSU Career Center, 2001).

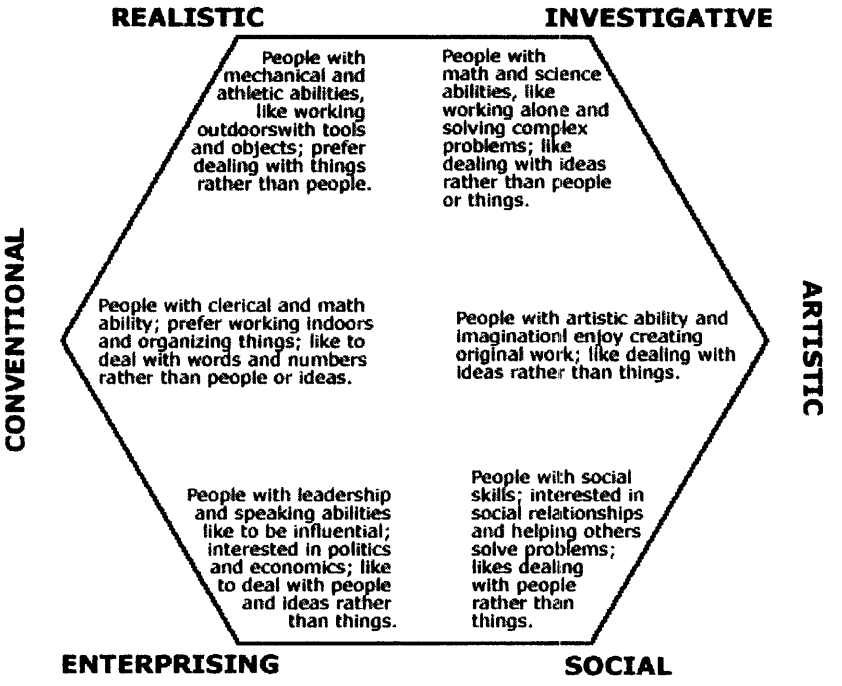


Figure 2.2: John Holland's Hexagon of Personality Types

Each of these factors moderates predictions about the behaviour related to the congruence level between a person and an environment. Persons and environments are typically described proportionally in terms of the most highly weighted three of the six Holland types, for example, Lawyer, ESI; Accounting, CEI (Reardon, 2004).

If we choose E then S and then I, we would most resemble the Enterprising type, somewhat less resemble the Social type, and resemble the Investigative type even less. The types that are not in our code are the types we resemble least of all. Most people, and most jobs, are some combination of two or three of the Holland interest areas (MU Career Center, 2005).

The research of Reardon (2004) in holland's theory and implications for academic advising and career counselling stated that academic advising is more narrowly

focused on college and university students and life/career decision making related to curricular and co-curricular activities. Career counselling is a broader, more comprehensive term not limited to educational settings. However, both functions involve a process of individual or small group interventions to help persons use information to make educational and occupational decisions that are consistent with their personal goals, values, interests, and skills. He believes the theory that informs career counselling, such as John Holland's RIASEC theory, can also inform academic advising. The article examined Holland's RIASEC person-environment interaction theory as a practical basis for academic advising and career counselling services in colleges and universities. The major assumptions of Holland theory were supported and new information related to the development of student's interests and abilities and academic departmental socialization in relation to Holland's RIASEC types was provided. The report also concluded with a description of possible academic advising and career counselling interventions along with other applications that are base on Holland's theory. A theory-based model for academic advising and counselling was presented.

2.5 Previous Research Works Related to Advising System

In recent years, several automated advising systems have been developed. These systems have been developed for both undergraduate and post-graduate education and have wide varieties of functionality. Below are several applications in advising system.

Student Advisement by Grupe (2002), is a web- based expert system for selection of an academic major for high school students and college freshmen who are seeking a

potential major. Academic advisement is unevenly provided in many high schools and colleges and it appears to be an appropriate domain for an expert system. The on-demand consultation gathers information about a student's grades, interests, test scores, interest and aptitudes. It assesses student qualifications for a variety of majors.

The author developed an expert system that, after an assessment of a student's capabilities, informs and recommends the six best majors for them and provides further information sources about the major. The system was originally written using Visual Basic, but it has since been re-implemented as a web-based application at the site www.mymajors.com. It concludes with recommendations from 60 majors. The system is used by students without the involvement of system developers. Only an elementary knowledge of how to use a computer keyboard and mouse is necessary. Help screens are available throughout the advising session to provide students with instructions in the entry of responses, as well as in the interpretation of conclusions.

Students report that they enjoyed using the program, that it appeared to communicate with them in a natural manner, and that the techniques for obtaining their responses seem appropriate and realistic. The recommendations often duplicated choices already made by students, matched recommendations by counsellors, and paralleled suggestions from aptitude tests.

This program also has the limitations such as it has not been validated with psychological assessment instruments. It is an expert system that represents the heuristics of selected advisors and career counsellors. It provides responses whether or not the student has taken the batteries of aptitude tests that may be available. It

should be pointed out that the author has communicated with several authorities on academic advisement and has been told that there are no studies extant that examine the recommendations of humans for consistency or "validity." Thus, while some studies evaluating the degree of consistency of the program with actual advisors is being considered, there is no guarantee, that given the same input data, two or more advisors would agree on the curriculum a student should consider. Another limitation of the system is that it may suggest a major that the student does not fully understand. A recommendation to consider sociology, for example, may hold no meaning for a student who has not yet had the opportunity to take a sociology course. The student can retrieve this information if they choose to do so, however. Similarly, students may have a naive view of what some majors involve. There needs to be follow-up advising to assist the student in evaluating the recommendation clearly. The final expert system could initiate this learning process.

Although the system was developed to assist high school seniors in selecting a major, it could also be adapted to students who have already been admitted to and who have had experience with college-level course work. The system works effectively now. It can be extended in breadth by adding majors, and it can be extended in depth by refining some of the conclusions and by meeting the unique needs of other institutions. For instance, it could include the rules needed to recommend eligibility for honours courses, the need to take remedial work, the correct English or mathematics course, and so on, as long as there are rules to follow in making these recommendations. This paper also describes an expert system designed to improve the ability of colleges and universities to offer student advising. The system provides

a basis for designing other advising systems and for conducting research on the role of computer-based systems in major counselling.

According to Noran (2000), his study about a Course Advisor Expert System to support the planned Conversion Course within Griffith University that increasing need for highly qualified IT personnel in Australia and abroad is currently being met in two ways which are (a) new students enrolling in undergraduate IT courses and (b) Existing graduates, notably engineers from other fields, enrolling in IT Masters courses and PhDs. Up until now, there have been difficulties in accepting enrolments from the second category of people, mainly because of their lack of IT background. But the primary reason for them wanting to undertake a postgraduate course in IT is the lack of IT skills. Unfortunately, very often this leads to a deadlock in their career. One way to solve this dilemma is a conversion course and it is not a new concept. Many Universities have already implemented such courses, most notably Griffith University, Gold Coast campus. Since the conversion course is designed for non-IT background people, the main obstruction in their acceptance in a postgraduate course is eliminated. The expert system users will be prospective postgraduate students and also lectures, tutors or people that seeking advice on how the subjects may work together within the Conversion Course (or any other course for that matter).

This expert system is based on a range of existing but enhanced concepts, which will make the subject selection and education processes more flexible and effective for the postgraduate students. These concepts are;

a) Modularity of subjects. Presently, each subject already has a certain structure attached to it, as envisaged by the subject convenor. Using this structure, it can consider the subject as being composed of several modules;

b) Prerequisites and outcomes of the subject modules. These concepts already exist, albeit applied only to the subject as a whole. Still it is possible (within a reasonable amount of effort) to group prerequisites and outcomes for each module composing a subject;

c) Credit for previous studies. Applied to modules within a subject (rather than a subject as a whole), it will allow a student to satisfy a prerequisite for and enrol in a particular module without having to enrol in the whole subject.

This study is a knowledge-based system that contains facts and rules referring to the partial / complete prerequisites and outcomes of the subjects offered in the School of Computing and Information Technology in Griffith University. Other supplementary information is provided, such as semester, credit points, parent subject, etc. This expert system is in Java applet within a Web page. However, there are two (2) options to run the programs; as a Java application using Java Virtual Machine which is faster to load. Another way for user to run the application is by using a host web page and web browser to run the applet. The Java implementation of CLIPS is called JESS (Java Expert System Shell) as inference engine. This expert system will load and start the rule base, and the consultation process will begin. Currently the program is available as an applet installed within a host page at the address http://www.cit.gu.edu.au~noran/CCourse.htm.

Course Inventory Expert System is a logical representation of the decision rules for classifying undergraduate courses, which have been converted to a step-by-step process (Ohio Board of Regent, 1999). The Course Inventory Expert System utilizes a series of decision trees to guide users (i.e., institutional and Regents staff) through the decision-making process. The goal is to achieve consistent treatment of all undergraduate courses across the system based on existing decision rules and policies.

There are four (4) stages in the Course Inventory Expert System. Each stage is designed to narrow the universe of courses under consideration. This "process of elimination" forms the basis for achieving consistent assignments of courses to subject codes and levels among institutions.

a) Stage One--courses for which credit is not awarded, courses specifically identified for funding at particular levels, developmental courses, and Transfer Module courses (for technical colleges only).

b) Stage Two--courses required for technical degree programs.

c) Stage Three--courses to which general decision rules apply regardless of field of study, including capstone courses, General Education Requirements, personal enrichment or general interest courses, survey courses, student teaching course, teaching methods courses, calculus-based courses, skill/medium courses, first-year introductory courses, and courses for non-majors only.

d) Stage Four--courses to which "discipline-specific" decision rules apply.

The study of Stand-Alone PC-Based Advising Aid for Students (Hagler, 1995), shows a modest approach to utilizing computers to make the advising process more productive, and pleasant, for both faculty and students. The advising software, which

features a graphical user interface, allows students to request only courses for which they have appropriate prerequisites, corequisites and standing. The software is designed for straightforward modification, without programming to accommodate addition or deletion of courses, prerequisites, corequisites and rules.

These systems exploit artificial intelligence, expert systems or knowledge-based systems to provide some of the functions of a faculty advisor to students. Several of them provide students with a prioritized list of suggested courses and check prerequisites and sequencing. Most of them run on mainframes and have access to databases that contain student records. This environment makes them potentially extremely powerful and, in addition, offers the possibility of making advice available to students when advisors may not be readily available.

The program also offers rule-based advice to students regarding special circumstances that it spots. The software automatically takes into account differences in advisement made necessary because, during the spring advisement and scheduling period, students may request courses for both fall and summer terms. A student requests courses by submitting a printout of the file to the department for approval. The printout uses highlighting to let advisors see at a glance that individual entries have been checked by the software. An advisor can approve the requested courses simply by signing the sheet and leaving it at the departmental office for the student. An advisor who wishes to talk with the student, for any reason, before approving a selection of courses simply writes a note on the printout before returning it to the student.

In recent study of an automated advising system for course selection and scheduling (Siegfried et. al, 2002), it is stated that less than three quarter of freshmen at four-year institutions return for a second year; the percentage is even lower for students at two-year institutions. While the causes for such attrition are complex, inaccurate advising is clearly a contributing factor. The first author developed an expert system for advising freshmen several years ago that did not address scheduling, an important factor in advising students. In this updated version of the program, the issue of scheduling is addressed and the re-engineered system is specified. The authors described two versions, built to meet the advising criteria of two different undergraduate institutions as well as discussing the design of a general model that can be customized for the needs of other schools.

FROSH was developed as a tool that could be used as an automated consultant or as a training tool for freshman advisors. FROSH was written using the expert system development tool VP-Expert and helped the freshman advisor select a set of courses for the first-semester freshman. It first determined the maximum number of courses that a student should take, and then chose the appropriate composition and math classes for the student. After determining the student's choice of major, it selected the appropriate beginning course in that major for the student (or advised the student to wait until certain prerequisites were taken) and then helped the student choose additional courses until his or her program was complete.

The process of advising incoming freshmen has many similarities regardless of the college or university. There are certain basic decisions that are made either by freshmen or their advisors. These include:

a) The number of credits or courses that the incoming freshman will take in the first semester.

b) The courses that the student will take as part of the common curriculum taken by all incoming freshmen.

c) The courses that the student will take to begin a major field of study.

d) The other courses that fill the remainder of the student's course load.

The first author's experience in advising students at Saint Peter's College and subsequently at Adelphi University provided an interesting contrast. At Saint Peter's College, virtually all courses are three credits, with an extremely small number of four-credit and one credit courses. While most courses at Adelphi University are three credits, there are a significant number of courses that are one, two and three credits that might be taken by the typical incoming freshman. While it made sense to count courses for Saint Peter's freshmen, this does not work in the Adelphi model where it is essential to count credits. While both schools require all incoming freshmen to take a composition and orientation seminar, Saint Peter's requires a math course and Adelphi requires a Freshman Seminar whose subject varies section to section. At Saint Peter's the Orientation Seminar was non credit; at Adelphi, it is a one-credit course that runs for half the semester.

FROSH version 2 was written in Visual BASIC for three reasons: it made it easier to create an interface that was graphical and therefore easier to use; Visual BASIC's popularity makes it easier for other schools to modify FROSH for their own use; and it uses databases written in Microsoft Access, which simplifies the development process.

The basic algorithm for Adelphi University and Saint Peter's College:

a) Make sure that all necessary data was entered. If not, display the appropriate error message.

b) Determine the maximum number of credits/courses that the student may take.

c) Determine the general freshman courses to be taken by the student.

d) Determine the courses that the student should take for the chosen major.

e) Allow the student or advisor to choose sections for these courses.

f) Allow the student or advisor to choose other courses with which to complete the schedule.

g) Make sure that there are no time conflicts and that the student is not taking multiple sections of the same course.

The current version of FROSH was hard-coded, for example, the advising actions appear as Visual BASIC procedures and there are two distinctly different versions of the program, one for each of the two schools. This was done to verify that the advising done by FROSH is comparable to that which is done by experienced advisors at both schools. While this design approach made it easy to ensure that both versions are accurate in advising students, it makes the customizing of FROSH for other schools more difficult. The next step is to create a "general framework" for FROSH that is easily customized for other schools. This will be done by the use of database tables where feasible and by different versions of code "commented-out", where the person customizing the code chooses the version to "de-commented."

According to Patel et. al (2004), to improve retention rates, motivate students to complete their undergraduate degrees and enhance the success of students in the science, technology, engineering and mathematics related programs (STEM), they propose and develop InVEStA- Interactive Virtual Expert system for Advising. The main purpose of this system is to assist undergraduate students and their advisors in providing timely, accurate and conflict-free schedules. The proposed system is based on Java and object-relational database technologies and consists of the Database Layer, Transaction Layer, Scheduler and the web-based Front-End. They use an open-source Database Management System (DBMS) to accomplish easy portability and deployment of this system. The Transaction Layer serves as a "switch board" that transmits requests and data back and forth to other system components and provides multi-user capabilities. The Scheduler provides non-conflicting class schedules based on student's major curriculum, preferences, prerequisites requirements and class availability/enrolment. The front-end serves the purpose to provide the client's (students and/or advisors) interface. In this paper they discuss the structure and functionality of the system with particular emphasis on database design and specifies of the scheduling algorithm.

InVEStA can resolve many advising dilemma that students and advisors face, such as: the number of credits a student needs to graduate; the courses that may be taken for a particular curriculum instance; substitution of a course by another course; fulfilment of prerequisites for the chosen course; the schedule that best fits student's preferences; what-if scenarios (e.g. if student changes major, how many courses can be applied towards the new major requirements). The proposed system allows the faculty advisor to resolve various requirements with little effort while ensuring the

consistent advising across multiple advisers. Its modular open-source database-driven structure permits flexibility and versatility while providing enough performance to accomplish highly-concurrent multi-user environment. In addition to being stand-alone, InVEStA can be integrated with a university database system using standardized database connectivity. Once fully deployed, InVEStA will be used to assist in advising students at Dewalare State University.

According to Bansal et. al (2003), one of the most difficult tasks that many university students and advisors face every semester is the process of student advising. From a student's perspective, the task of deciding what courses to take and when to take them is a process that is both tedious and time consuming. Duties such as designing a degree plan and creating a schedule each semester is a long and complex process that requires an understanding of all the policies and regulations within the university. As the education process evolves, it becomes more complex in its structure. With the increase in special rules, exceptions, and prerequisites used in university today, it is no wonder why more universities are investing in software that centralizes and simplifies the enrolment and advising process. Thus, the KRAK Virtual Advisor was born.

This system is designed to help with the advising process. The KRAK virtual advisor is a web-based support system to be used by both students and advisors. Its function is to assist its users in the various advising tasks that occur during the registration and degree planning processes. Virtual Advisor provides an interactive site in which users are able to gather and organize information collected throughout a student's college career. Students who interact with the system have the ability to play a more vital role as a mentor to students rather than being bogged down with endless loads of

paperwork. Its main features include: Degree Planning, Semester Scheduling, and the retrieval of general course, faculty, and university information. It uses a combination of HTML, VB scripts, and JAVA applets to create an interactive platform. The three main modules implemented with the Virtual Advisor are the Preliminary Analysis Module, the University Retrieval Module, and the Administrative Specification Module. Each module is structured using two different coding approaches and organization perspectives.

In 1997, Abg. Jawawi compared the student advisor systems with AI technology and other technology. Most of the student advisor with AI technology can suggest the courses to be taken by students, generate one term schedule based on student's availability, recommend on the best courses for student based on interest and progress, and suggest available courses and faculty. It differs with the student advisor system that was developed using other technology; it normally can suggest all the remaining courses that offered in their faculty or university. The study used the knowledge based system in solving student course advising problem such as to advise student to select the right course that involves first year student, second year direct entry student and final year direct entry student; advise on change course for student already began their course but decided to change their course and also provides information to students who have problem in particular units; advise to select the electives subjects for final year students.

The Student Course Advising System (SCAS) is developed using object-oriented C++. Knowledge behaviour was produced where the 'expert' and 'knowledge' is

stored separately from the inference engine. Object-oriented programming technique was found to enhance the development of the system.

According to Roa et. al (1987), ADVISOR is a small expert system that provides academic advisement for a Brockport Math/Computer Science major. The college rules are coded as a rule base of if-then rules. The system answers questions in simple English, produces a course schedule for future semesters and prints a student transcript. The language of implementation is LISP.

Based on personal experience of one of the authors as a college teacher and an advisor for the past five years suggest that many students have similar questions. The advisor usually spends considerable time with the advisee explaining the college regulations, major requirements. Although these details can be found in the college handbook, many times the students are not aware of them. Thus the advisement can be a very time consuming process (especially if you have 50 students to advise). This implies the need for the automation of some parts of the advisement process. The idea is to make the automated advisor available to all the students so that they can get answers to routine questions and even get a printed advisement form. The student can then meet with the human advisor for further consultation. This, hopefully, will save some time for the human advisor.

ADVISOR is both a database system and an Expert System in the sense that, it stores structured knowledge about each student in an individual permanent file and the unstructured knowledge about college regulations in the form of if-then rules. In a typical session, the user enters the identification and proceeds to enter any new

information. The system then is ready for use. An ideal situation would be for the ADVISOR to link up directly with the Data Processing computer and obtain all the student information. However, this has not been attempted. The main menu offers the user the following options; Enter New Information, Ask questions, Print Course Schedule and Print Transcript

A summary of these systems that have been discussed above their functionalities is illustrated in Table 2.5. From these works, it was found that the student advising domain is amenable to knowledge-based system method.

Table 2.5: Published Student Advisor Systems with AI Technology

Project Name	Student Advisement (Grupe, 2002)	Stand-Alone PC-Based Advising Aid for Students (Hagler, 1995)	Course Advisor Expert System (Noran, 2000)
Academic Institution	St. John Fisher College.	Texas Tech University	Griffith University
Department	-	Electrical Engineering	
Student Status	High school, College freshmen	Undergraduate	Postgraduate
Language Used	Visual Basic		Java, CLIPS and Prolog
Main Functions	- Gather information (grades, interest, test scores, interest and aptitudes) from students - Recommends 6 majors from among 60 majors - Provides information sources about the major	- Allows students request only courses that they have appropriate prerequisites, co requisites and standing - offers rule-based advice	- Check and match prerequisites or an outcomes subject with degree requirements -Suggest the course that need to take for the students
Checks Required Course?	Yes	Yes	Yes
Suggest Course to Take	Yes	No	Yes

Course Inventory Expert System (Ohio Board of Regents, 1994)	InVEStA- Interactive Virtual Expert system for Advising (Patel et. al , 2004)	KRAK: Knowledge-based Resource Advising Kit (Bansal et. al, 2003)	System: Undergraduate Computing Advise System (SCAS) (Abg.Jawawi, D. N., 1997)
Ohio State University	Dewalare State University	Texas Christian University	Sheffield Hallam University
-	-	-	School of Computing
Undergraduate	Undergraduate	Undergraduate	Undergraduate
Prolog	Java Server Pages (JSP)	HTML, VB Scripts, Java applets	C++
- assigning undergraduate courses to subsidy levels L1- courses for which credit is not awarded L2 – courses required technical programs L3 – courses in field of study L4- courses which discipline-specific	-recommend courses that may be taken; -substitution of a course by another course; - fulfilment of prerequisites for the chosen course; - generate the schedule that best fits student's preferences	-advising tasks that occur during the registration and degree planning. - generate and provide degree planning, semester scheduling, and the retrieval of general course, give faculty, and university information -be guidance to students in taking courses during their college career.	- advise student to select the right course (1st year, 2nd year and 3rd year) - advise on change course for student already began to new course - advise to select the electives subjects for final year student
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes

An Automated Advising System for Course Selection and Scheduling (Siegfried et. al, 2003)	Manhattanville College Expert Academic Advisor (Kiernan et. al, 1985)	ADVISOR- An Expert System for student Advisement (Roa et. al, 1987)	A Course Advisor (Crooke, 1993)
Saint Peter's College & Adelphi University	Manhattanville College	State University College, Brockport	Univ. of Massouri - Columbia
Mathematics and Computer Science	Art	Mathematics and Computer Science	Industrial Engineering
Freshmen	Undergraduate	Undergraduate	Undergraduate
ES tool (VP-Expert)	Expert System Shell	LISP	Expert System Shell

- set of courses for the 1st semester freshmen - determined maximum number of courses student to take - chose the appropriate composition and match classes for the student	-advisor on courses to be taken to satisfy a student' major requirement	- answering questions expressed in simple English - printing an individualized course schedule for the next few semesters - printing the student transcript.	Check degree requirement Suggest on the best courses for student based on interest and progress.
Yes	N/A	Yes	Yes
Yes	Yes	Yes	Yes

CHAPTER 3

CURRENT SITUATION

In this chapter, an overview of the current system that applied in KUTPM that can determines the student's personality types which can be guidance to their career paths were briefly described. Discussion on some of the aspect in decision making process is also presented.

3.1 Introduction

The system used in KUTPM to determine the personality types for each student is traditional based. Each student need to fill in the form when they asked or needed a consultation on an academic programme. Table 3.1 shows the form of Career Self Assessment provided by KUTPM.

Table 3.1: KUTPM Career Self Assessment

REALISTIC		R Total =
Are You:	Can You	Like To:
Practical	Fix electrical things	Tinker with mechanics
Athletic	Solve mechanical problems	Work outdoors
Straight forward	Pitch a tent	Be physically active
Mechanically inclined	Play a sport	Use your hands
A nature lover	Read a blueprint	Build things
Operate tools and machinery	Work on cars	

INVESTIGATIVE			I Total =
Are You:	Can You:		Like To:
Inquisitive	Think abstractly		Explore ideas
Analytical	Solve math problems		Use computers
Scientific	Understand physical theories		Work independently
Observant	Do complex calculations		Perform lab experiments
Precise	Use a microscope		Read scientific or technical magazines
Operate tools and machinery	Work on cars		
	Analyze data		

ARTISTIC			A Total =
Are You:	Can You:		Like To:
Creative	Sketch, draw, paint		Attend concerts, theatres, art exhibits
Intuitive	Play a musical instrument		Read fiction, plays, poetry
Imaginative	Write stories, poetry, music, sing, act, dance		Work on crafts
Innovative	Design fashions or interiors		Take photographs
An individualist			Express yourself creatively

SOCIAL			S Total =
Are You:	Can You:		Like To:
Friendly	Teach/train others		Work in groups
Helpful	Express yourself clearly		Help people with problems
Idealistic	Lead a group discussion		Participate in meetings

Insightful	Mediate disputes	Do volunteer service
Outgoing	Plan and supervise an activity	Work with young people
Understanding	Cooperate well with others	Play team sports

ENTERPRISING		E Total =
Are You:	Can You:	Like To:
Self-confident	Initiate projects	Make decisions affecting others
Assertive	Convince people to do things your way	Be elected to office
Sociable	Sell things or promote ideas	Win a leadership or sales award
Persuasive	Give talks or speeches	Start your own political campaign
Enthusiastic	Organize activities and events	Meet important people
Energetic	Lead a group	

CONVENTIONAL		C Total =
Are You:	Can You:	Like To:
Well groomed	Work well within a system	Follow clearly defined procedures
Accurate	Do a lot of paper work in a short time	Use data processing equipment
Numerically inclined	Keep accurate records	Work with numbers
Methodical	Use a computer terminal	Type or take shorthand
Conscientious	Write effective business letters	Be responsible for details
Efficient		

After answering all the questions in the given form, they need to calculate the sum for each types of their personality group manually. The result will be used to verify the types of student's personality.

3.2 Current Traditional Based in Choosing Academic Programme

Figure 3.1 shows the current traditional method for student to choose an academic programme at KUTPM. Normally student will try to get advice from parents, teachers/lecturers and friends to select the suitable academic programme for them. Students also use their qualification and interest to choose an academic programme. The problems arise when they did not decide very well. Some of the students follow their friends influence without thinking their ability and capability to studying in certain academic programmes. As solution, ESSAP can give a better solution for all the problems that arise to replace the traditional method in choosing the suitable academic programme at KUTPM.

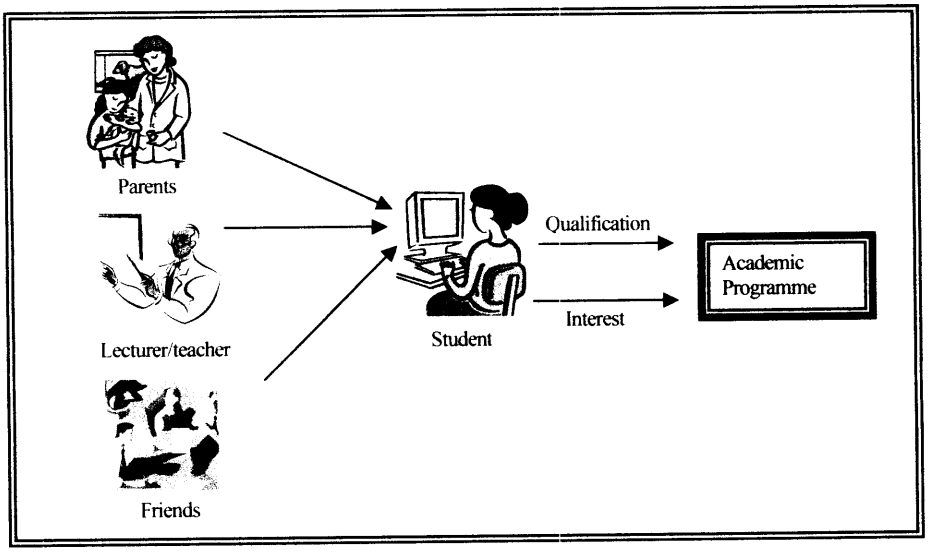


Figure 3.1: Current Traditional Based for Student to Choose an Academic Programme

3.3 Summary

In summary, there is promising work towards relating expert system. The ability of expert system in selection of academic programme was derived provides a powerful tool for decision making process. Further discussion of the design can be found in Chapter 4.

CHAPTER 4

METHODOLOGY

This chapter provides the methodology in Expert System for Selection of Academic Programme (ESSAP) development. The development consists of several steps namely planning, knowledge definition, knowledge design, code and checkout, knowledge verification, and system evaluation.

4.1 Introduction

Methodology followed in this study is adapted from Linear Model (Giarratano & Riley, 2005) which is a life cycle model that has been successfully used in a number of expert systems projects. The Linear Model is illustrated in Figure 4.1 below.

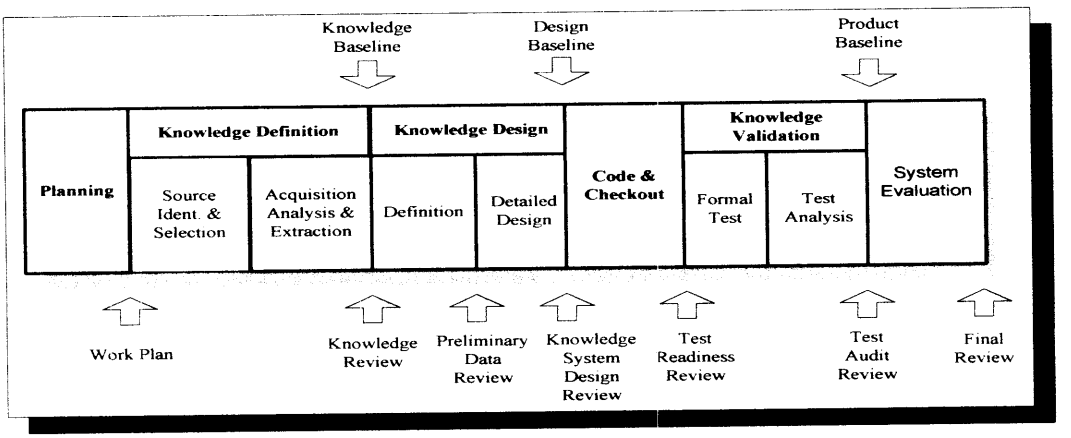


Figure 4.1: The Linear Model of Expert System Development Life Cycle

The tasks involved in Expert System for Selection of Academic Programme (ESSAP) system are:

a) Planning

b) Knowledge Definition

c) *Knowledge Design*

d) *Code and Checkout*

e) *Knowledge Verification*

f) *System Evaluation*

4.1.1 Planning

The purpose of the Planning Stage is to produce a formal work plan for the ESSAP system development. The work plan is a set of documentations that will be used to guide and evaluate development. The tasks that involve in this stage are:

a) *Feasibility assessment*

Determine if it is worthwhile to build the ESSAP for students of SISE at KUTPM to solve the problem or to recommend in selection of academic programme that suitable for the students.

b) *Resource management*

Assess the multiple experts that will be involved in this project. Identify the suitable programming languages for ESSAP which is a web-based expert system.

c) *Schedules*

Develop the Gantt chart to specify the starting and delivery dates of tasks in the stages of ESSAP system (Refer Appendix A).

4.1.2 Knowledge Definition

The objective of knowledge definition is to define the knowledge requirements of ESSAP system. It consists of two main tasks:

a) *Knowledge source identification and selection*

Identify the experts that suitable for ESSAP, which are Puan Norizah Ismail (Head of Counselling and Communication) and Assoc. Prof. Md Gapar B. Md Johar (Dean of SISE). Besides that, knowledge sources are from books, journal, interviews and the Internet.

b) *Knowledge acquisition, analysis and extraction*

In this stage, the knowledge will be acquired, organized and analyzed to gather the body of knowledge on the problem of interest that can be encoded into the expert system. The most common knowledge elicitation techniques in this process that had been used today in designing the expert system is the interview method. For this project, the interview session is with one of the expert that had an experience in handling the academic programme and student advising cases, Mrs. Norizah Bt Ismail. The interview session was about the current student advising process itself, which includes the regulation of student admission, methods to consult the student career choices, how to choose the right academic programme for student, potential to develop an expert system in academic advising and the future of academic advising in KUTPM. Another interview session was with Assoc. Prof. Md. Gapar on the specific characteristics personality and interest for each academic programme that offered by SISE.

4.1.3 Knowledge Design

The objective of this stage is to produce the detailed design for ESSAP. There are two (2) main tasks which are:

a) Knowledge definition

Specifies how knowledge will be represented, such as rules, frames, or logic. For this phase, the interview transcript is reviewed in order to get the key pieces of knowledge. From that transcript also, the concepts, objects, rules and heuristics is identified.

i) Production Rule

To make the interpretation of the knowledge become clearer, all the knowledge is converted into production rules. This is because the production rules can describe how to solve the problem by representing the rules in the form of condition action pairs. Table 4.1 below is the examples of rules in ESSAP system.

Table 4.1: Examples of Rules
IF you are good at repairing or making new things THEN you are practical person
IF you are physically strong and good at sport THEN you are athletic person

Each of the rules has their own Certainty Factor (CF). CF is an alternative to probability theory, which relies on defining judgemental measures of belief rather than adhering to strict probabilities estimates. The differences between each answer are based on the CF value and CF terms. Rules for Personality Test questions are based on Holland J. Theory (100 rules) and rules for academic programme is based on KUTPM admission requirements (21 rules). The full documentation of production rules is attached in Appendix A.

ii) Semantic Network

Semantic network is a method of knowledge representation using graph made up of nodes and areas where the nodes represent objects and the arcs the relationships between the object (Durkin, 1994). The following Figure 4.2 is a semantic network of student in ESSAP system.

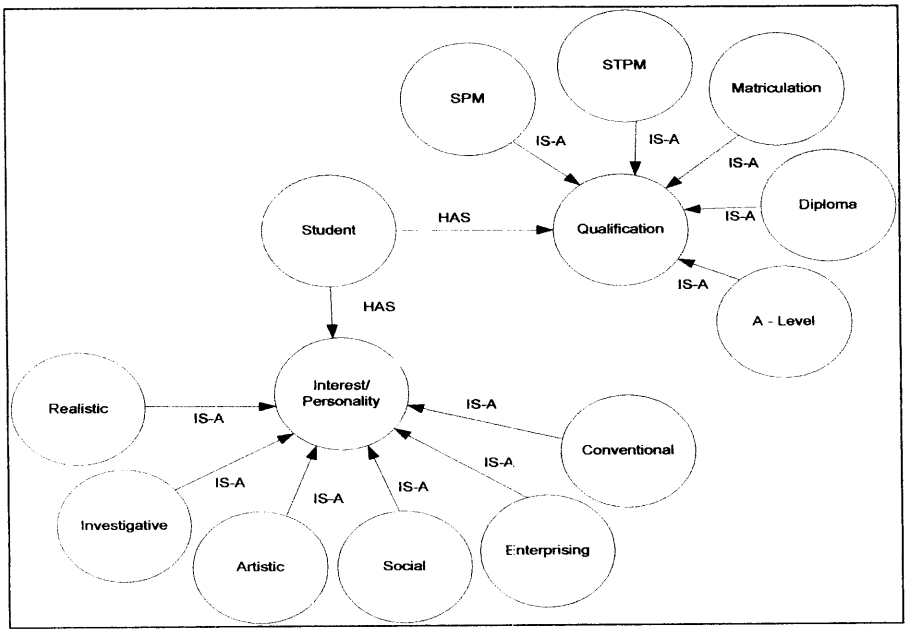


Figure 4.2: Semantic Network of ESSAP System

iii) Inference Network

Inference network provides graphical representation of the system's rules, with the antecedent and consequences of the rules drawn as nodes and their supporting relationship drawn as link. Figure 4.3 shows the inference network for ESSAP system.

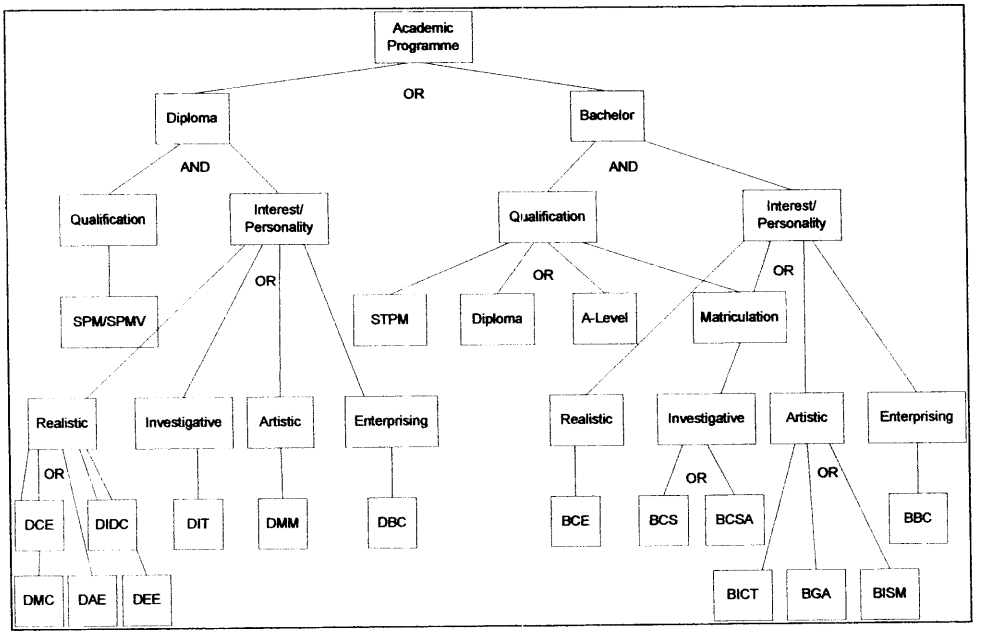


Figure 4.3: Inference Network of ESSAP System

iv) Decision Table

Decision table is one of the knowledge acquisition techniques. Each table consists of a series of decision factors, which labels columns and represent preconditions needed to reach a conclusion, which is represented in another column. Decision factor values are placed in rows, which lead to specific conclusion. It also provides an easy to fill out form that the expert can use to provide the decision making knowledge.

Table 4.2: Characteristics for Realistic Personality Type	
Type Of Personality	**Characteristics**
REALISTIC	practical person
	athletic person
	straight forward person
	mechanically inclined person
	nature lover person
	operate tools and machinery person
	can fix electrical things
	can solve mechanical problems
	can pitch a tent

	can play a sport
	can read a blueprint
	can works on cars
	like to tinker with mechanics
	like to work outdoors
	like to physically active
	like to use your hands
	like to build things

Table 4.3: Characteristics for Investigative Personality Type	
Type Of Personality	**Characteristics**
INVESTIGATIVE	inquisitive person
	analytical person
	scientific person
	observant person
	precise person
	operate tools and machinery
	think abstractly
	can solve math problems
	can understand physical theories
	can do complex calculations
	can use a microscope
	can works on cars
	can analyze data
	like to explore ideas
	like to use computers
	like to work independently
	like to perform laboratory experiments or works
	like to read scientific or technical magazines

Table 4.4: Characteristics for Artistic Personality Type	
Type Of Personality	**Characteristics**
ARTISTIC	creative person
	intuitive person
	imaginative person
	innovative person
	individualist person
	can sketch, draw or paint
	can play a musical instrument
	can write stories, poetry, music, sing, act or dance

	can design fashion or interiors
	like to attend concerts, theatres, or art exhibits
	read fiction, plays, poetry
	like to work on crafts
	like to take photographs
	like to express yourself clearly

Table 4.5: Characteristics for Social Personality Type	
Type Of Personality	**Characteristics**
SOCIAL	friendly person
	helpful person
	idealistic person
	insightful person
	outgoing person
	understanding person
	can teach and train others
	can express yourself clearly
	can lead a group discussion
	can mediate disputes
	can plan and supervise an activity
	can cooperate well with others
	like to works in group
	like to help people with problems
	like to participate in meetings
	like to do volunteer service
	like to work with young people
	like to play team sports

Table 4.6: Characteristics for Enterprising Personality Type	
Type Of Personality	**Characteristics**
ENTERPRISING	self-confident person
	assertive person
	sociable person
	persuasive person
	enthusiastic person
	energetic person
	can initiate projects
	can convince people to do things your way
	can sell things or promote ideas
	can give talks or speeches

	can organize activities and events
	can lead a group
	like to make decisions affecting others
	like to be elected to office
	like to win a leadership or sales award
	like to start your own political campaign
	like to meet important people

Table 4.7: Characteristics for Conventional Personality Type	
Type Of Personality	**Characteristics**
CONVENTIONAL	well groomed person
	accurate person
	numerically inclined person
	methodical person
	conscientious person
	efficient person
	can work well within a system
	can do a lot of paper work in a short time
	can keep accurate records
	can use a computers
	like to follow clearly defined procedures
	like to use data processing equipment
	like to work with numbers
	like type or take shorthand
	like to be responsible for details

Table 4.8: SPM Qualification Requirement for Diploma Programme	
Type Of Qualification	**Minimum Entry Requirement**
SPM (FOR DIPLOMA PROGRAMME)	Credit in 5 subject
	Credit in BM
	Credit in BI
	Credit in Science subject or either one of (Biology/Chemistry/Physic) subject
	Others 2 subject that taken in SPM

Table 4.9: STPM Qualification Requirement for Bachelor Programme	
Type Of Qualification	**Minimum Entry Requirement**
STPM (FOR BACHELOR PROGRAMME)	3 subject principal
	2 subjects principal and 2 subjects subside
	STPM can be any course either art or science stream

	Principal in Islamic Study
	Consider SPM that Credit in BM, Pass in Mathematic and English

Table 4.10: Diploma Qualification Requirement for Bachelor Programme

Type Of Qualification	Minimum Entry Requirement
DIPLOMA (FOR BACHELOR PROGRAMME)	CGPA >= 2.00
	No matter what types of diploma but must get LAN accreditation
	Consider SPM that Credit in BM, Pass in Mathematic and English

Table 4.11: Matriculation Qualification Requirement for Bachelor Programme

Type Of Qualification	Minimum Entry Requirement
MATRICULATION (FOR BACHELOR PROGRAMME)	CGPA >= 2.00
	Only Matriculation of KPM accepted. No matter any courses that already taken
	Consider SPM that Credit in BM, Pass in Mathematic and English

Table 4.12: Foundation Qualification Requirement for Bachelor Programme

Type Of Qualification	Minimum Entry Requirement
FOUNDATION / A-LEVEL (FOR BACHELOR PROGRAMME)	CGPA >= 2.00
	No matter what types of foundation courses but must get LAN accreditation
	Consider SPM that Credit in BM, Pass in Mathematic and English

b) Detailed design

Specifies the knowledge that will be organized in the MySQL as knowledge base. Specifies the detailed user interface after receiving user feedback, document the design and how the code will be tested and verified.

4.1.4 Code and Checkout

Begins the actual code implementation using PHP, test code using test data, test drivers and test analysis. Produce the working's user manual so experts and student of SISE can provide feedback on ESSAP system (see Appendix B). The overall functionally, limitations, and problems of ESSAP were documented. This stage terminates with the test readiness review, which determines if the ESSAP is ready for the next stage of knowledge verification.

4.1.5 Knowledge Verification

The objective of this stage is to determine the correctness, completeness, and consistency of the ESSAP for the students, lecturers and counsellor of KUTPM. This stage is divided into two (2) main tasks which are:

a) Formal test

Implement formal test procedures. ESSAP has been tested by students, lecturers, and counsellors in KUTPM are used to get their feedback for analysis questionnaires (refer Appendix C and D).

b) Test analysis

Test analysis will look for the major problems in ESSAP such as incorrect answers, incomplete answers and inconsistent answers. It also will determine if the problem lies in rules, inference chains, uncertainty, or some combination of these factors. In this task, the result from the evaluation will be analyzed and documented with recommendations and conclusions of test and it were discussed in Chapter 6.

4.1.6 System Evaluation

This is the final step in the development life cycle and, the purpose is to summarize the results of testing and verification and provide recommendations if there any changes in the ESSAP system.

4.2 Summary

In this chapter, the methodology of development an ESSAP was presented. It involves several steps such as planning, knowledge definition, knowledge design, code and checkout, knowledge verification, and system evaluation. The designing of several knowledge designs such as semantic network, inference network, and decision table were discussed thoroughly. In the next chapter, implementation and system design are represented.

CHAPTER 5
SYSTEM IMPLEMENTATION

This chapter will discuss about the system implementation for Expert System for Selection of Academic Programme (ESSAP), which includes system analysis, system design and system architecture. In system analysis section, it will discuss about the context diagram, system flowchart and data flow diagram. In the other section, which is system design, it will discuss about database schema and system module. The last section is the system architecture, which will discuss about the system requirement for this system, knowledge base, working memory and inference engine.

5.1 System Analysis

System analysis consists of three main components such as Flow Chart, Context Diagram and Data Flow Diagram.

5.1.1 Flow Chart

Figure 5.1 show the flowchart of the system. The diagram shows the main module of the system; Consultation (ESSAP) Module. When a student wants to have a consultation using ESSAP system, he/she must register their User ID and Password for the first time user, but for returning user, they should enter their previous User Id and Password. After the new user has registered their User Id and Password, the interface about their registration verification will appear to

confirm their registration. After that, they need to insert their qualification and answer all the questions about their interest.

For the returning user, after they entered his /her User Id and Password, the system will ask them either they want to start again the personality test or just viewing the latest result. If the user chooses to start again the personality test, the interface of consultation will appear and they can start the consultation again. At the end of the consultation, the system will conclude and give the result to the user about their type of personality and the system also will recommend them a suitable academic programme.

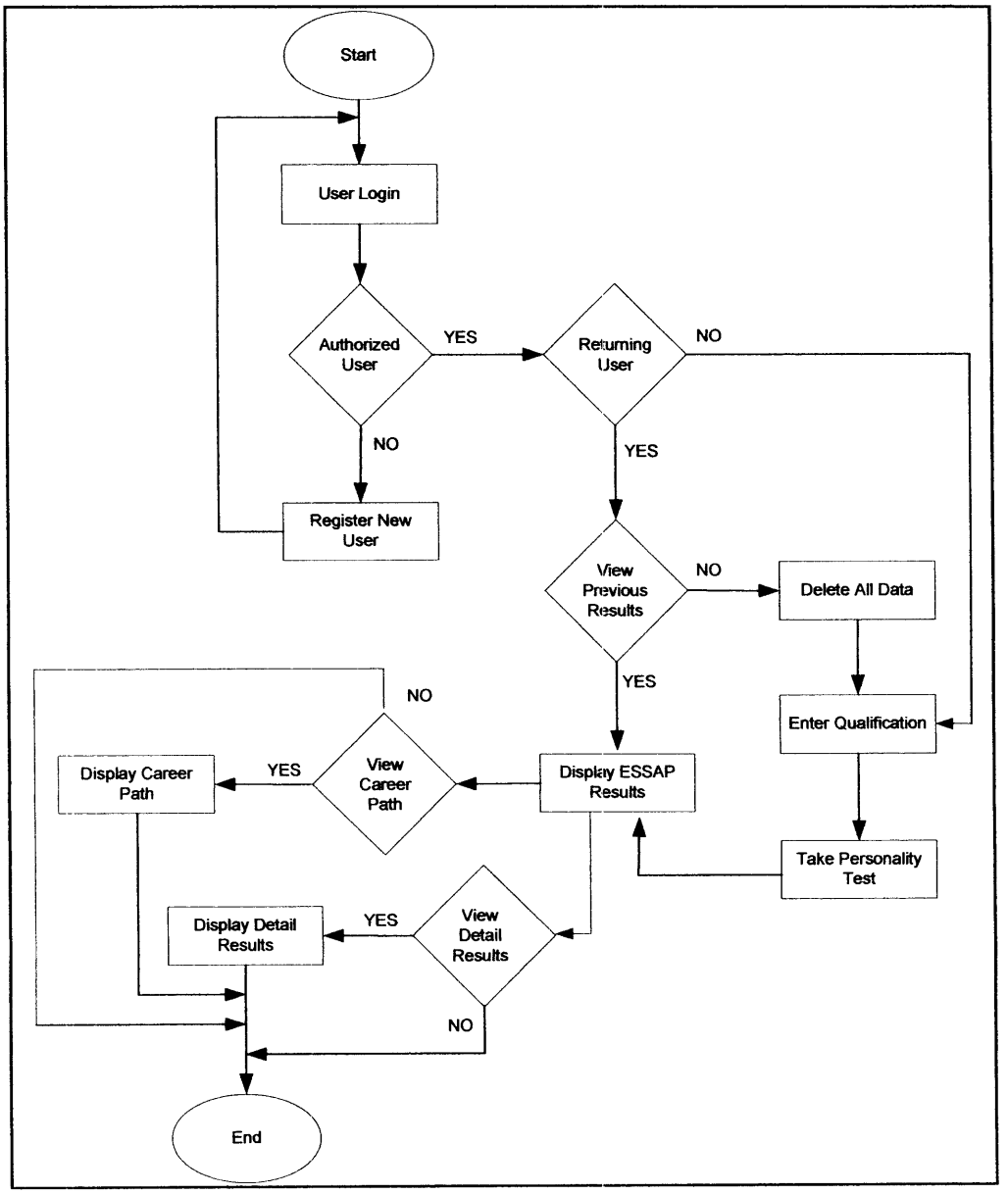


Figure 5.1: ESSAP System Flow Chart

5.1.2 Context Diagram

User will input their qualification and answer all the questions about their interest that given by the system. The system then will give the type of user's personality and recommend the suitable academic programme based on the user's input. The Administrator can update the new data such as academic programme, for the future. Figure 5.2 below shows context diagram of ESSAP system.

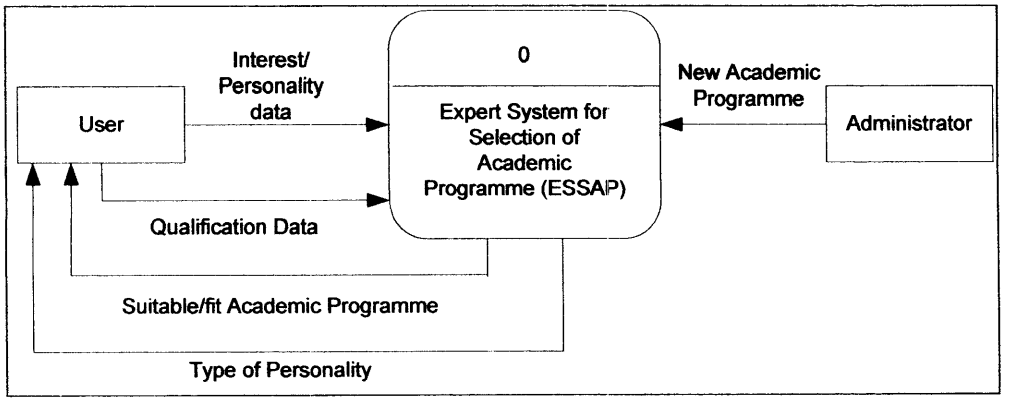


Figure 5.2: Context Diagram of ESSAP System

5.1.3 Data Flow Diagram (DFD)

Data Flow Diagram (DFD) is a means of representing a system at any level of details with a graphic network of symbols showing data flows, data stores, data processes and data sources/destination. The purpose of DFD is to provide a semantic bridge between users and system developers. The goal of DFD is to have a commonly understood model a system. For this system, the DFD is focused in the system analysis process model phase. Figure 5.3 will show the flow of data in level 0.

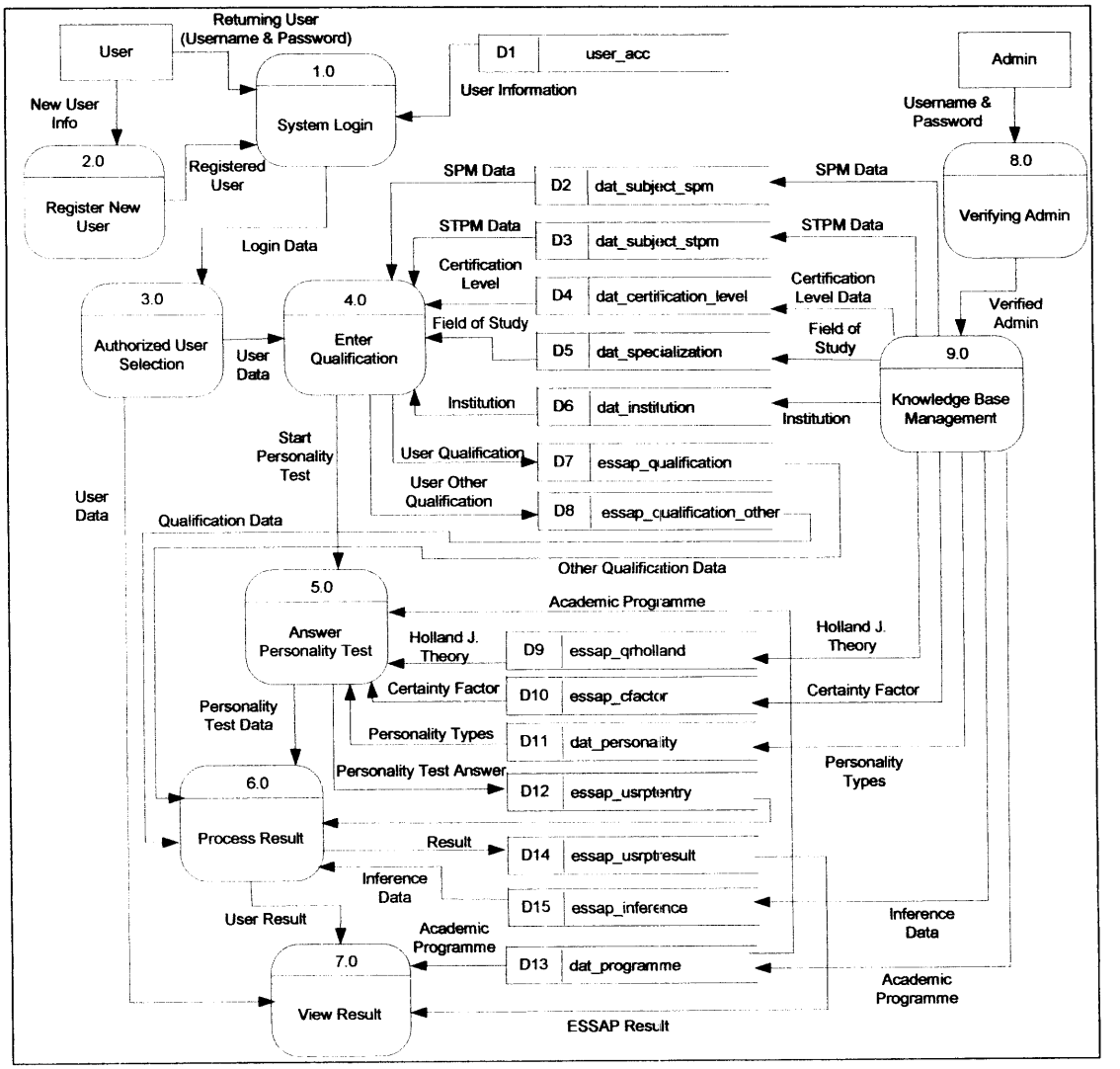


Figure 5.3: ESSAP Data Flow Diagram (DFD Level 0)

Referred to the Figure 5.3 above, there are nine main processes that involved in the system. There are Enter Login Info, Register New User, Authorized User Selection, Enter Qualification, Answer Personality Test, Process Result, View Result, and Knowledge Base Management. Diagnosis Process, Diagnose Results, Knowledge Base Management and Verifying Admin. The Process Result which is the process 6.0 is the core in the system because it will represent the inference engine.

5.2 System Design

5.2.1 Database Scheme

Database schema defines the database structure in term of table; attribute data type and size. The following (Table 5.1 – 5.15) shows the database structure in this system. The database relationship between all the tables can be referred in Appendix E.

Table 5.1: Data Structure of dat_certification_level

Field	Field Description	Type of Data	Size
id (PK)	Id	int unsigned	
cert_level	Level of certification	varchar	100
cert_rank	Ranking of certification	int unsigned	

Table 5.2: Data Structure of dat_institution

Field	Field Description	Type of Data	Size
id (PK)	Id	int unsigned	
title	Name of institution	varchar	255

Table 5.3: Data Structure of dat_personality

Field	Field Description	Type of Data	Size
id (PK)	Id	char	2
personality	User personality type	varchar	45

Table 5.4: Data Structure of dat_programme

Field	Field Description	Type of Data	Size
id (PK)	Id	varchar	12
programme	Name of academic programme	varchar	100
dept_id	Department id	varchar	45
acronym	Acronym for academic programme	varchar	45
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.5: Data Structure of dat_specification			
Field	Field Description	Type of Data	Size
id (PK)	Id	int unsigned	
title	Specification descriptions	varchar	255

Table 5.6: Data Structure of dat_subject_spm			
Field	Field Description	Type of Data	Size
id (PK)	Id	varchar	12
subject_name	Name of SPM subject	varchar	100
abbreviation	Abbreviation of subject name	varchar	45

Table 5.7: Data Structure of dat_subject stpm			
Field	Field Description	Type of Data	Size
id (PK)	Id	varchar	12
subject_name	Name of STPM subject	varchar	100
abbreviation	Abbreviation of subject name	varchar	45

Table 5.8: Data Structure of essap_factor			
Field	Field Description	Type of Data	Size
id (PK)	Id	varchar	5
uncertain_term	Terms of uncertain	varchar	45
cf	Value of uncertainty	float	2
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.9: Data Structure of essap_inference			
Field	Field Description	Type of Data	Size
id (PK)	Id	int unsigned	
grade_level	Level of grade of certification	varchar	45
dat_personality_id (FK)	Personality id	char	2
dat_programme_id	Programme id	varchar	12
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.10: Data Structure of essap_qrholland			
Field	Field Description	Type of Data	Size
id (PK)	Id	varchar	10
dat_personality_id (FK)	Personality id	char	2
question	Holland J. question	varchar	255
q_index	Question index	int	
cf_value	Value of certainty factor	float	2,1
rule	Rule	varchar	255
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.11: Data Structure of essap_qualification			
Field	Field Description	Type of Data	Size
username_id (PK)	Id	varchar	16
subject_id (FK)	Subject id	varchar	12
grade	Qualification grade	varchar	5
cert_year	Certificate year	varchar	4
cert_type	Certificate year	varchar	10
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.12: Data Structure of essap_qualification_other			
Field	Field Description	Type of Data	Size
username_id (PK)	Id	varchar	16
year_finish	Year finish	varchar	4
grade	Other qualification grade	varchar	12
cgpa	Other qualification cgpa	double unsigned	3,2
cert_level_id (FK)	Certificate level	int unsigned	
specialization_id (FK)	Specialization id	int unsigned	
instituition_id (FK)	Institution i	int unsigned	
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.13: Data Structure of essap_usrptentry			
Field	Field Description	Type of Data	Size
username_id (FK)	Username id	varchar	16
question_id (FK)	Question id	varchar	10
question_cfval	Question CF value	float	2,1
answer_cfval	Answer CF value	float	2,1
sum_cfval	Sum CF value	float	3,2
cfcombine	CF combine	varchar	255
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.14: Data Structure of essap_usrptresult			
Field	Field Description	Type of Data	Size
id (PK)	Id	int unsigned	
username_id (FK)	Username id	varchar	16
cfcombine_r	CF combine for Realistic types	varchar	255
cfcombine_i	CF combine for Investigative types	varchar	255
cfcombine_a	CF combine for Artistic types	varchar	255
cfcombine_s	CF combine for Social types	varchar	255
cfcombine_e	CF combine for Enterprising types	varchar	255
cfcombine_c	CF combine for Conventional types	varchar	255
created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

Table 5.15: Data Structure of user_acc			
Field	Field Description	Type of Data	Size
Username (PK)	username	varchar	16
password	User password	varchar	255
nric	User nric	varchar	14
name	User name	varchar	100
email	User email	varchar	100
user_role_id (FK)	User role id	varchar	4
online_status	Online status	char	1
user_status	User status	varchar	45
last_session	Last session	datetime	16

created_date	Data created date	datetime	
created_by	Data created by	varchar	16
last_update	Data last update	datetime	
last_update_by	Data last update by	varchar	16

5.2.2 System Module

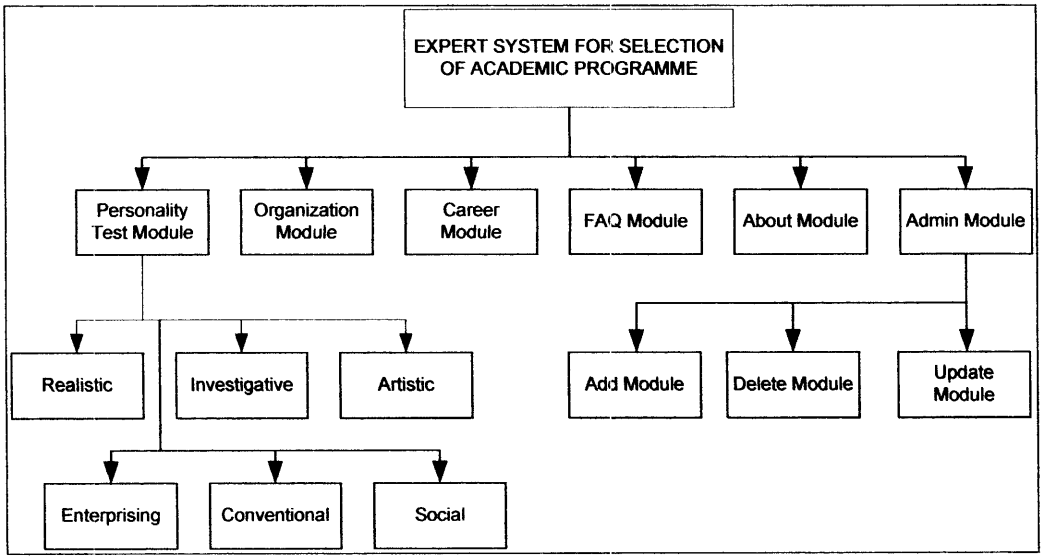


Figure 5.4: ESSAP System Module

As shown in Figure 5.4, the system has five main modules and six sub modules such as:

a) Personality Test Module

In Personality Test Module, the types of questions can be divided into six categories which are Realistic Types, Investigative Types, Artistic Types, Enterprising Types, Conventional Types and Social Types. All the personality questions are based on Holland J. Theory.

b) Organization Module

This module provides the organization that related with student career choices based on their education line. The information includes company

name, address, descriptions works, job requirements and descriptions about the company.

c) *Career Module*

The Career Module is designed to provide the information about the career field on the types of personality (Holland J. Theory) that matched with the user.

d) *FAQ Module*

This module provides the Frequently Asked Question that can help the user to more understand about their personality types, and career field.

e) *About Module*

The About Module has a brief introduction about the knowledge engineer (system developer).

f) *Admin Module*

The Admin Module is designed for authorized user to add, delete and update the question of personality, academic programme, and students' admission. With this, the information in this system is up-to-date. This is to ensure the information provided is current.

5.2.3 System Interface

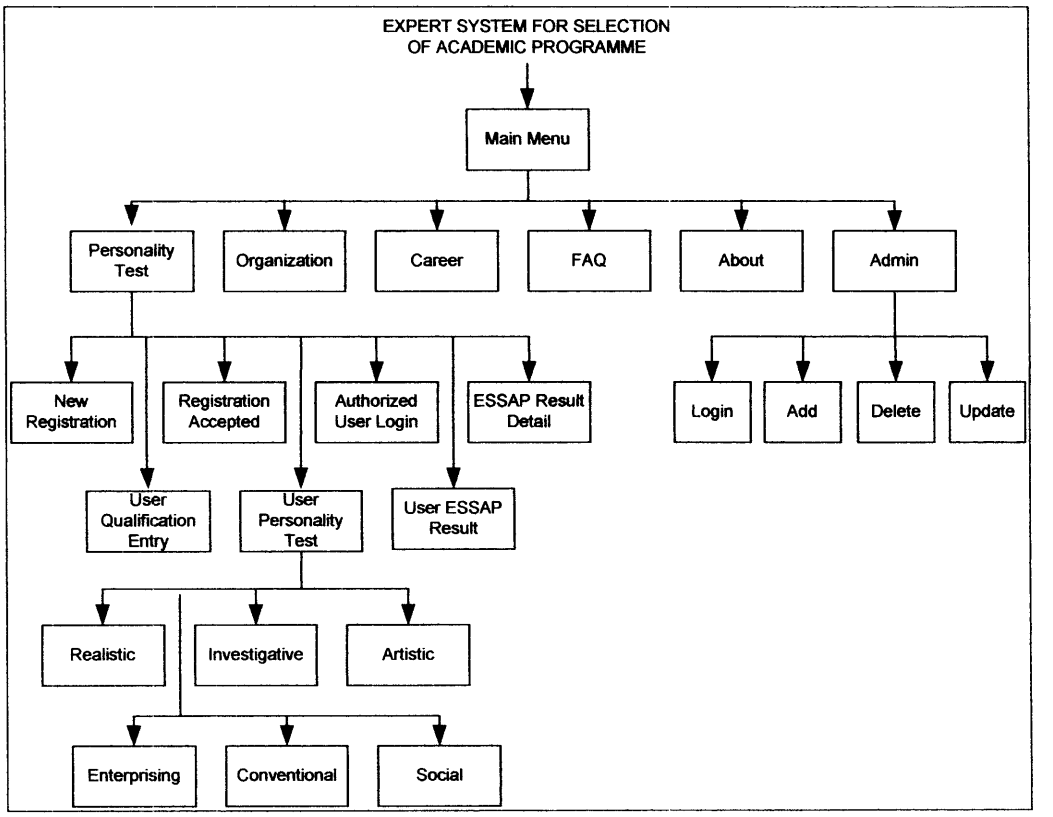


Figure 5.5: The Interface Design of ESSAP System

Figure 5.5 shows the structure of the user interface in Expert System for Selection of Academic Programme (ESSAP). The user interface starts with Main Menu. The Main Menu has six sub-menus: Personality Test, Organization, Career, FAQ, About, and Administrator. The Administrator Menu has four sub-menus: Login Menu, Add Menu, Delete Menu and Update Menu. The Personality Test Menu has six sub-menus: Realistic, Investigative, Artistic, Enterprising, Conventional, and Social Types.

5.2.4 ESSAP Interface

This part is discussed for the interface of ESSAP system. Below are the descriptions about the interface.

i) Home Interface for ESSAP system

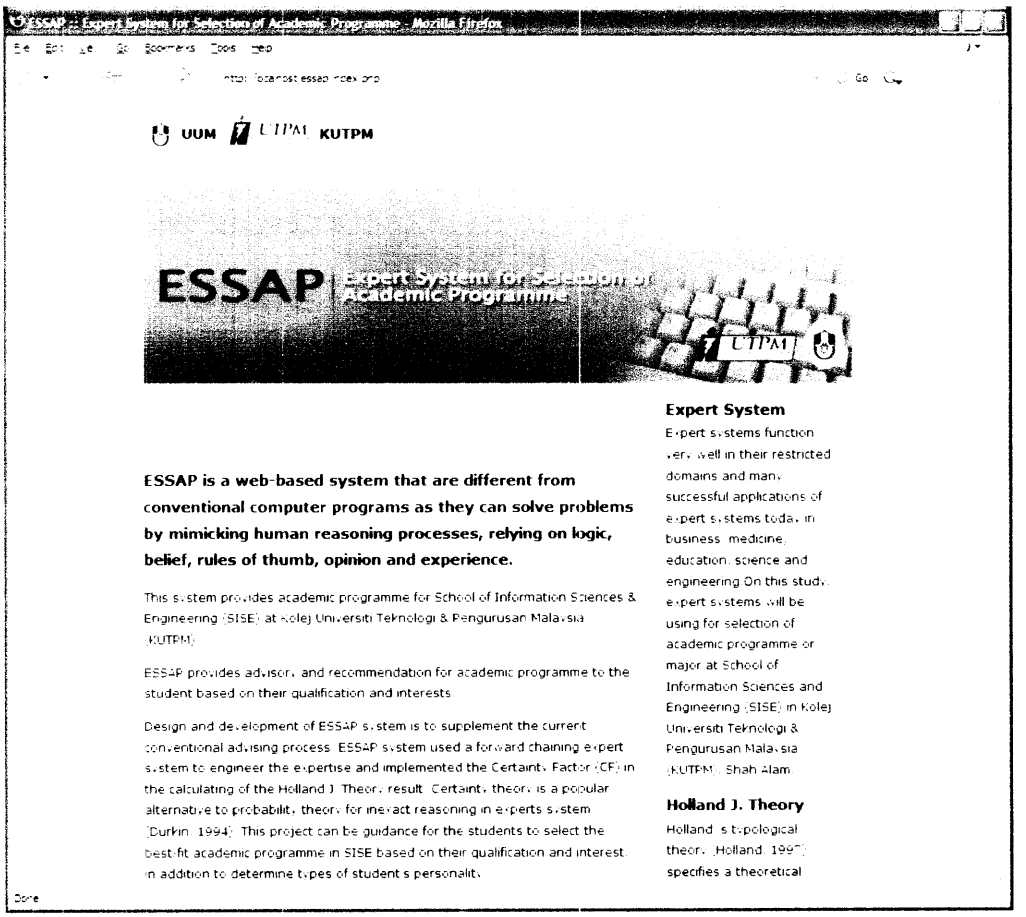


Figure 5.6: The Home Interface for ESSAP System

Figure 5.6 shows Home page for Expert System for Selection of Academic Programme (ESSSAP) system. It consists of six (6) main menus such as ESSAP System, Organization, Career, F.A.Q, Admin, and About.

ii) Main Login Interface for ESSAP System

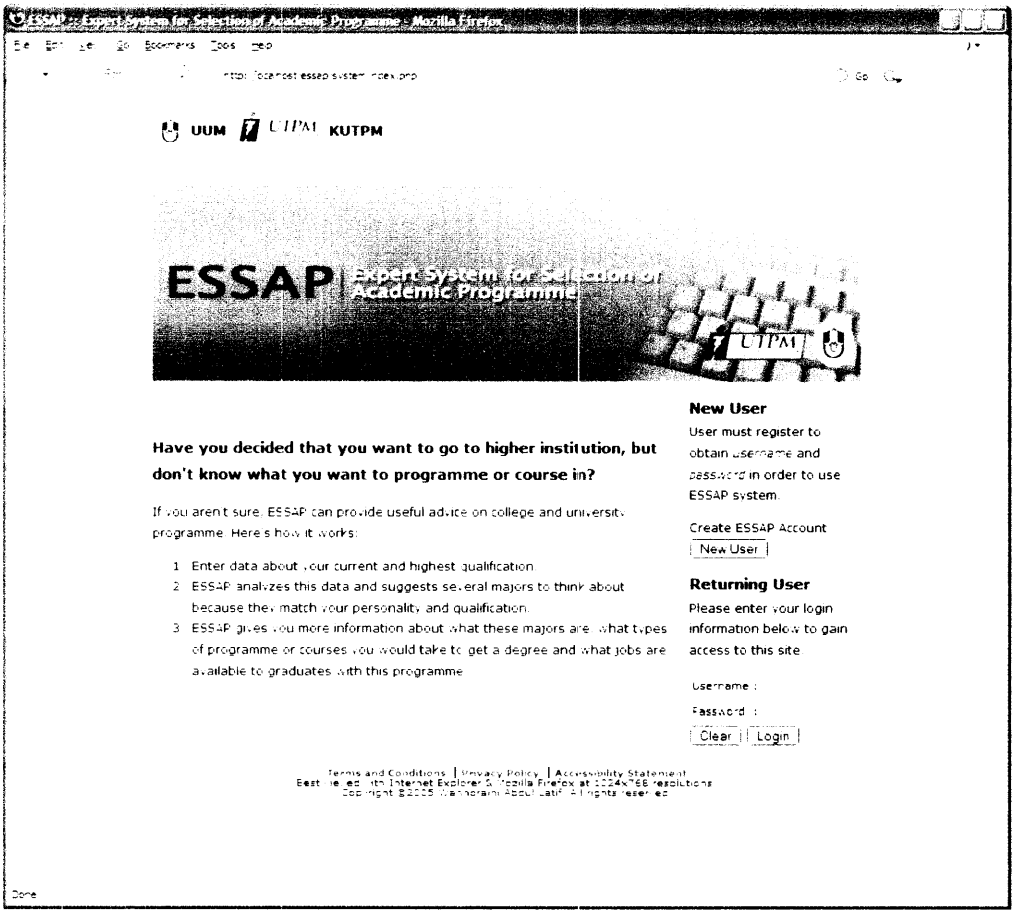


Figure 5.7: The Main Login page for ESSAP System

Figure 5.7 show the page of Main Login for ESSAP system. In order to use ESSAP system, new users need to register to obtain username and password. For returning user, they just have to login using their previous username and password.

iii) Interface for New User Registration

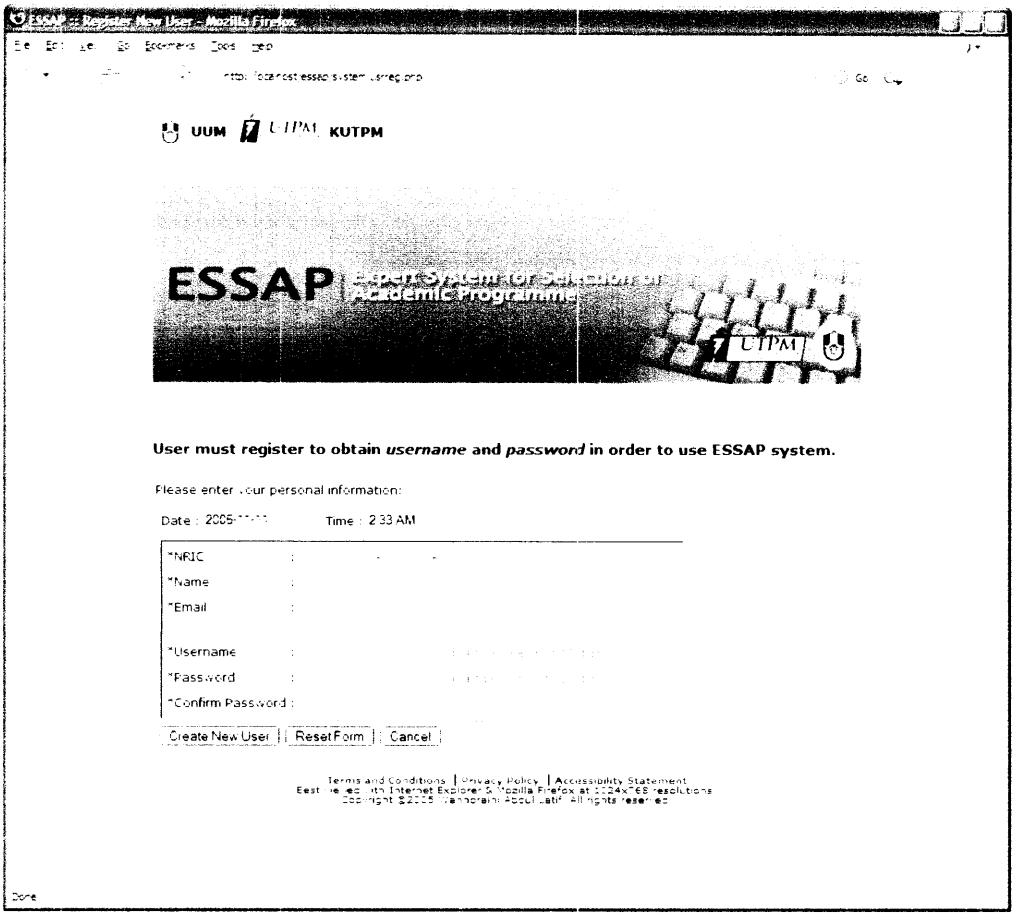


Figure 5.8: New User Registration Interface

Figure 5.8 show the interface of New User Registration. User must enter their personal information such as NRIC, Name, Email, Username, and Password to register.

iv) Interface for Accepted New User Registration

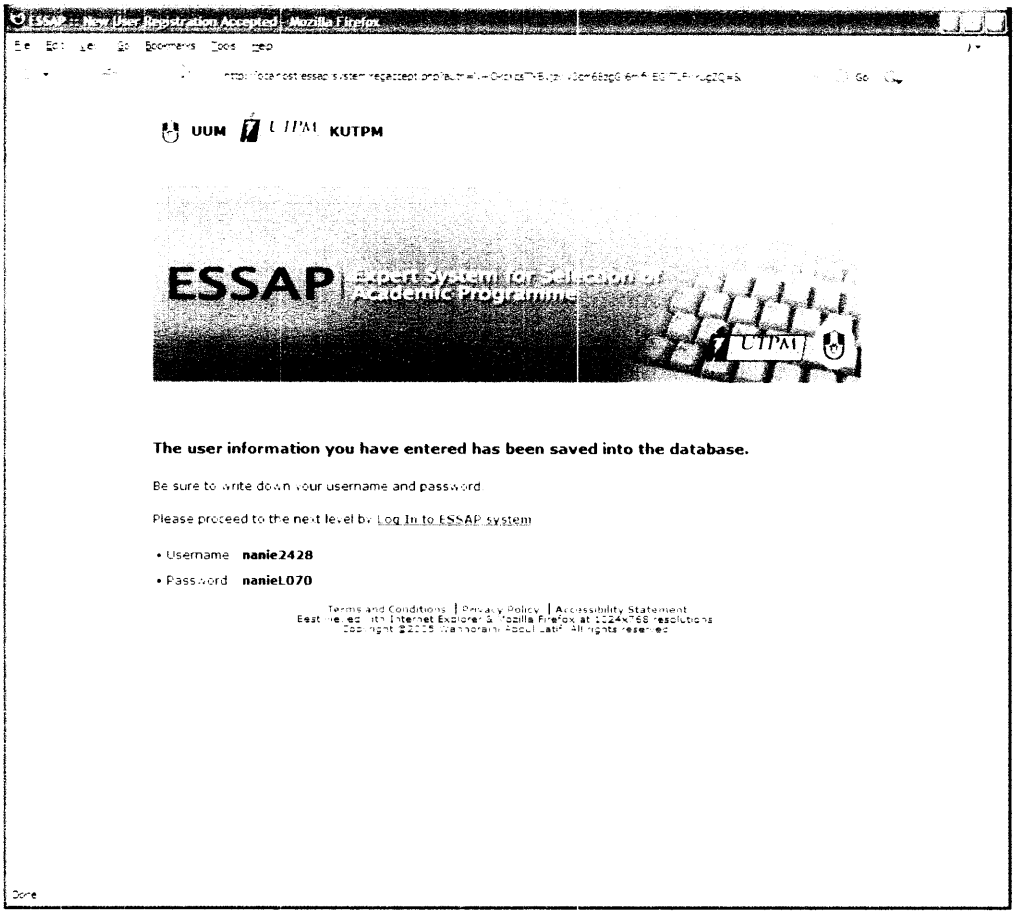


Figure 5.9: New User Registration Accepted Confirmation Page

Figure 5.9 shows the interface of New User Registration Accepted Confirmation. This page will appear when the registration process of new user has succeesful and accepted by the system. User's username and password were also displayed for user's information and confirmation.

v) Authorized User Login Interface (New User)

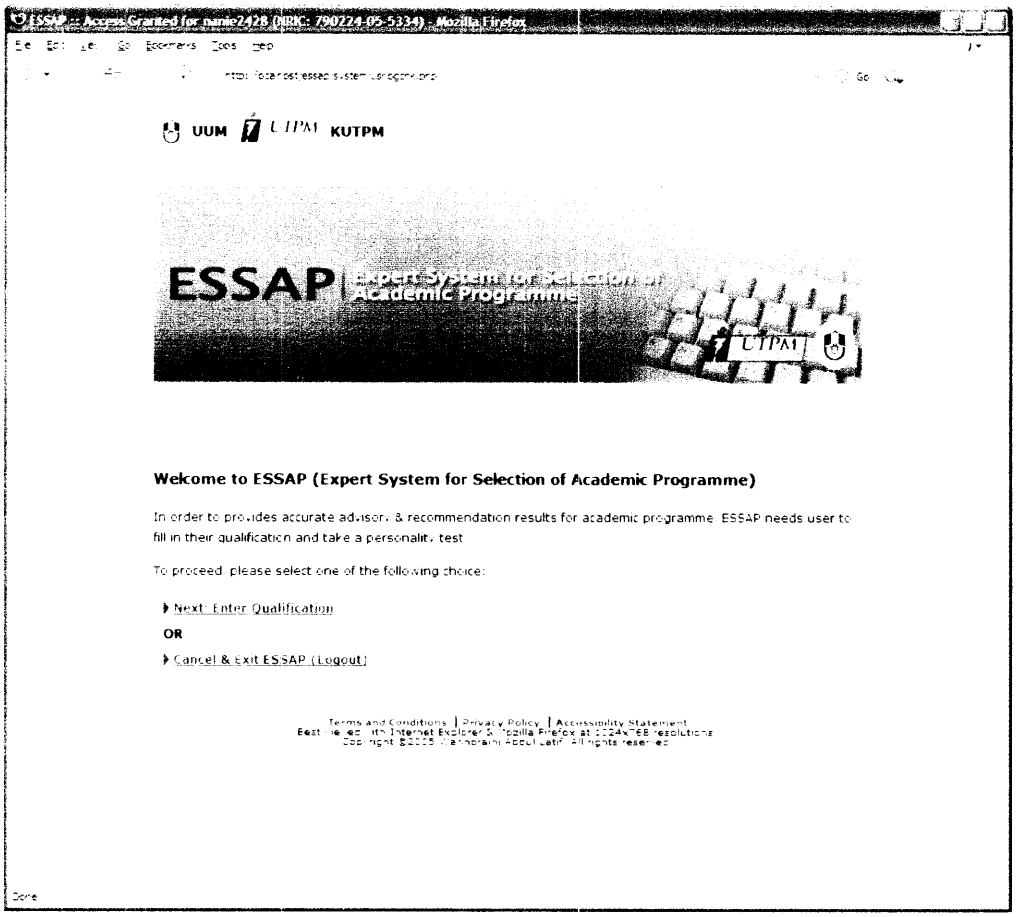


Figure 5.10: Authorized User Login Interface for New User

Figure 5.10 shows the interface of an Authorized User Login for New User. This page was slightly different from returning user interface (see Figure 5.11). User can proceed to the next level by click at Enter Qualification hyperlink or Exit ESSAP by click at Cancel & Exit ESSAP hyperlink.

vi) Authorized User Login Interface (Returning User)

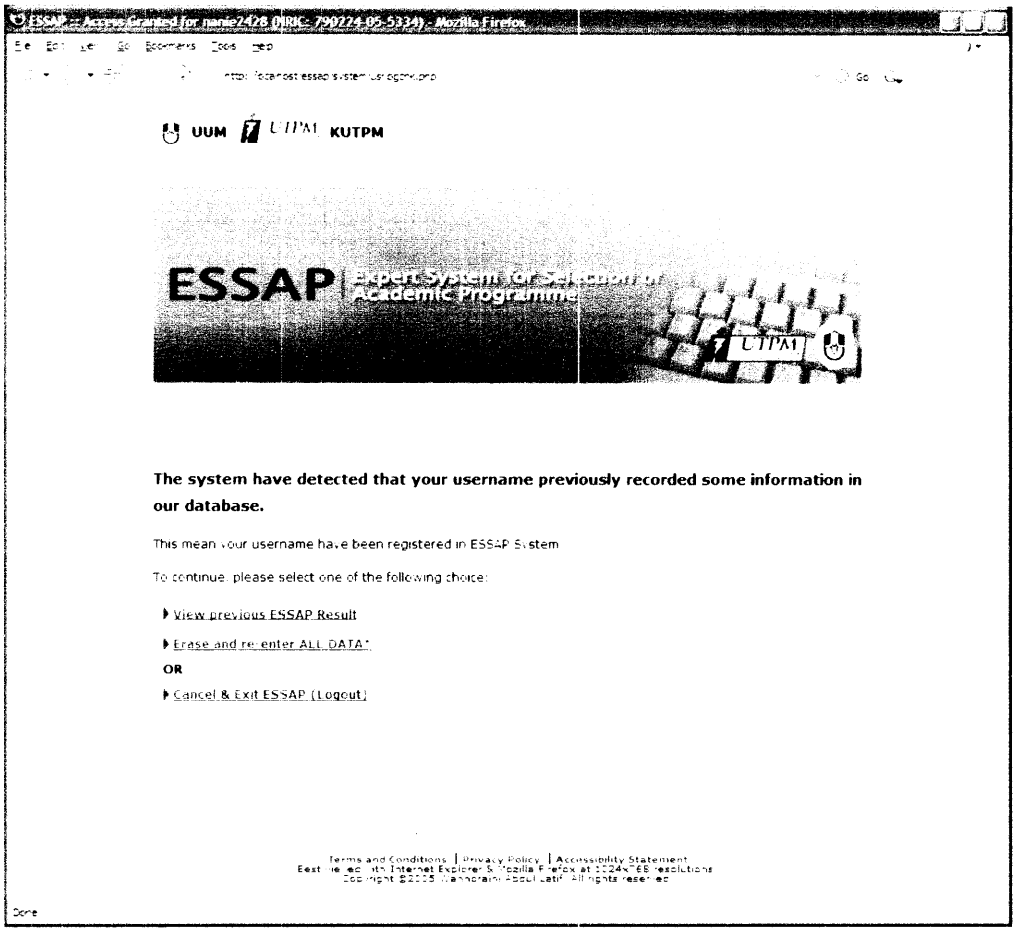


Figure 5.11: Authorized User Login Interface for Returning User

Figure 5.11 shows the interface of an Authorized User Login for Returning User. This page will provide the options for returning user either they want to view their previous ESSAP Result (see Figure 5.21) or Erase and Re-enter All Data.

vii) Interface for User Qualification Entry

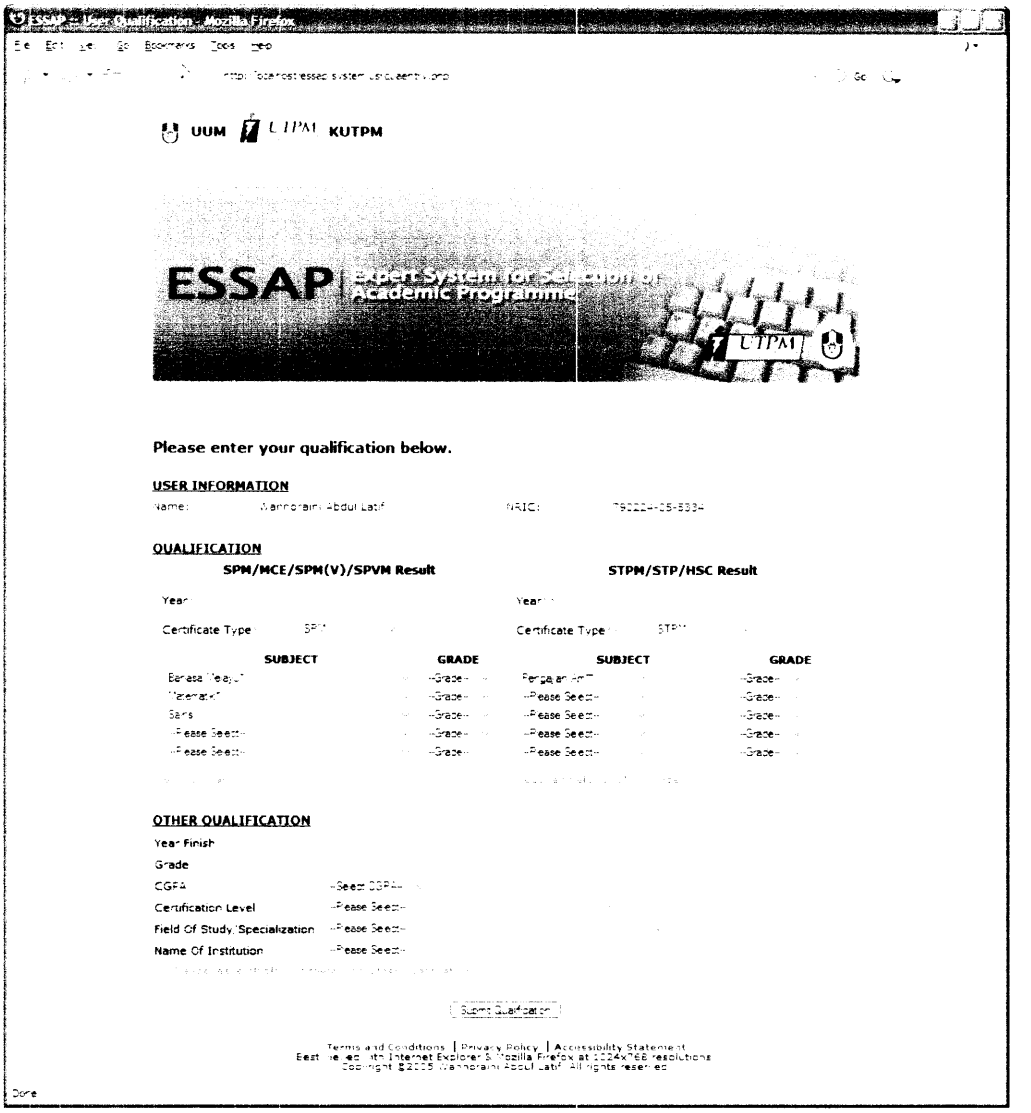


Figure 5.12: User Qualification Entry page

Figure 5.12 shows the interface for User Qualification Entry Page. This page will require user to fill-in SPM results or STPM results, or Other Qualification based on user qualification that their have.

viii) Interface for User Personality Test (Realistic)

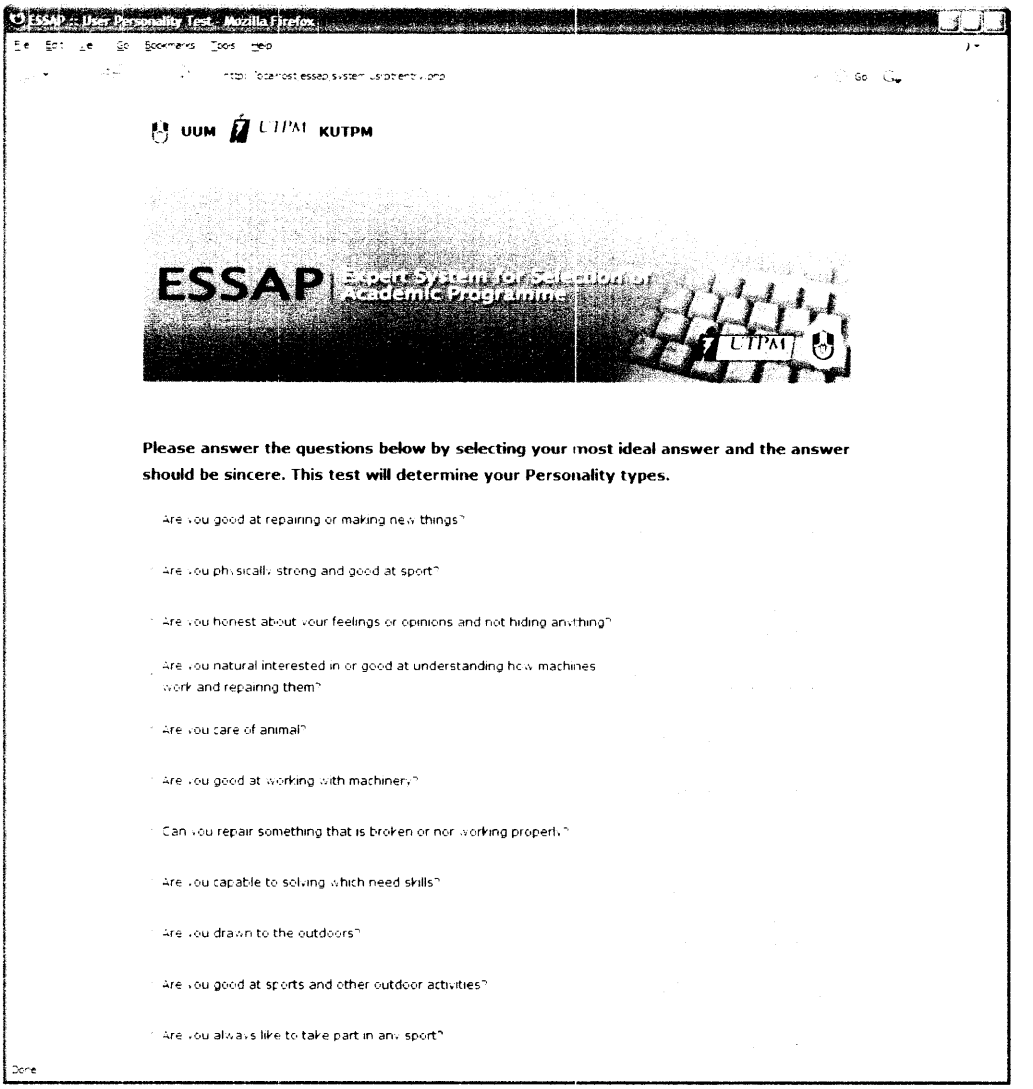


Figure 5.13: User Personality Test (Realistic) top page

Figure 5.13 shows the top page of User Personality Test for Realistic Types. User need to answer all the questions in this page to determine the type of user personality.

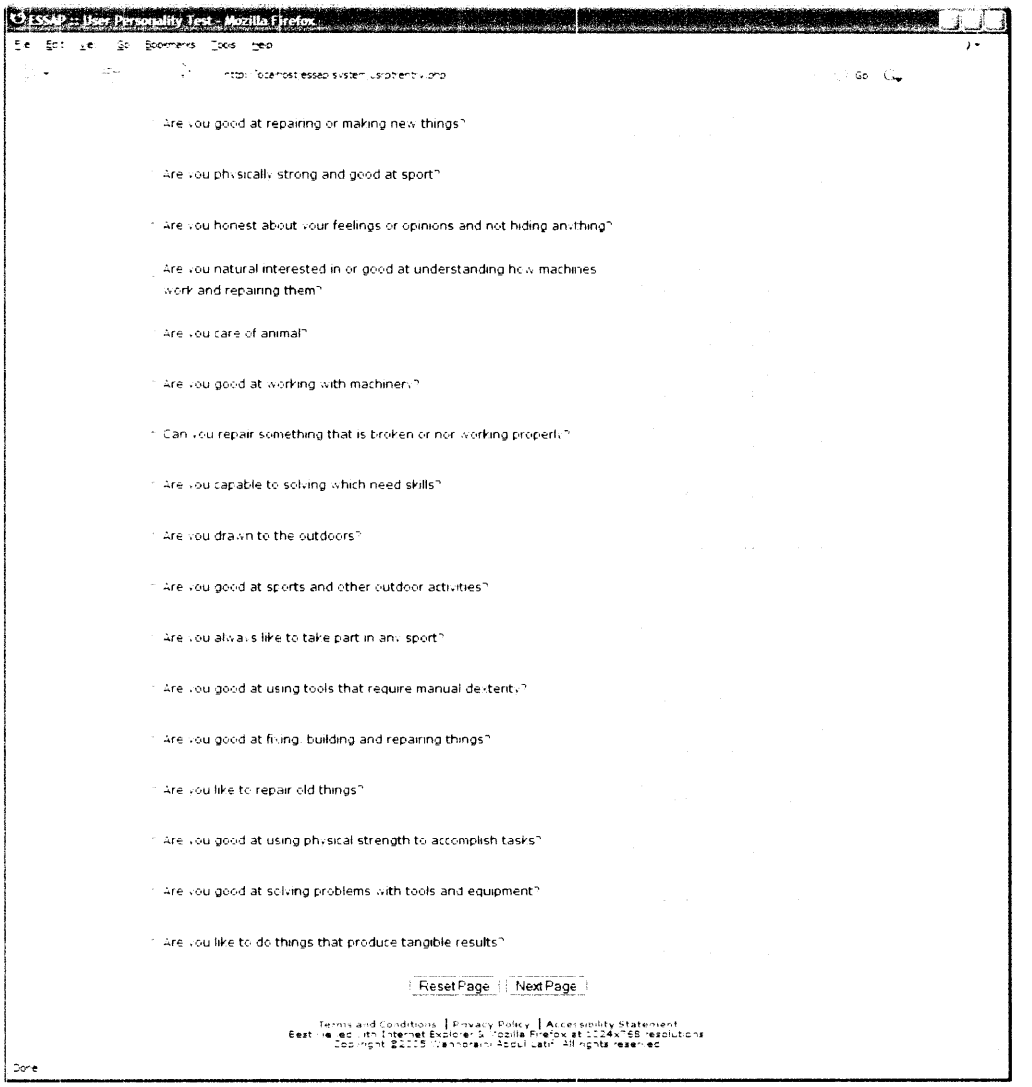


Figure 5.14: User Personality Test (Realistic) bottom page

Figure 5.14 shows the bottom page of User Personality Test for Realistic Types. User need to answer all the questions in this page to determine the type of user personality. User can Reset Page to clear all the current entered data and Next Page to submit current page in and proceed to the next level.

ix) Help/How window for User Personality Test (Realistic)

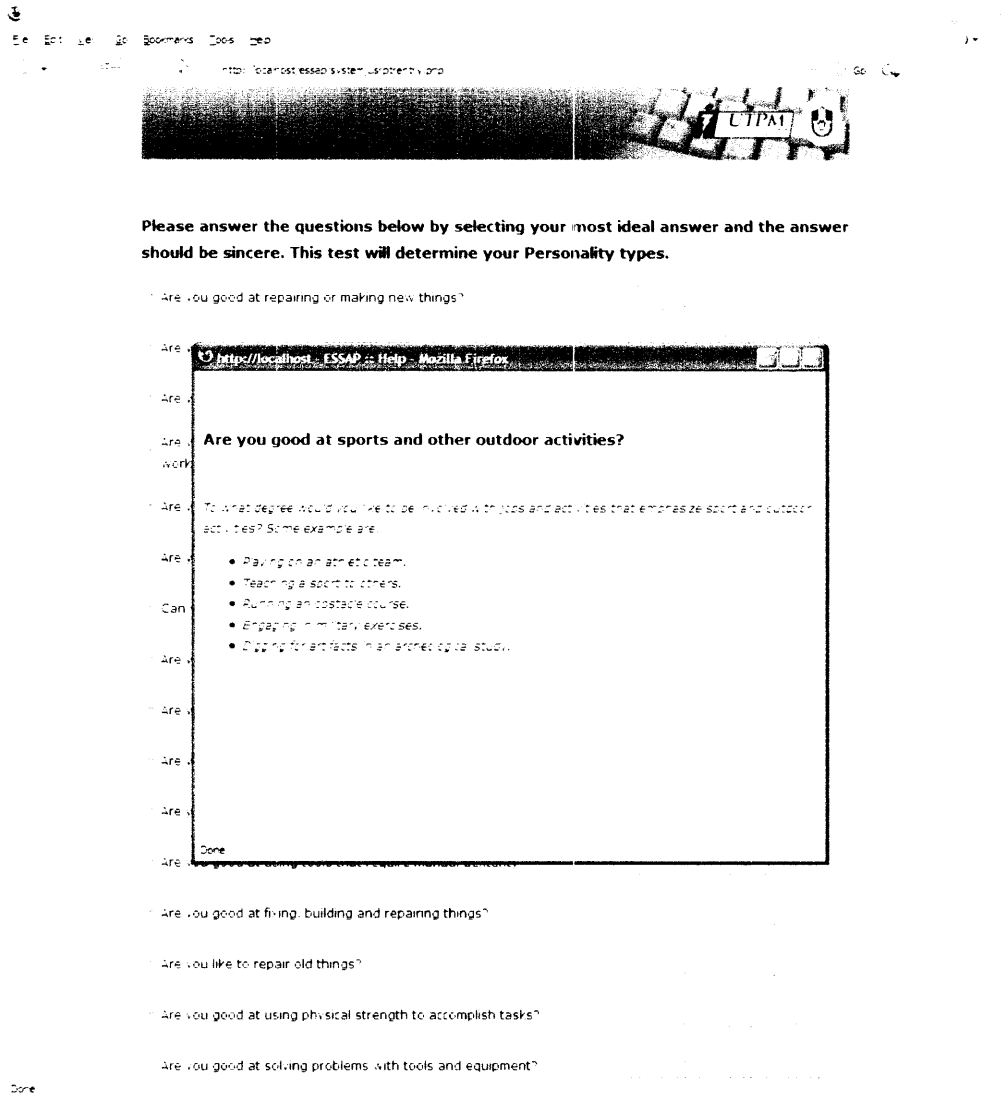


Figure 5.15: Help/How window for User Personality Test (Realistic)

Figure 5.15 shows the Help or How window for User Personality Test page for Realistic Types. If user can't fully understand of question, user can access the How window by clicking at red question icon located at begin of the question.

Every User Personality Test page has these features in order to assist user to give the most correct answers for the test.

x) Interface for User Personality Test (Investigative)

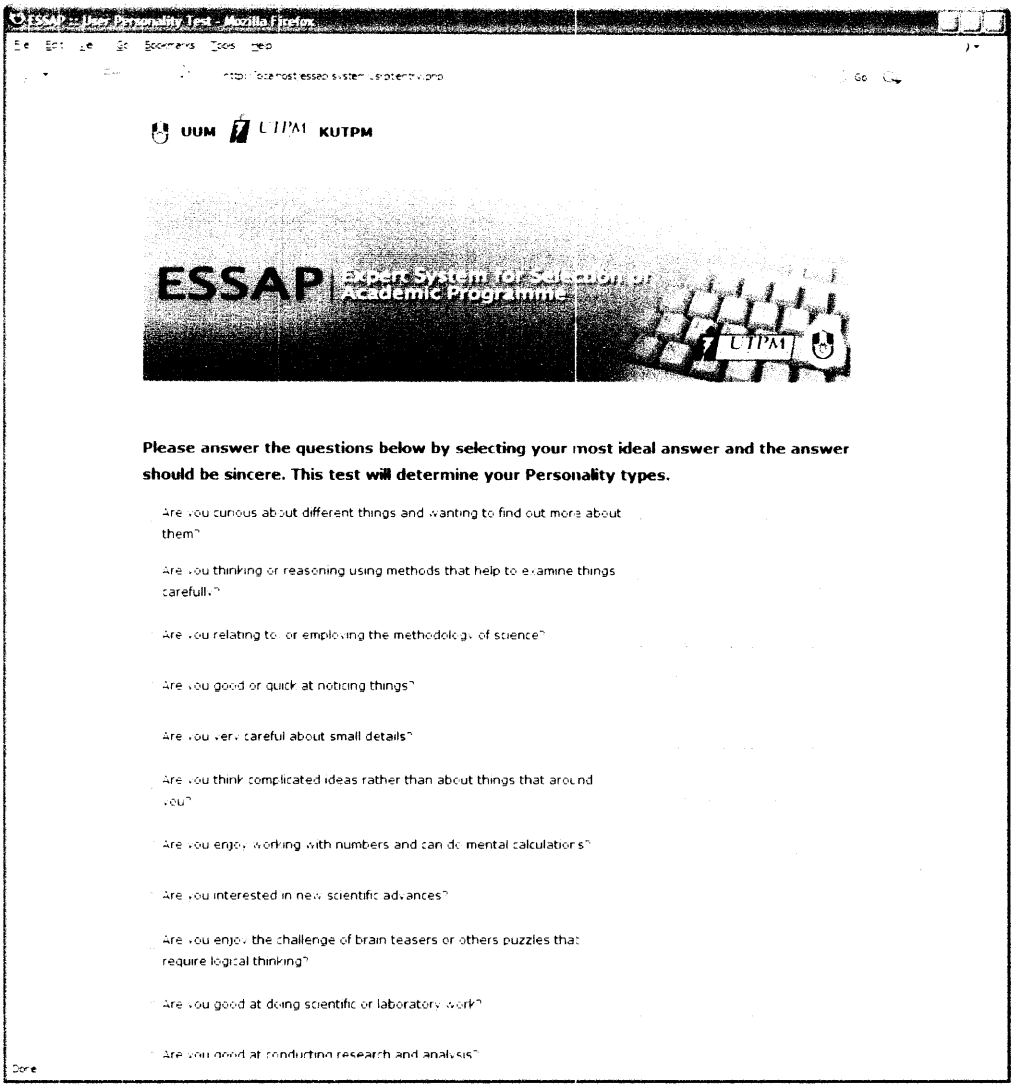


Figure 5.16: User Personality Test (Investigative) page

Figure 5.16 shows the top page of User Personality Test for Investigative personality types. User need to answer all the questions in this page to determine the type of user personality.

xi) Interface for User Personality Test (Artistic)

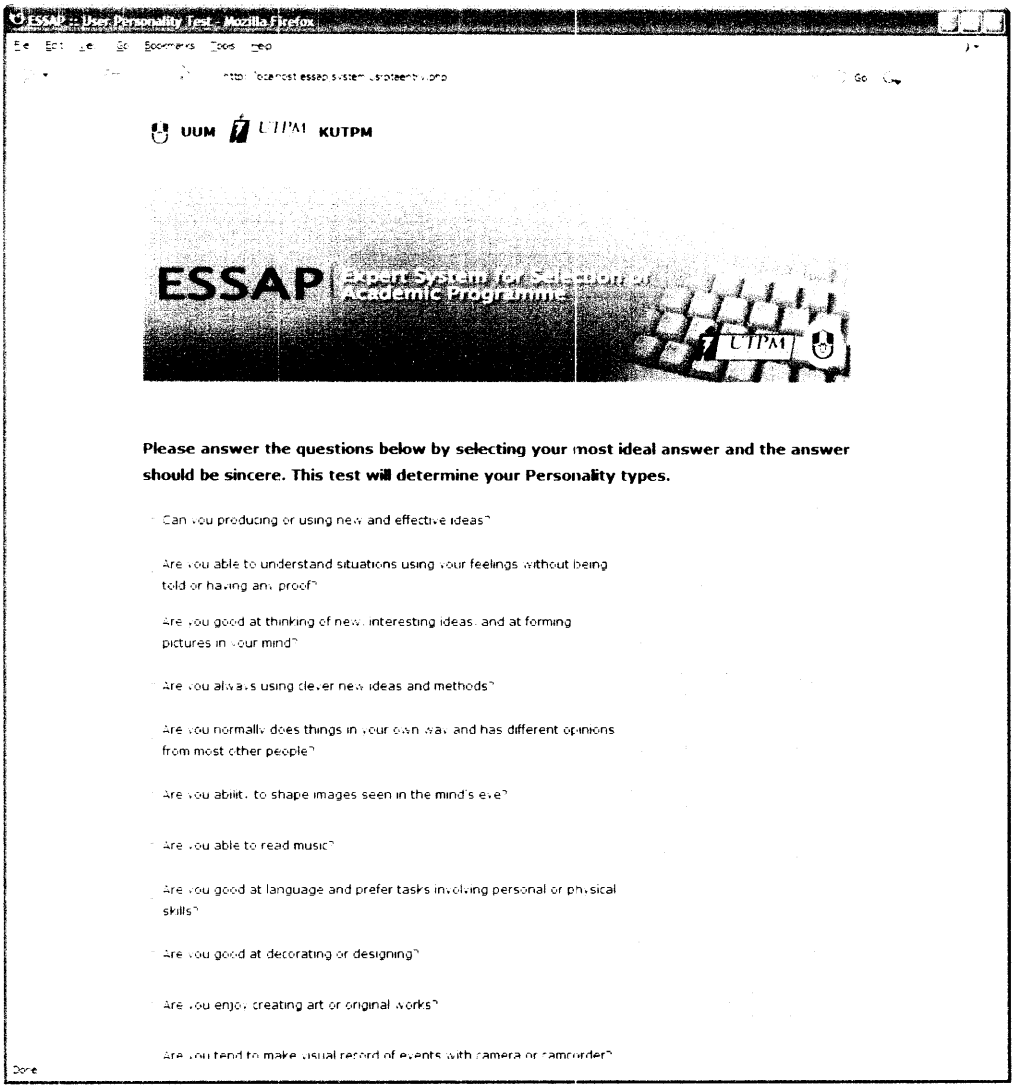


Figure 5.17: User Personality Test (Artisitc) page

Figure 5.17 shows the top page of User Personality Test for Artistic personality types. User need to answer all the questions in this page to determine the type of user personality.

xii) Interface for User Personality Test (Social)

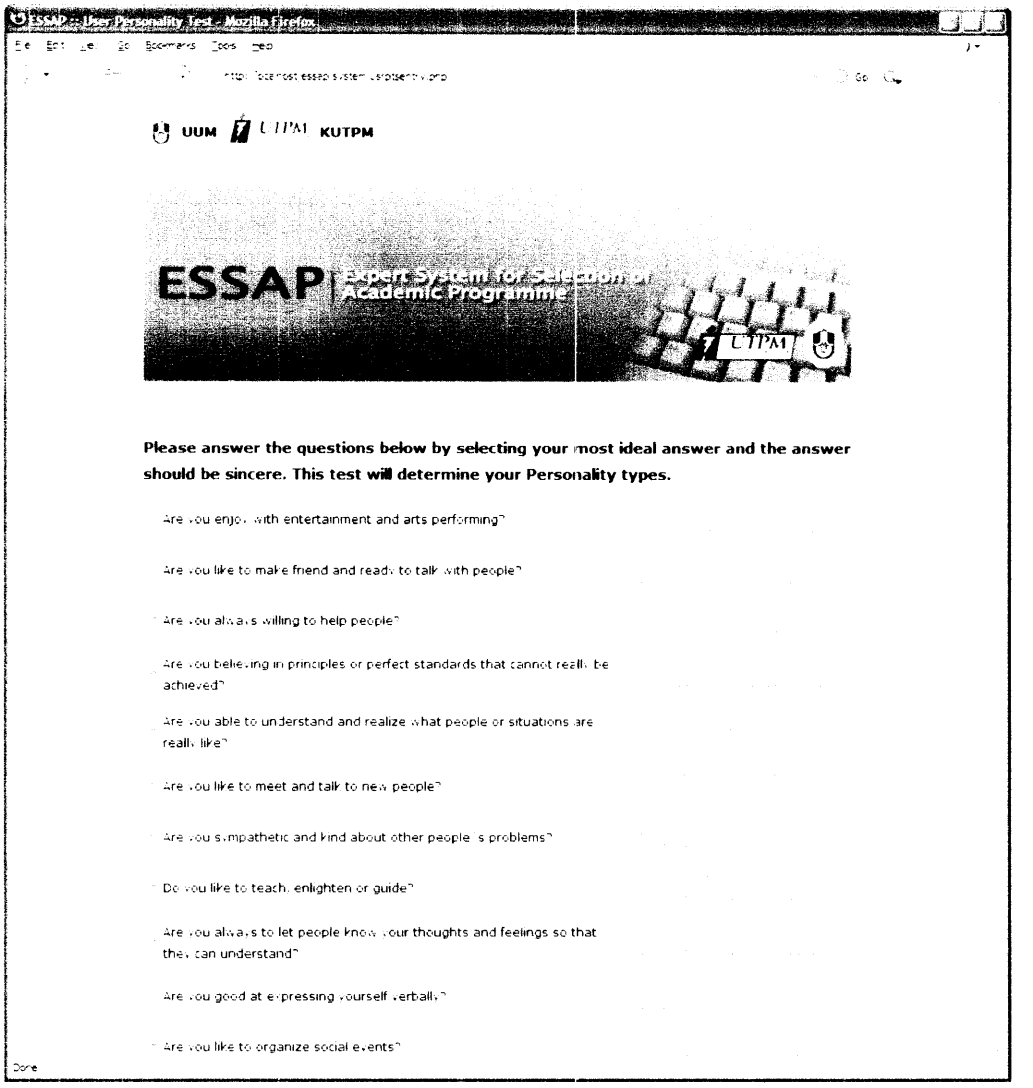


Figure 5.18: User Personality Test (Social) page

Figure 5.18 shows the top page of User Personality Test for Social personality types. User need to answer all the questions in this page to determine the type of user personality.

xiii) Interface for User Personality Test (Enterprising)

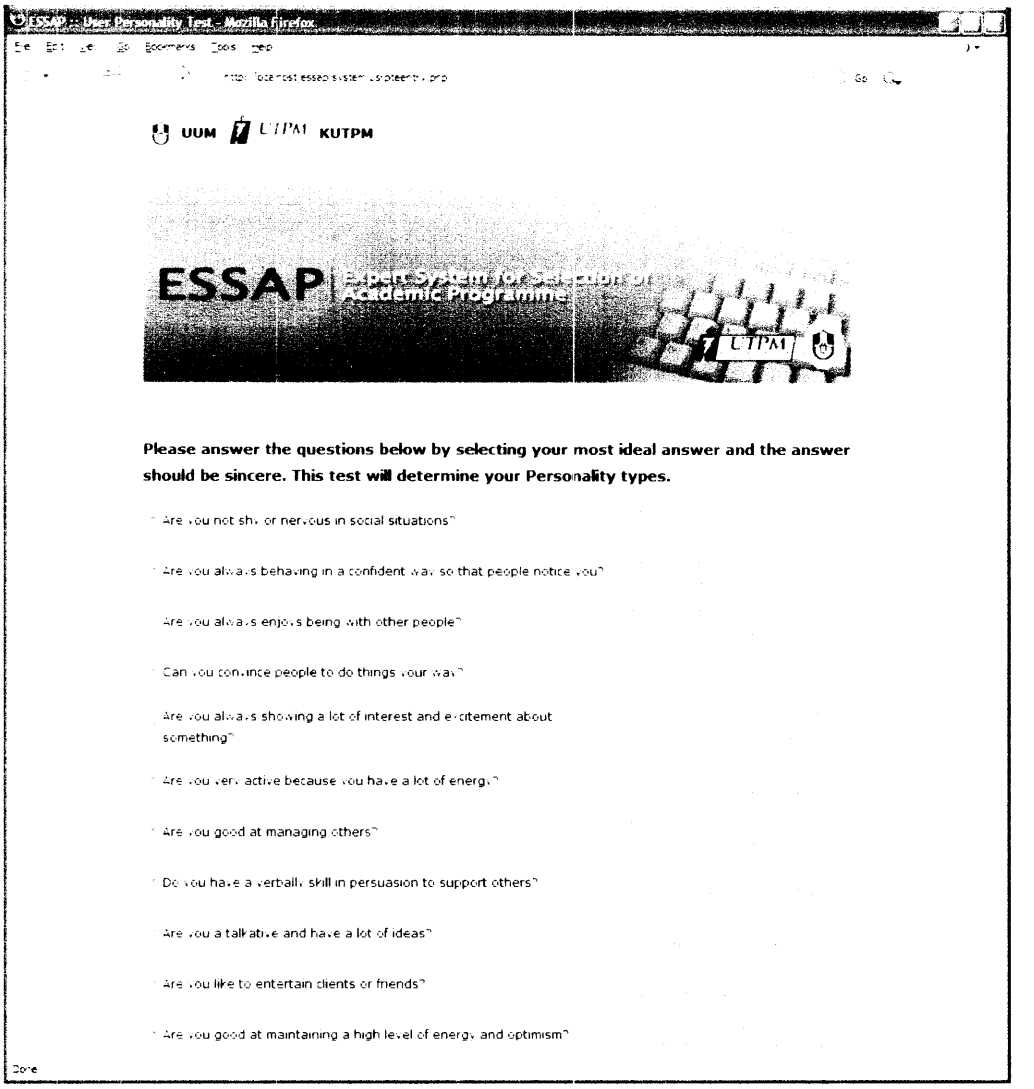


Figure 5.19: User Personality Test (Enterprising) page

Figure 5.19 shows the top page of User Personality Test for Enterprising personality types. User need to answer all the questions in this page to determine the type of user personality.

xiv) Interface for User Personality Test (Conventional)

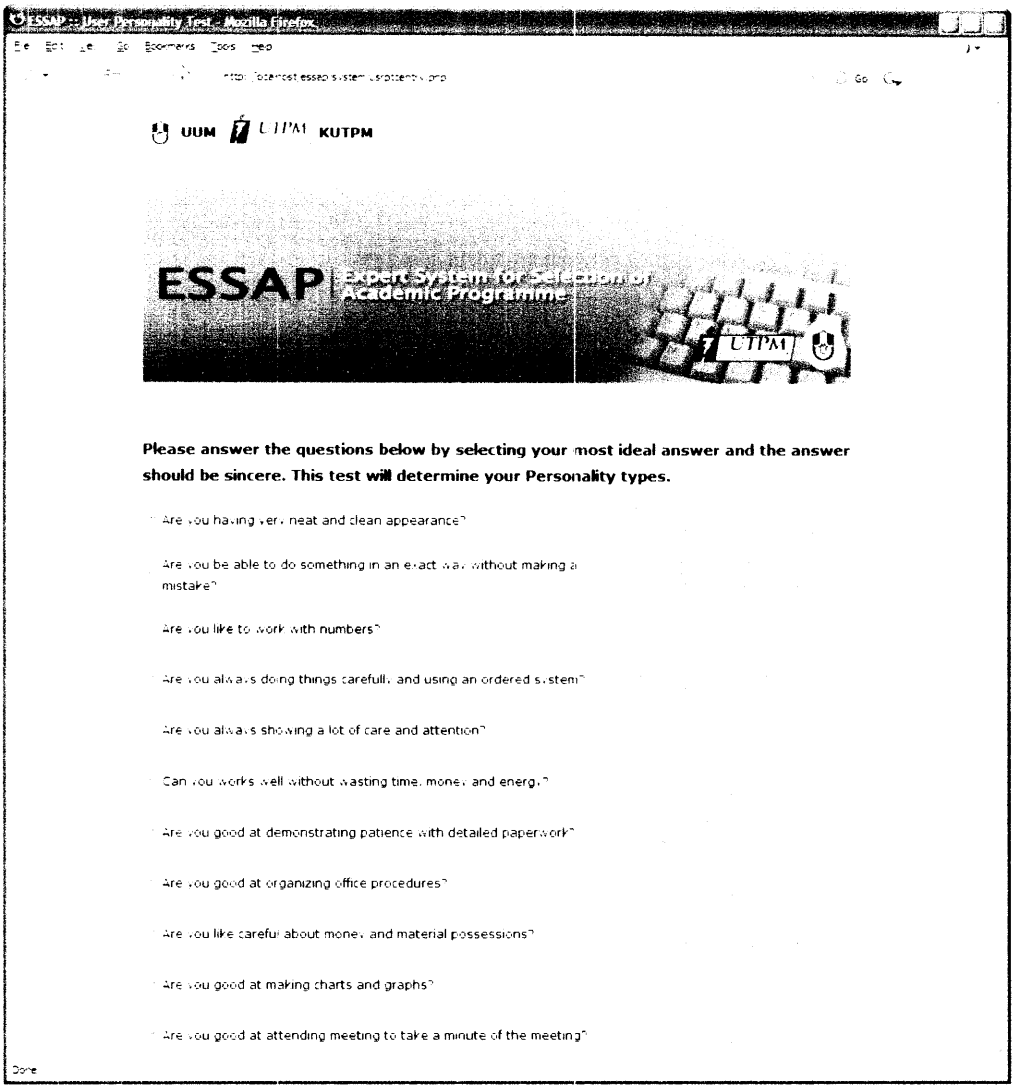


Figure 5.20: User Personality Test (Conventional) page

Figure 5.20 shows the top page of User Personality Test for Conventional personality types. User need to answer all the questions in this page to determine the type of user personality.

xv) Interface for ESSAP Result / System Output

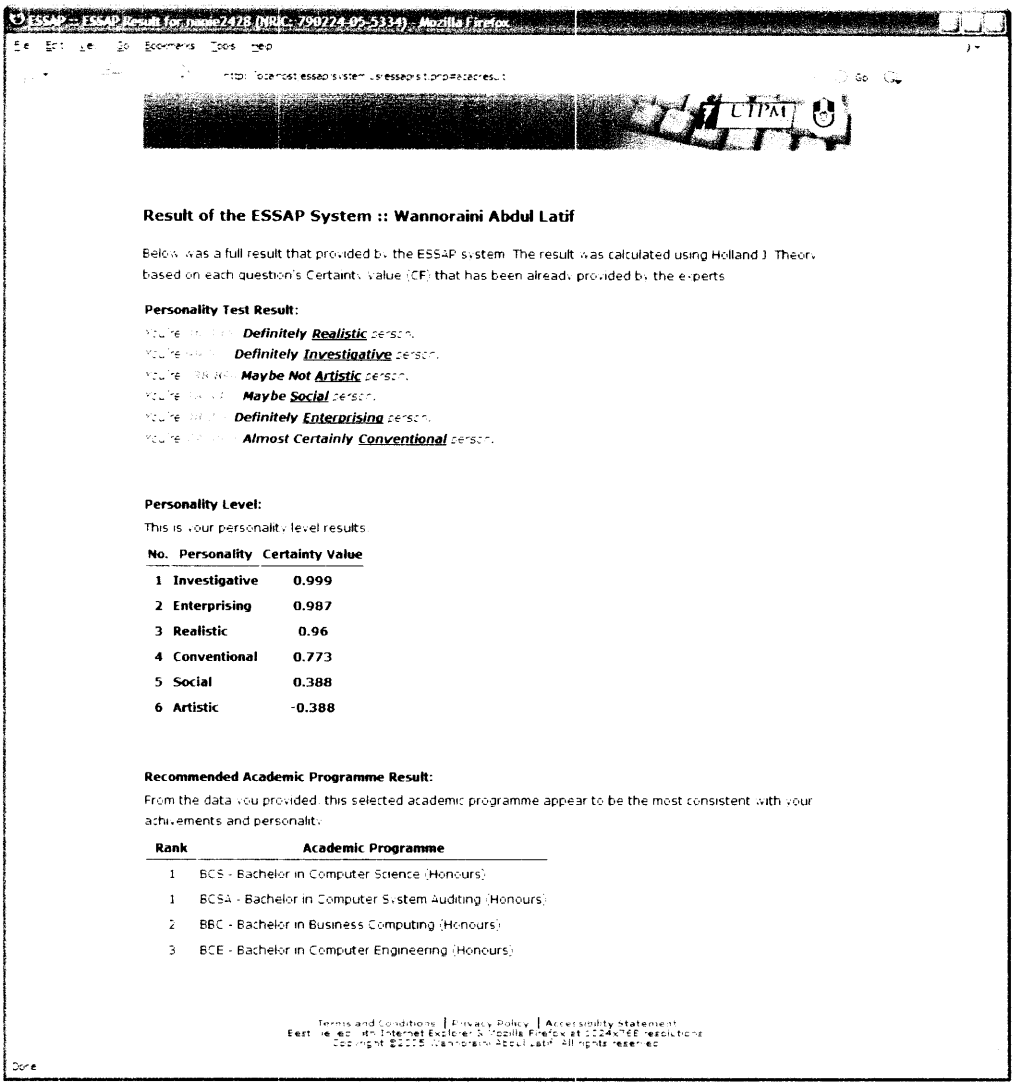
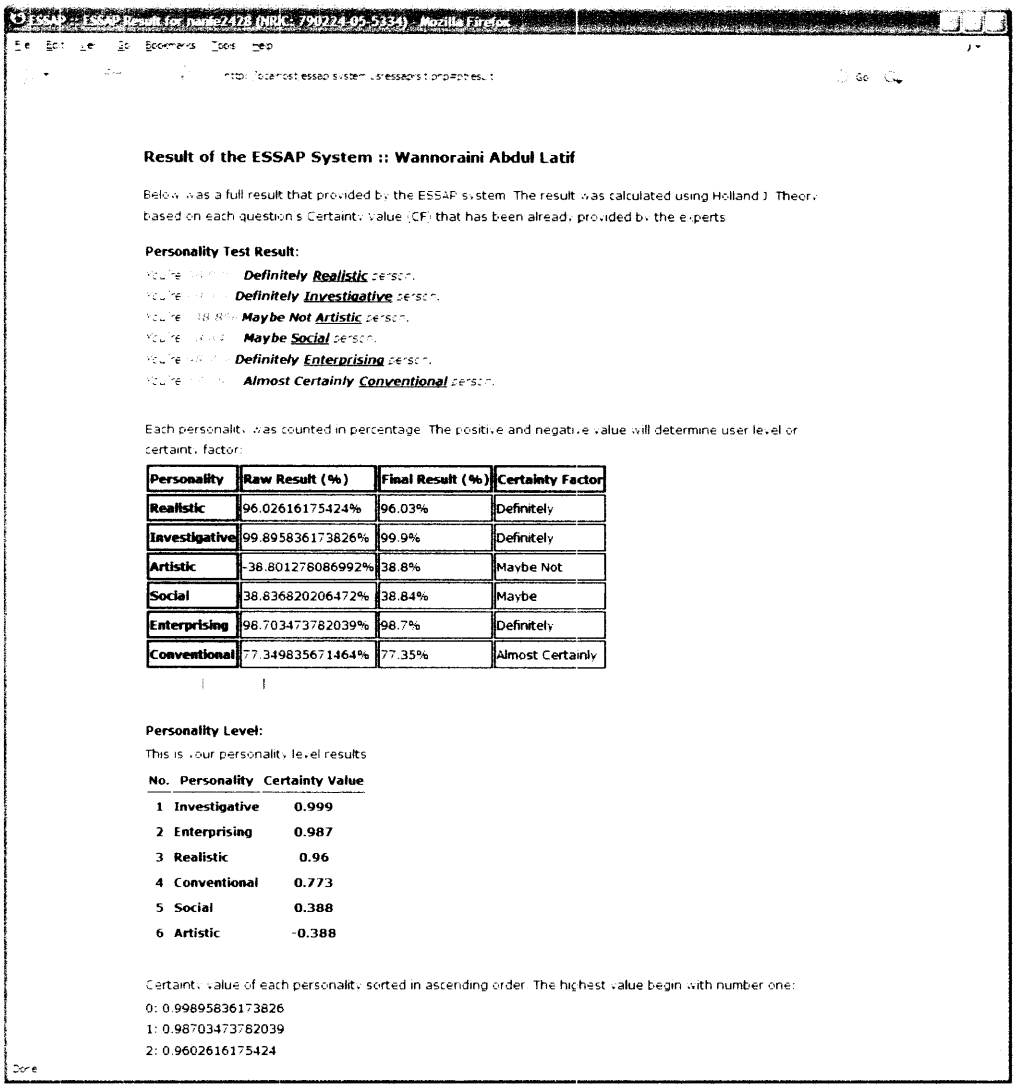


Figure 5.21: ESSAP Result / System Output page

Figure 5.21 show the ESSAP results. These results were determined by user's entry based on qualification and personality test using Holland J. Theory method.

xvi) Interface for ESSAP Result / System Output (Detail)



Result of the ESSAP System :: Wannoraini Abdul Latif

Below was a full result that provided by the ESSAP system. The result was calculated using Holland's Theory based on each question's Certainty Value (CF) that has been already provided by the experts.

Personality Test Result:

You're ... ***Definitely Realistic*** person.
You're ... ***Definitely Investigative*** person.
You're ... ***Maybe Not Artistic*** person.
You're ... ***Maybe Social*** person.
You're ... ***Definitely Enterprising*** person.
You're ... ***Almost Certainly Conventional*** person.

Each personality was counted in percentage. The positive and negative value will determine user level of certainty factor:

Personality	Raw Result (%)	Final Result (%)	Certainty Factor
Realistic	96.02616175424%	96.03%	Definitely
Investigative	99.895836173826%	99.9%	Definitely
Artistic	-38.801276086992%	38.8%	Maybe Not
Social	38.836820206472%	38.84%	Maybe
Enterprising	98.703473782039%	98.7%	Definitely
Conventional	77.349835671464%	77.35%	Almost Certainly

Personality Level:

This is your personality level results

No.	Personality	Certainty Value
1	Investigative	0.999
2	Enterprising	0.987
3	Realistic	0.96
4	Conventional	0.773
5	Social	0.388
6	Artistic	-0.388

Certainty value of each personality sorted in ascending order. The highest value begin with number one:

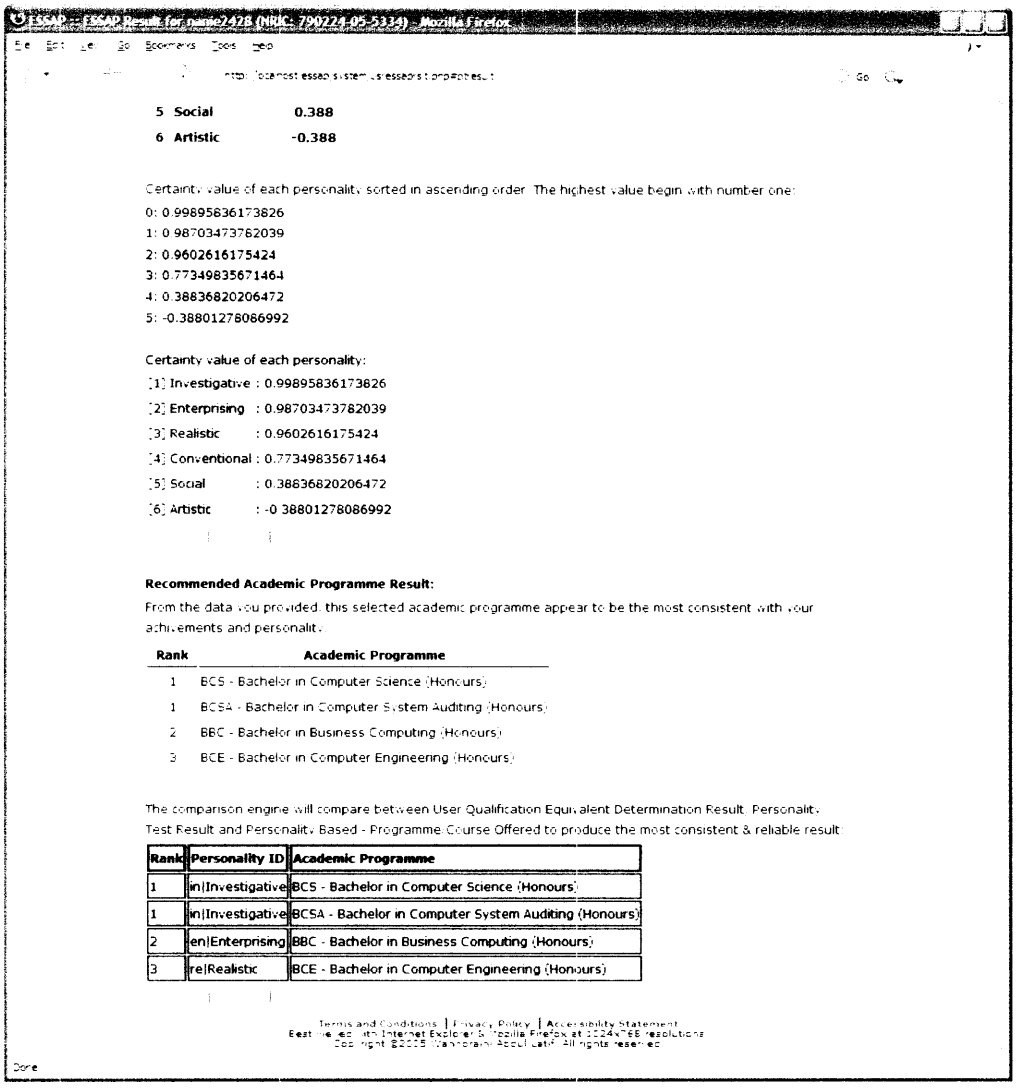
0: 0.99895836173826
1: 0.98703473782039
2: 0.9602616175424

Done

Figure 5.22: ESSAP Detail Result / System Output top page

Figure 5.22 show the ESSAP results top page in more details. The detail results provide how the system gets the output/results based on user's qualification and personality test. User can hide/show the details and can highlight or undo the details highlighting.

ESSAP Result / System Output (Detail) (Continued)



5 Social 0.388

6 Artistic -0.388

Certainty value of each personality sorted in ascending order. The highest value begin with number one:

0: 0.99895836173826
1: 0.98703473782039
2: 0.9602616175424
3: 0.77349835671464
4: 0.38836820206472
5: -0.38801278086992

Certainty value of each personality:

[1] Investigative : 0.99895836173826
[2] Enterprising : 0.98703473782039
[3] Realistic : 0.9602616175424
[4] Conventional : 0.77349835671464
[5] Social : 0.38836820206472
[6] Artistic : -0.38801278086992

Recommended Academic Programme Result:

From the data you provided, this selected academic programme appear to be the most consistent with your achievements and personality.

Rank	Academic Programme
1	BCS - Bachelor in Computer Science (Honours)
1	BCSA - Bachelor in Computer System Auditing (Honours)
2	BBC - Bachelor in Business Computing (Honours)
3	BCE - Bachelor in Computer Engineering (Honours)

The comparison engine will compare between User Qualification Equivalent Determination Result, Personality Test Result and Personality Based - Programme Course Offered to produce the most consistent & reliable result.

Rank	Personality ID	Academic Programme
1	in|Investigative	BCS - Bachelor in Computer Science (Honours)
1	in|Investigative	BCSA - Bachelor in Computer System Auditing (Honours)
2	en|Enterprising	BBC - Bachelor in Business Computing (Honours)
3	re|Realistic	BCE - Bachelor in Computer Engineering (Honours)

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Done

Figure 5.23: ESSAP Detail Result / System Output bottom page

Figure 5.23 show the ESSAP results bottom page in more details. The detail results provide how the system gets the output/results based on user's qualification and personality test. User can hide/show the details and can highlight or undo the details highlighting.

xvii) Interface for ESSAP Career

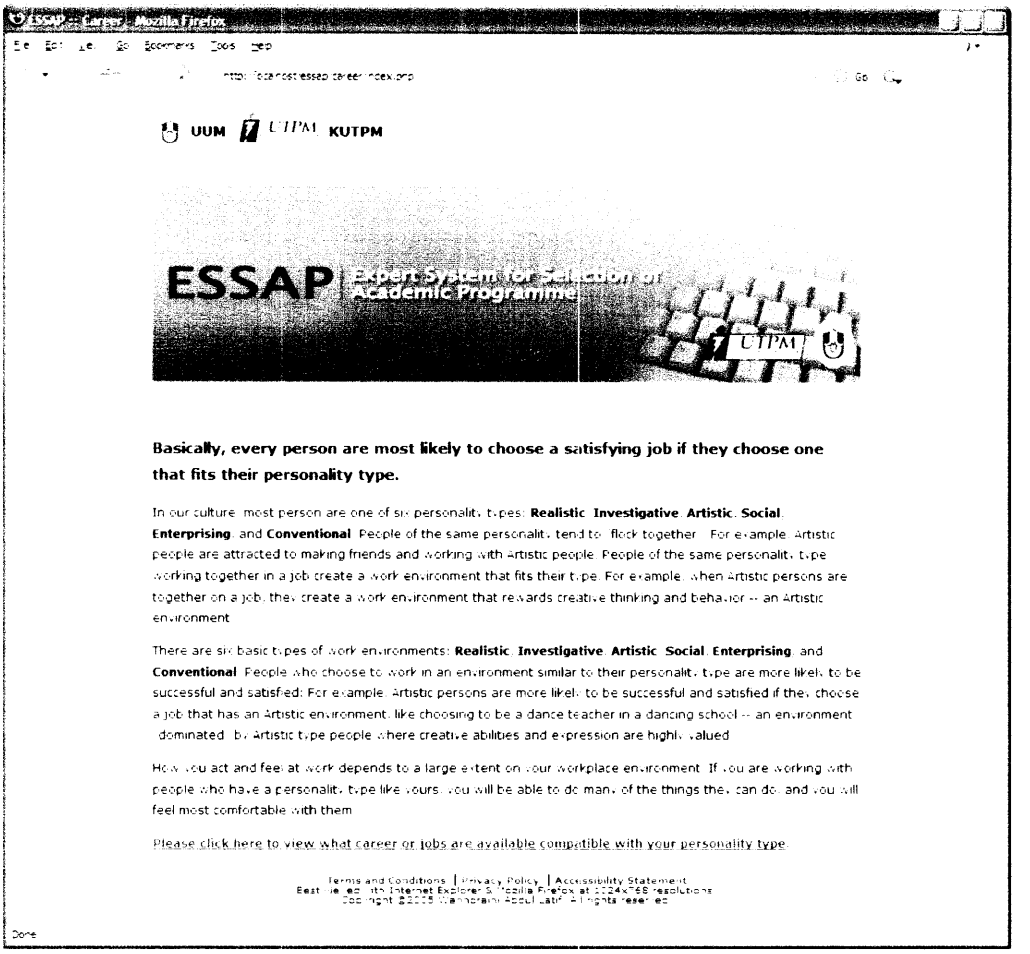

Figure 5.24: ESSAP Career page

Figure 5.24 show the ESSAP Career page. This page describes relation with user personality type and link between personality type and type of work environment and career.

xiii) Interface for ESSAP Career Table by Personality Type

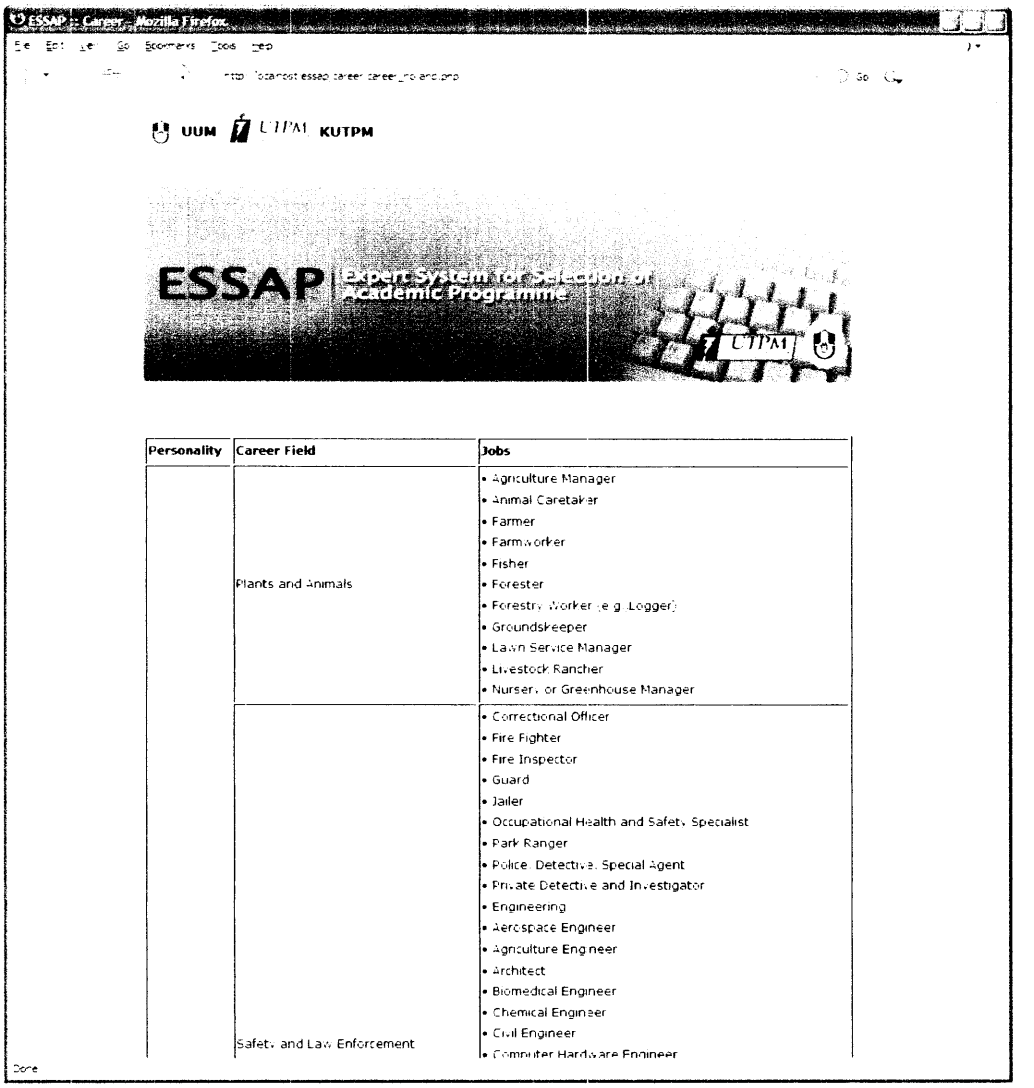

Figure 5.25: ESSAP Career Table by Personality Type page

Figure 5.25 show the ESSAP career table by user personality type. Detail of career and jobs offered under each career field was shown in the table.

xix) Interface for ESSAP System Admin Menu

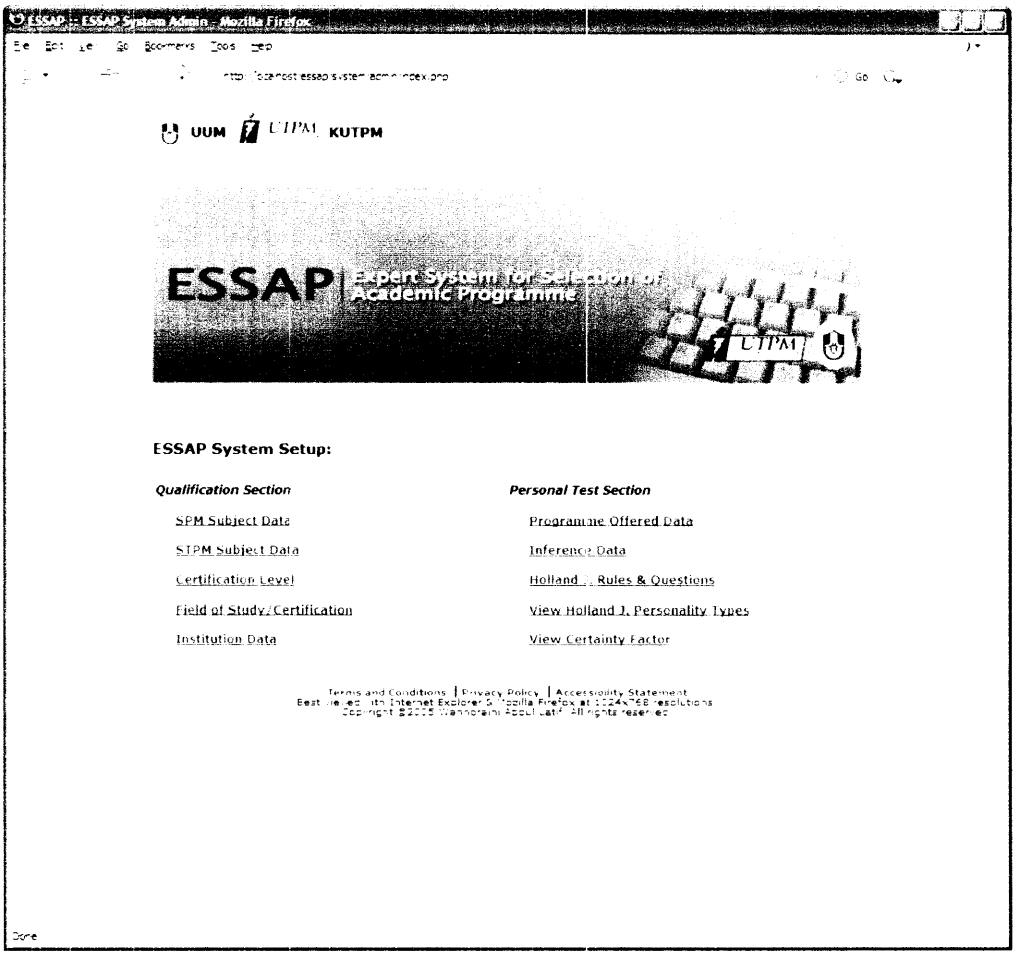

Figure 5.26: ESSAP System Admin Menu page

Figure 5.26 show the ESSAP System Admin Menu page. Each menu will redirect system admin to the specified system setup. The system setup in ESSAP was devided into two groups, setup for Qualification Section data and Personal Test Section data.

System admin can add, update and delete all data except Holland J. Personality Types and Certainty Factor which is it can't be change. Each edit and update will restrict by foreign key rules. These mean parent values can not be deleting as

long as child data exist in the database and update to the parent data will also update/affected the child data.

5.3 System Architecture

Based on Figure 5.27 below, it shows the new method that applied for student to choose their academic programme by using ESSAP system. For prototype, ESSAP system only focused on academic programme that offered by SISE which were eight (8) diploma programmes and seven (7) bachelor programmes. Student need to provide all the information that ESSAP required. The question-based technique has been used to gather the information from the student included qualifications and interests. ESSAP system will generate the conclusion based on the process of inference engine.

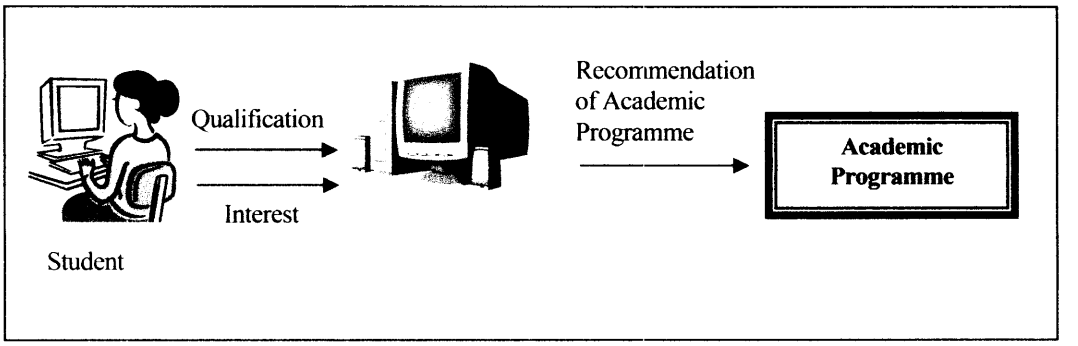

Figure 5.27: New Method for Student to Choose Academic Programme

5.3.1 Certainty Factor

In real life, people always face with certainty. Some of the situation needs people to give exact answer, but some of it makes the people confuse and at the end it makes them answer it uncertainly.

In expert system, this uncertain answer such as maybe and probably will lead to in exact reasoning. So, to overcome this problem, it needs to use certainty theory in developing this system.

This system provides the answer with ten (10) types of answers which is based on certainty factor value as shown in Table 5.16 below (Durkin, 1994). Each question in Personality Test Module has their on certainty factor value and also same with the user answer. When the user answered the Personality Test question (by clicking the radio button), this certainty factor will be calculated. This calculates result that will lead to the final certainty factor value and it will lead to final result of the Personality Result part.

Table 5.16: Uncertain Terms and Their Interpretation

Term	Certainty Factor
Definitely not	- 1.0
Almost certainty not	- 0.8
Probably not	- 0.6
Maybe not	- 0.4
Unknown	- 0.2 to + 0.2
Maybe	+ 0.4
Probably	+ 0.6
Almost certainly	+ 0.8
Definitely	+ 1.0

To calculate a combine certainty factor, the system uses the following equation (Durkin, 1994).

$$CF_{COMBINE}(CF_1, CF_2,) = \begin{cases} CF_1 + CF_2 * (1 - CF_1) & \text{both} > 0 \\ \dfrac{CF_1 + CF_2}{1 - \min\{|CF_1|, |CF_2|\}} & \text{one} < 0 \\ CF_1 + CF_2 * (1 + CF_1) & \text{both} < 0 \end{cases}$$

where:

CF_1 is the confidence in hypothesis H established by Rule 1;

CF_2 is the confidence in hypothesis H established by Rule 2;

$|CF_1|$ and $|CF_2|$ are absolute magnitudes of CF_1 and CF_2, respectively.

Figure 5.28: Equations of Certainty Theory for Calculation and Updated CF

5.3.2 Programming Languages

Expert system for Selection of Academic Programme (ESSAP) is a web-based expert system that is located in the server and can be accessed through the World Wide Web. The system is implemented using three (3) web based programming language such as XHTML, PHP, JavaScript, and CSS as scripting interface design.

i) **XHTML** stands for EXtensible **H**yper**T**ext **M**arkup **L**anguage that specifies the format of the text that is displayed in a Web browser such as Microsoft' Internet Explorer, Mozilla Firefox or Netscape (Deitel et. al, 2004).

ii) **PHP or PHP: Hypertext Preprocessor** is a server side scripting language designed specifically for the Web (Welling & Thomson, 2004). PHP is an Open Source product which means we have to access to the source code and use, alter, and redistribute it all without charge. PHP has many strengths

compared to it competitors such as Perl, Microsoft ASP.NET, JavaServer Pages (JSP), and ColdFusion. The strengths are:

a) *High performance*

PHP is very efficient. Using a single inexpensive server, we can serve millions of hits per day.

b) *Interfaces to many different database systems*

HP has native connections available to many database systems. Using MySQL, we can directly connect to PostgresSQL, mSQL, Oracle, dbm, FilePro, Hyperwave, Infromix, InterBase, and Sybase database among others.

c) *Built-in libraries for many common web tasks*

PHP can generate GIF images on the fly, connect to web services and other network services, parse XML, send email, work with cookies, and generate PDF documents, all with just a few lines of code.

d) *Low cost*

PHP is free; we can download the latest version at any time from http://www.php.net for no charge.

e) *Ease of learning and use*

The syntax of PHP is based on other programming languages, primarily C and Perl. If we already know C and Perl, or C-like language such as C++ or Java, we will be productive using PHP almost immediately.

f) Strong object-oriented support

PHP version 5 has well-designed object-oriented features such as inherintance, private and protected attributes and methods, abstract classes and methods, interfaces, constructors, and destructors.

g) Portability

PHP is available for many different operating systems. We can write PHP code on free Unix-like operating systems such as Linux and FreeBSD, commercial UNIX versions such as Solaris and IRIX, or on different versions of Microsoft Windows.

h) Availability of source code

PHP is unlike commercial, closed-source product because we can free simply modify something or add to the language. We do not need to wait for the manufacturer to release patches. We also do not need to worry about the manufacturer going out of business or deciding to stop supporting a product.

i) Availability of support

Zend Technologies (www.zend.com), the company behind the engine that powers PHP, funds its PHP development by offering support and related software on a commercial basis.

iii) Javascript

Javascript was originally created by Netscape. It can facilitate a disciplined approach to designing computer programs that enhance the functionality and appearance of Web pages (Deitel et. al). JavaScript is used in millions of Web pages to improve the design, validate forms, detect browsers, create cookies, and much more. JavaScript is the most popular scripting language on the internet, and works in all major browsers, such as Internet Explorer, Mozilla, Firefox, Netscape, and Opera (w3schools.com, 2005).

iv) Cascading Style Sheets (CSS)

The interface has been developed using Cascading Style Sheets (CSS), and Adobe Photoshop. CSS is a simple mechanism for adding style (e.g. fonts, colours, and spacing) to Web documents, tutorials, books, mailing lists for users (w3.org.com, 2005).

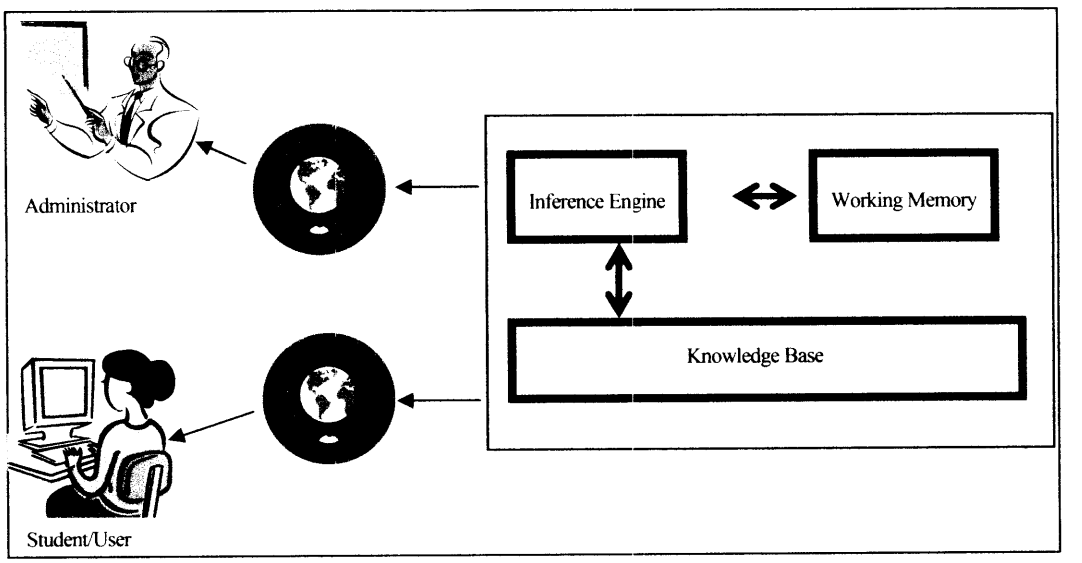

Figure 5.29: ESSAP System Architecture

5.3.3 Knowledge Base

Knowledge base is the important part in developing the expert system. Knowledge base contains everything necessary for understanding, formulating and solving the problem in the system. The most popular approach to representing domain knowledge is using production rules. All the knowledge will be represented in different ways in the table of the database. For the system, we had used MySQL as a database to store the knowledge and rules of the qualifications and interest base on Holland J. Theory (refer Figure 5.29).

According to Welling & Thomson (2004), MySQL is a very fast, robust, relational database management system (RDBMS). Hence, MySQL is a multiuser, multithreaded server. It uses Structural Query Language (SQL), the standard database query language worldwide. MySQL is available under a dual licensing scheme. We can use it under an open source licence (the GPL) free as long as we are willing to meet the terms of the license.

5.3.4 Working Memory

Working memory contains facts about a problem that are discovered during the consultation with the expert system. All the information on the current problem will be located in the working memory. The system will match this information with knowledge contained in the knowledge base to infer new facts. The system reaches some conclusion that is also entered into the working memory.

5.3.5 Inference Engine

The inference engine will generate the consultation result. It works with facts contained in the working memory and the domain knowledge base to derive new information. It will match the facts to draw a conclusion about the problem.

5.4 Summary

In this chapter, the implementation of ESSAP system was presented. The system is named as ESSAP, acronym of Expert System for Selection of Academic Programme. ESSAP uses the artificial intelligence approach which is expert system as its main engine for selection and reasoning tasks. In the next chapter, the ESSAP system results are evaluated empirically.

CHAPTER 6
RESULTS & FINDINGS

In this chapter, the system performance and evaluation in Expert System for Selection of Academic Programme (ESSAP) system will be discussed. The experiments were carried out under Windows XP Professional platform using 1.7-megahertz Pentium IV processor and 256 MB RAM. The experimental results on students are discussed in Section 6.1. Experimental works on staff of KUTPM are presented in Section 6.2.

6.1 Evaluation on Students of KUTPM

Several tests have been conducted to determine whether ESSAP system full fill students' needs. Questionnaires were distributed to the students to fill up after they finished in trying the ESSAP system (refer Appendix D). A total of 50 students were involved in this system evaluation. The questionnaire is divided into three (3) sections which are a section for student information (question 1 to question 2), current system (question 3 to question 11), and ESSAP system (question 12 to question 20). The students' feedback were tabulated, analyzed and presented.

6.1.1 Questions on Student Information

a) Question 1: What is your current semester?

Table 6.1: Current Semester Student	
Current Semester	**Value**
1st semester	12
2nd semester	5
3rd semester	3
4th semester	4
5th semester	16
6th semester	10
Others	0

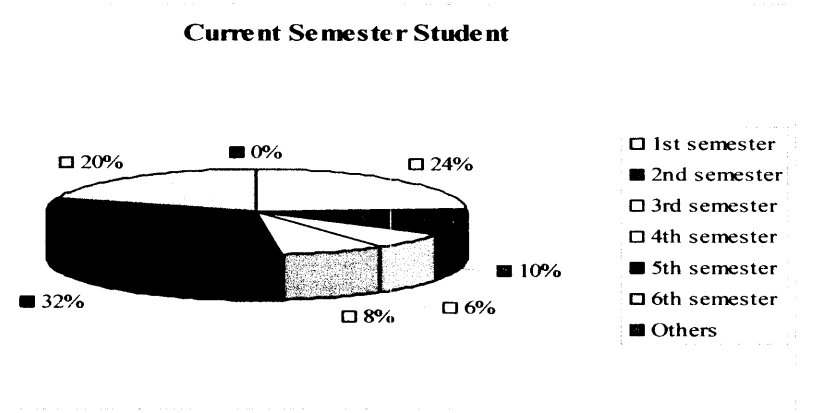

Figure 6.1: Pie Chart of Current Semester Student

Based on the Table 6.1 above, it shows the majority of the respondents were fifth semester students (16 students) and the third semester students were the least (3 students). Figure 6.1 shows the percentage of current semester student based on the value from Table 6.1. the chart shows that 32 percent of the respondents were in their fifth semester, while the third semester students only constitute six percent of the total respondents in this survey.

b) *Question 2: What is your academic programme that you are taking in KUTPM?*

Table 6.2: Student Academic Programme

Academic Programme	Value
BCS (Artificial Intelligence)	10
BCS (Management Information System)	4
BCS (Networking)	8
BCS (Software Engineering)	5
BICT (Graphic Design)	5
BICT (Multimedia)	18

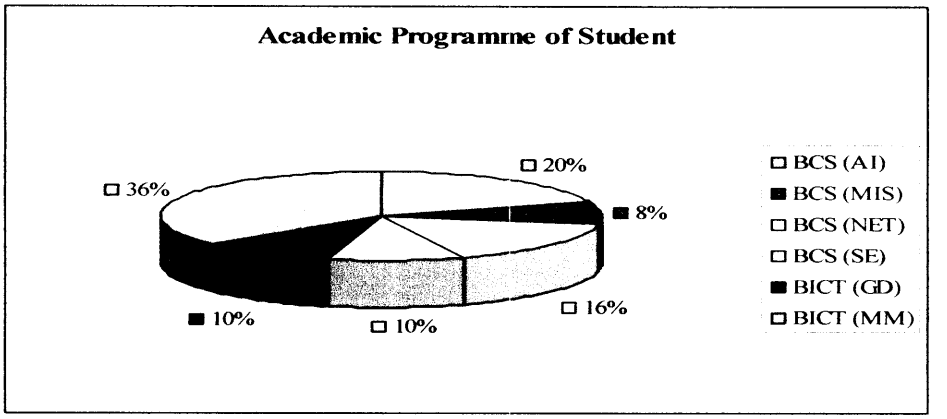

Figure 6.2: Pie Chart of Student Academic Programme

Table 6.2 shows the breakdown of academic programmes that the respondents were currently enrolled in. Figure 6.2 shows that the majority of students were from Bachelor in Information Communication and Technology (BICT - MM), majoring in multimedia which represents 36 percent (18 students) of the respondents, while respondents from Bachelor in Computer Science (BCS – MIS), majoring in Management Information System only constitute 8 percent (4 students).

6.1.2 Questions on Current System

a) Question 3: How did you choose your academic programme in KUTPM?

Table 6.3: The Way Student Choose Academic Programme	
The Way Chosen Academic Programme	**Value**
Decide Myself	22
Follow Friends	20
Family Recommendation	8

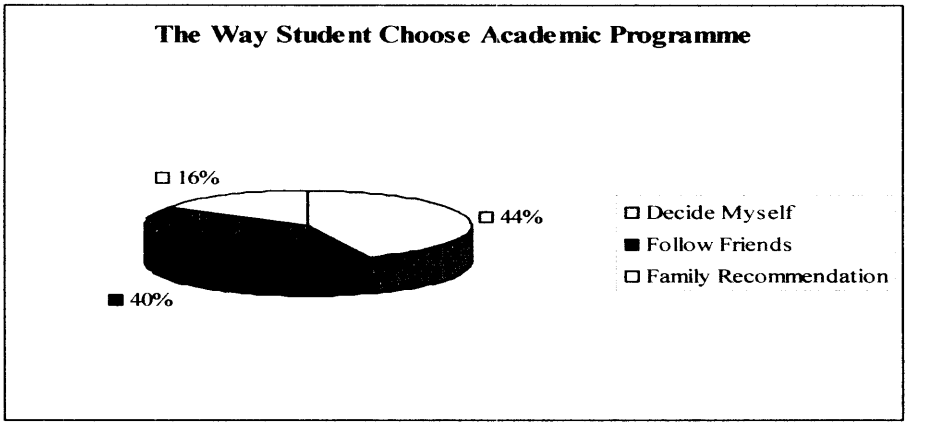

Figure 6.3: Pie Chart of the Way Student Choose Academic Programme

Table 6.3 above shows the way students choose an academic programme. There are three ways students choose their academic programme, that is by deciding themselves, follow their friends, or through family recommendation. The chart in Figure 6.3 depicts the percentage of respondents corresponding to the ways they choose their academic programme. Majority of them decided themselves (44 percent), while those who follow their friends and family recommendation were 40 percent and 16 percent respectively.

b) *Question 4: Have you seen any advisor/counsellor to help you in choosing the academic programme that is suitable with your qualification and interest?*

Table 6.4: Student Seen Any Advisor	
Student Seen Any Advisor	**Value**
Yes	15
No	35

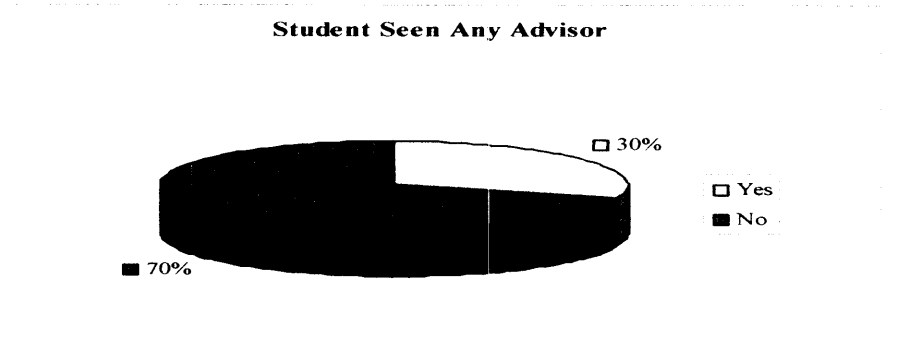

Figure 6.4: Pie Chart of Student Seen Any Advisor

Based on Table 6.4, from out of the 50 respondents, only 15 of them went to see an advisor /counsellor before choosing their academic programme at SISE, KUTPM. From Figure 6.4, the remaining 70 percent of these students never sought the advice of counsellor in choosing a suitable academic programme for themselves.

c) *Question 5: If yes, how long does it take to make an appointment with the advisor/counsellor?*

Table 6.5: Duration Make Appointment With Advisor	
Time	**Value**
1 day	4
2 days	6
3 days	3
4 - 6 days	1
1 - 2 weeks	1
> 2 weeks	0

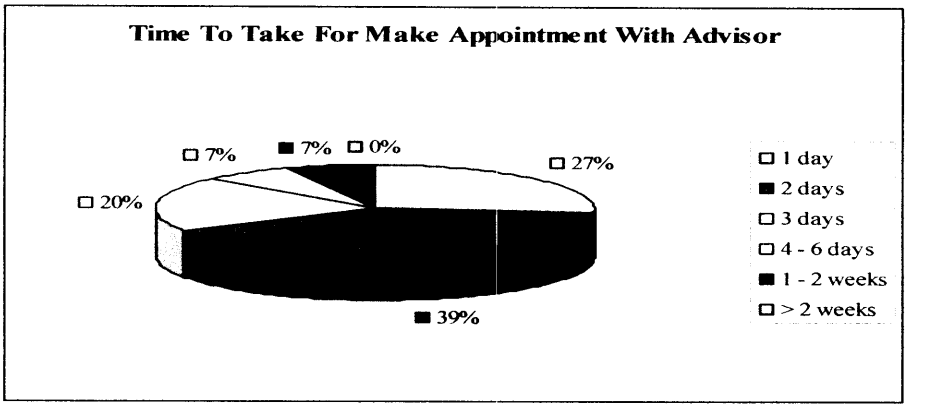

Figure 6.5: Pie Chart of Duration to Make Appointment with Advisor

Table 6.5 shows the duration to make appointment with an advisor. Most respondents claimed that it takes 2 days to make an appointment, while only one student each that said it takes 4 to 6 days and 1 to 2 weeks. Figure 6.5 shows the percentage which the majority is 39 percent, while the last two categories only share seven percents each.

d) *Question 6: It usually takes me ..... minutes to complete the advising process.*

Table 6.6: Duration to Complete Advising Process	
Duration (Time)	**Value**
Never met	35
< 10 minutes	0
11 - 20 minutes	1
21 - 30 minutes	3
31 - 40 minutes	6
> 40 minutes	5

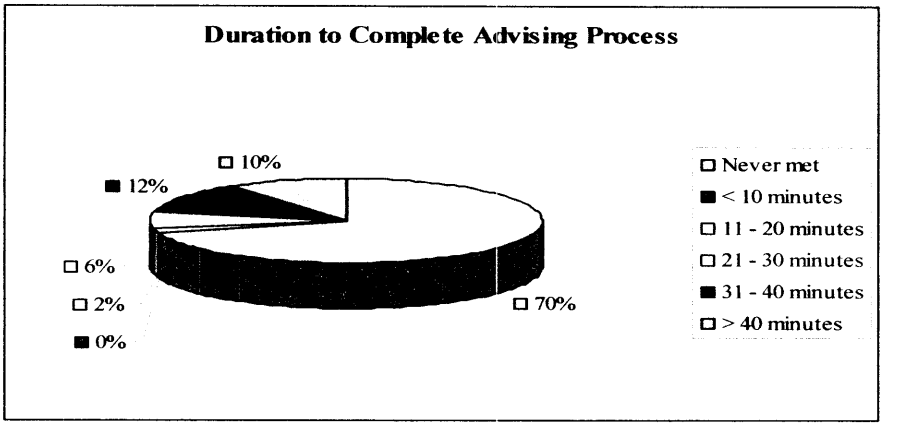

Figure 6.6: Pie Chart of Duration to Complete Advising Process

Results from Question 6 revealed that 70 percent of students never met an advisor. Those who spent more than 30 minutes in an advisory session constitute 22 percent of the respondents, while the remaining eight percent only need about 10 to 30 minutes with their advisor.

e) *Question 7: Have you ever had a walk-in appointment at school/advisor/counsellor office?*

Table 6.7: Walk-in Appointment for Advising Process	
Walk-in Appointment for Advising Process	**Value**
Yes	10
No	40

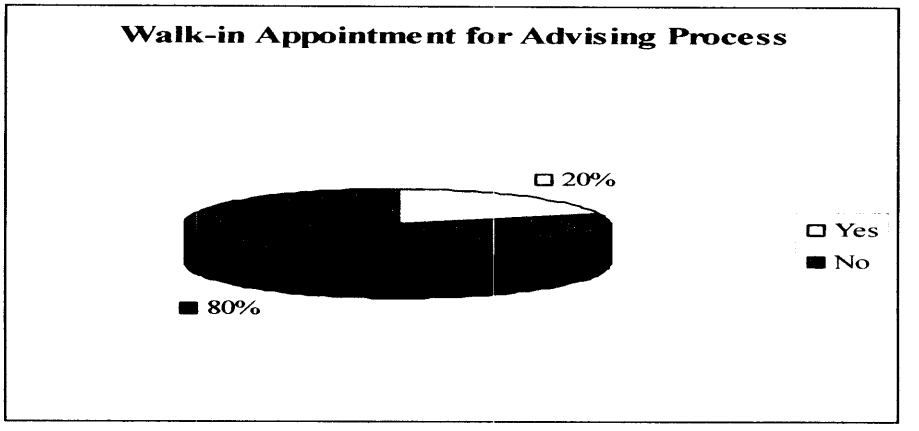

Figure 6.7: Pie Chart of Walk-in Appointment for Advising Process

Table 6.7 shows the result of walk-in appointment for advising process in SISE. Majority of students did not have any walk-in appointment (40 students), while the other 10 had. Figure 6.7 shows the percentage of the respond to this question.

f) Question 8: If yes, then on average, how many minutes did you have to wait for an appointment?

Table 6.8: Average Duration Have to Wait for Appointment	
Average Duration	**Value**
0 - 10 minutes	1
11 - 20 minutes	2
21 - 30 minutes	4
31 - 40 minutes	2
> 40 minutes	1

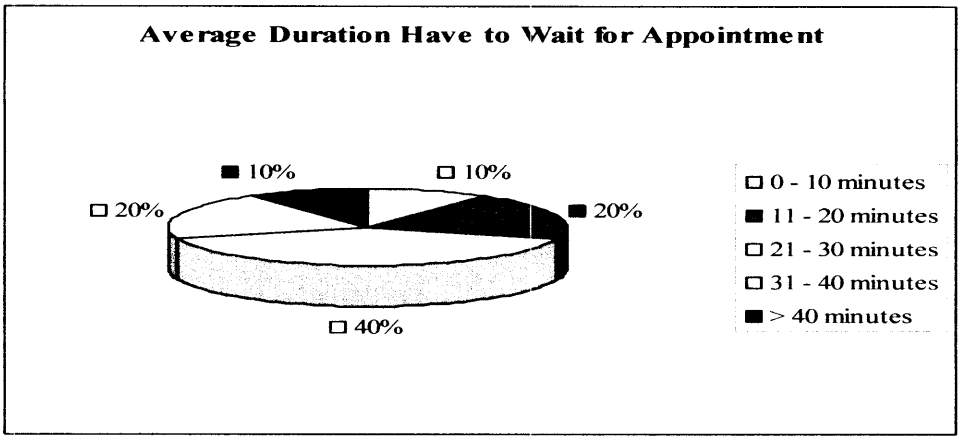

Figure 6.8: Pie Chart of Average Duration Have to Wait for Appointment

Question 8 applies to the 10 respondents who answered positively in Question 7. Out of these 10 students, the majority (40 percent) stated that the average duration they have to wait for an appointment is about 21 to 30 minutes.

g) *Question 9: Do you think this was a reasonable time to wait?*

Table 6.9: Reasonable Time to Wait	
Reasonable Time to Wait	**Value**
Yes	2
No	8

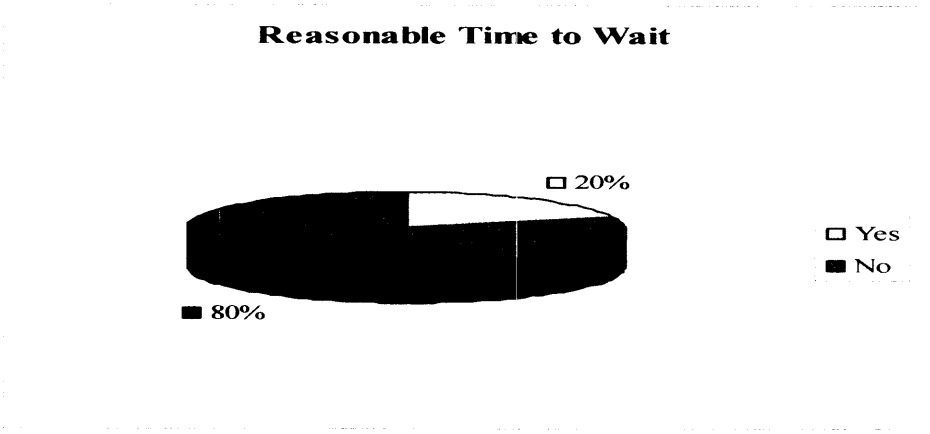

Figure 6.9: Pie Chart of Reasonable to Wait for Academic Process

Out of these same 10 respondents, eight percent of them said that it is not a reasonable time to wait for an advisor as shown in Figure 6.9, in relation to Question 8 and Question 9.

h) Question 10: If you never met your advisor/counsellor, give a reason why?

Table 6.10: Reason for Never Met Advisor	
Reason	**Value**
Lack of Time	7
Too Shy	8
Lazy to Wait	10
Not Comfortable	5
Do Not Interested	3
Do Not Know	2

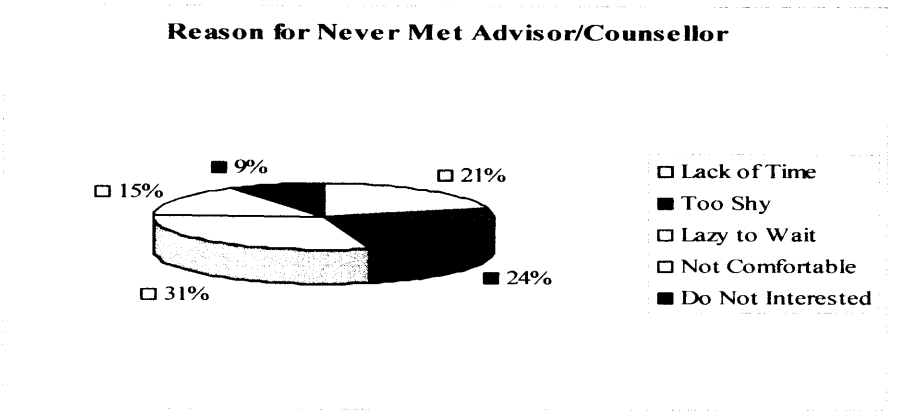

Figure 6.10: Pie Chart of Reason for Never Met Advisor/Counsellor

Based on the 35 students who claimed that they never met an advisor prior to choose their academic programme, the majority of them gave the reason that they are lazy to wait for a session with an advisor. Only two of them said that they do not know any advisor to seek (refer Table 6.10 and Figure 6.10).

6.1.3 Questions on ESSAP System

a) *Question 11: How about the Graphical User Interface (GUI) for this system?*

Table 6.11: Evaluation of Graphical User Interface	
Ranking	**Value**
Very Poor	0
Poor	0
Average	3
Good	20
Very Good	27

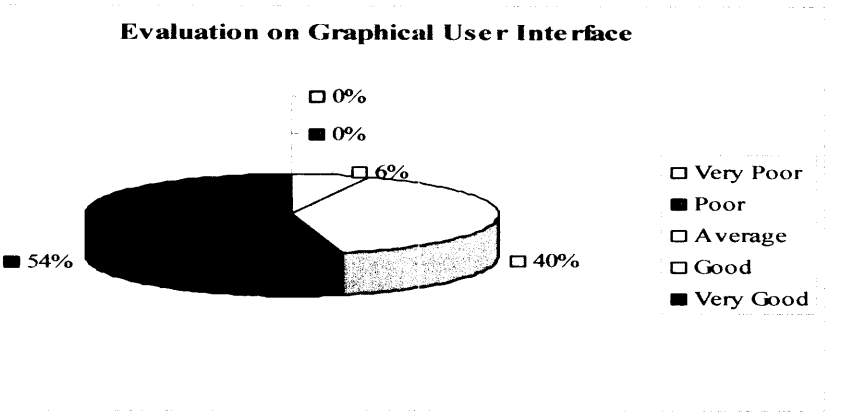

Figure 6.11: Pie Chart of Evaluation on Graphical User Interface

Question 11 and onwards cover the responds on ESSAP System. Figure 6.11 shows that about 94 percent of the respondents agreed that the ESSAP GUI is good, while the remaining 6 percent said that it is average.

b) *Question 12: How about the functionality of the system, user interaction and navigational tools?*

Table 6.12: Evaluation of System Functionality	
Ranking	**Value**
Very Poor	0
Poor	0
Average	4
Good	22
Very Good	24

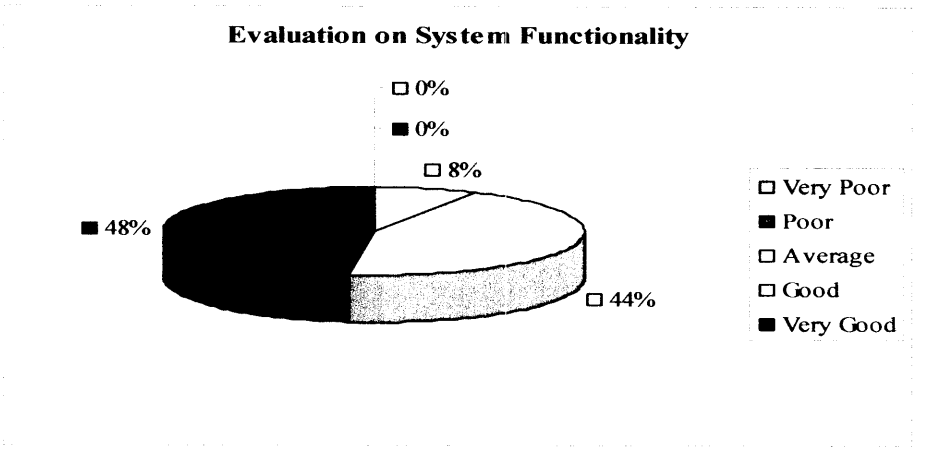

Figure 6.12: Pie Chart of Evaluation on System Functionality

Table 6.12 shows the responds on the evaluation of system functionality, user interaction and navigational tools by the students. Twenty four out of fifty respondents said that the system functionality is 'very good' while another 22 and four said that it is 'good' and average respectively. Refer to Figure 6.12 for the summary in percentage.

c) *Question 13: Do you think an explanation function would be helpful in answering interest (based on Holland J. Theory) questions?*

Table 6.13: Evaluation of Explanation Functions	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	2
Agree	20
Strongly Agree	28

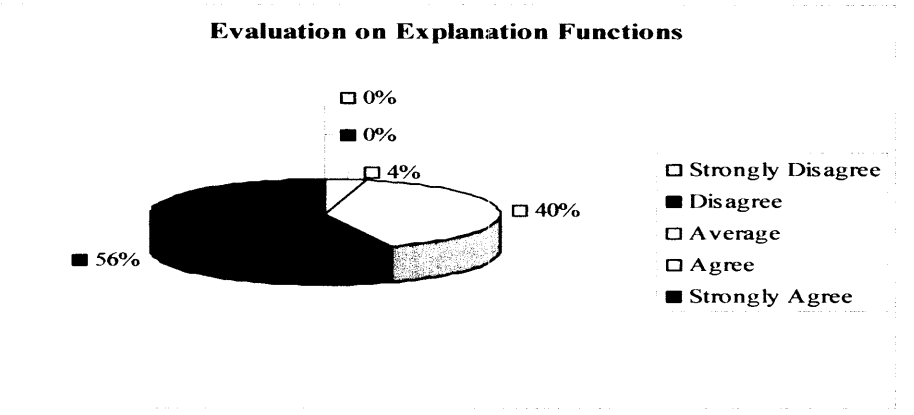

Figure 6.13: Pie Chart of Evaluation on Explanation Functions

Question 13 asked the respondents for their opinion on helpfulness of the explanation function in the system. About 96 percent of the respondents agreed that the function is helpful in answering interest based on Holland J. Theory.

d) *Question 14: Would this system determine your personality types correctly (such as Realistic, Investigative, Artistic, Social, Enterprising and Conventional)?*

Table 6.14: Evaluation of System Results	
Ranking	**Value**
Very Poor	0
Poor	0
Average	2
Good	23
Very Good	25

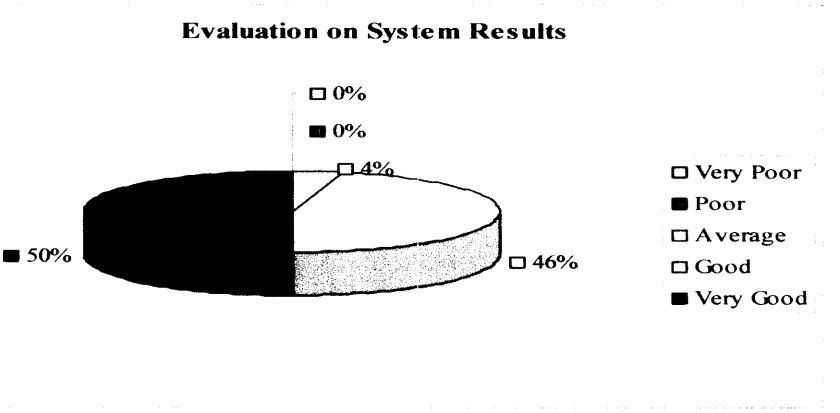

Figure 6.14: Pie Chart of Evaluation of System Results

Table 6.14 shows the evaluation of system result of ESSAP system. Majority of the students (96 percent) self that the system is good enough to determine their personality types correctly. The remaining four percent found it to be average.

e) *Question 15: Are you clear about your career and education path after using this system?*

Table 6.15: Clear of Career Path After Using ESSAP	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	2
Agree	22
Strongly Agree	26

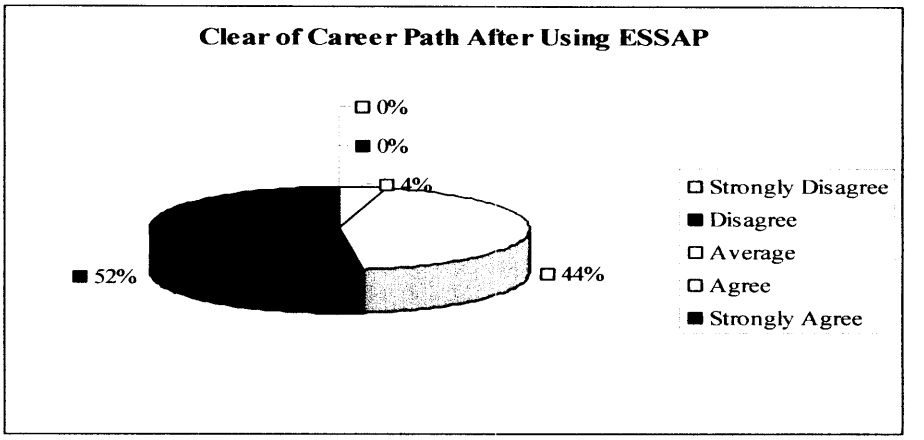

Figure 6.15: Pie Chart of Clear of Career After Using ESSAP

Figure 6.15 shows the chart that almost all respondents agreed that they are clear about their career and education path after using ESSAP System. This shows that the system can tremendously help students to decide the suitable academic programme for them to enroll.

f) Question 16: How long does it take to use this system (in minutes)?

Table 6.16: Duration of Using ESSAP System	
Duration	**Value**
0 - 10 minutes	26
11 - 20 minutes	18
21 - 30 minutes	5
31 - 40 minutes	1
> 40 minutes	0

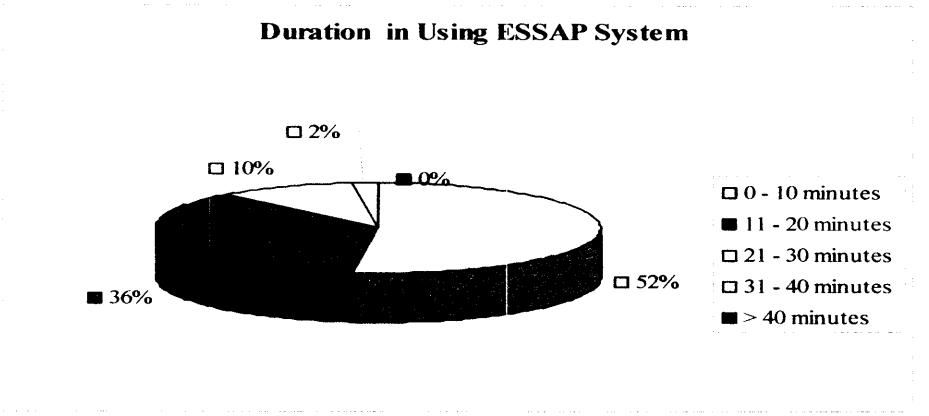

Figure 6.16: Pie Chart of Duration of Using ESSAP System

Table 6.16 shows the duration of using ESSAP system by 50 students of SISE. Twenty six students stated that they took less than 10 minutes to use the system, while another 18 spent 11 - 20 minutes, five students use the system for about 21 – 30 minutes, and only one student spent about 31 – 40 minutes to use the system.

g) *Question 17: Would this system recommend the suitable/fit academic programme based on your interests and qualifications?*

Table 6.17: Recommend Suitable Academic Programme	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	4
Agree	22
Strongly Agree	24

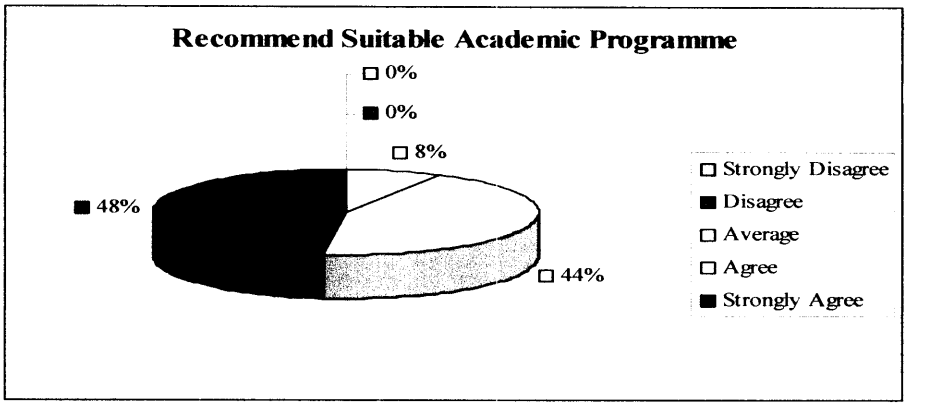

Figure 6.17: Pie Chart for Recommend Suitable Academic Programme by ESSAP System

Figure 6.17 represents the responds on whether the system recommends suitable academic programme based on the respondents' interest and qualifications. More than 90 percent of the respondents agreed that the system showed them a suitable academic programme.

h) *Question 18: What is your evaluation of the overall effectiveness and value of the system?*

Table 6.18: Overall Evaluation of ESSAP System	
Ranking	**Value**
Very Poor	0
Poor	0
Average	2
Good	23
Very Good	25

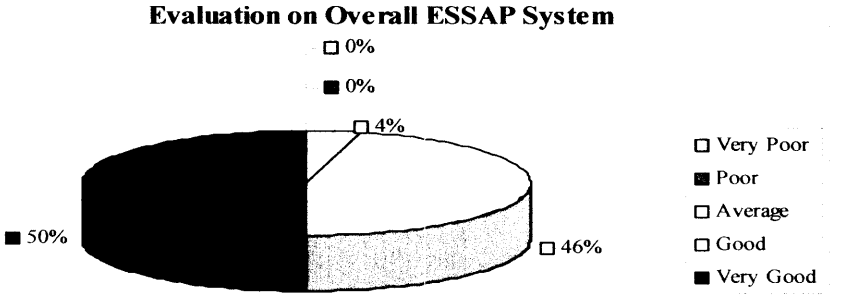

Figure 6.18: Pie Chart for Overall Evaluation of ESSAP System

Table 6.18 shows the overall evaluation of ESSAP system by the students. The highest ranking is very good (25 students) and the lowest ranking is average (2 students). Figure 6.18 show that more than 90 percent of the respondents believe that overall, the system is effective, while only four percent said it is average.

i) Question 19: Would you recommend this system to others?

Table 6.19: Will Recommend ESSAP System to Others	
Will Recommend	**Value**
Yes	50
No	0

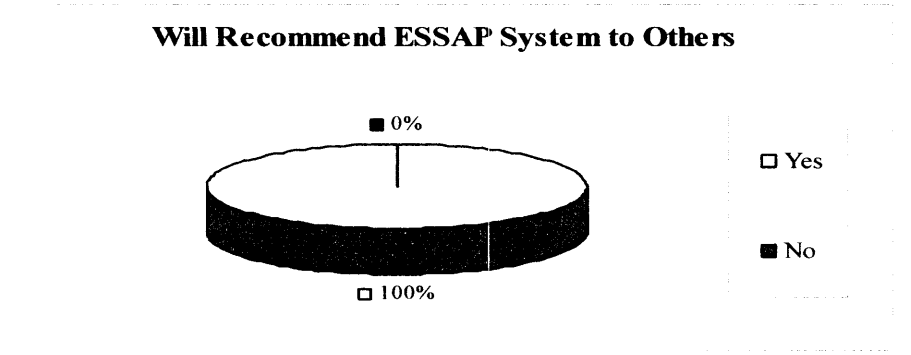

Figure 6.19: Pie Chart for Recommendation of ESSAP System to Others

Table 6.19 shows the result whether the students will recommend ESSAP system to others or not. All the 50 students said that they will recommend the ESSAP System for others to use.

6.2 Evaluation on Staffs of KUTPM

A questionnaire has been constructed to gauge KUTPM staff opinion on the use of the ESSAP System (refer Appendix E). For this system evaluation only 10 people were involved as a sample; seven (7) persons from Communication and Counselling department (C&C) and three (3) persons are lecturers of SISE. The questionnaire is divided into two (2) sections which a section for the current system (question 1 to question 2), and other for the ESSAP System (question 3 to question 13). The results that follows are based on each of the questions in the questionnaire.

6.2.1 Questions on Current System

a) *Question 1: How many students that normally you can consult in academic programme and their career path?*

Table 6.20: Number of Students in Daily Consultation	
Number of Students	**Value**
1 - 3 persons	3
4 - 7 persons	5
8 - 11 persons	2
12 - 15 persons	0
> 16 persons	0

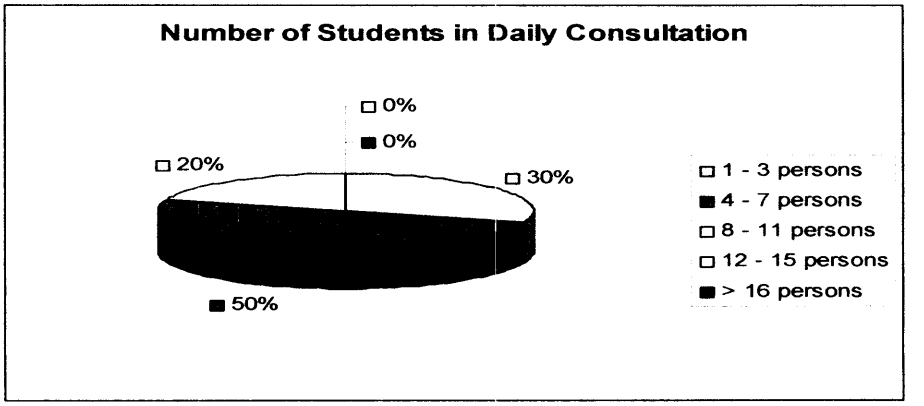

Figure 6.20: Pie Chart for Number of Students in Daily Consultation

Table 6.20 shows the number of students that KUTPM staff can consult in a day. Majority of the respondent claimed that they can consult about 4 – 7 students daily, while only two staff would be able to consult 8 – 11 students in a day. Figure 6.20 show that half of the respondents can consult an average of 4 – 7 students in a day.

b) *Question 2: How many minutes did you spend to consult a student in one appointment?*

Table 6.21: Duration in Academic Process Consultation	
Duration	**Value**
0 - 10 minutes	0
11 - 20 minutes	1
21 - 30 minutes	3
31 - 40 minutes	4
> 40 minutes	2

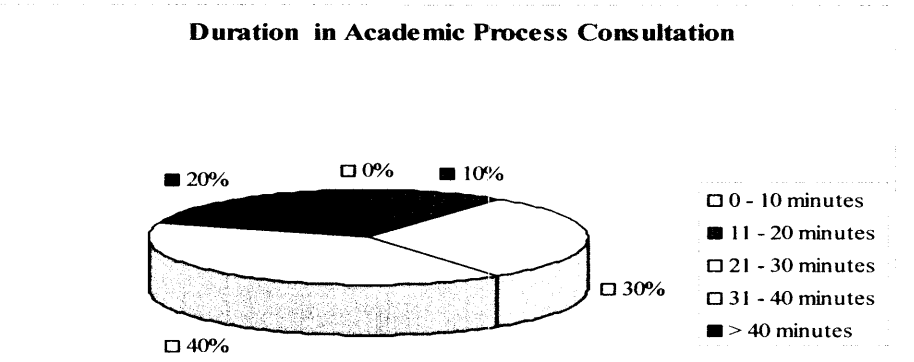

Figure 6.21: Pie Chart for Duration in Academic Process Consultation

Form Figure 6.21, it shows that 40 percent of the respondents spent about 31 – 40 minutes to consult a student in a session. Twenty percent of them spent more than 40 minutes per session, while only 10 percent spent 11 – 20 minutes per session.

6.2.2 Questions on ESSAP System

a) Question 3: How about the Graphical User Interface (GUI) for this system?

Table 6.22: Evaluation on Graphical User Interface

Ranking	Value
Very Poor	0
Poor	0
Average	1
Good	2
Very Good	7

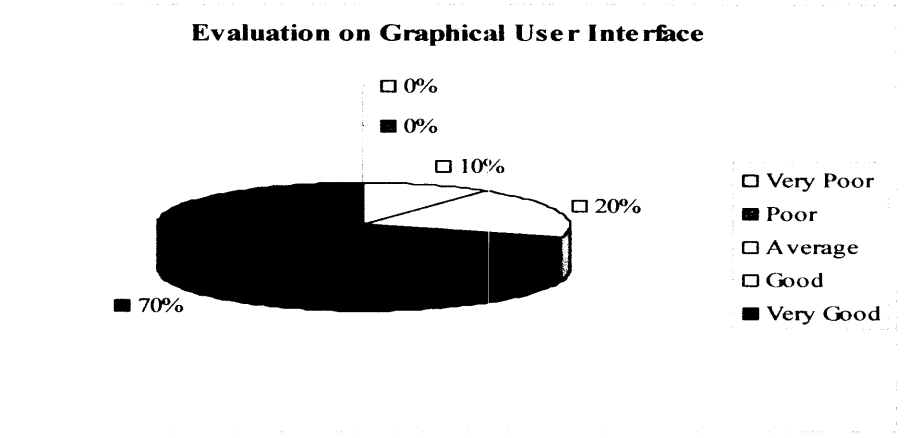

Figure 6.22: Pie Chart for Evaluation on Graphical User Interface

Out of the 10 staff involved in evaluating ESSAP System, nine of them said that it has a good GUI, while the remaining one respondent found that the GUI average (refer to Table 6.22).

b) *Question 4: How about the functionality of the system, user interaction and navigational tools?*

Table 6.23: Evaluation of System Functionality	
Ranking	**Value**
Very Poor	0
Poor	0
Average	0
Good	4
Very Good	6

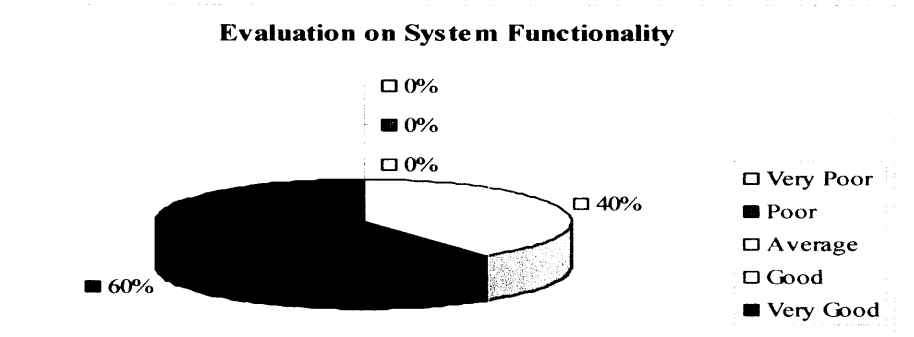

Figure 6.23: Pie Chart for Evaluation of System Functionality

Table 6.23 shows the results of evaluation of system functionality, user interaction and navigational tools by the staff. Figure 6.23 summaries the results from Table 6.23. it shows that 60 percent of the respondents were very impressed with the system functionality and the other 40 percent felt that the system functionality is good enough.

c) *Question 5: Do you think an explanation function would be helpful in answering interest (based on Holland J. Theory) questions?*

Table 6.24: Evaluation of Explanation Function	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	0
Agree	3
Strongly Agree	7

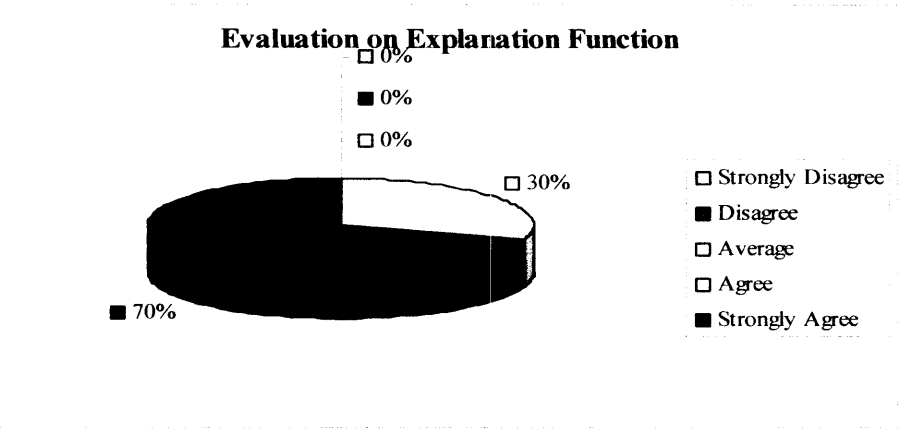

Figure 6.24: Pie Chart for Evaluation of Explanation Function

Question 5 captured the opinion of the 10 respondents towards the system explanation function. Seventy percent of the respondents strongly agreed that the function is helpful, and the other 30 percent of respondents agreed to it.

d) Question 6: Would this system determine the student's personality correctly?

Table 6.25: Determine Students Personality Correctly	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	0
Agree	2
Strongly Agree	8

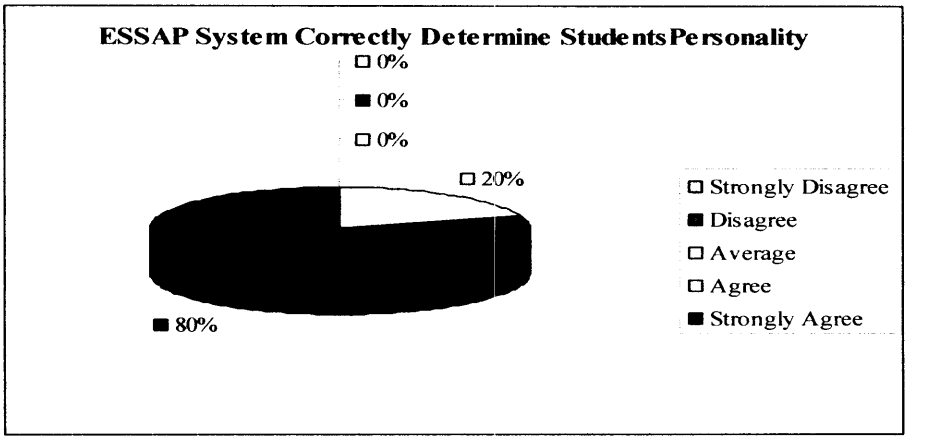

Figure 6.25: Pie Chart for Determine Students Personality Correctly

The 10 staffs were asked whether the system can determine a student's personality correctly. From the respond, it shows that 80 percent of the respondents strongly agreed to the statement, while 20 percent still agree to it (refer Figure 6.25).

e) *Question 7: Does this system give clear descriptions about student's career and education path?*

Table 6.26: Give Clear Descriptions in Career Paths	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	1
Agree	2
Strongly Agree	7

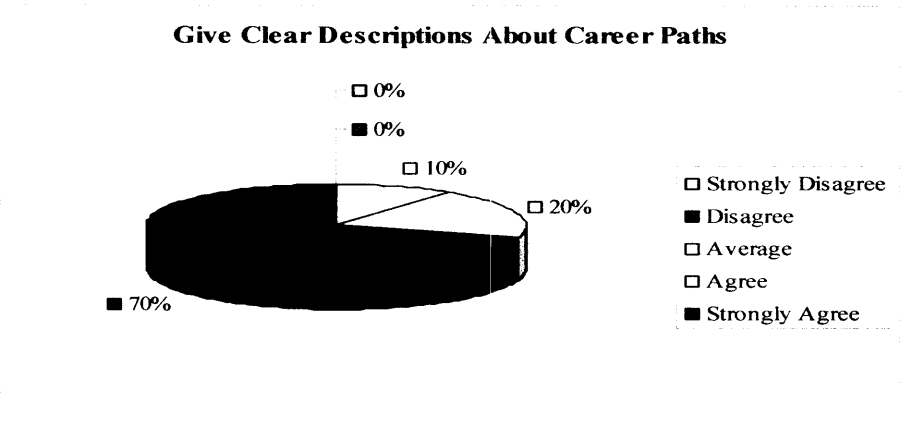

Figure 6.26: Pie Chart for Give Clear Descriptions in Career Paths

Table 6.26 shows that nine out of 10 respondents somehow agreed that the system gives a clear description on a student's career and education path. The other 10 percent felt that the system provide an average description on this matter.

f) Question 8: Would this system recommend the suitable academic programme based on student's interests and qualifications?

Table 6.27: Recommend Suitable Academic Programme	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	0
Agree	3
Strongly Agree	7

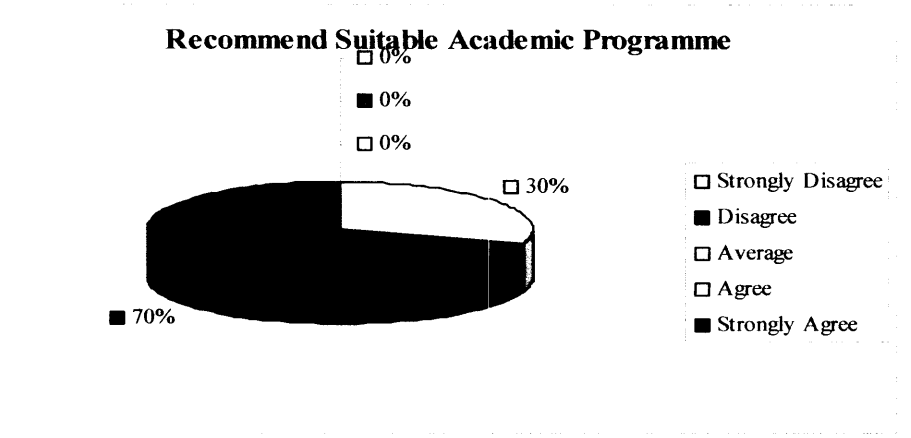

Figure 6.27: Pie Chart for Recommend Suitable Academic Programme

Table 6.27 illustrate the results from Question 8. Here it clearly shows that 70 percent of the staff felt that the system can recommend the suitable academic programme based on the student's interests and qualifications. The remaining 30 percent agreed to it at same degree.

g) Question 9: How long does it take to use this system (in minutes)?

Table 6.28: Duration Used ESSAP System	
Duration	**Value**
0 - 10 minutes	6
11 - 20 minutes	3
21 - 30 minutes	1
31 - 40 minutes	0
> 40 minutes	0

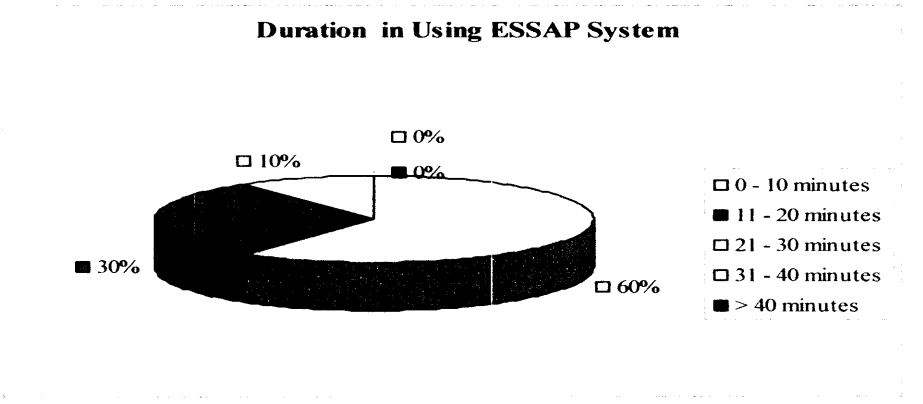

Figure 6.28: Pie Chart for Duration Used ESSAP System

Table 6.28 shows that the majority of the staff took about less than 10 minutes to use this system. The remaining the staff did not take more than 30 minutes to use this system. This shows that this system is not that hard to comprehend and use.

h) *Question 10: Does the duration of consultation used in system is better and less time consuming rather than traditional method?*

Table 6.29: Better and Less Time Consuming Than Traditional System	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	0
Agree	3
Strongly Agree	7

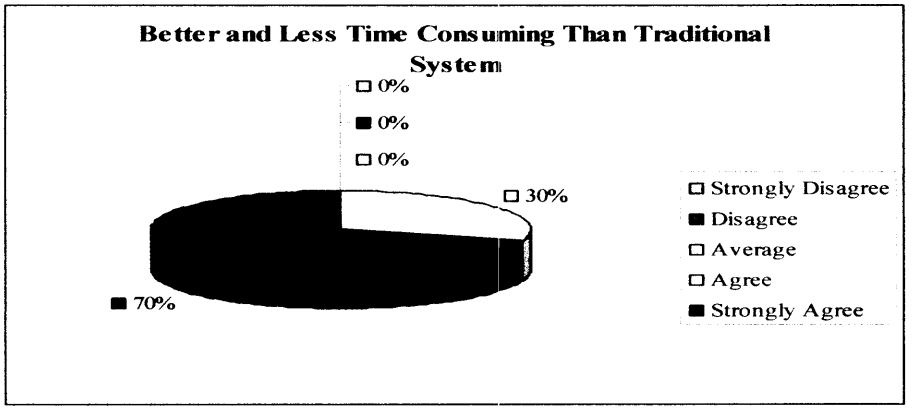

Figure 6.29: Pie Chart for Better and Less Time Consuming Than Traditional System

Based on Figure 6.29, it shows that all the 10 respondents agreed that the ESSAP System is better and less time consuming then the traditional method of consultation. Table 6.29 provides the details of the result shown by Figure 6.29.

i) *Question 11: Do you think that this system is reasonable to be used by the student?*

Table 6.30: Reasonable to Use by Student	
Ranking	**Value**
Strongly Disagree	0
Disagree	0
Average	0
Agree	4
Strongly Agree	6

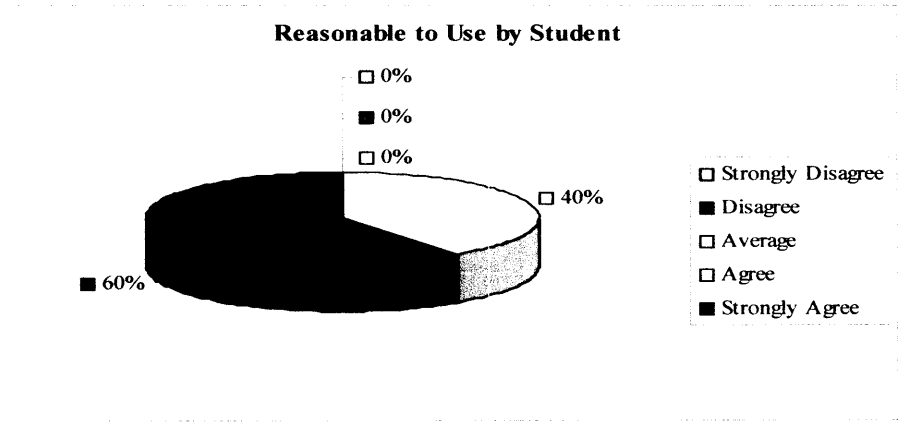

Figure 6.30: Pie Chart for Reasonable to Use by Student

Result from the respond on Question 11 shows that the majority staff believe that this system can be reasonably use by the students in choosing the right academic track for them. Table 6.30 shows that six out of the 10 respondents strongly agreed to this statement.

j) Question 12: What is your evaluation of the overall effectiveness and value of the system?

Table 6.31: Evaluation of Overall System	
Ranking	**Value**
Very Poor	0
Poor	0
Average	0
Good	4
Very Good	6

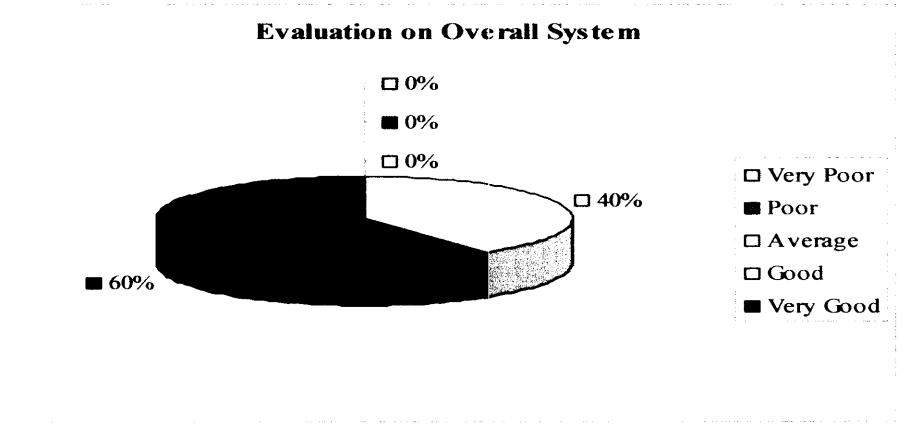

Figure 6.31: Pie Chart for Evaluation on Overall System

Overall, all the 10 respondents agreed that the system is effective in doing what it suppose to do. From Table 6.31, it shows that six out of the 10 staff strongly agreed to the system effectiveness, while the other four felt the system is good enough to fulfil its function/objective.

k) Question 13: Would you recommend this system to students?

Table 6.32: Will Recommend ESSAP System to Students	
Will Recommend	**Value**
Yes	10
No	0

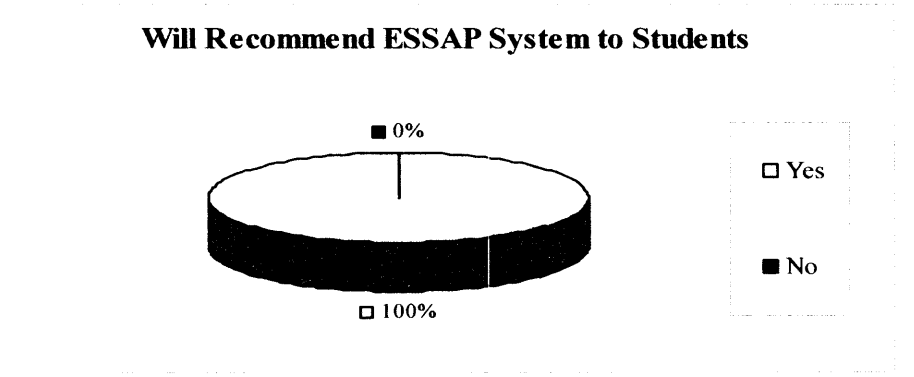

Figure 6.32: Pie Chart of Will Recommend ESSAP System to Students

The last question asked the 10 respondents whether they will recommend this system to the students. Interestingly, the respond was a 100 percent yes.

6.3 Summary

In this chapter, the testing results and performance of ESSAP system have been discussed. Several surveys have been performed to obtain the verification of this system. In conclusion the ESSAP system is suitable to be used as decision making tool for the students in order to help the staff of KUTPM in the consultation process.

CHAPTER 7
CONCLUSION AND DISCUSSION

Design and development of ESSAP system is to supplement the current conventional advising process. ESSAP system used a forward chaining expert system to engineer the expertise and to implement the Certainty Factor (CF) in the calculation of the Holland J. Theory result. Certainty theory is a popular alternative to probability theory for inexact reasoning in experts system (Durkin, 1994). This project provides guide for the students to select the suitable academic programme in SISE based on their academic qualification and interest, in addition to the types of student's personality (Holland J. theory).

In this chapter, it will discuss the limitations and recommendations for future works of the ESSAP system.

7.1 Limitation of the System

There are some limitations in this ESSAP system, such as:

a) This system only covers the academic programme that offered by SISE.

b) This system does not cover majoring selection such as Artificial Intelligence (AI), Software Engineering (SE), Networking, and Management Information System (MIS).

7.2 Recommendation

Below are the recommendations for the future works:

a) Integrating other technique such as prediction using Neural Network technique that can predict the type of student personalities. Student's data will be used for training and testing. It can be also integrated with Fuzzy Logic technique that can enhance the reasoning when dealing with the fuzzy data. This system can be called as Hybrid System.

b) The system can handle more types of academic programmes offered by another school in KUTPM such as School of Health Sciences (SHS), School of Business Management (SBM), and School of Foundation Study (SFS).

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APPENDIX A

1.0 Rules for Holland J. Theory	
No.	**Rules**
Rule 1	IF you are a practical person OR you are an athletic person OR you are a straight forward person OR you are a mechanically inclined person OR you are a nature lover person OR you are an operate tools and machinery person OR you can fix electrical things OR you can solve mechanical problems OR you can pitch a tent OR you can play a sport OR you can read a blueprint OR you can works on cars OR you are like to tinker with mechanics OR you are like to work outdoors OR you are like to physically active OR you are like to use your hands OR you are like to build things THEN your personality is realistic
Rule 2	IF you are an inquisitive person OR you are an analytical person OR you are a scientific person OR you are an observant person OR you are a precise person OR you can operate tools and machinery OR you are think abstractly OR you can solve math problems OR you can understand physical theories OR you can do complex calculations OR you can use a microscope OR you can works on cars OR you can analyze data OR you are like to explore ideas

	OR you are like to use computers OR you are like to work independently OR you are like to perform laboratory experiments or works OR you are like to read scientific or technical magazines THEN your personality is investigative
Rule 3	IF you are a creative person OR you are an intuitive person OR you are an imaginative person OR you are an innovative person OR you are an individualist person OR you can sketch, draw or paint OR you can play a musical instrument OR you can write stories, poetry, music, sing, act or dance OR you can design fashion or interiors OR you are like to attend concerts, theatres, or art exhibits OR read fiction, plays, poetry OR you are like to work on crafts OR you are like to take photographs OR you are like to express yourself clearly THEN your personality is artistic
Rule 4	IF you are a friendly person OR you are a helpful person OR you are an idealistic person OR you are an insightful person OR you are an outgoing person OR you are an understanding person OR you can teach and train others OR you can express yourself clearly OR you can lead a group discussion OR you can mediate disputes OR you can plan and supervise an activity OR you can cooperate well with others OR you are like to works in group OR you are like to help people with problems OR you are like to participate in meetings

	OR you are like to do volunteer service OR you are like to work with young people OR you are like to play team sports THEN your personality is social
Rule 5	IF you are a self-confident person OR you are an assertive person OR you are a sociable person OR you are a persuasive person OR you are an enthusiastic person OR you are an energetic person OR you can initiate projects OR you can convince people to do things your way OR you can sell things or promote ideas OR you can give talks or speeches OR you can organize activities and events OR you can lead a group OR you are like to make decisions affecting others OR you are like to be elected to office OR you are like to win a leadership or sales award OR you are like to start your own political campaign OR you are like to meet important people THEN your personality is enterprising
Rule 6	IF you are a well groomed person OR you are an accurate person OR you are a numerically inclined person OR you are a methodical person OR you are a conscientious person OR you are an efficient person OR you can work well within a system OR you can do a lot of paper work in a short time OR you can keep accurate records OR you can use a computers OR you are like to follow clearly defined procedures OR you are like to use data processing equipment OR you are like to work with numbers

	OR you are like type or take shorthand OR you are like to be responsible for details THEN your personality is conventional
Rule 7	IF you are good at repairing or making new things THEN you are practical person
Rule 8	IF you are physically strong and good at sport THEN you are athletic person
Rule 9	IF you are honest about your feelings or opinions and not hiding anything THEN you are straight forward person
Rule 10	IF you are natural interested in or good at understanding how machines work and repairing them THEN you are mechanically inclined person
Rule 11	IF you are care of animal THEN you are nature lover person
Rule 12	IF you are good at working with machinery THEN you are an operate tools and machinery person
Rule 13	IF you can repair something that is broken or nor working properly THEN you can fix electrical things
Rule 14	IF you are capable to solving which need skills THEN you can solve mechanical problems
Rule 15	IF you are drawn to the outdoors THEN you are like to work outdoors
Rule 16	IF you are good at sports and other outdoor activities THEN you can pitch a tent
Rule 17	IF you are always like to take part in any sport THEN you can play a sport
Rule 18	IF you are good at using tools that require manual dexterity THEN you can read a blueprint
Rule 19	IF you are good at fixing, building and repairing things THEN you can works on cars
Rule 20	IF you are like to repair old things THEN you are like to tinker with mechanics
Rule 21	IF you are good at using physical strength to accomplish tasks

	THEN you are like to be physically active
Rule 22	IF you can are good at solving problems with tools and equipment THEN you are like to use your hands
Rule 23	IF you are like to do things that produce tangible results THEN you are like to build things
Rule 24	IF you are curious about different things and wanting to find out more about them THEN you are an inquisitive person
Rule 25	IF you are thinking or reasoning using methods that help to examine things carefully THEN you are an analytical person
Rule 26	IF you are relating to, or employing the methodology of science THEN you are a scientific person
Rule 27	IF you are good or quick at noticing things THEN you are an observant person
Rule 28	IF you are very careful about small details THEN you are a precise person
Rule 29	IF you are think complicated ideas rather than about things that around you THEN you can think abstractly
Rule 30	IF you are enjoy working with numbers and can do mental calculations THEN you can solve math problems
Rule 31	IF you are interested in new scientific advances THEN you can understand physical theories
Rule 32	IF you are enjoy the challenge of brain teasers or others puzzles that require logical thinking THEN you can do complex calculations
Rule 33	IF you are good at doing scientific or laboratory work THEN you can use a microscope
Rule 34	IF you are good at conducting research and analysis THEN you can analyze data
Rule 35	IF you are good in writing reports and papers or analysis the data THEN you are like to use computers
Rule 36	IF you are like to examine or discuss something carefully in order to find out more about it

	THEN you are like to explore ideas
Rule 37	IF you are confident and able to do things by yourself in your own way without wanting help or advice from other people THEN you are like to work independently
Rule 38	IF you can use a microscope THEN you are like to perform laboratory experiments or works
Rule 39	IF you are always to find out information from books THEN you are like to read scientific or technical magazines
Rule 40	IF you can producing or using new and effective ideas THEN you are a creative person
Rule 41	IF you are able to understand situations using your feelings without being told or having any proof THEN you are an intuitive person
Rule 42	IF you are good at thinking of new, interesting ideas, and at forming pictures in your mind THEN you are an imaginative person
Rule 43	IF you are always using clever new ideas and methods THEN you are an innovative person
Rule 44	IF you are normally does things in your own way and has different opinions from most other people THEN you are an individualist person
Rule 45	IF you are ability to shape images seen in the mind's eye THEN you can sketch, draw or paint
Rule 46	IF you are able to read music THEN you can play a musical instrument
Rule 47	IF you are good at language and prefer tasks involving personal or physical skills THEN you can write stories, poetry, music, sing, act or dance
Rule 48	IF you are good at decorating or designing THEN you can design fashion or interiors
Rule 49	IF you are enjoy creating art or original works THEN you are like to work on crafts
Rule 50	IF you are tend to make visual record of events with camera or camcorder THEN you are like to take photographs
Rule 51	IF you are always to let people know your thoughts and feelings so

	that they can understand THEN you are like to express yourself clearly
Rule 52	IF you are enjoy with entertainment and arts performing THEN you are like to attend concerts, theatres, or art exhibits
Rule 53	IF you are like to make friend and ready to talk with people THEN you are a friendly person
Rule 54	IF your are always willing to help people THEN you are a helpful person
Rule 55	IF you are believing in principles or perfect standards that cannot really be achieved THEN you are an idealistic person
Rule 56	IF you are able to understand and realize what people or situations are really like THEN you are an insightful person
Rule 57	IF you are like to meet and talk to new people THEN you are an outgoing person
Rule 58	IF you are sympathetic and kind about other people's problems THEN you are an understanding person
Rule 59	IF you like to teach, enlighten or guide THEN you can teach and train others
Rule 60	IF you are always to let people know your thoughts and feelings so that they can understand THEN you can express yourself clearly
Rule 61	IF you are good at expressing yourself verbally THEN you are like to be participate in meetings
Rule 62	IF you are like to organize social events THEN you can plan or supervise an activity
Rule 63	IF you are like to showing other people how to get things done THEN you can lead a group discussion
Rule 64	IF you are always communicate well with people THEN you can mediate disputes
Rule 65	IF you are good at listening to and understanding others THEN you can cooperate well with others
Rule 66	IF you prefer to play basketball, softball, soccer or football THEN you are like to play team sports

Rule 67	IF you are like to working that involving other people THEN you are like to works in group
Rule 68	IF you are always give advice to other people THEN you are like to help people with problems
Rule 69	IF you are concerned for the welfare of others THEN you are like to do volunteer service
Rule 70	IF you are like to take great pride in being a mentor to someone else THEN you are like to work with young people
Rule 71	IF are not shy or nervous in social situations THEN you are a self-confident person
Rule 72	IF you are always behaving in a confident way so that people notice you THEN you are an assertive person
Rule 73	IF you are always enjoys being with other people THEN you are a sociable person
Rule 74	IF you can convince people to do things your way THEN you are a persuasive person
Rule 75	IF you are always showing a lot of interest and excitement about something THEN you are an enthusiastic person
Rule 76	IF you are very active because you have a lot of energy THEN you are an energetic person
Rule 77	IF you are good at managing others THEN you can initiate projects
Rule 78	IF you have a verbally skill in persuasion to support others THEN you can sell things or promote ideas
Rule 79	IF you are a talkative and have a lot of ideas THEN you can give talks or speeches
Rule 80	IF you are like to entertain clients or friends THEN you can organize activities or events
Rule 81	IF you are good at maintaining a high level of energy and optimism THEN you can lead a group
Rule 82	IF your are a good leader THEN you are like to make decisions affecting others

Rule 83	IF you are like to participate in political activities THEN you are like to start your own political campaign
Rule 84	IF you are good at organizing office procedures THEN you are like to be elected to office
Rule 85	IF you are an ambitious and competitive person THEN you are like to win a leadership or sales award
Rule 86	IF you are like to attend or participate in sporting events THEN you are like to meet important people
Rule 87	IF you are having very neat and clean appearance THEN you are a well groomed person
Rule 88	IF you are be able to do something in an exact way without making a mistake THEN you are an accurate person
Rule 89	IF you are like to work with numbers THEN you are a numerically inclined person
Rule 90	IF you are always doing things carefully and using an ordered system THEN you are a methodical person
Rule 91	IF you are always showing a lot of care and attention THEN you are a conscientious person
Rule 92	IF you can works well without wasting time, money and energy THEN you are an efficient person
Rule 93	IF you are good at demonstrating patience with detailed paperwork THEN you can do a lot of paper work in a short time
Rule 94	IF you are good at organizing office procedures THEN you are like to follow clearly defined procedures
Rule 95	IF you are like careful about money and material possessions THEN you can keep accurate financial books and records
Rule 96	IF you are good at making charts and graphs THEN you are like to work with numbers
Rule 97	IF you are good at attending meeting to take a minute of the meeting THEN you are like to type or take shorthand

Rule 98	IF you are like to belong to civic or fraternal organizations THEN you are like to be responsible for details
Rule 99	IF you are good at conducting financial analyses THEN you are like to use data processing equipment
Rule 100	IF you are an organized person THEN you can work well within a system

2.0 Rules for Qualification	
No.	**Rules**
Rule 1	IF pass Bahasa Melayu >= C6 AND pass Bahasa Inggeris >= C6 AND pass Science >= C6 AND pass 2 subjects >= C6 THEN pass SPM with 5 credits
Rule 2	IF pass Biology >= C6 OR pass Chemistry >= C6 OR pass Physic >= C6 THEN pass Science >= C6
Rule 3	IF you are pass SPM with 5 credits THEN you can take a Diploma program
Rule 4	IF you are pass STPM with three (3) subjects that have C Grade THEN you can take a Bachelor program
Rule 4	IF you are pass STPM with two (2) subjects that have C Grade OR you are pass STPM with two (2) subjects that have Pass Grade THEN you can take a Bachelor program
Rule 5	IF you are pass A Level OR you are pass Foundation program THEN you can take a Bachelor program
Rule 6	IF you are pass Diploma that accredited by LAN with CGPA >= 2.00 THEN you can take a Bachelor program
Rule 7	IF you can take a Diploma program AND your first personality is realistic

	THEN you can take Diploma in Electronic and Engineering (DEE)
Rule 8	IF you can take a Diploma program AND your first personality is realistic THEN you can take Diploma in Mechatronic Engineering (DME)
Rule 9	IF you can take a Diploma program AND your first personality is realistic THEN you can take Diploma in Automation Engineering (DAE)
Rule 10	IF you can take a Diploma program AND your first personality is investigative THEN you can take Diploma in Information Technology (DIT)
Rule 11	IF you can take a Diploma program AND your first personality is realistic THEN you can take Diploma in Industrial Computing (DIDC)
Rule 12	IF you can take a Diploma program AND your first personality is realistic THEN you can take Diploma in Computer Engineering (DCE)
Rule 13	IF you can take a Diploma program AND your first personality is artistic THEN you can take Diploma in Multimedia (DMM)
Rule 14	IF you can take a Diploma program AND your first personality is enterprising THEN you can take Diploma in Business Computing (DBC)
Rule 15	IF you can take a Bachelor program AND your first personality is artistic THEN you can take Bachelor in Information and Communication Technology (BICT)
Rule 16	IF you can take a Bachelor program AND your first personality is artistic THEN you can take Bachelor in Game Art and Animation (BGA)
Rule 17	IF you can take a Bachelor program AND your first personality is artistic THEN you can take Bachelor in Instructional Multimedia (BISM)
Rule 18	IF you can take a Bachelor program AND your first personality is investigative THEN you can take Bachelor in Computer Science (BCS)

Rule 19	IF you can take a Bachelor program AND your first personality is realistic THEN you can take Bachelor in Computer Engineering (BCE)
Rule 20	IF you can take a Bachelor program AND your first personality is investigative THEN you can take Bachelor in Computer Systems Auditing (BCSA)
Rule 21	IF you can take a Bachelor program AND your second personality is enterprising THEN you can take Bachelor in Business Computing (BBC)

APPENDIX B

ESSAP USER MANUAL

System Name: Expert System for Selection of Academic Programme

Web Application: ESSAP v1.0

1.1 System Application Requirements

System Application Requirements for ESSAP v1.0 are as follows:

1.1.1 Hardware Requirements

- 1.5 GHz Intel Pentium 4 CPU
- 256 MB Memory minimum
- 20 GB Hard disk space minimum
- Graphic Support
- Network Support (10/100 LAN) (if applicable)

1.1.2 Software Requirements

- Operating System Microsoft Windows or Linux or UNIX based
- Apache HTTP Server Version 2.0
- PHP 4.4.0
- MySQL Database Server & Client Application Version 4.1
- Browser Support

1.2 Installation Procedures

Procedures to install ESSAP v1.0 system are as follows:

1.2.1 Pre-Condition

User's server already installed an operating system.

1.2.2 Software Support Installation

a) Apache HTTP Server 2.0

1. Copy the installer program (*apache_2.0.54-win32-x86-no_ssl.msi*) to a location on hard drive (e.g., C:\temp).
2. Run the installer program by double-clicking on the *apache_2.0.54-win32-x86-no_ssl.msi* icon.
3. Follow the instructions of the installer program to install the Apache HTTP Server 2.0. The installation process should look familiar like many other Windows installers.
4. The install program will prompt user for the following:

   The network name, server name, and administrator's email address. The answers are not particularly important if building a server for personal use.

   Selection to run Apache as a service.

   The installation type. Recommend to select the *Complete* option or *Custom* where some components are not installed such as the documentation.

   The directory in which to install Apache. (The default is C:\Program Files\Apache Group\Apache.)

5. Apache will be listening to port 80 (unless Port, Listen, or BindAddress directives were changed in the configuration files) after it starts. To connect to the server and access the default page, launch a browser and enter this URL: http://localhost/ or http://127.0.0.1/

b) PHP 4.4.0

Manual Installation

1. Unzip the Zip file (*php-4.4.0-Win32.zip*) to the C:\ directory. Eg. *C:\PHP.*
2. In the main directory there is a file called *php.exe*, and one called *php4ts.dll*. These are the files user will need to run PHP as a CGI. If user would like to run it as a SAPI module user will need to look in the directory *c:\PHP\sapi* and copy the relevant *DLL* file to *C:\PHP*. If user using Apache, the file is called *php4apache2.dll* for example. The SAPI modules are faster and easier to secure; the CGI version allows user to run PHP from the command line.
3. Set up a *php.ini* configuration file (*C:\ PHP\php.ini-recommended*):

   Change the *extension_dir* directive to point to the directory where user extension DLLs resides. In the normal install this will be *C:\PHP\extensions*.

   extension_dir = c:/php/extensions

   Set the *doc_root* directive to point at the root directory that user Web server serves from.

   Apache Server:

   doc_root = "c:/Program Files/Apache Group/Apache/htdocs"

IIS Server:

doc_root = "c:/Inetpub/wwwroot"

Close, save and rename to *php.ini*

4. Set PHP *.ini* directive in Apache Server Configuration file (append the *httpd.conf* file).

   # path to php.ini configuration

   PHPIniDir "c:/php"

5. Then, add these three line in the end of Apache Server Configuration file (append the *httpd.conf* file).

   Installing as a **CGI binary**:

   ScriptAlias /php/ "c:/php/"

   AddType application/x-httpd-php .php

   Action application/x-httpd-php "/php/php.exe"

   OR

   Installing as a **Apache module (SAPI)**:

   LoadModule php4_module "d:/php/php4apache2.dll"

   AddType application/x-httpd-php .php

Binary Installation

1. Run the installer program by double-clicking on the *php-4.4.0-Win32.exe* icon.
2. Follow the instructions of the installer program to install the *PHP 4.4.0*. The installation process should look familiar like many other Windows installers. Refer manual instruction above for *php.ini* configuration and *httpd.conf* configuration.

c) *MySQL Server 4.1.14*

1. Unzip the Zip file (*mysql-4.1.14-win32.zip*) to the C:\ directory. Eg. *C:\Temp*
2. Follow the instructions of the installer program to install the *MySQL 4.1.14*. The installation process should look familiar like many other Windows installers. For further information, please refer to online help at http://www.mysql.com

1.2.3 ESSAP Installation

1. Copy folder *ESSAP* to computer *htdocs* (refer Figure 1.1)

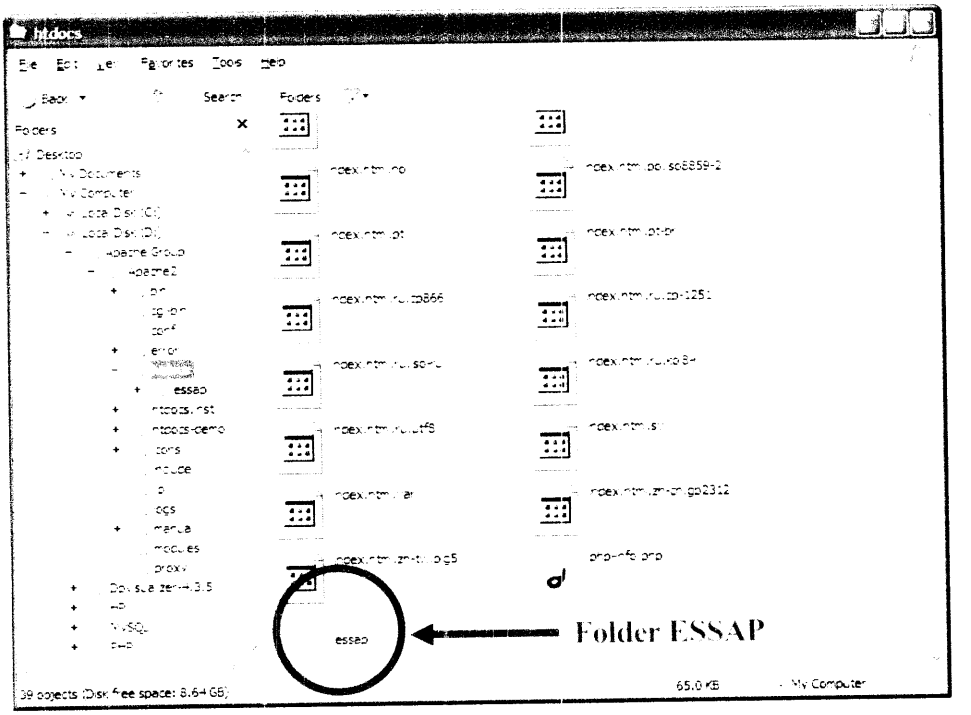

Figure 1.1: Copying folder ESSAP to htdocs (localhost)

2. Restore ESSAP database to MySQL Server using MySQL Administrator client program (installer was included in the cd-rom).

   Database File: *dbESSAP.sql*

3. Run ESSAP System by using address http://localhost/essap/index.php.

2.0 ESSAP System Manual

i) Home Interface for ESSAP system

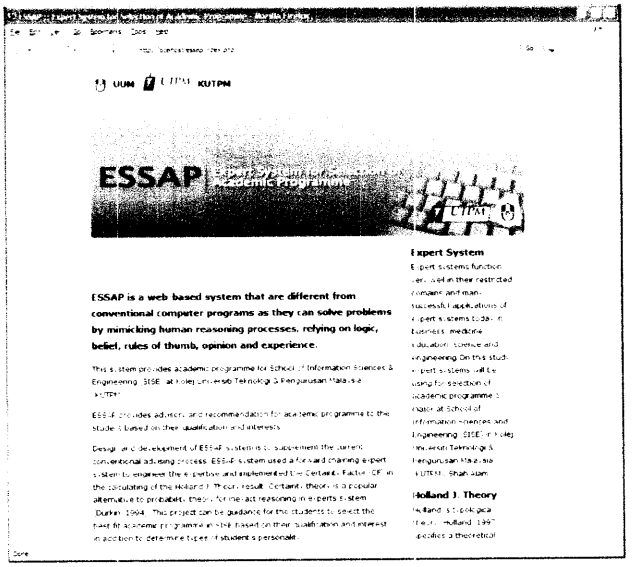

Figure 2.1: The Home Interface for ESSAP System

Figure 2.1 shows the main page of the ESSAP System. It consists of 7 main modules; (1) Home (2) ESSAP (3) Organization (4) Career (5) F.A.Q (6) Admin and (7) About.

ii) Main Login Interface for ESSAP System

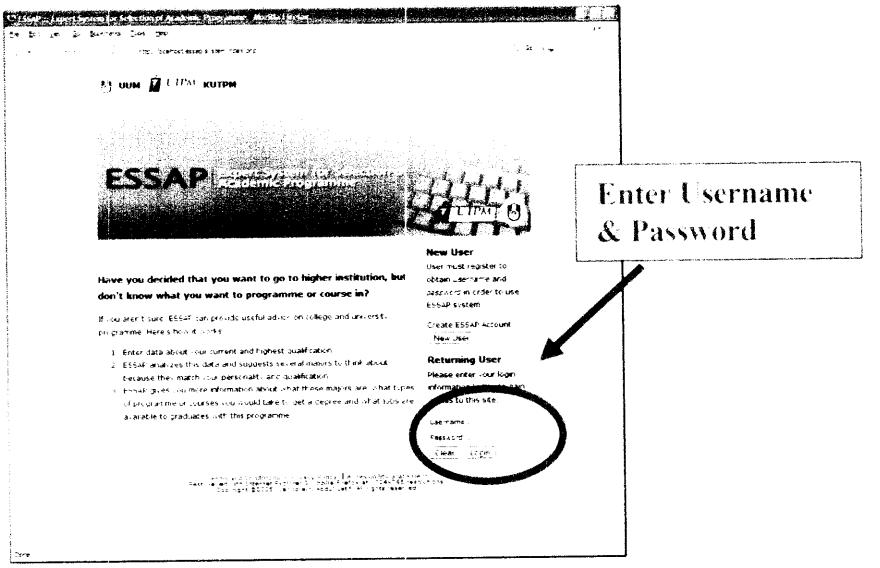

Figure 2.2: The Main Login page for ESSAP System

Figure 2.2 show the page of Main Login for ESSAP system.

iii) Interface for New User Registration

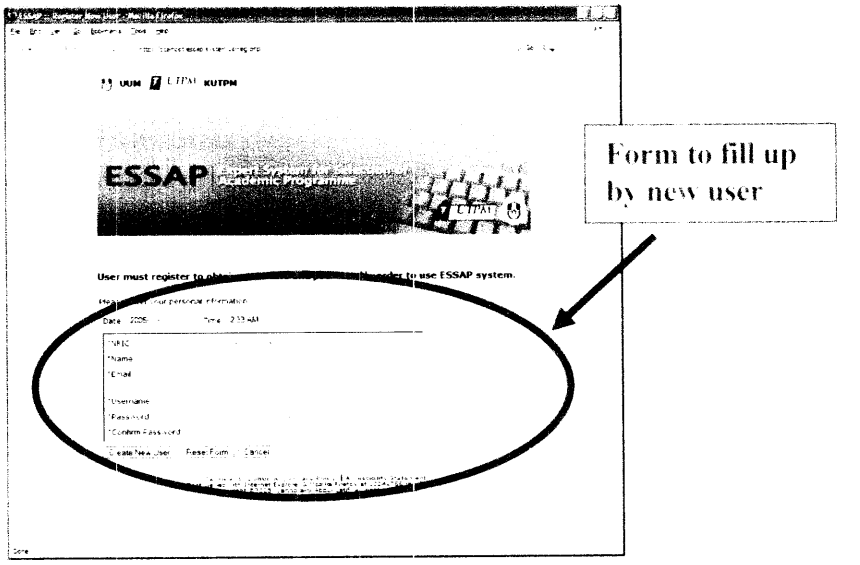

Figure 2.3: New User Registration Interface

Figure 2.3 show the interface of New User Registration. New user must fill up this form.

iv) Interface for Accepted New User Registration

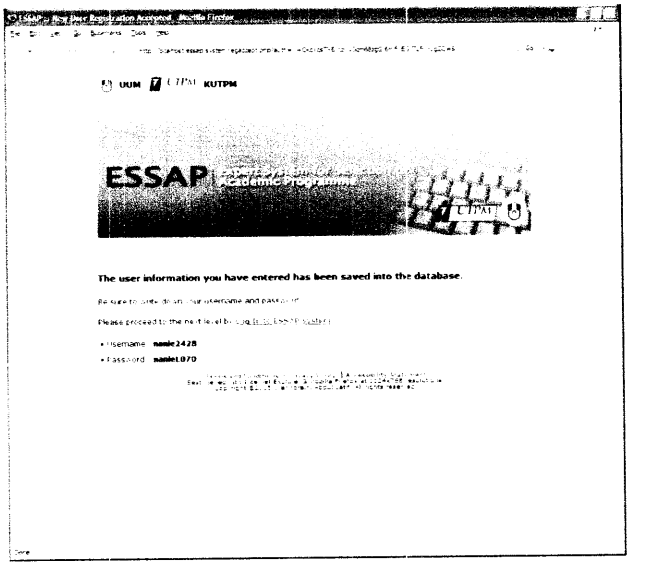

Figure 2.4: New User Registration Accepted Confirmation Page

Figure 2.4 shows the interface of New User Registration Accepted Confirmation. This page will appear when the registration process of new user has succeesful and accepted by the system. User's username and password were also displayed for user's information and confirmation.

v) Authorized User Login Interface (New User)

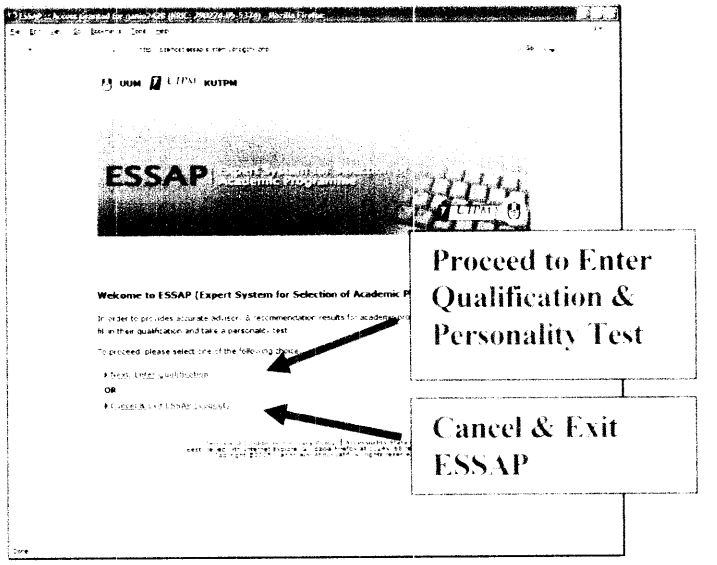

Figure 2.5: Authorized User Login Interface for New User

Figure 2.5 shows the interface of an Authorized User Login for New User.

vi) Authorized User Login Interface (Returning User)

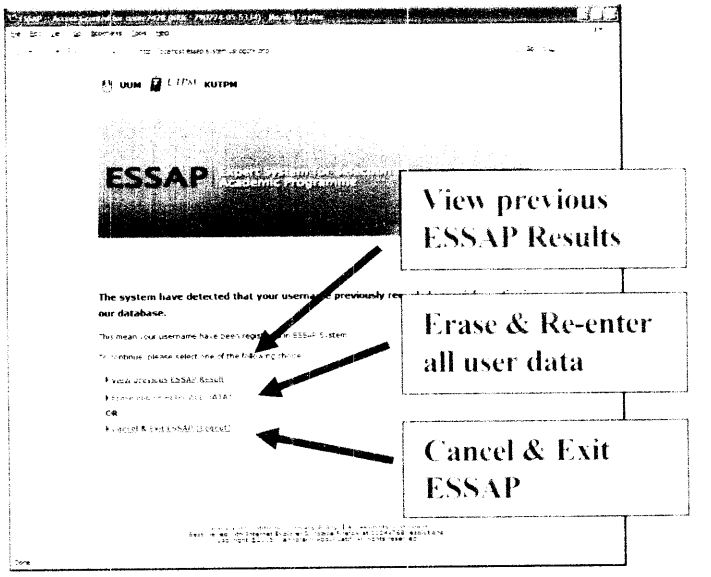

Figure 2.6: Authorized User Login Interface for Returning User

Figure 2.6 shows the interface of an Authorized User Login for Returning User.

vii) Interface for User Qualification Entry

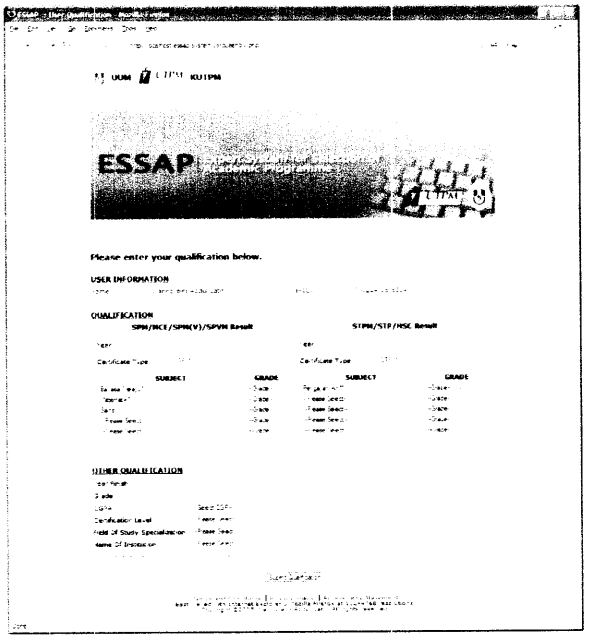

Figure 2.7: User Qualification Entry page

Figure 2.7 shows the interface for User Qualification Entry Page. New user must fill up this form.

viii) Interface for User Personality Test

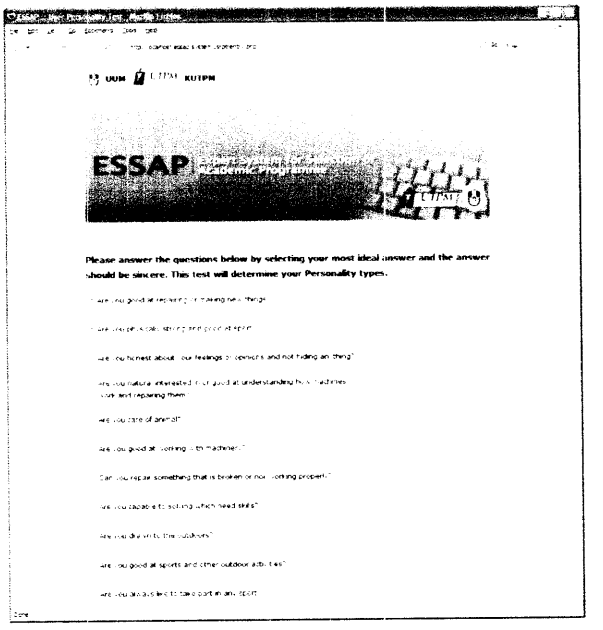

Figure 2.8: User Personality Test

Figure 2.8 shows the page of User Personality Test. User need to answer all the questions in this page to determine the type of user personality.

ix) Help/How window for User Personality Test

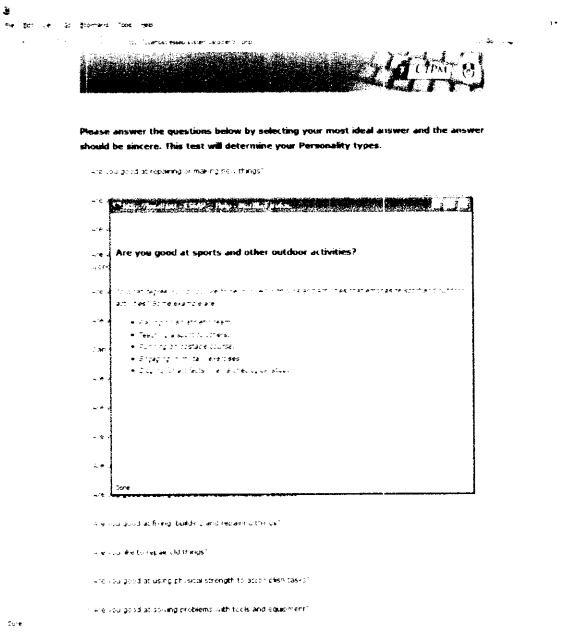

Figure 2.9: Help/How window for User Personality Test (Realistic)

Figure 2.9 shows the Help window for User Personality Test page for Realistic Types. If user can't fully understand of question, user can access the Help window by clicking at red question icon located at begin of the question.

x) Interface for ESSAP Result / System Output

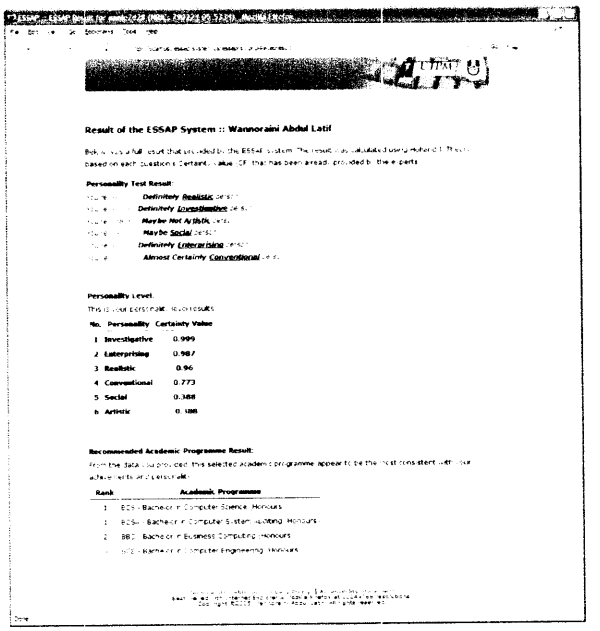

Figure 2.10: ESSAP Result / System Output page

Figure 2.10 show the user's ESSAP results.

xi) Interface for ESSAP Result / System Output (Detail)

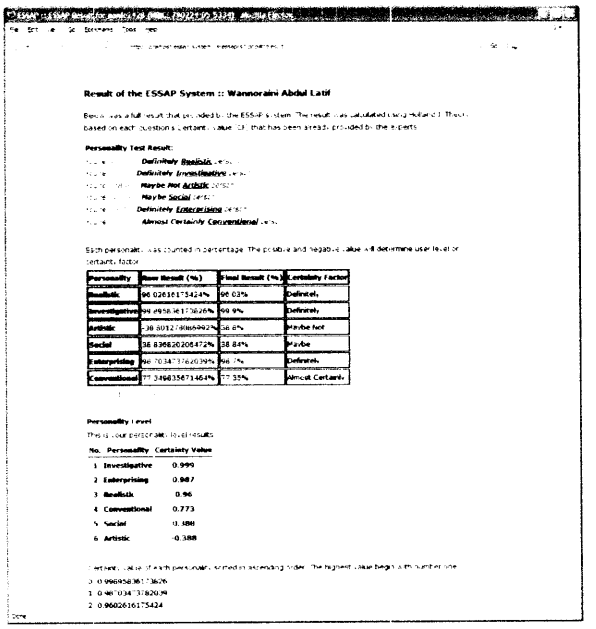

Figure 2.11: ESSAP Detail Result / System Output top page

Figure 2.11 show the ESSAP results top page in more details. The detail results provide how the system gets the output/results based on user's qualification and personality test. User can hide/show the details and can highlight or undo the details highlighting.

xii) Interface for ESSAP Career

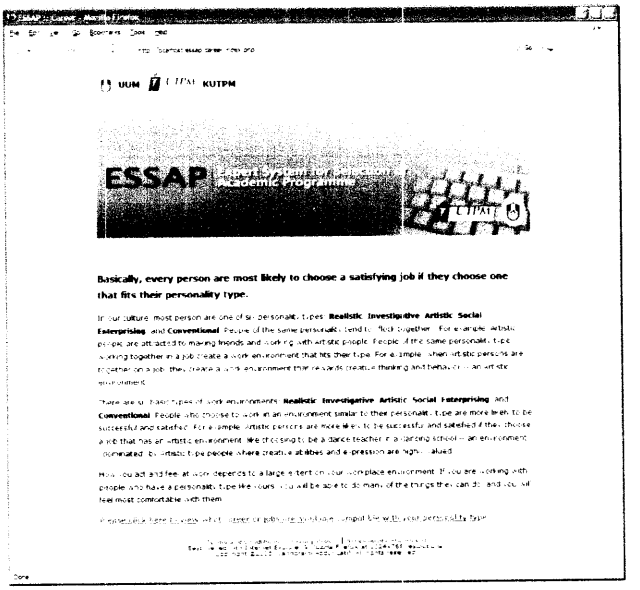

Figure 2.12: ESSAP Career page

Figure 2.12 show the ESSAP Career page.

APPENDIX C

Title: Expert System for Selection of Academic Programme (ESSAP)

A Survey on Academic Programme Advising (For Student)

INSTRUCTION

Please answer **ALL** the questions below. Choose only **ONE** answer for each question in the box.

Student Information

Gender: Male ☐ Female ☐

Ethnic: Malay ☐
Chinese ☐
Indian ☐
Others: _____

1. What is your current semester?

	1st		2nd		3rd		4th		5th		6th		Others

2. What is your academic programme that you are taking in KUTPM?

	Diploma Programme		Bachelor Programme
	Information Technology (DIT)		Info. & Comm. Technology (BICT)
	Electronic & Engineering (DEE)	■	Computer Science
	Multimedia (DMM)		• Artificial Intelligence
	Computer Engineering (DCE)		• Networking
	Business Computing (DBC)		• Software Engineering
			• Management Info. Syst
			Business Computing (BBC)
			Computer Engineering
			Graphic Design

Current System

3. How did you choose your academic programme in KUTPM?

Decide Myself	Follow friends	Family's recommendation	Others (Please state)

4. Have you seen any advisor/counsellor to help you in choosing the academic programme that is suitable with your qualification and interest?

	Yes		No

5. If yes, how long does it take to make an appointment with the advisor/counsellor?

1 day	2 days	3 days	4-6 days	1-2 weeks	> 2 weeks

6. It usually takes me ..... minutes to complete the advising process.

Never met	< 10	11 – 20	21 – 30	> 30

7. Have you ever had a walk-in appointment at school/advisor/counsellor office?

	Yes		No

8. If yes, then on average, how many minutes did you have to wait for an appointment?

0 – 10	11 – 20	21 – 30	31 – 40	> 40

9. Do you think this was a reasonable time to wait?

	Yes		No

10. If you never been met your advisor/counsellor, give a reason why?

Lack of Time	Too Shy	Lazy	Not comfortable	Do not Know

ESSAP system

11. How about the Graphical User Interface (GUI) for this system?.

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

12. How about the functionality of the system, user interaction and navigational tools?.

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

13. Do you think an explanation function would be helpful in answering interest (based on Holland J. Theory) questions?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

14. Would this system determine your personality types correctly (such as Realistic, Investigative, Artistic, Social, Enterprising and Conventional)?

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

15. Are you clear about your career and education path after using this system?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

16. How long does it take to use this system (in minutes)?

0 - 10	11 - 20	21 - 30	31 - 40	> 40

17. Would this system recommend the suitable/fit academic programme based on your interests and qualifications?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

18. What is your evaluation of the overall effectiveness and value of the system?

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

19. Would you recommend this system to others?

Yes		No

APPENDIX D

Title: Expert System for Selection of Academic Programme (ESSAP)

A Survey on Academic Programme Advising (For Staff)

INSTRUCTION

Please answer **ALL** the questions below. Choose only **ONE** answer for each question in the box.

Staff Information

Position: ☐ Gender: Male ☐ Female ☐

Current System

1. How many students that normally you can consult in academic programme and their career path?

1 - 3	4 - 7	8 - 11	12 - 15	> 16

2. How many minutes did you spend to consult an student in one appointment?

0 - 10	11 - 20	21 - 30	31 - 40	> 40

ESSAP system

3. How about the Graphical User Interface (GUI) for this system?.

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

4. How about the functionality of the system, user interaction and navigational tools?.

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

5. Do you think an explanation function would be helpful in answering interest (based on Holland J. Theory) questions?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

6. Would this system determine the student's personality correctly?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

7. Does this system give clear descriptions about student's career and education path?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

8. Would this system have recommends the suitable/fit academic programme based on student's interests and qualifications?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

9. How long does it take to use this system (in minutes)?

0 - 10	11 - 20	21 - 30	31 - 40	> 40

10. Does the duration of consultation used in system is better and time consuming rather than traditional method?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

11. Do you think that this system is reasonable to be used by the student?

Strongly Disagree (1)	Disagree (2)	Average (3)	Agree (4)	Strongly Agree (5)

12. What is your evaluation of the overall effectiveness and value of the system?

Very Poor (1)	Poor (2)	Average (3)	Good (4)	Very Good (5)

13. Would you recommend this system to students?

	Yes		No

APPENDIX E

ESSAP Relational Database Schema