AN INTELLIGENT MODEL FOR STUDENT ADMISSION SYSTEM

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BY

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BEING A MASTER'S THESIS SUBMITTED TO THE DEPARTMENT OF INFORMATION TECHNOLOGY, MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY, YOLA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER DEGREE IN INFORMATION MANAGEMENT TECHNOLOGY OF MAUTECH, YOLA, NIGERIA

SUPERVISOR: Dr B.Y. Baha

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DECLARATION

I hereby declare that this thesis was written by me and it is a record of my own research work. It has not been presented before in any previous application for a higher degree. All references cited have duly been acknowledged.

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Moveh Fred Fudah Date

DEDICATION

This project work is dedicated to Almighty God for his infinite mercies and for keeping mr from the beginning of the study to the end. To God alone is the glory.

APPROVAL PAGE

This project report/thesis entitled "Intelligent model for student Admission System" meets the regulations governing the award of Master's Degree in M.Tech Information and Management Technology of Modibbo Adama University of Technology, Yola and is approved for its consideration to knowledge and literary presentation.

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ABSTRACT

The use of intelligent systems in various fields to solve problems cannot be over emphasized. Intelligent systems are applied in areas of basic automatic grading and intelligent tutor. The need to apply intelligent systems in admission process has becomes imperative, since admission is a gate way into tertiary institutions. While Applicant's Past Educational Records (APER) are central key requirements in admission process, it is, however, not adequate for placement of individuals into course of studies. This research proposed the use of Intelligent Quotient (IQ) in addition to applicant's interest and APER for placement of candidates into University programmes. Unified Modeling Language (UML) was used to design the proposed system, Active Server Pages (ASP) using Model-View-Controller (MVC) was used to design the front end of the application, the back end and the inference engine was designed using Microsoft SQL Server Database and the fuzzy logic respectively.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Intelligent systems are computer programs that emulate the reasoning process of a human expert. An intelligent system also referred to as expert systems can be used in different fields to solve different problems. For example: it is used by management of an organization for decision making concerning employee appraisals. In the medical field, intelligent systems are used for decision making and treatment. These systems guide the users in collecting patient information, based on this information; possible diagnoses are made followed by treatment.

Today, the role of intelligent systems in the educational sector cannot be over emphasized, with intelligent systems now being used in addressed various issues such as; automating basic grading activities, pointing out places where courses need to improve and intelligent tutors.

Admission decision is a major activity in every tertiary institution; it is the process through which students enter tertiary education at universities and colleges, a process that begin with every candidate filling an application. Admission system varies from country to country and sometimes from institution to institution. In some countries prospective students apply during the last year of high secondary school or community college. In some countries, there are independent organizations or specialized Government agencies to centralize the administration of standardized admission examination and processing of application. Regardless of the system of admission, an applicant's past educational record remains central to the admission process because they are the major criteria in deciding whether an applicant gets admitted or not.

While past educational records are central key elements in deciding who gets admitted, the decision of which course suits an applicant still remains an issue. This research seeks to design an intelligent model for student admission in to tertiary institutions that does not only determines who get admitted but also determines which course suits the applicant.

1.2 Statement of the problem

The admission into any tertiary institution starts with the submission of an application. Regardless of the system of admission, an applicant's past educational records remain central a key element to the admission process. While past educational records remain central in decision concerning who gets admitted, the decision to place applicants in to course of study should not only depend on past educational records alone because past educational records alone are not better indicators of academic abilities. There is therefore need to design an intelligent model for student admission.

This study seeks to design an intelligent model for student admission that will help admission officers make better course placement decision using fuzzy logic.

1.3 Aim and objectives of the study

The Aim of this thesis is to design an intelligent model for student admission into tertiary institutions. The specific objectives of the study are to:

i. Study existing admission process in tertiary institutions.

ii. Identify possible requirements for applicant's placement

iii. Define a fuzzy membership function for each input parameter and fuzzyfy each record.

iv. Define a rule-based model for candidate's admission and placement.

v. Implement the model using ASP.net MVC technology.

1.4 Significance of the study

This study is significant because it demonstrates a model that helps tertiary institutions make better admission and efficient course placement decisions. This study is also important to researcher working on intelligent systems.

1.5 Scope of the study

The scope of this research is limited to the designing an intelligent model for student admission in to tertiary institutions using fuzzy logic and also demonstrate the model using ASP.net MVC technology.

1.6 Operational Definition of Terms

This research work is filled with many terminologies mainly in web-application development. Most of these terminologies are confusing for people with little or no knowledge of web development. Many of these terms are defined here for clarity.

- **Intelligent model**: A rule-based model.
- **Rule-based System:** These are systems coded with expert knowledge to mimic an expert in solving knowledge intensive problems.
- **ELDR:** Educationally less developed regions.
- **Catchment Area (CA):** State that belong to the same geo-political regions as the state the school is located.
- **HDMSOW:** Hamming Distance method with Subjective and Objective Weight.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literatures that are related and important to this study. The review of related literature in this study are grouped in to the following sections: The first section will give a background description of the concept of admission systems, types of admission systems, admission policies, transparency in admission process, factors considered in admission process and factors that influence students' performance. The second section describes intelligent, types of intelligence, assessment of intelligence, intelligent systems, artificial intelligence, expert systems, rule-based systems and information systems. The third section discusses the various types of software development methodologies. The fourth section concludes with some empirical studies related to this research study and finally a summary of the review.

2.1 Concept of Admission system

Admission System is a system used by educational institution in selecting suitable candidate in to the various available courses for that academic session. Different institution operates different type of Admission System. According Helms (2008), admission is a very important activity of any educational institution, Helms defines it as a specific activity undertaken to admit students in to tertiary institutions. The process of admission of students into university is a very important activity in every educational system. Admission starts from when a potential student develops interest in higher education, until enrolment in a particular institution (Harman, 1994).

The system of Admission varies from country to country, Helms (2008) in a research noted that in some countries, government bodies or independent organizations are tasked with centralizing the administration of entrance examination and student placement.

According to Sargent *et al.* (2012) admission can either be open or selective. An open admission system exists when holders of relevant secondary school certificates have an automatic right of access to higher education while a selective admission system is a

system where applicants have to meet other criteria in addition to holding a secondary school certificate to be admitted to higher education institutions.

Seeman and O'Hara (2006) in a research pointed out that, because graduating high school seniors have a wide variety of choice in higher education, competition for their business in keen. Therefore, viewing students as customers by colleges provide these colleges with competitive advantage when it comes to attracting, retaining and serving these students.

Therefore, there is the need for colleges to have an admission system that covers three key dimensions namely: Quality, Equity and Mobility. Quality refers to the ability of a system to act as a reliable predictor for student's future academic success; Equity is the capacity of the system to cater for the need of the diverse group of learners (e.g. disable students and matured students) as well as students from different socio economic background and mobility for a system to favor inbound and outbound students (Durazzi, 2014).

2.2 Factors Considered in Admission Process

According to Helms (2008), a useful first step in sorting through the wide and complex range of admission systems and procedures in existence, is to identify the factors that are most commonly considered in admission processes throughout the world. These factors can be grouped into four main categories: examinations, secondary school preparation, application materials, and demographic factors.

i. Examinations

In most admission systems, a candidate's score on one or more examinations is a key consideration. The exams used can be grouped into three primary categories: secondary leaving exams, entrance exams, and standardized aptitude tests. Secondary leaving exams and entrance exams are generally achievement focused, designed to measure acquired learning, knowledge, and ability in a particular curriculum or domain of interest. Standardized aptitude tests generally measure aptitude in more general cognitive skills and are designed to estimate a person's ability to learn (Helms, 2008).

ii. Secondary School Preparation

A variety of components of secondary school preparation are taken into account by admission systems. In many cases, a candidate's high school grade point average is considered and may be combined with an examination score to produce a composite score used for admission decisions. Grades in all subjects may be reviewed or only grades in the particular field of study the candidate intends to pursue at the university level (Helms, 2008).

iii. Application Materials

In some countries, universities require candidates to submit an application that has a variety of components. Common elements of a university application include essays in which candidates answer a number of questions designed by the institution, together with recommendation letters from teachers, employers, coaches, public officials, and others. The relative weight of each application element is generally determined by the individual institution (Helms, 2008).

iv. **Demographic Factors**

In some cases, admission procedures also take into account the demographic characteristics of applicants. These qualities are often used as "tipping" or "plus" factors, which are considered in conjunction with other criteria when all other conditions are equal and a differentiation is desired, or in the context of equalizing the consideration of different applicants. Although not an exhaustive list, typical demographic factors include race and/or ethnicity, gender, socioeconomic status, ability to pay tuition, and social class (Horn 2007).

2.2.1 Transparent admission system

According to Steering Group (2004), a transparent admission system is one that provide equal opportunity for all individual, regardless of background, to gain admission to a course suited to their ability. Fujo (2019) in a research on web-based Admission System looked at the various challenges facing admission procedures. The researcher identified that the manual process associated with most admission systems makes the system less transparent. Universities and colleges should provide applicants with the appropriate mechanisms and information that an applicant need to make informed choice. This is done

through the provision of admission policy, admission criteria and steps for the admission process (Macrae & Maguire, 2002). The assessment of the ability of individual student on the basic criteria should not contain only the previous examination marks, the ability of the applicant to complete the course should be an essential part of the criteria. Therefore, the educational background of applicant in terms of achievements, potential, abilities though interviews should also be considered. The reliability of the factors affecting assessment in the admission procedure is important. The assessment maybe measured through the admission entry test in to the higher education institution.

2.2.2 Admission policies

Admission policies are high profile; they directly relate to university reputation regarding teaching, learning and research as entry requirements display and serve to uphold university academic standards. Marginson *et al*. (2013) suggest that 'university faculties want to attract the highest scoring students so as to maximize the university's market position'. Admission policies also reflect university strategic objectives regarding social inclusion and specific student markets (for example, international students). As an outward facing policy, admission policies translate university strategy for audiences including prospective students, education providers (school, vocational education and training, higher education), tertiary admissions centers, industry and the broader public. As such, formal admission policies are inexorably linked with myriad of related principles, processes and reputational considerations.

Fundamentally, the objective of admission policies is to select applicants with potential to succeed in university studies, with reference to university's specific academic standards. Admission policies embody the concepts of merit-based selection and equitable treatment; applications are competitive, 'tempered with equity considerations'. Furthermore, admission policies aim to facilitate government policy and university strategy, perhaps best currently exemplified by social inclusion objectives. But according to CfBT Education Trust (2007), equity and fairness in admissions systems have continued to be controversial issues, discussed by researchers, policy-makers and the media for a number of years, because there is national policy but no nationally applied practice. Different criteria are used in different schools in different parts of the country.

2.3 Factors influencing students' performance

Academic performance has been defined as the degree to which a student is accomplishing his or her tasks and studies (Ali *et al.,* 2009). There are several ways to determine students' academic performance, which include grade point average (GPA), cumulative grade point average (CGPA) and test results (Saladeen & Murtala, 2005).

The Western Australian Aborigin Child Health Survey (2001) studied the factors that influence academic performance. The health survey identified students' factors and academic performance, maternal and neonatal health, students' physical health and students' social and emotional well-being. The study linked good physical health with academic performance; and the importance of the early years of development as an essential base for later learning. Barbara and Sylhia (2002) & Adegoke and Moronha (2002) carried out similar studies and found that age is a major variable in the differences found in the performance of students when their admission grades were compared to their performance in university examinations as the students go through the university.

Australian Council for Educational Research (ACER 2004) identified seven key principles that were of relevance to students' academic performance. The Educational Research studied the relationship between students' social and emotional well-being and academic performance. The study found a high proportion of relationship. The factors studied were emotional or behavioral difficulties, negative acceptance by peers, relationship with teachers, conduct problems and hyperactivity among university students. ACER also investigated other factors in the university settings (the language spoken at school and tutorial attendance). The body found significant association between academic performance and the language spoken in the classroom especially when the language spoken is English language as against the aboriginal language in Australia. Students who did tutorial assignments were found to perform higher than those that do not. The research however found no significant association found between overall academic performance and students' admission grades.

2.4 The Role of Information and Communication Technology in Educational Institution

Information and Communication Technology (ICT) plays a key role in the activities of Educational institution today, the application of ICT in the area of improve

learning and teaching provides tools to enhance learning, giving students and teachers more opportunities for feedback and reflection, and building local and global communities.

Moore (2001) noted that ICT, properly utilized, makes educational activities easier by increasing access and transcending traditional physical and spatial constraints.

Kozma (2005) in a research looked at how ICT can be applied to support education and how it can be applied in educational institution. The research looked at four types of approaches in general; the use of ICT in teaching, student's benefits from the application of ICT in learning process, the use of ICT in increasing student understanding and finally the use of ICT to improve delivery and access to education. Concluding that if these four approaches are followed, knowledge creation, technology, technological innovativeness, and knowledge sharing can contribute to the transformation of the education system and to sustained economic growth and social development.

2.5 ICT Implementation and Adoption Theories

Software developers in their attempt to design software that meet the need of the general public must rely on established guideline or theories that applies to the design process. According to Levine (1997), in the process of ICT adoption, an important factor that should be considered in the plan for adoption. This plan should be based on real needs, one that is realistic, achievable and effective. The plan should be produced not for the purpose of making the Technology available but in order to make effective Technology deployment. As a result, there is therefore need to examine some of these theories that applies to this research topic.

2.5.1 Diffusion of Innovation Theory

Rogers (2003) defines adoption as the decision to make full use of an innovation as the best course of action available. He differentiates the adoption process from the diffusion process by stating that adoption process pertains to an individual, whereas the diffusion process occurs within a society as a group process. Rogers (2003) defines innovation adoption process as 'mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject and to confirmation of this decision.

Rogers (2003) breaks the adoption process down into five stages; the knowledge stage where the adopter become aware of an innovation through different sources available in the social system; the persuasion stage where the adopter becomes interested in the

innovation and develops mental acceptance, or makes a decision to reject the innovation; the decision stage where the adopter engages in activities that lead to a choice to adopt or reject the innovation. It is the feasibility stage where the adapter assesses the benefit of the innovation and its anticipated future situation, then decides whether or not to implement it; the implementation stage where the adopter makes full use and applies the new innovation on a small or full scale in order to determine its utility in his/her own situation: the confirmation stage where the adopter seeks support for the innovation decision that had already been made at the previous stages and uses the new innovation continuously, full scale, and applies any improvement for upgrades.

As an important marketplace, more and more equipment and software have been made and be sold into schools. The industry declares it has the revolutionary effect of ICT in education. In the university sector, ICT has already made an important impact, whether in terms of teaching, research or administration.

Leithwood *et al.* (2004) noted that as different as these innovations are, the success of any innovation depends on the motivation and capacities of the three main key agents; which are innovators, adopters and change agents, who play a leading role in implementing school change.

Zhang (2013) suggested that because, technology use is contextual and tends to follow, often invisible, ground rules within the education organization, these rules and sanctions regarding technology use become increasingly complex. There is therefore need for innovation to be adopted with positive external guidance, Cooperation of Different Driving Forces and Strengthen In-depth Interactions between Academic Organizations and Schools

2.5.2 Use and Gratification Theory

The Use and Gratification theory is an audience centered approach that focuses on what people do with media, as opposed to what the media does for them. According to Windahl *et al.* (2008), Use and Gratification theory adapts a functionalistic approach to communication and media and states that the media's most important role is to fulfill the need and the motivation of the audience. Therefore, the more these needs are met, the more satisfaction is yielded.

The theory of satisfaction and gratification is based on two core questions; why are people attracted to a certain media and what kind of satisfaction do the media provide for

the people. In other words, this theory concentrates on how users seek media and to what extent they are satisfied with its type, content and method of use (Amiri *et al.*, 2012).

Windahl *et al. (*2008) in a study of Use and Gratification theory, stated that because a person choose a particular media does not necessary mean that it could be successful, emphasizing that "gratification sought" and "gratification obtained" should not be considered equal in research. Gratification sought (GS) and Gratification obtained (GO), differ with respect to concept and applicability, and neglecting their difference can lead to misconception and misinterpretation of the results.

In summary, the User and Gratification theory shows that a user choice of media is driven by his desire to fulfill a particular need and his knowledge of being able to choose the right media to achieve that need. This theory is therefore useful because it provides a background for studying why educational institution; in particular Tertiary institutions use ICT and media and how their information need determines their choice of media.

2.5.3 Technology Adoption Model

The Technology Acceptance Model (TAM), introduced by Davis (1986) is one of the most widely used models to explain user acceptance behavior. TAM explains that a user's intention to adopt technology is based on two main determinants; namely, perceived usefulness ad perceived ease of use. Perceived usefulness is generally defined as the degree to which a user believes that a particular system will enhance his/her performance and perceived ease of use is defined as the degree to which an individual believes that using a particular technology would be relatively free from effort.

Bhattacherjee (2001) & Benett (2003) suggested that users will eventually use technology, if they have the ultimate belief that they will acquire expected benefits by using it. Benett (2003) conducted a study on the impacts of instructional technology on faculty members' readiness to make use of technology in their teaching, which revealed that among the most important factors which hampered the adoption of ICT was the educator' beliefs and their reluctance to change and not lack of instructional facilities or financial funds.

Watson (2006) in a research found that understanding an institution's perception of innovation is vital to successful adoption of technology in the institution. Hence, in this context, institution's perceived ease of use toward ICT is viewed as a determining factor in respect to its integration in the institutions activities.

In summary, perceived ease of use directly affects the usefulness. Therefore, in developing an admission model, more emphasis should be paid to the design of the application; the application should be user friendly and easy to use. Training should be conducted and support readily available for the users of the application. The ease of use and the usefulness of the application should be the focus of the design.

2.6 Intelligence

There are many definition of intelligence, however intelligence is typically defined in term of a person ability to adapt to the environment and learn from experience (Sternberg & Detterman, 1986). Intelligence is not a single, unitary ability but rather a composition of several functions. The term denotes the combination of ability required for survival and advancement within a particular culture (Anastasi, 1992).

According to Sternberg (2004), intelligence is the skill used in achieving whatever it is you want to attain in life within your socio-cultural context by capitalizing on your strength and compensating for or correcting your weakness. The term intelligence can also mean different things to different individuals. The individual who wishes to become a Supreme Court judge will take a different path from the individual who wishes to become a novelist.

An evaluation of intelligence should focus not on what goals is chosen but rather on whether the individual has chosen a worthwhile goal and shown the skills and depositions needed to achieve them (Sternberg, 2005). Virtually no one is good at everything or bad at everything. People who are the positive intellectual leaders of the society have identified their strength and weaknesses, and have found ways to work effectively within that pattern and abilities.

2.6.1 Types of Intelligence

There are two types of general intelligence; the fluid intelligence (is the capacity to reason and solve novel problems, independent of any knowledge from the past. It is the ability to analyze novel problems, identify patterns and relationships that underpin these problems and the extrapolation of these using logic) and the crystallized intelligence (crystallized intelligence is the ability to use skills, knowledge, and experience. It does not equate to memory, but it does rely on accessing information from long-term memory. Crystallized intelligence is one's lifetime of intellectual achievement, as demonstrated

largely through one's vocabulary and general knowledge. This improves somewhat with age, as experiences tend to expand one's knowledge (Cattell, 1941) & (Horn, 1965).

Carroll (1993) proposed the three-spectrum theory. The three-stratum theory is derived primarily from Spearman's (1927) model of general intelligence and Horn and Cattell (1966) theory of fluid and crystallized intelligence. This model suggests that intelligence is best conceptualized in a hierarchy of three strata. The three layers (strata) are defined as representing narrow, broad, and general intelligence (Carroll, 1993).

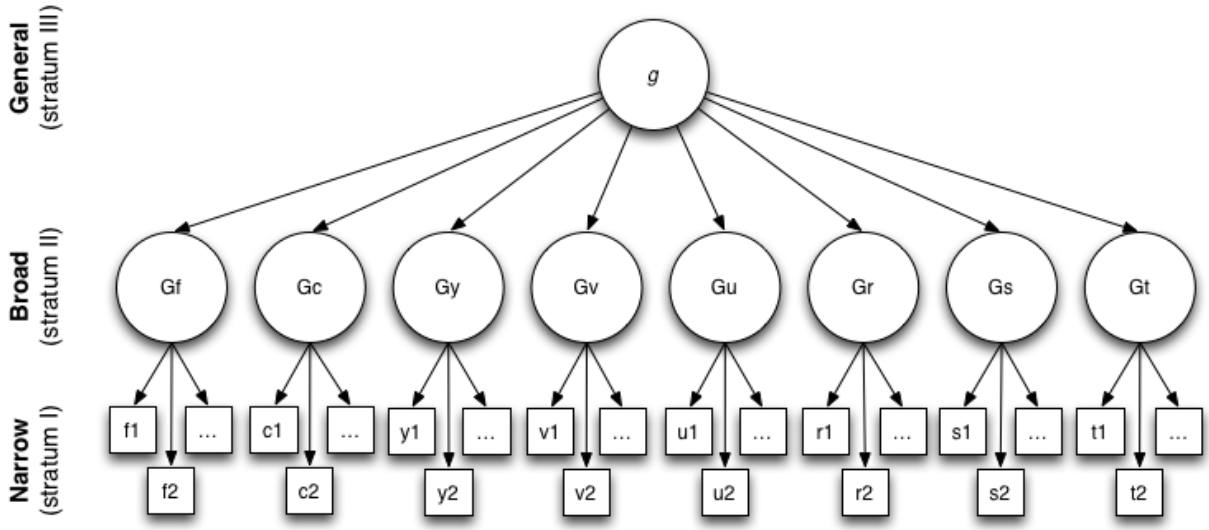


Figure 2. 1: Three-stratum model Source Carroll's t: wikipedia.org

Stratum III (general intelligence): *g* factor, accounts for the correlations among the broad abilities at Stratum II. Stratum II (broad abilities): 8 broad abilities—fluid intelligence, crystallized intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speediness, and processing speed. Stratum I (specific level): more specific factors under the stratum II.

Due to substantial similarities between the two theories they were successfully amalgamated to form the Cattell–Horn–Carroll theory (CHC) (Willis, 2011). In the late 1990s the CHC model was expanded by McGrew, later revised with the help of Flanagan. Later extensions of the model are detailed in McGrew (2011) & Schneider and McGrew (2012). There are a fairly large number of distinct individual differences in cognitive ability, and CHC theory holds that the relationships among them can be derived by classifying them into three different strata: stratum I, "narrow" abilities; stratum II, "broad abilities"; and stratum III, consisting of a single "general ability" (or g).

Today, the Cattell–Horn–Carroll theory is widely accepted as the most comprehensive and empirically supported theory of cognitive abilities, informing a substantial body of research and the ongoing development of IQ (Intelligence Quotient) tests (Kaufmann, 2009).

2.6.2 Assessment of Intelligence

Sternberg (2008) organizes the assessment of intelligence around the analytical, creative, and practical aspects of intelligence.

i. Analytical intelligence: is involved when the information processing components of intelligence are applied to analyze, evaluate, judge, or compare and contrast. It typically is involved when components are applied to relatively familiar kinds of problems where the judgments to be made are of a fairly abstract nature.
ii. Creative intelligence: Intelligence tests contain a range of problems, some of them more novel than others. Creative intelligence is particularly well measured by problems assessing, how well an individual can cope with relative novelty.
iii. Practical Intelligence: Practical intelligence involves individuals applying their abilities to the kinds of problems that confront them in daily life, such as on the job or in the home. Practical intelligence involves applying the components of intelligence to experience so as to: a) adapt to, b) shape, and, c) select environments.

2.7 Artificial Intelligent

According to McCarthy (1956), artificial intelligence is the science and engineering of making intelligent machines. The field of artificial intelligence, or AI, attempts to understand intelligent entities (Russell *et al*., 2003). It is the ability of a system to act appropriately in an uncertain environment, where appropriate action is that which increases the probability of success, and success is the achievement of behavioral sub goals that support the system's ultimate goal (Albus, 2001).

According to Duda *et al*. (2001), AI is a concept that describes the creation of a device or devices that will emulate the ability of the human brain to absorb, and more importantly, interpret data, in context. Gurney (1997) defined artificial intelligence as both a system and a concept, this refers to the idea of a computer system that can think and

"learn" like a human. A computer with artificial intelligence could update and increase its knowledge based on previous problems and results.

The main advances over the past sixty years have been advances in search algorithms, machine learning algorithms, and integrating statistical analysis into understanding the world at large. However most of the breakthroughs in AI aren't noticeable to most people. Rather than talking machines used to pilot space ships to Jupiter, AI is used in subtler ways such as examining purchase histories and influence marketing decisions (Shaw, 2001).

Although John McCarthy was the first to coin the term Artificial Intelligence, the journey to understand if machines can truly think began much before that. Vannevar Bush's seminal work "As We May Think" proposed a system which amplifies people's own knowledge and understanding (Bush, 1945). Five years later Alan Turing wrote a paper "Computing Machinery and Intelligence" which opened the doors to the field that would be called AI (McGuire, 2006).

2.7.1 Intelligent System

According to Mankad (2015), intelligent system can be defined as the system that incorporates intelligence into applications being handled by machines. It is biologically-inspired "soft computing" techniques which can be incorporated into an information system (IS) in order to improve performance, and secondarily in the sense of intelligence gathering, in order to render an IS more secure (Fulcher, 2009).

Sun *et al*. (2012) defines intelligent systems as a system that can imitate, automate some intelligent behaviors of human being. Expert systems, intelligent agents and knowledge-based systems are examples of intelligent systems.

2.7.2 Expert System

An expert system is an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution (Feigenbaum, 1979). It a computer program designed to model the problem solving ability of a human expert (Tomic, 2009). It is a system designed based on a set of rules to determine what action to set off when a certain situation is encountered. In other words, expert system is such a technology that able the human being to collect & control the human expert's knowledge and expertise in a particular

problem domain for further use to solve similar problems through computer system (Pham and Chen, 2002). It is a system that uses knowledge and inferences to solve problems in a way that experts might (Rada, 2009). According to Poggi (2009), it is a system that encodes the knowledge of an expert into the rule set of a rule-based system. When exposed to the same data, the expert system AI will perform in a similar manner to the expert.

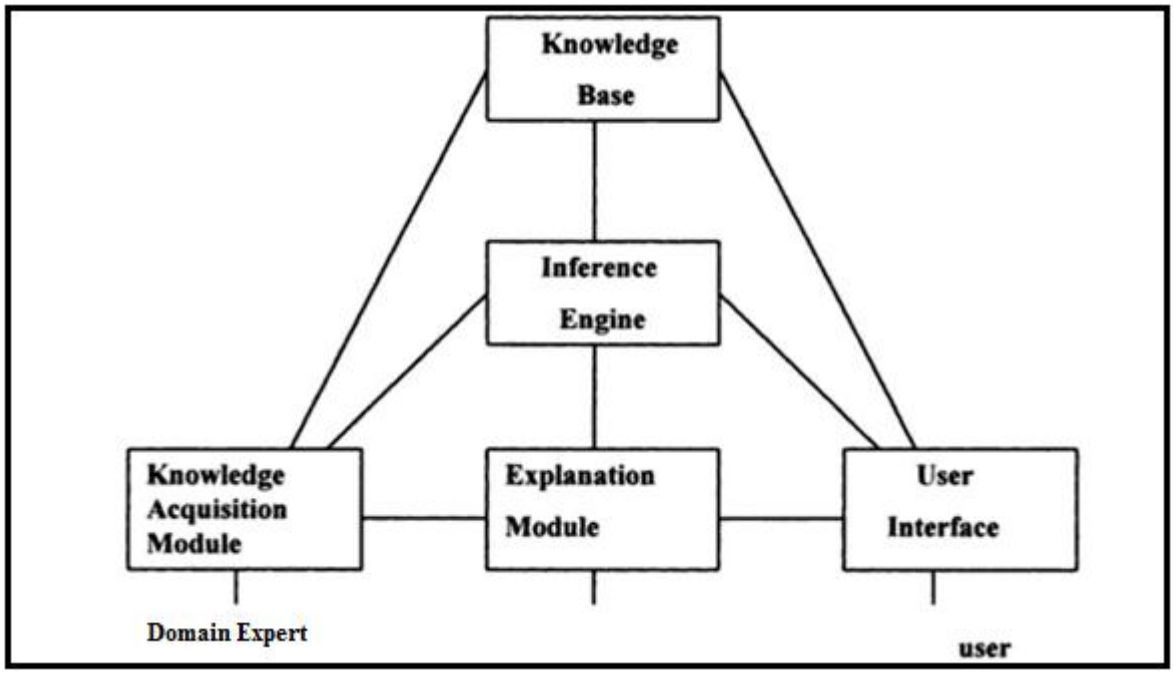


Figure 2. 2: Architecture of an expert system Source: Nikolopoulos, (1997)

2.7.3 Rule-Based System

A rule-based system is a 'knowledge based system', which works as a production system in which rules encode expert knowledge. Most decision support systems are rule-based. It is a DSS based on a set of rules that a human expert would follow in solving a problem. A classic example of a rule-based system is the domain-specific expert system that uses rules to make deductions or choices.

A rule-based system consists of if-then rules, a bunch of facts, and an interpreter controlling the application of the rules, given the facts. If-then rules are one of the most common forms of knowledge representation used in decision support systems. Systems employing such rules as the major representation paradigm are called rule based systems.

2.7.4 Fuzzy Logic

Fuzzy Logic is a form of logic based on the concept of fuzzy set. The concept of fuzzy set was first published by Dr. Lotfi Zadeh in 1965. Zadeh (1965) defines fuzzy set as a mathematical definition of classes that lacks precisely define criteria of membership.

According to Gupta *et al.* (2013), the theory of fuzzy logic is based on the notion of relative graded membership as inspired by the process of human perception and cognition, fuzzy logic is an approach to computing based on the degree of truth rather than the usual true or false (1 or 0) Boolean logic on which modern computing is based.

2.8 Information system

The best system is one that provides useful information and user interaction at all levels. An information system is a collection of activities, procedures, methods, technology and peoples that are organized to get the valuable related data and information. This system must also be able to store this information until it is required by the user. It should be capable of data processing and responding to its end user by providing the answers to all set of queries. Information systems should best interact and communicates with the end user in order to provide the accurate required information (Knight & Silk, 1990).

Lucy (2002) technically defined information system as a set of interrelated component that collect (or retrieve), process, store and distribute information to support decision making and control in an organization. Buckingham *et al.* (2007) however, defined information system as a system which assembles, store, process and delivers information relevant to an organization (or society), in such a way that information is accessible and useful to those who wish to use it, including managers, staff, clients and citizens.

Therefore, an information system (IS) is a set of software, data, people and procedures that work together to produce information. Information is a valuable and costly asset that must be preserved, protected, controlled and planned for, as other valuable assets with an organization such as money facilities and people, (Longely & Shain, 2005). In addition to supporting decision making, information system help workers and managers to analyze complex problems, to develop new products and to integrate the various modules and department. Moreover, the transmission losses associated with interdepartmental

communication are reduced considerably leading to better coordination and improved transparency (information sharing) within the organization as a whole.

According to Cooper and Sullivan (2003), failure of the information system can cause a major loss of service, and so dependability is a major concern. The current facet of dependability, such as reliability and availability, do not address the need of critical information system adequately because they do not include the notion of degraded service as an explicit requirement. Some background about critical information system is helpful in understanding the need for a precise notion of survivability and how it differs from other notion of dependability.

According to John (2003), the information system development process is viewed as consisting of analysis, design, and implementation phase, prior to the operation phase. These phases do not ordinarily take place strictly in the order given but rather exist together in a continuing pattern of interaction. The development of information system then consists of an iterated process of information analysis, system design, and implementation. This "system life cycle," it has been pointed out, applies to other kind of development effort as well.

Therefore, the importance of information system in admission process cannot be overemphasized as it provides management with timely and effective information that enables it to make decisions.

2.8.1 Types of information systems

According to Kroenke (2003) & Lucy (2002), there are different types of information system which include the following:

i. Transaction Processing Systems (TPS)

This system captures and process data from day to day business activities. It can either be responses to business transactions (such as orders, time or payment), initiated transactions (such as invoice, paychecks, or both). Examples of these transactions include bank deposits and withdrawal, customer returns, order processing and payment etc. TPS are the oldest types of information systems and the underlying technology is relatively stable.

ii. Management Information Systems (MIS)

This generates accurate, timely, and organized information; it is often integrated with TPS. When integrated with TPS, the TPS records sales update customer account balance and update the inventory count. With this information the MIS can produce report standard summary of daily transaction.

iii. Executive Information System (EIS)

These are forms of data retrieval systems that provides selected and summarized information for senior executives. They assist top management by providing information on critical areas of the organization activities drawn from both internal and external databases. EIS are becoming more widely available and organizations such as British Airways and others are enthusiastic users.

iv. Office Support System (OSS)

This exists to support office communication. OSS are multimedia, they process data, text, graphics, illustrations, voice, and video communication. OSS will be structured to fit an office or department organization, and thus, OSS will be as stable as the organization. The application of OSS will change as office and department work changes.

v. Decision Support System

This is an information application that provides its users with decision oriented information whenever a decision making situation arises. A DSS does not typically make decision or solve problems people do, but it provides useful information that supports decision process. In general, DSS provides one or more of the following types of support to decision:

i. Identification of the problem or decision.

ii. Analysis of possibilities or variables that will affect a decision.

Lucy (2002) clearly asserted, "The objectives of DSS is to support managers in their work, especially decision making, DSS tends to overlap both data processing system and office support systems. They acquire much of their basic data from routine transaction processing and the result of analysis performed on such data may be included in reports prepared by the office support system, for example, on a word processing application.

2.8.2 Educational management information system

The revolution in the information and communication technologies (ICTs) has greatly influenced the life style of whole world. Over the past several years, ICT infrastructure is considered as a symbol for a country's development. In every way of life, there is a vital role of these Information and Communication Technologies (ICTs) by all means to improve the quality, standardizing the different stakeholders' role and imparting the operating procedures (Crowley, 2003).

ICTs has a proven role in the field of medical, business, industry, entertainment, communications but now these technologies have emerging efficient role in education field. The goal of every educational institute is to provide quality education to all of its students. In these institutes management at all level continuously strives to achieve this goal. Universities are hiring highly qualified professors and equipping their scientific laboratories with latest equipment, adding new technologies and books to their libraries. In these educational institutes the concept of digital libraries is also introduced. In classrooms multimedia projects are installed. The concept of distant learning, different tutorials like web and disk based as well as the concept of audio and visual data to aid lectures is introduced. In short, ICTs have played a major significant role for knowledge dissemination among various groups in these educational institutes.

In order to get the maximum benefits of the available facilities of hardware and software, it is not enough to just connect the laboratories with the internet facility; there is a lot more to this. This type of human attitude towards the computer resources propose that there is always a need for some educational intervention to get the possible benefits. The better usage of information and communication technologies (ICTs) can be attained by pedagogic intercessions (Franco *et al*., 2006). As the issues rises, it starts creating interesting opportunities for the individuals and organizations for improving the individuals' understanding and skills. From the educational point of view, it is believed that when the individuals' discernment is challenged and they receive any sort of intellectual or practical support then their productive and creative talents are used which can also be enhanced (Franco *et al*., 2006).

In all this competitive ICTs equipped educational institutes there is much more than the quality education that is expected by the students. Students need quality service in all

of the required information that is required by them. In order to present their day to day problems, students need an environment that can facilitate them in every way.

Different higher educational institutes are continuously striving to achieve this target. For example when a student requires his transcripts after graduation, it can take more than a month to process with the conventional system installed in educational institutes. It takes more time because of the limited numbers of staff that are working on the transcripts issuing process.

There are many other daily issues that can arise and this limited number of staff will not be able to promptly attend to all of the students. In order to handle such hectic routines, universities need to employee more staff but as it is known, increasing manpower can never solve the problem. So another solution that can cope with such issues is required. There are many activities that cannot be handled with simple processing of applications because they are also time consuming, these activities are simple processes like registration, conduction of examination, keeping track of the employees and students and managing both employees and students accounts (Pierce *et al.*, 2002). In order to manage thousands of its students and employees the best effective way is to use the information and communication technologies.

2.8.3 Transforming Education Decision-Making

The day-to-day administration of schools involves working on large amount of records and management data, which have to be collected, stored, and selectively retrieved, updated and statistically analyzed. Utilizing a decision support system is a proactive way to use data to manage, operate, and evaluate education institutions. Depending on the availability and quality of the underlying data, such a system could address a wide range of questions by distilling data from any combination of school records systems. School decision-making can be transformed by Extraction, Transform and Loading (ETL) functions.

2.8.4 Extract, Transform and Loading (ETL) Process

The extract, transform, and load (ETL) process is necessary when source data in a decision support system reside in separate, non-interoperable databases. As the name implies, ETL is a three-stage process designed to move data from legacy source systems into an interoperable format in the decision support system. In the first step, an “extract”

function reads from a specified database and pulls out the desired data. In step two, a "transform" function uses predetermined business rules to convert the extracted data into a format that is interoperable with other system data. Finally, in step three, a "load" function moves the edited and cleaned data to a database repository within a decision support system.

2.9 Database System

A database system is a connection of one or more data or tables stored in structured manner such that interrelationship which exist between items or set of data can be utilized by the DBMS software for manipulation and retrieval purposes. Database system will, in general, serve data requirement of a variety of users rather than a single user (Martin, 2006).

According to Mark (2008), in order to generate useful information, data needs to be collected, stored, and processed. Basically a database is a collection of logically related files which can be integrated and organized so as to provide a single comprehensive file system. Database system is also described as a data processing system dealing with a database, that is, computer-based-system, whose overall purpose is to record and maintain large scale data which may support the operation of multiple users (community of Users).

Indeed, database system design is concerned with the problem of organizing the database, assessing the data on it, updating and providing the output (report to a file interrogation) to a variety of users. The purpose of database is to provide convenient access to common data for a wide variety of users and user needs.

2.9.1 Types of Database Systems

i. Relational database system

Relational database uses a collection of tables to represent both data and the relationship among those data. Each table has multiple columns and each column has a unique name. According to Mark (2008), relational database, until recently, were considered the most flexible and therefore most desirable. Database structure in a relational database, the data in several files is related through the use of common key fields. The content on a key field are unique to one record in a file, enabling the file to be used to identify records. The

computer uses this key to access records without having to search through the entire file.

ii. Network database

According to Mark (2008), data in the network database are represented by collection of records and relationships among data which is represented by ink, which can be viewed as pointers. The records in the database are organized as a collection of arbitrary graph.

As in hierarchical, a network database organize data in parent-child relationship and all the relationship among the items must be determined during the design phase. In a network structure, however, a child can have more than one parent or no parent at all.

iii. Hierarchical database

According to Mark (2008), the first of the four database systems were developed by IBM in 1968. The hierarchical database is similar to the network model in the sense that data are represented by a collection of records and relationships among data which are represented by ink. It differs from the network model because records are organized in a collection of trees rather than arbitrary graphs.

The database elements at the top of the hierarchy are known as the parent elements; there may be several child elements beneath the parent elements.

Each of these children may in turn become parents to several lower level elements. The structure that is created resembles a pyramid or an organizational chat.

iv. Object oriented database

Mark (2008) contended that object oriented database are newer type of database structure and are likely to gain popularity. In an object oriented database, the result of a retrieval operation is an object of some kind. Such as documents within this object are meaning programs that enable the object perform task, such as displaying a graphic; object oriented database can incorporate sound,

video, text, and graphics in to a single database record. This type of database will suit multimedia application.

2.10 Software Development Life Cycle (SDLC)

Software Development Life Cycle is a process used by software industry to design, develop and test high quality software's. The SDLC aims to produce high quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates.

Software Development Life Cycle (SDLC) is also called Software development process. The software development life cycle (SDLC) is a framework for defining the tasks performed at each step in the software development process.

SDLC consists of a detailed plan describing how to develop, maintain, replace and alter or enhance specific software. The life cycle defines a methodology for improving the quality of software and the overall development process. The process is divided into some phases such as Requirement Analysis, Defining, Designing, Building, Testing, Installation and maintenance. All these activities are carried out in different ways as per the staff need. Every system must go through these phases whether it is for a small or big organization (Naresh & Shukia, 2013).

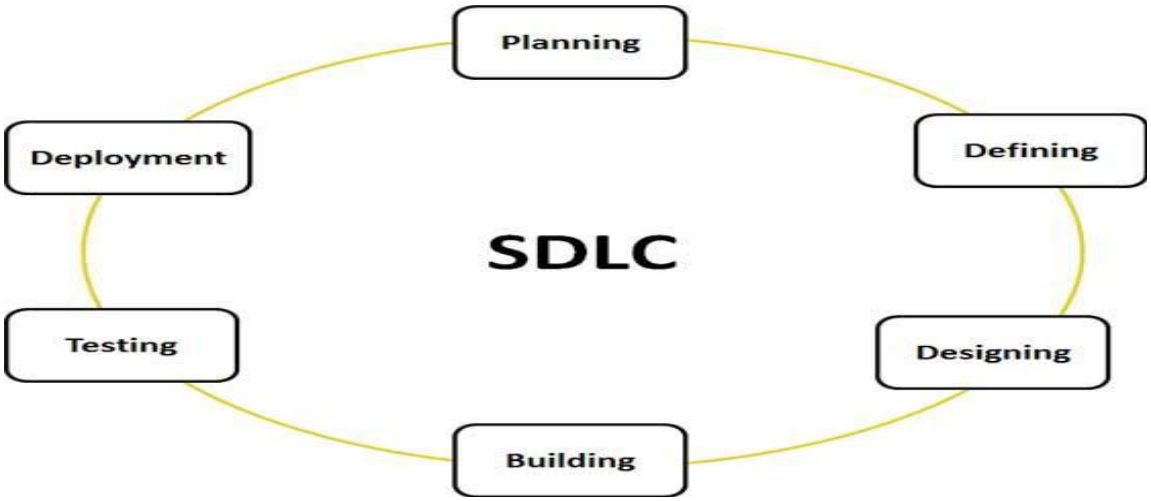


Figure 2. 3: Typical Soft Development Life Cycle (SDLS)

The concept of system development life cycle models came into existence to examine an identified need, define requirements for potential solutions, potential solutions are evaluated and a system specification is developed. Development model are various processes or methodologies, selected to develop the project according to its purpose and

objectives. Many development models were suggested such as waterfall models, spiral model, agile model RAD model (Rapid Application Development). Etc. Each model has advantages and drawbacks and must be selected according to organization needs.

2.10.1 Waterfall model

The water-fall model was introduced by Royce in (1970) specifically for the design of spacecraft mission software design and has been a popular method of assessing the evolution of a product or system. It is a sequential description of the products life cycle and spans across seven (7) stages. In this model, planning every phase at the early stage is important because it ensure the flow of design before they are developed. Additionally, the extensive documentation and planning of the project makes this work extremely well for projects which quality control is important. The model consists of various steps which generally start with requirement analysis, design, implementation, testing, development and maintenance. Figure 4 describes these steps in order.

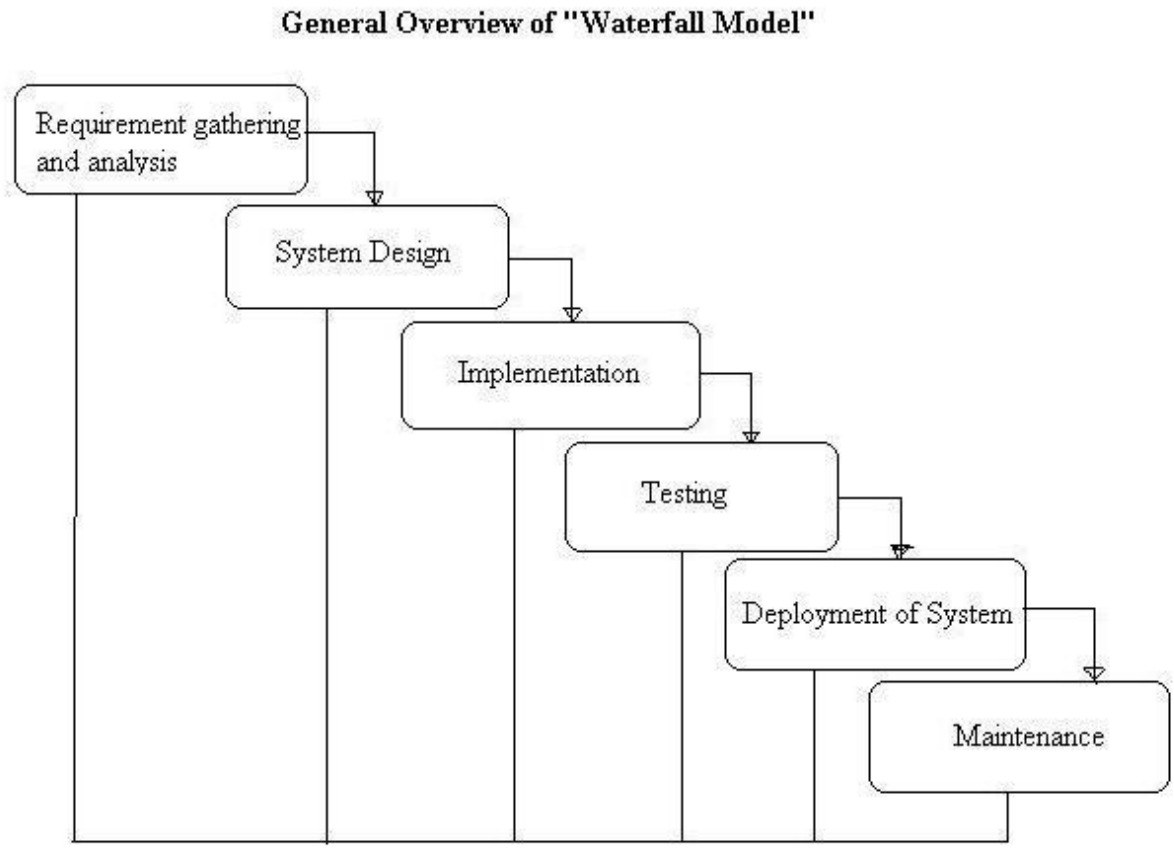


Figure 2. 4: A Waterfall Model (Balaji and Murugaiyan, 2012)

Waterfall model is also known as linear/sequential life cycle model. This model is easy to understand and use. Each stage must be completed before next one can start. At the end of each stage the project is reviewed to ensure compliance with requirements.

The communication of objectives between developers and clients is greatly hindered because if the client changes the requirements of the system, the development process needs to completely restart for those changes to be taken into account (Balaji & Murugaiyan, 2012). This model is an idealized and greatly simplified concept of SDLC. It is not very flexible, but it is still popular as a conceptual basis for other frameworks or models. Its greatest strength lies in that it outlines generally accepted positive habits of software development, such as minute and accurate planning early in the project, extensive documentation of the entire process, and having robust design concepts before starting to code (Munassar & Govardhan, 2010).

2.10.2 Spiral model

The spiral model dates back to the end of the 1980s, when it was outlined by Barry Boehm. It introduces something that other models did not take into account, which is risk analysis. In essence, the spiral model attempts to bring together key aspects of some other prominent models (namely the waterfall, incremental, and evolutionary prototyping), in an attempt to gather the most appropriate traits from each one, because specific projects might be more or less adaptable to specific models. According to this SDLC model, the process of developing a system consists of a series of cycles or iterations. Each cycle begins with the identification of objectives and requirements of the current stage, as well as an analysis of alternatives and constraints (Boehm, 2000). He further asserts that each cycle or iteration of the process will invariably display six particular characteristics, which be named the invariants.

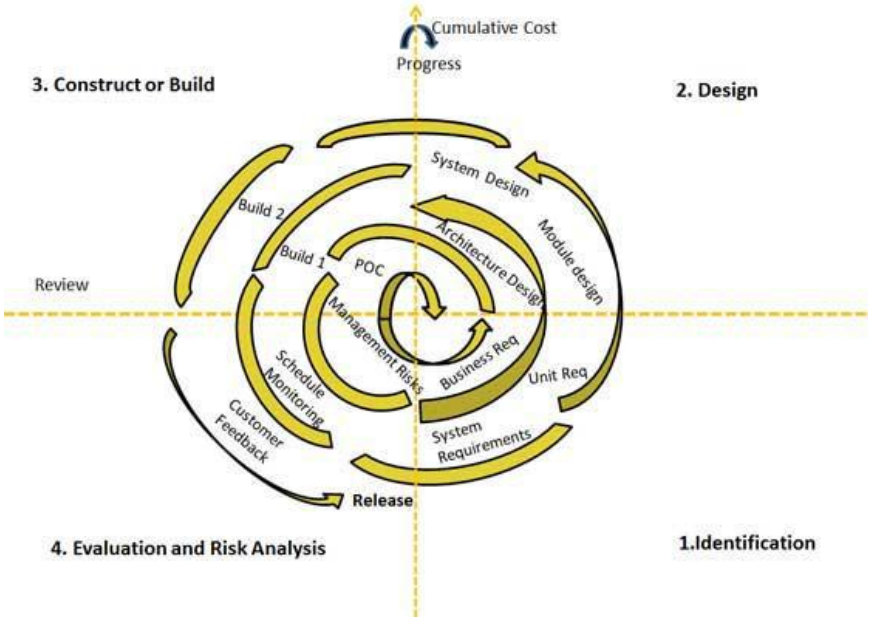


Figure 2. 5: A Spiral Development Model (Boehm, 2000)

The spiral model bears some resemblance to the incremental life cycle, but the emphasis on risk evaluation presents a major difference. The stages or spirals that constitute this model regard planning as a first step, moving then to the exploration of what the requirement are and subsequently calculating the risks. In this stage of risk calculation, the model is structured to initiate a process of determination of risks and of formulation of alternatives (Massey & Satao, 2012); thus, risk management can be considered the centerpiece of the model

2.10.3 V-Model

V - Model is an extension of the waterfall model and is based on association of a testing phase for each corresponding development stage. This means that for every single phase in the development cycle there is a directly associated testing phase. This is a highly disciplined model and next phase starts only after completion of the previous phase.

Under V-Model, the corresponding testing phase of the development phase is planned in parallel. So there are Verification phases on one side of the V and Validation phases on the other side. Coding phase joins the two sides of the V-Model.

The below figure illustrates the different phases in V-Model of SDLC.

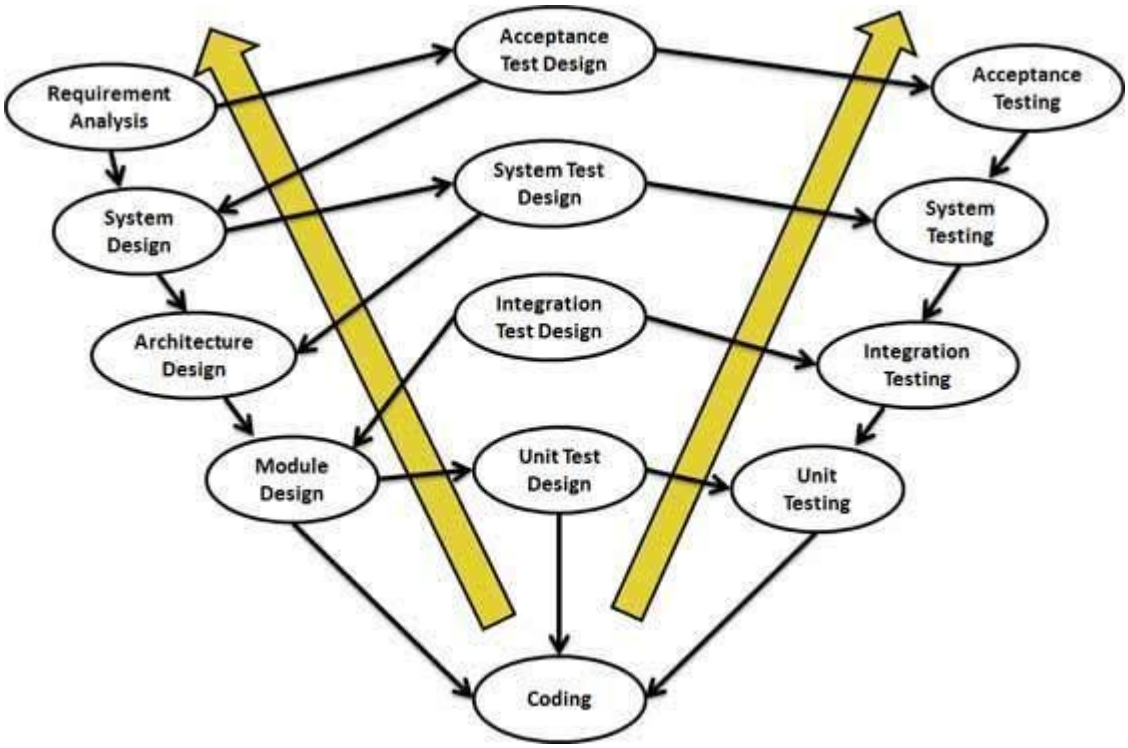


Figure 2. 6: V-development model (ER Parag, 2015)

V- Model application is almost same as waterfall model, as both the models are of sequential type. Requirements have to be very clear before the project starts, because it is usually expensive to go back and make changes. This model is used in the medical development field, as it is strictly disciplined domain. Following are the suitable scenarios to use V-Model:

2.10.4 Agile model

In 2001, the manifesto for the development of the Agile development methodology was presented by 17 software developers, in an attempt to bring together all the best traits of other agile-like development models in to one framework (Bhalerao *et al*., 2009). Agile Methods break the product into small incremental builds. These builds are provided in iterations. Each iteration typically lasts from about one to three weeks. Every interaction involves cross functional teams working simultaneously on various areas like planning, requirements analysis, design, coding, unit testing, and acceptance testing. At the end of the iteration a working product is displayed to the customer and important stakeholders.

Agile model believes that every project needs to be handled differently and the existing methods need to be tailored to best suit the project requirements. In agile the tasks

are divided to time boxes (small time frames) to deliver specific features for a release. Iterative approach is taken and working software build is delivered after each interaction. Each build is incremental in terms of features; the final build holds all the features required by the customer.

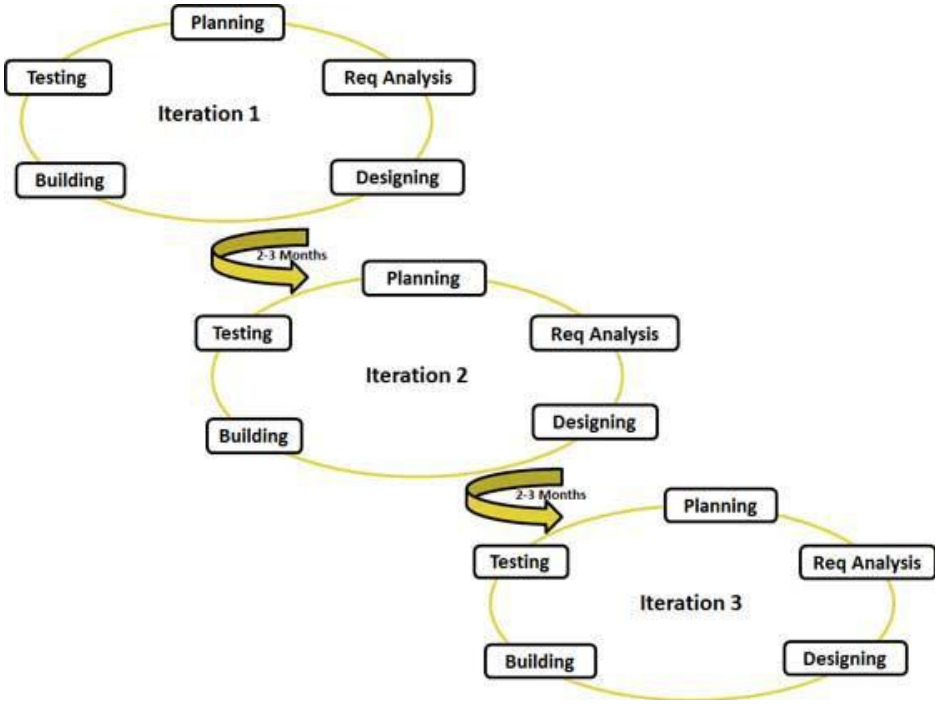


Figure 2. 7: Development Model (Bhalerao et al., 2009)

With the popularization of waterfall-like SDLC models, an alternative approach has been developing that attempts to counter their rigidness and lack of flexibility. Since then, agile methods of development have become increasingly popular (Bhalerao *et al*., 2009).

Another advantage of using agile model is that, it is very flexible. It has been occasionally combined with other existing models. It has the capacity to deliver systems whose requirements go through constant changes while at the same time, demanding strict time limits.

Finally, the model is often praised for its high degree of client satisfaction and user-friendliness, reduced error margins and the ability to incorporate solutions to address the needs of highly mutable requirements. Agile models are client-centric and advocate short

iterations and small releases in order to obtain feedback on what has been accomplished. With the feedback that is received, improvements can be made that will have positive repercussions on the quality of the end product (Bhalerao *et al*., 2009).

2.11 Empirical Study

An empirical study was carried out by Vohra and Das (2011) on an intelligent decision support system for admission management in to higher educational institutes. The researchers focus on using enterprise resource planning (ERP) systems with intelligent decision support system (DSS) for admission management.

The aim of the research was to design an ERP-based decision support system to help institution take full advantage of data in the ERP. The dynamic system model can then be applied to solving problems related to:

1. Determining the faculty's admission capacity for a specific degree setting and specific resource scenario.
2. Allows management to investigate changes in the key academic resource management processes before implementing any policy changes; computing the necessary adjustment of admission number or teaching resources for supporting a certain scenario, such as reduction in funding.

In another research conducted by Karande and Chakraborty (2013) fuzzy expert system technology was used in the research to make better material handling (MH) selection decision by considering most of the important issues that influences MH. The research used weighted utility additive (WUTA) method to solve the MH equipment selection problem. The ranking obtained using the WUTA method was compared with that derived by the past researchers which proves its potentiality, applicability, and accuracy to solve complex decision-making problems.

Hua *et al.* (2005) in a research on evaluating aggregate risk in green manufacturing, developed a fuzzy multiple attribute decision making (FMADM) method with a three level hierarchical decision making model to evaluate the aggregate risk for green manufacturing projects.

Andalib *et al.* (2009) used fuzzy expert system (FES) in application to earthquake prediction. The idea is to reproduce the performance of a human expert in earthquake prediction. The first step was to use the rules provided by the human expert to generate a

fuzzy rule base. These rules were then fed into an inference engine to produce a fuzzy inference system (FIS) and to infer the results. An adaptive network-based fuzzy inference system (ANFIS) was used to refine the FES parameters and improve its performance. The framework was then employed to attain the performance of a human expert used to predict earthquakes in the Zagros area based on the idea of coupled earthquakes.

Kabir & Sumi (2012) used fuzzy Delphi with graph theory and matrix methods for evaluation of Hazardous Industrial Waste Transportation Firm (HIWTF). The research identified the importance for a simple, systematic and logical scientific method or mathematical tool to guide user organizations in making a proper HIWTF selection decision. The objective of the selection procedure is to identify the HIWTF selection attributes, and obtain the best combination of HIWTF attributes with the real requirements. Delphi method was used to collect and distil the judgments of experts using a series of questionnaires interspersed with feedback. Fuzzy set theory and Delphi (FDM) methodology was used for identifying the significant factors and issues for the evaluation and selection of HIWTF and the matrix approach was used to derive the system function and index to meet the objectives.

2.10 Summary of Review

In this chapter we reviewed literature concerning admission systems, transparent admission systems, admission policies and also highlighted some factors that in admission process. We also reviewed intelligence, types of intelligence, assessment of intelligence and intelligent systems. A brief review was also done on some of the research that has been carried out on application of fuzzy logic to determine how fuzzy logic is applied in selection decision problem.

This research also reviewed Rule-based systems to determine how they can be used to provide a solution to some of the inherent problems with admission systems.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. This chapter deals with the software design tools that can easily specify the functional requirement of the proposed intelligent model for student admission system.

3.2 Analysis of Existing System

An analysis of the existing systems was conducted followed by a preliminary investigation to come up with the software requirement document containing the functional requirement of the intelligent model for student admission.

3.2.1 Process Model

The first objective of this research is to examine the current admission system with the view of better understanding how placement decisions are made. This was carried out through direct interview with staff of the Joint Admission and Matriculation Board (JAMB) and the Admission officer of Modibbo Adama University of Technology, Yola. Discussion with subject matter experts in the field of intelligent systems was also done in other to better understand the framework of intelligent systems. The As-Is model shows the current obtainable process of admission.

It was observed that course placement if not properly handled; subjectivity could have a negative effect on the quality of the placement process. Therefore, giving rise to the need for the development of an intelligent model in the placement of candidates. The As-Is model shows the current obtainable process of admission.

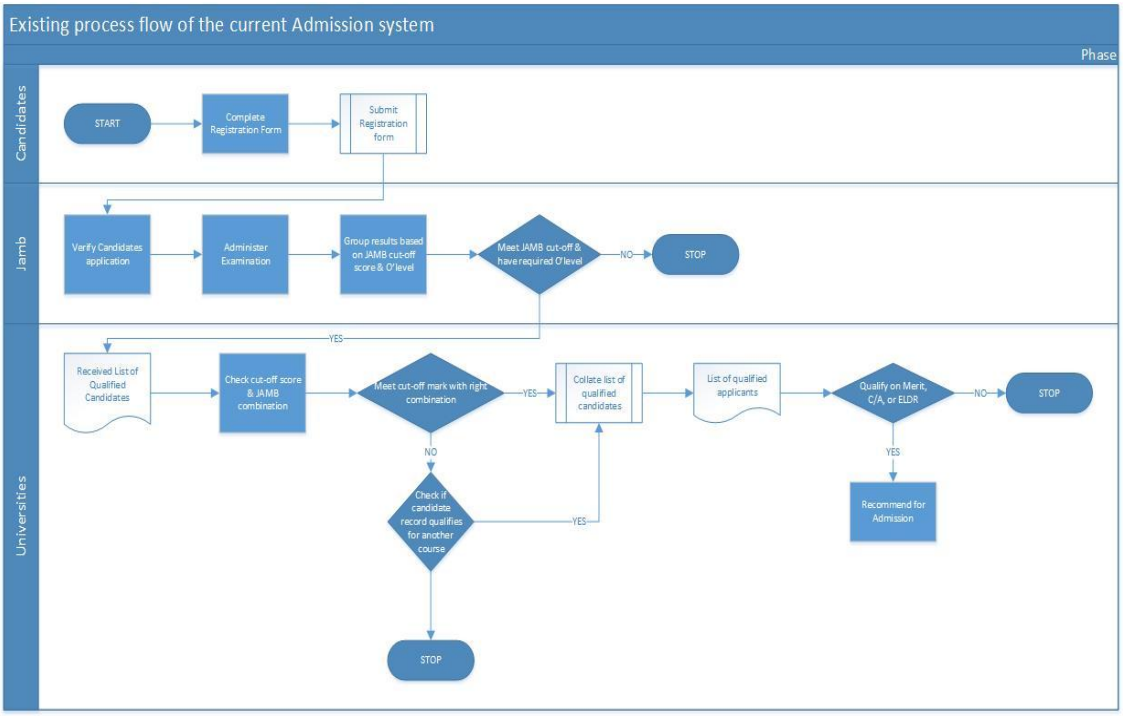


Figure 3. 1: As-Is Model of the Current admission procedure

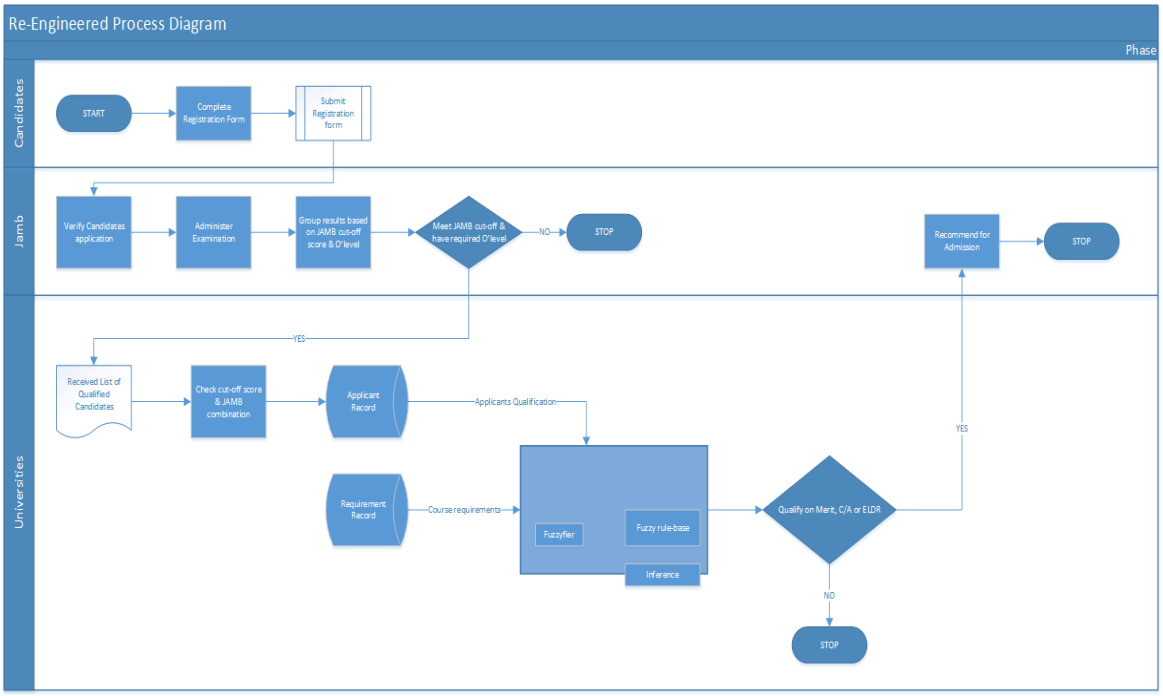


Figure 3. 2: The Re-Engineered Process Mode

The second objective of this research is to identify possible requirements for applicant placements. The intelligent model for student admission will use the following requirements in placement of candidates:

i. UTME Results
ii. IQ assessment
iii. Interest assessment
iv. O'Level results

The third objective is to define a membership function for each of the input parameter.

3.3 Fuzzy Inference System

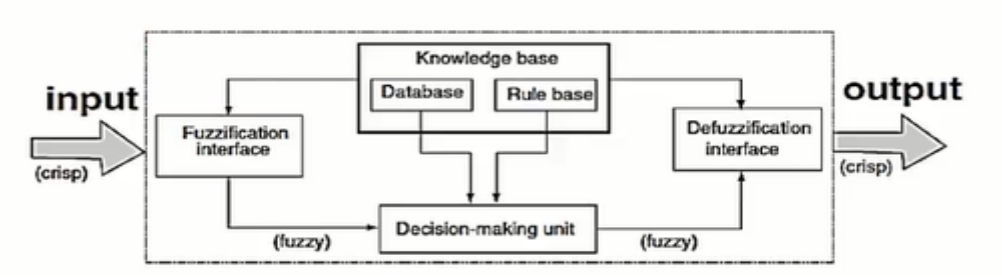


Figure 3. 3: Inference System

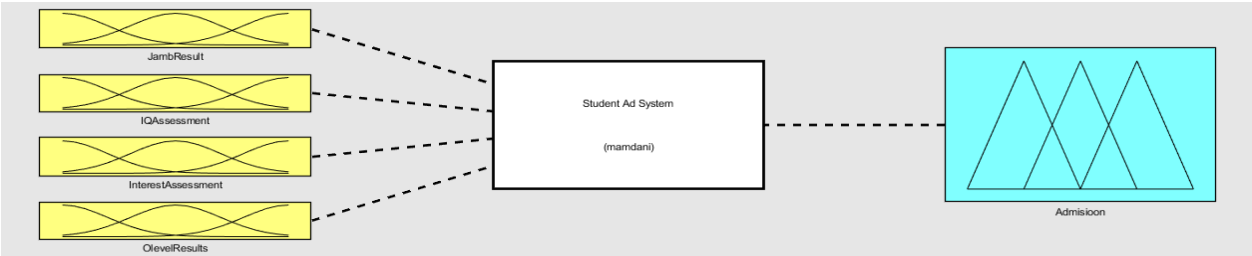


Figure 3. 4: Complete Model

Complete Model with 4 input and 1 output

3.3.1 Fuzzy Membership Function

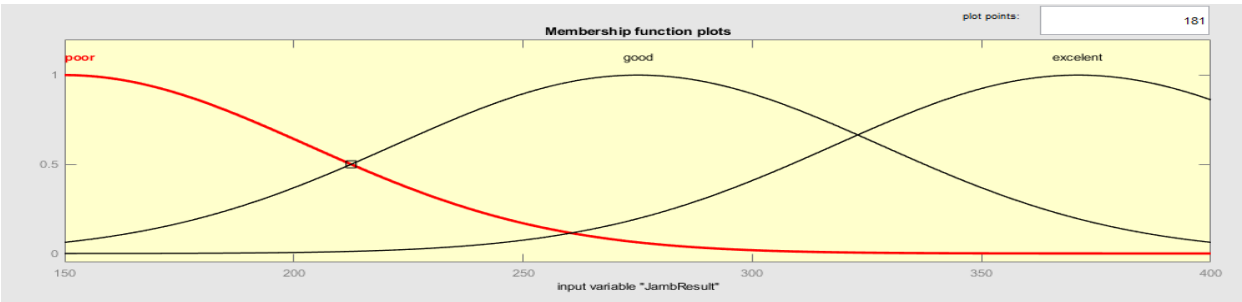


Figure 3. 5: UTME Membership Function

MF1 = Poor [53.08, 150]
MF2 = Good [53.08, 275]
MF3 = Excellent [53.1, 371]

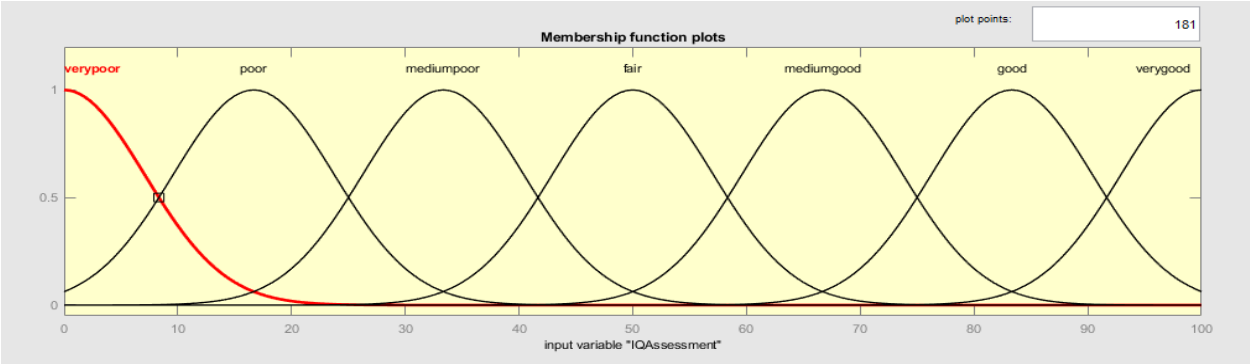


Figure 3. 6: IQ Assessment Membership Function

MF1 = Very Poor	[0, 7.078]
MF2 = Poor	[7.078, 16.67]
MF3 = Medium Poor	[7.078, 33.33]
MF4 = Fair	[7.078, 50]
MF5 = Medium Good	[7.078, 66.67]
MF6 = Good	[7.078, 83.33]
MF7 = Very Good	[7.078, 100]

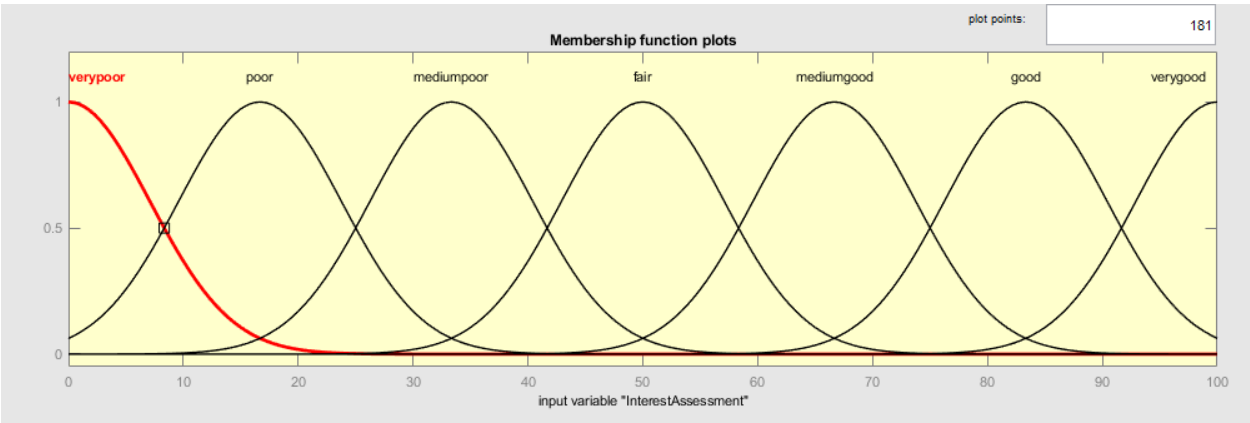


Figure 3. 7: Interest Assessment Membership Functions

MF1 = Very Poor	[0, 7.078]
MF2 = Poor	[7.078, 16.67]
MF3 = Medium Poor	[7.078, 33.33]
MF4 = Fair	[7.078, 50]
MF5 = Medium Good	[7.078, 66.67]
MF6 = Good	[7.078, 83.33]
MF7 = Very Good	[7.078, 100]

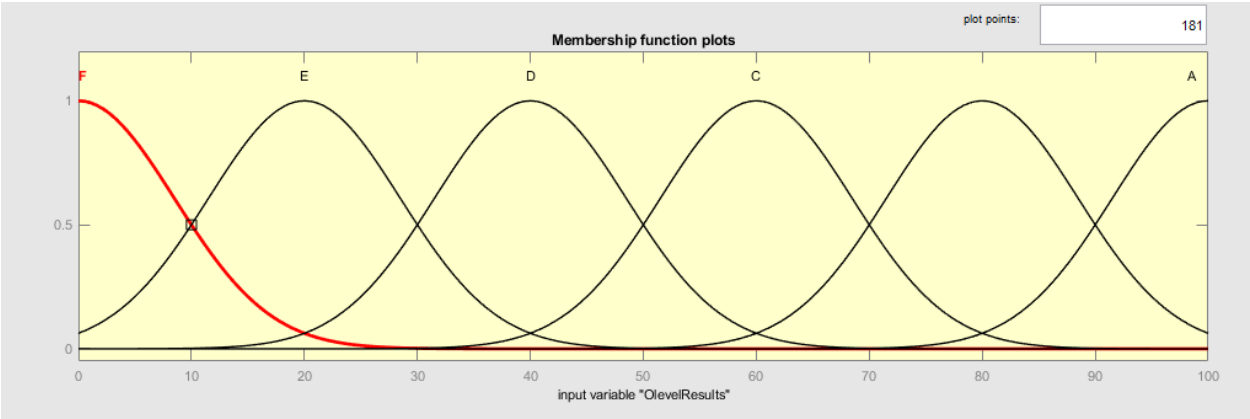


Figure 3. 8: O'Level Membership Function

MF1 = F [0, 8.493]
MF2 = E [8.493, 20]
MF3 = D [8.493, 40]
MF4 = C [8.493, 60]
MF5 = B [8.493, 80]
MF6 = A [8.493 100]

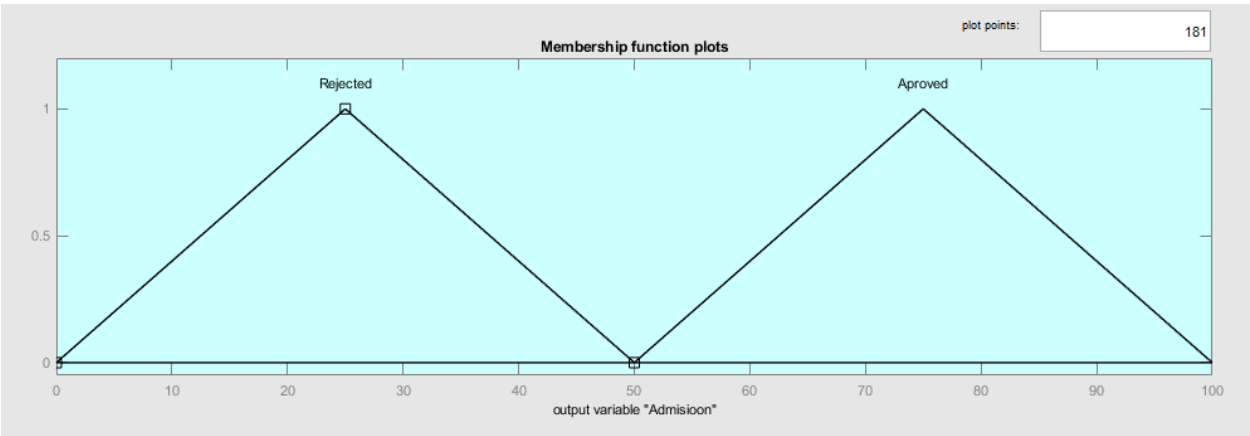


Figure 3. 9: Admission Output Membership function

MF1= Rejected [0, 25, 50]
MF2= Aproved [50, 75, 100]

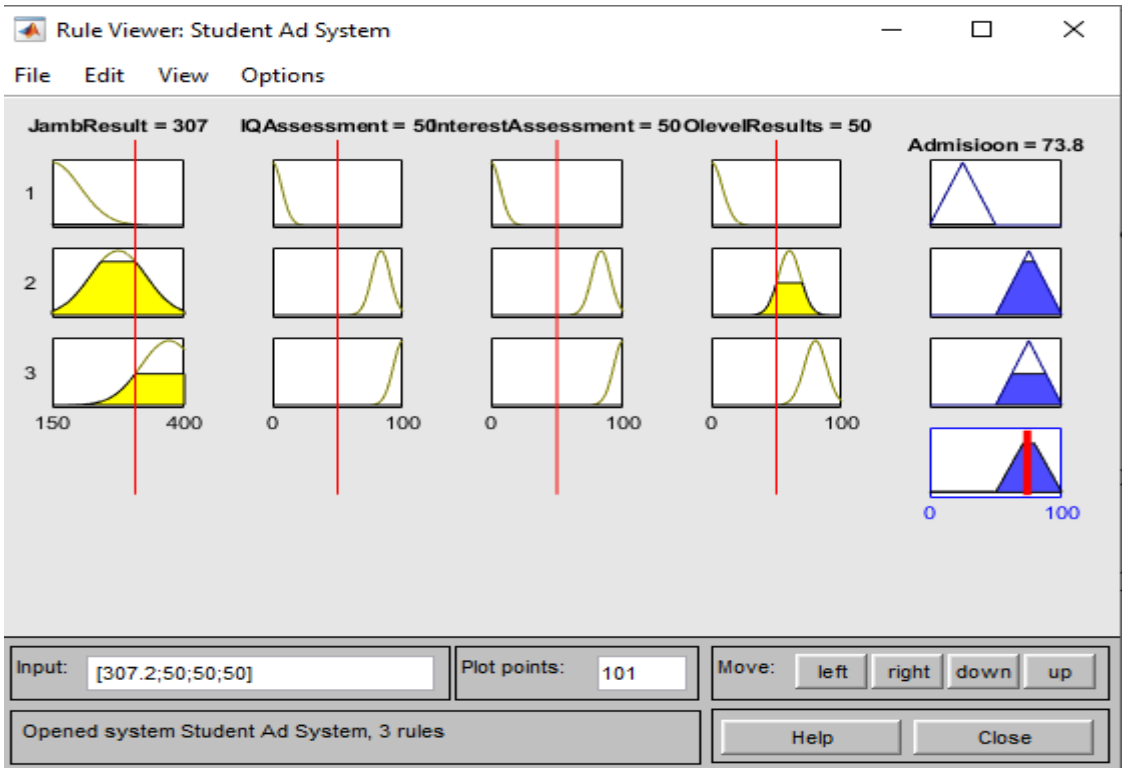


Figure 3. 10: Rule base for simulation

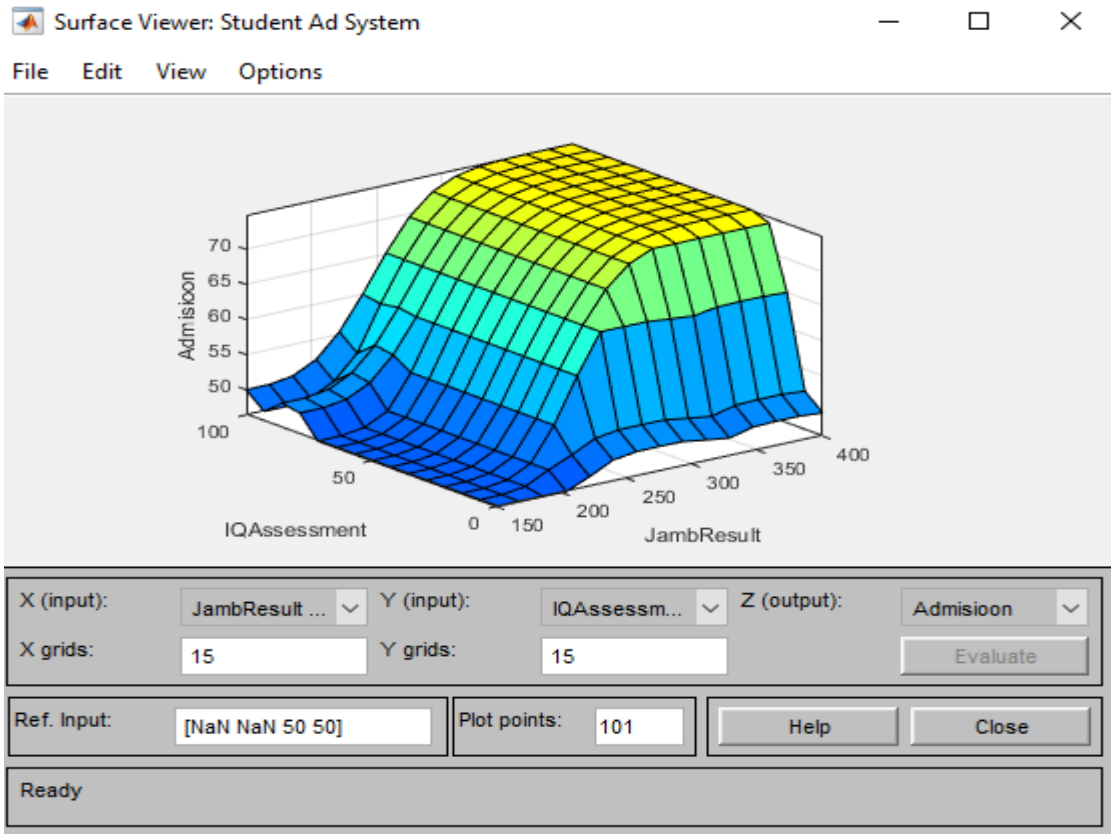


Figure 3. 11: Surface viewer

3.4 Modeling approach

Models are graphical representations of information used by a system analyst to design diagrams for a specific information system. In this research design, the researcher used the following modeling tools:

i. Use case diagrams to show the various activities of the actors of the proposed system.

ii. UML to represent the various class diagrams.

3.4.1 Use Case Scenario

The use case diagram has been designed and categorized into two section, the Student use case diagram and the Admin use case diagram. Section 3.4.1 and 3.4.2 further shows the detail scenario or activities of both the admin and the student use case diagrams.

3.4.2 Student use case

Student Registration	Each student is expected to register via the portal, supplying all his/her details on the platform, he is expected to choose his username and password. During the registration the student is expected to select his/her first and second course of choice.
Student Login	Each registered student is expected to logon into the system before gaining access to all other activities on the portal.
Testing Platform	The Testing platform is divided into two section the IQ Assessment Section and the Interest Assessment Section. Each student is only allowed to take the test once.
View Result	Each student can view his/her result after completing the Assessment test. The system automatically calculate and displays the result to the student.
View Admission List	Students that successfully logon to the application can also view the admission list when it is ready, that is apart from their individual test score and status, each student can view the list of admitted students from other departments.

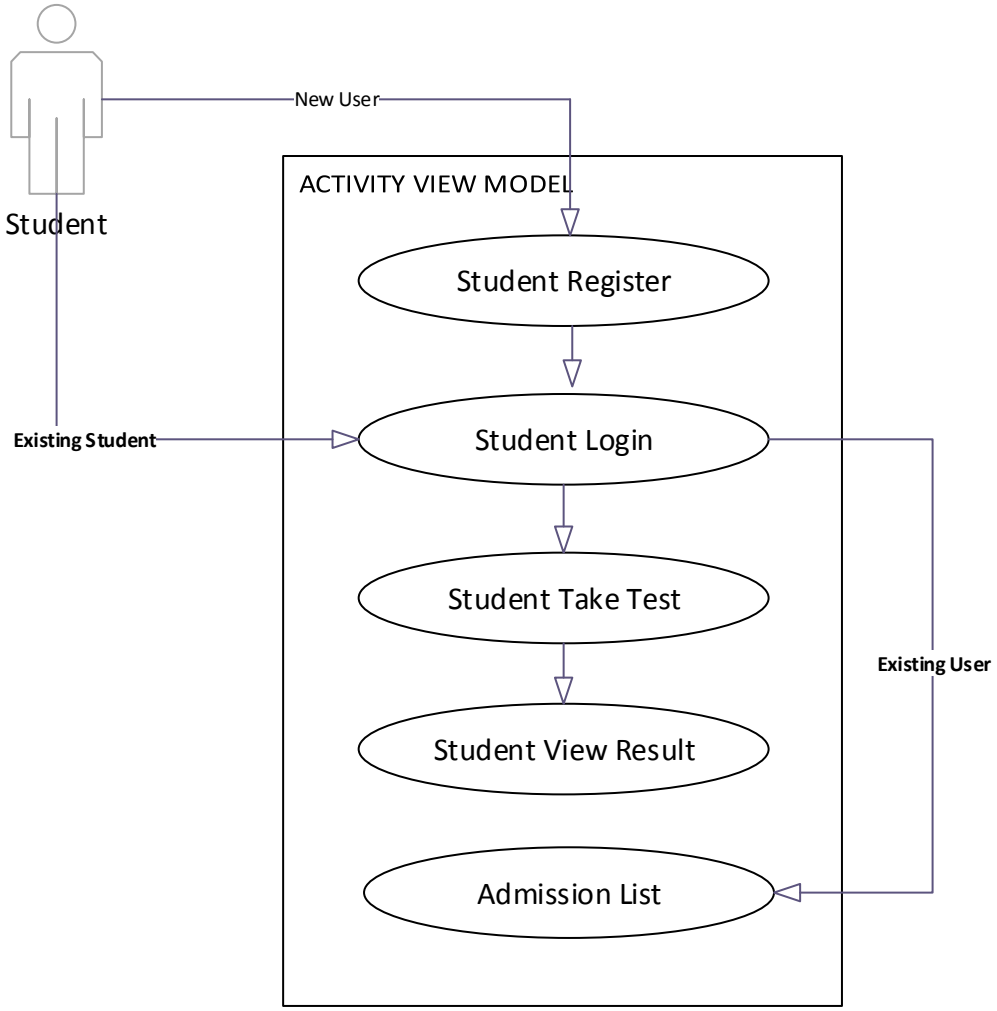


Figure 3. 12: Student Use Case Diagram

3.4.3 Admin use case

The Admin Use Case is divided into two sections as can be seen in figure 20 The first part is the Assessment views section and the second is the printout views.

Load IQ Questions	the Load IQ Question is only accessible to the System Administrator, this is basically where he loads the IQ Questions into the Database.
Load Interest Question	like the IQ Question, the Interest Questions is also used for loading Interest Assessment questions into the database.

Load IQ Answer	The Load IQ Answers view is used by the Admin for Questions options and answers loading by the admin into the system database.
Load Interest Answers	the load Interest answers just like the Load IQ answers is used for loading Interest assessment answers into the system Database by the Admin.
Load Courses	The load courses are used for loading all the available courses from each school into thecourse table by the admin.
Load Requirement	The load requirement is one of the most important aspect of this application, it is used by the Admin for loading the score requirement of each course.
Admin Login	this is where the system admin logon to the system before having access to any module in the system assigned to him/her.

The second section of the Admin Use Case contains three activities that the Admin can carry out, the ability to view and print all admitted students, the ability to also view and print all rejected student's and finally the ability to view all the registered students.

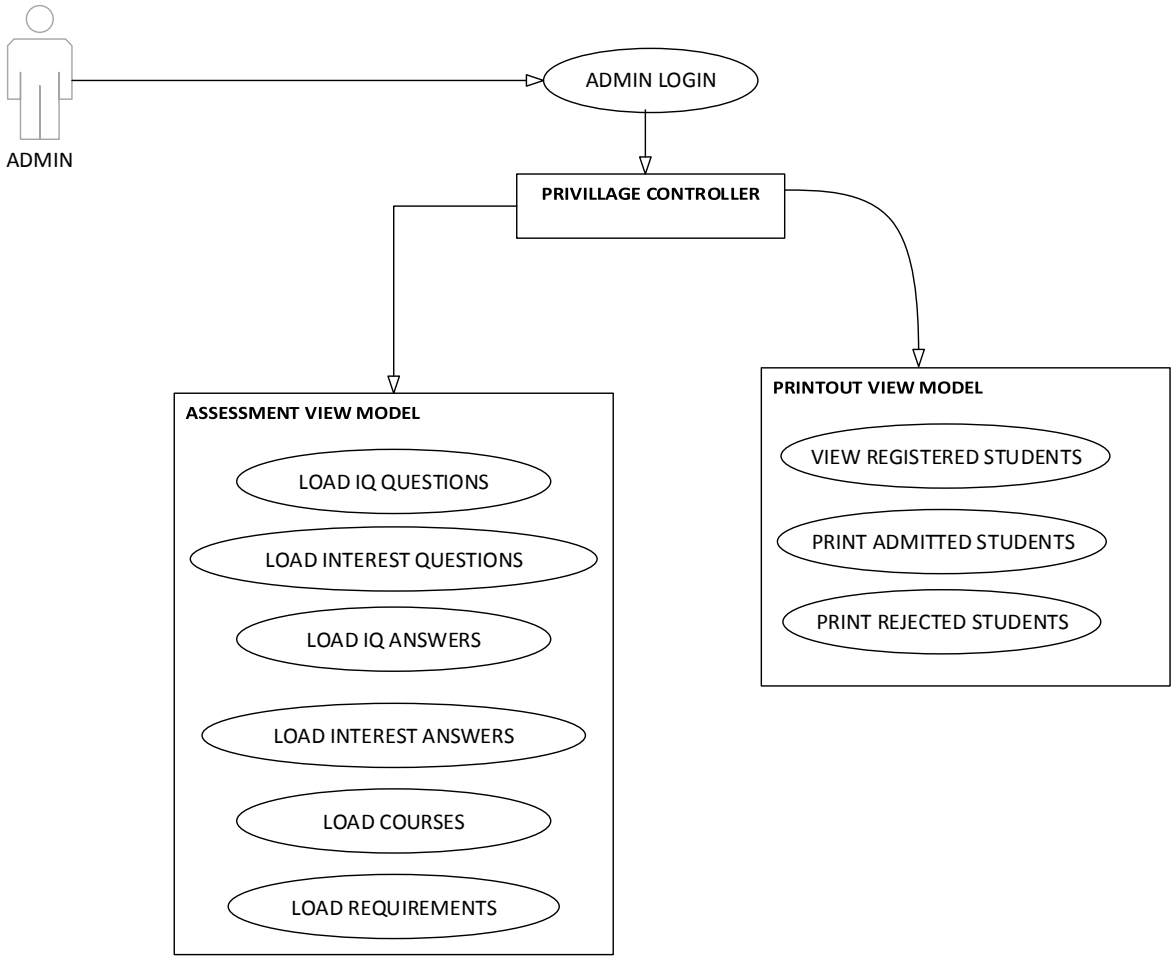


Figure 3. 13: System Admin Use Case Diagram

3.5 Class Diagram

The class diagram was design using Microsoft Visio; a UML tool used for Object Oriented Designed Approached (OOPA), the researcher designed each of the classes separately, with their objects. The researcher was able to design in total 12 individual classes that makes up the application. Figure 21 shows the entire class diagram classes and their various objects.

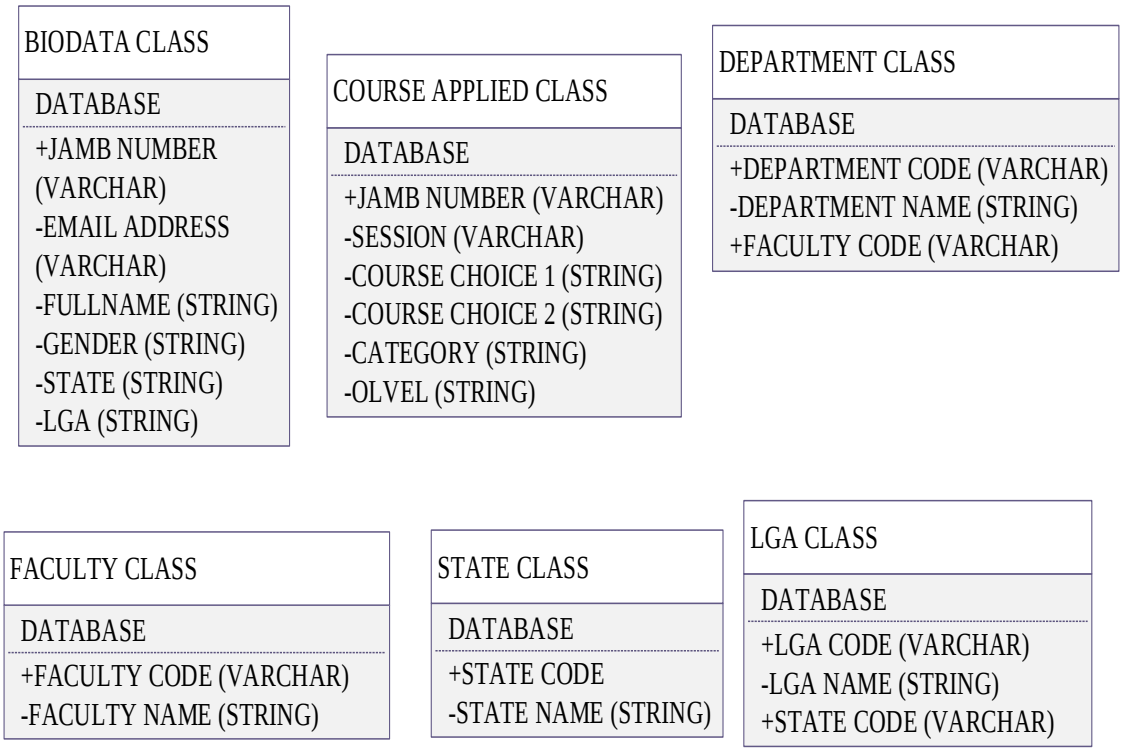


Figure 3. 14: Class Diagram of the entire application

3.6 SDLC Model

In the era of software development there exist a large number of Models to develop software. Each model has its own characteristics, limitations and working environment. This research used the Agile SDLC model.

3.7 Database Design

The application relational database was designed using Microsoft SQL Server Database on SQL Server Management Studio. As can be seen in Figure 22 the physical Database design of the system on an SQL Server Management Student.

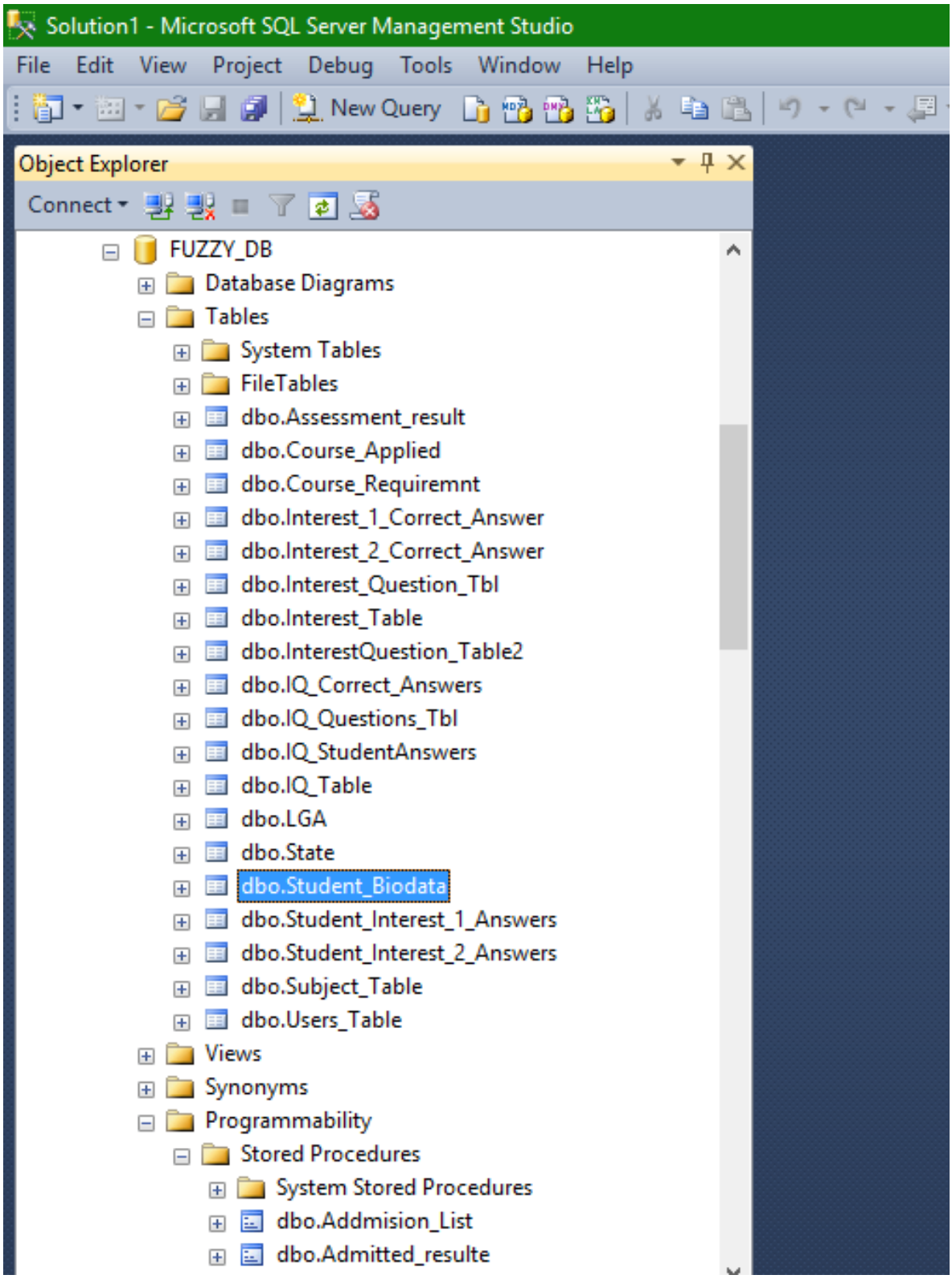


Figure 3. 15: Physical Database Design

3.7.1 Entity Relationship Design

The Entity relation of the entire database was designed using Unified Modelling Language (UML), it shows all the related links on each related table either by a foreign key or a primary key of each entity. The design contains 11 entities that are directly or indirectly connected. Figure 23 shows the entire entity relationship of the database.

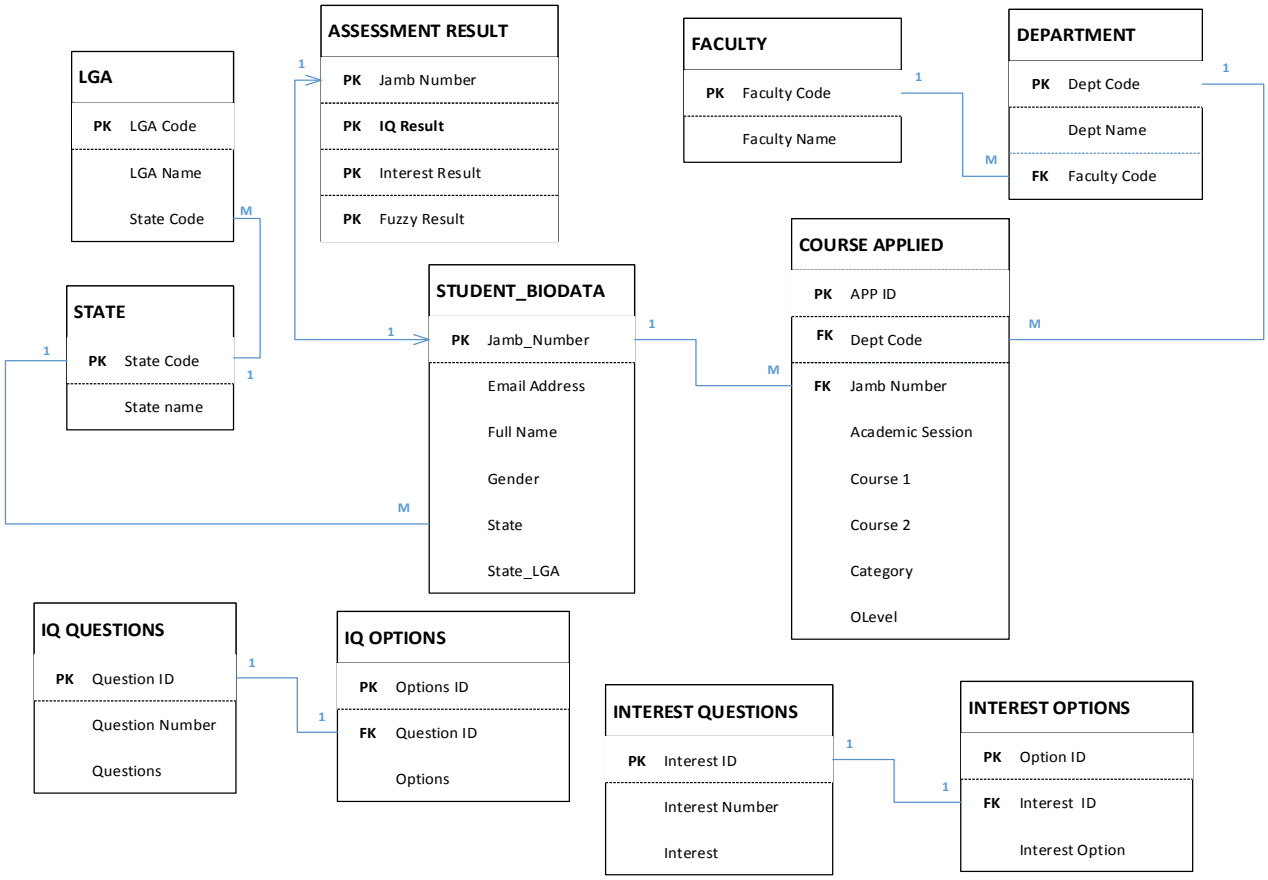


Figure 3. 16: Entity Relationship Diagram

3.7.2 Database Schema

The database schemas is used to display all attributes of each of the database.

Relational Schema for Student Bio-Data

STUDENT BIO-DATA (Jamb_Number [varchar, 50], Full Name [varchar, 50], Gender [varchar, 50], State [varchar, 50], LGA [varchar, 50], Email [varchar, 50])

Relational Schema for Course Applied

COURSE APPLIED (Jamb_Number [varchar, 50], Session [varchar, 50], Course_1 [varchar, 50], Course_2 [varchar, 50], Category [varchar, 50], Olevel_Reg [varchar, 50])

Relational Schema for Assessments Result

ASSESSMENTS RESULT (Jamb_Number [varchar, 50], IQ Result [varchar, 50], Interest Result, [varchar, 50], Fuzzy Result, [varchar, 50])

Relational Schema for Course Requirement

COURSE REQUIREMENT (Course [varchar, 50], Mark Requirement [varchar, 50], Olevel requirement [varchar, 50])

Relational Schema for Interest

INTEREST (ID_No [int. 5], Interest_Name [varchar, 50], Interest_Value [varchar, 50])

Relational Schema for Interest Questions

INTEREST QUESTIONS (Question_No [int, 5], Question, [varcha, Max], Option 1, [varchar, 50], Option 2, [varcha, 50], Option 3, [varchar, 50], Option 4, [varchar, 50])

Relational Schema for IQ Question

IQ QUESTION (Question_No [int, 5], Question, [varcha, Max], Option 1, [varchar, 50], Option 2, [varcha, 50], Option 3, [varchar, 50], Option 4, [varchar, 50])

Relational Schema for Interest Option

INTEREST OPTION (Jamb_Number [varchar, 50], Question_Number [int. 5], Question_Option [varchar, 50])

Relational Schema for IQ Option

IQ OPTION (Jamb_Number [varchar, 50], Question_Number [int. 5], Question_Option [varchar, 50])

3.8 Development/Design tools

The development/design tools used in this research was Microsoft Visio for the data flow diagrams and the UML will be created using rational rose. ASP.Net will be used to demonstrate the model.

CHAPTER FOUR

RESULTS, INTERPRITATION AND DISCUSSION

4.0 Introduction

This chapter has described the actual implementation process of this research.

4.1 Standard Query Language

Standard Query Language (SQL) was used in designing all the database entities, database view, database functions and the database store procedures for the entire application. Microsoft SQL Server Management Studio was used as the platform for writing and running the SQL Syntax. Figure 4.6 shows some of the SQL Syntax for creating tables.

```
CREATE TABLE [dbo].[Student_Biodata] (
[Jamb_Number] VARCHAR (14) NOT NULL,
[Fullname]    VARCHAR (50) NOT NULL,
[Gender]      VARCHAR (10) NOT NULL,
[State_Code]      VARCHAR (10) NOT NULL,
[Lga_Code]        VARCHAR (10) NOT NULL,
[Email]       VARCHAR (20) NOT NULL,
CONSTRAINT [PK_Student_Biodata] PRIMARY KEY CLUSTERED
([Jamb_Number] ASC)
);

CREATE TABLE [dbo].[Assessment_result] (
 [Jamb_number]      VARCHAR (14)  NOT NULL,
 [IQ_Result]        VARCHAR (10)  NOT NULL,
 [Interest_1_Result] VARCHAR (10)  NULL,
 [Add_Status]       VARCHAR (50) NULL,
 CONSTRAINT [PK_Assessment_result] PRIMARY KEY CLUSTERED
([Jamb_number]                    ASC)
);

CREATE TABLE [dbo].[IQ_Questions_Tbl] (
 [QuestionNum] INT          NOT NULL,
 [Question]    VARCHAR (MAX) NOT NULL,
 [Option1]     VARCHAR (MAX) NULL,
 [Option2]     VARCHAR (MAX) NULL,
 [Option3]     VARCHAR (MAX) NULL,
 [Option4]     VARCHAR (MAX) NULL,
CONSTRAINT [PK_IQ_Questions_Tbl] PRIMARY KEY CLUSTERED
([QuestionNum]                ASC)
);
```

4.2 Fuzzy Rule Based with C# Variables

C# was used for writing the simulation process of the fuzzy values rules used for comparing the student scores for student placement.

```
            double Fuzzy_CI = 50.00;
  double Fuzzy_BAI = 60.00;
  double Fuzzy_AI = 70.00;
  double Fuzzy_AAI = 80.00;
  double Fuzzy_GIFTED = 90.00;
    double Fuzzy_VERYGIFTED = 100.00;


            if(score < Fuzzy_CI)
{
   result =  " " + " BELLOW REQUIREMENT.";
}
else if (score >= Fuzzy_CI && score < Fuzzy_BAI)
{
   result =  " " + "COGNITIVE IMPAIRED.";
}
else if(score >= Fuzzy_BAI && score < Fuzzy_AI)
{
   result =  " " + "AVERAGELY INTELLIGENT.";
}
else if (score >= Fuzzy_AI && score < Fuzzy_AAI)
{
   result = " " + " ABOVE AVERAGE INTELLIGENCE.";
}
else if (score >= Fuzzy_AAI && score < Fuzzy_GIFTED)
{
   result =  " " + "GIFTED.";
}
else if (score >= Fuzzy_GIFTED && score < Fuzzy_VERYGIFTED)
{
   result = " " + "VERRY GIFTED.";
}
else
{
   result = " "  + "YOU SCORE BELLOW REQUIREMENT.";
    }
```

4.3 Graphical User Interface (GUI)

One of the most important aspects of this study is to design an application as prototype that will demonstrate how the application when fully implemented should work. This segment presents the prototype implementation of the application. The User interface design comprises of both the input and output designs. The designed system is categorized into the front-tier (GUI), the middle-tier (Logic codes) and the back-tier (database).

4.3.1 Student Registration Form

The Student Registration Form is basically where all the student details are captured their basic data are first captured, there Jamb Number, Full name, Email Address,

Gender, State and LGA of Origin. Figure 24 shows the details contain in the student registration form.

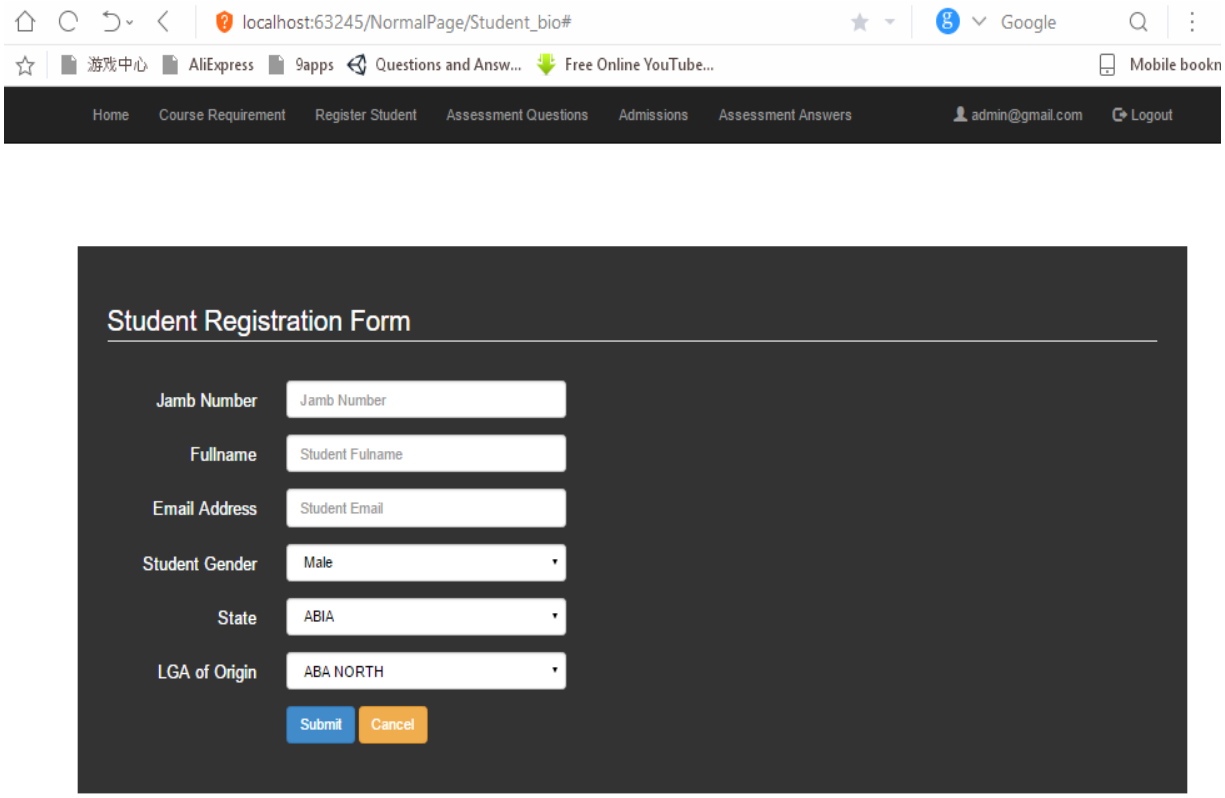


Figure 4. 1: Student Registration Form

4.3.2 Student Course Applied Form

The Student Course Form is used for capturing student course of choice, both the first and second choice, the session, the faculty of the courses and the students O-level status. See figure 25 detail information on Student Course Form.

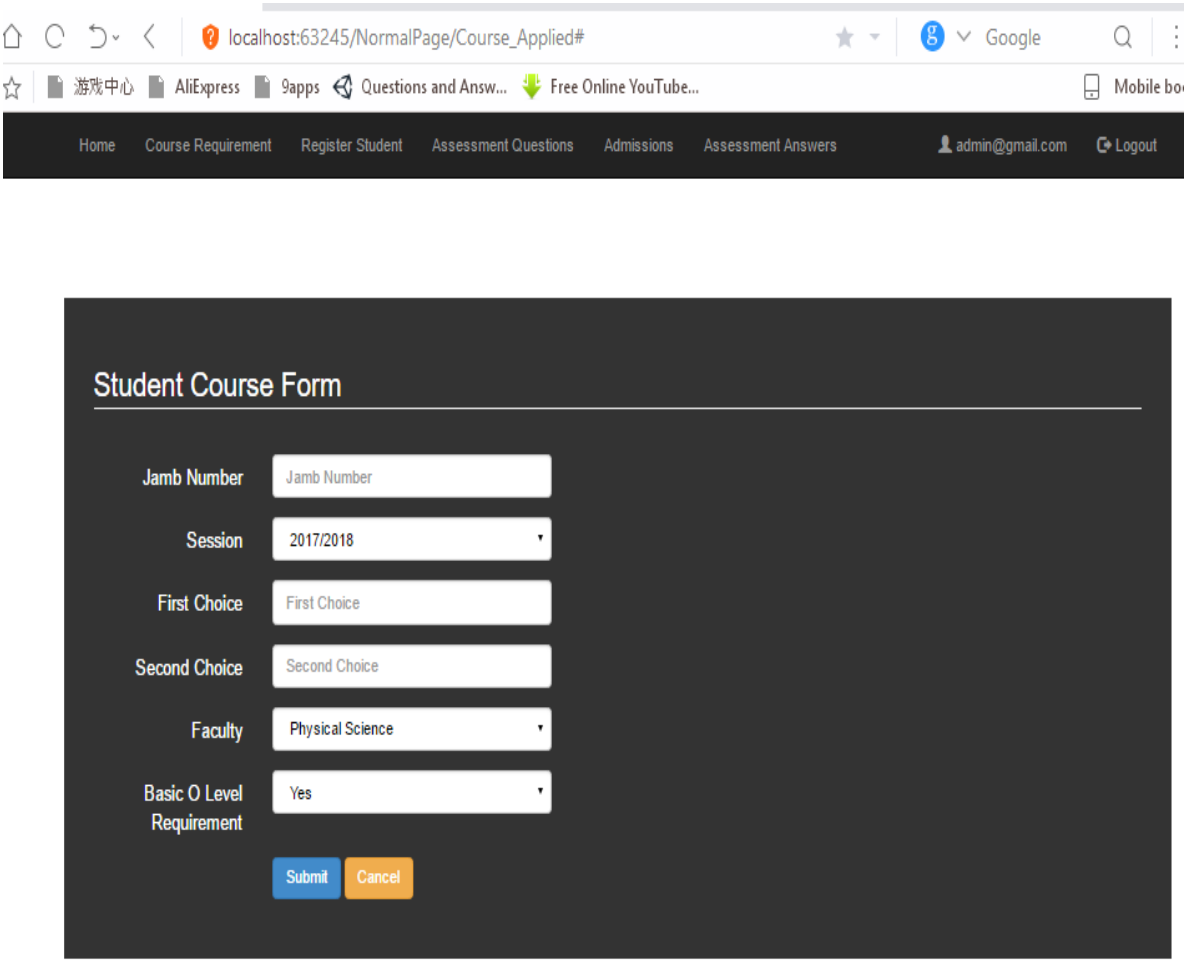


Figure 4. 2: Student Course Form

4.3.3 Login Form

The Login Form is one of the most important form on the application, for any one both the student and the Admin would have to Login to the system via the Login Form to have access to all the modules for any activity they want to carry out. Only users with authorized Username and Password would have access to the system. The Login page is attached with an SQL Login procedure that send request to the Back end Database to validate the authenticity of the credentials the user supplied. See Figure 26 for details.

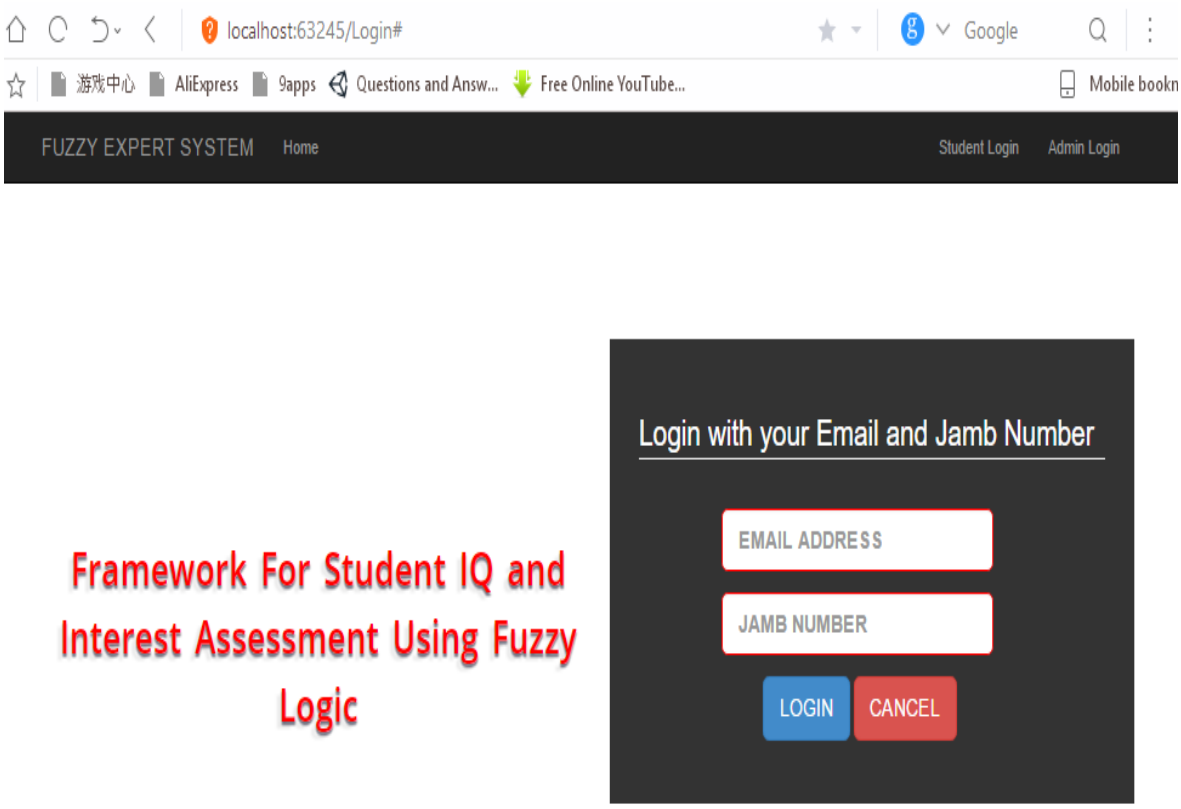


Figure 4. 3: Login Form

4.3.4 Student's First Contact Form

As can be seen in Figure 27, the First Contact Form displays gives the student his basic detail and the assessment instructions. The Form also contain two buttons, the Start Test button and the My Result button. Once he/she clicks the Start Test button a new form opens up where he/she can start the IQ and Interest Test respectively. Students that have already taken the Test will not be allowed to take it for the second time, as the system is going to automatically detect and redirect the student to another page telling him/her that they are not allowed to take the Assessment more than once.

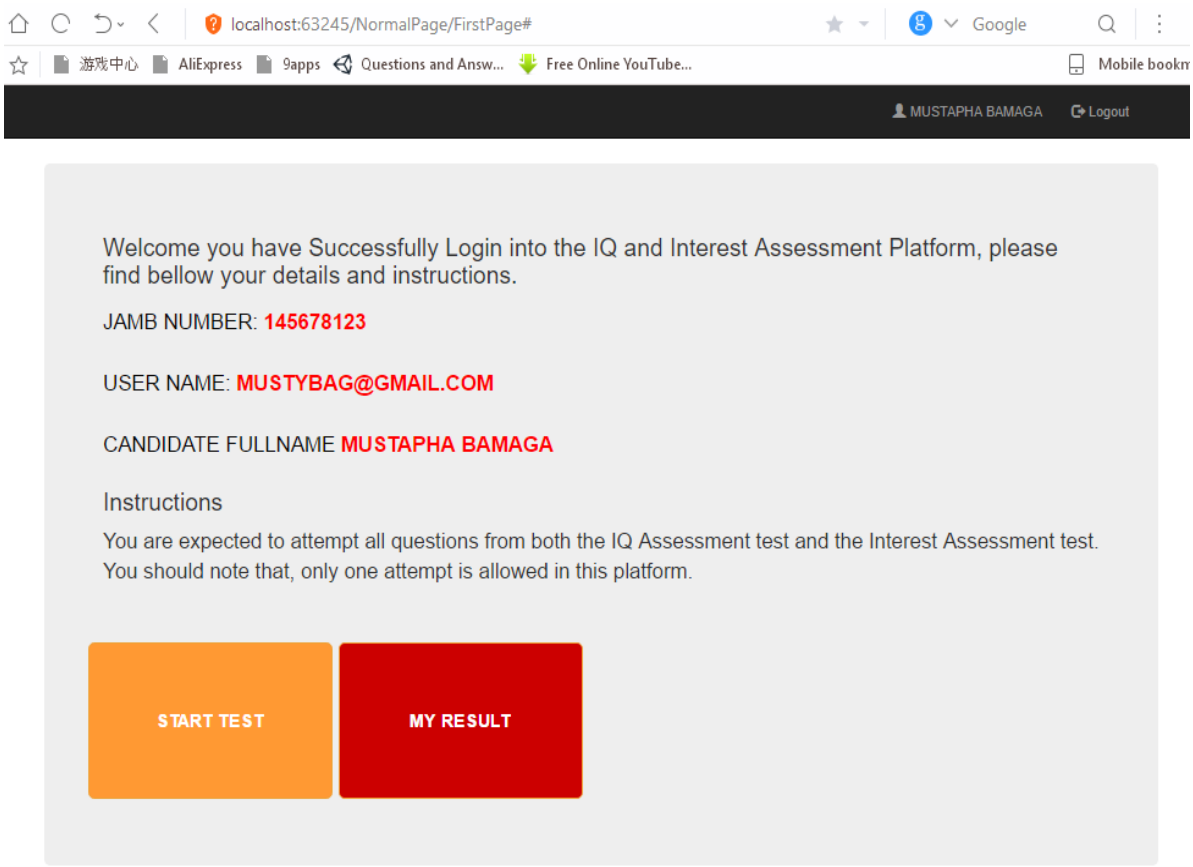


Figure 4. 4: Students First Contact Form

4.3.5 IQ Assessment Test Form

The IQ Assessment Form is only available to students with authorized login credentials that applied for placement in any of the department. The Form has a timer count down that shows the remaining time each student has while take the Test, it also has a submit button, a previous button and the next button. Once the submit button is click the form submit the Test, while if the next or previous button is click a new set of question is loaded for the student. See Figure 28 for more details

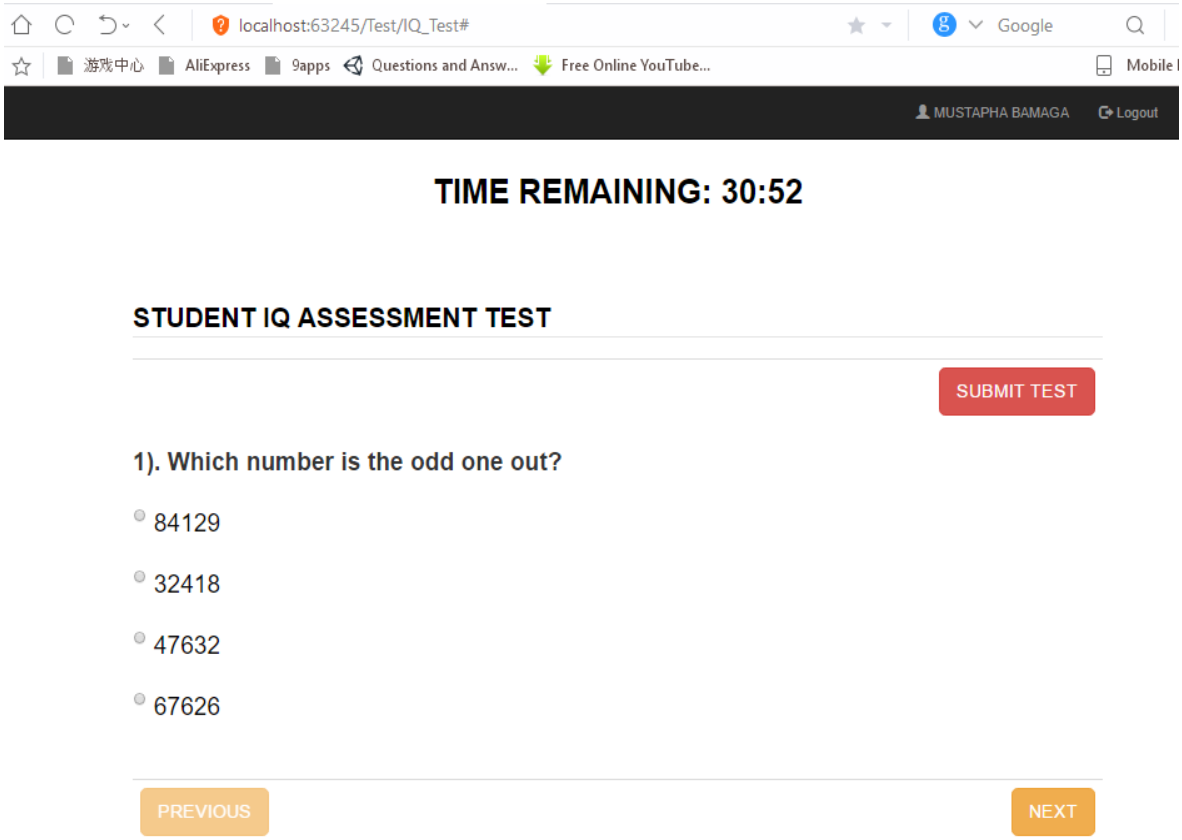


Figure 4. 5: IQ Assessment Form

4.3.6 Interest Assessment Form

Figure 29 shows the Interest assessment form; the form is used form the Interest assessment of students. It contains the interest assessment questions, the next and previous button and the time countdown. The page is loaded to each student immediately when he/she finish the IQ assessment.

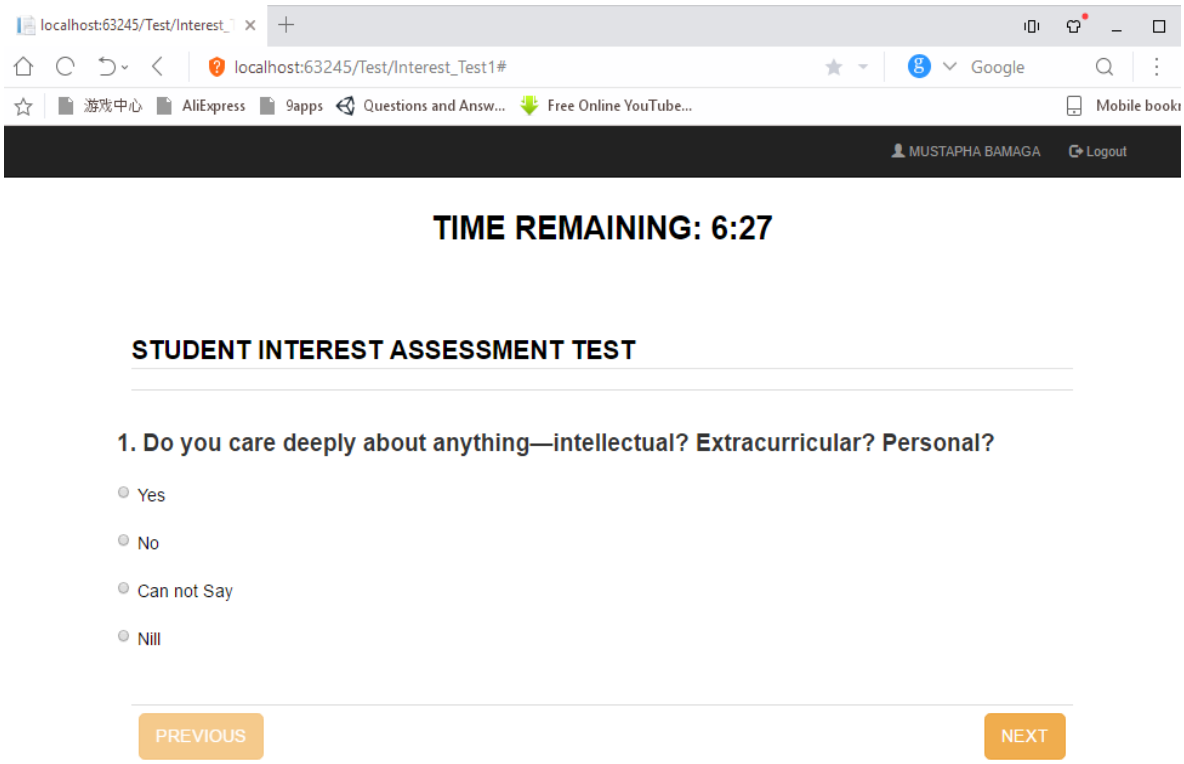


Figure 4. 6: Interest Assessment Form

4.3.7 Final Assessment Result

The Final Assessment Result form give each student a detail information on his/her assessment result, the form displays the student jamb number, IQ Assessment result, Interest assessment result and the final assessment status assigned base on his/her score using Fuzzy Logic. The form also display the IQ and Interest required scores for the course the student applied, the academic session. Figure 30 shows more detail on the Final assessment result form.

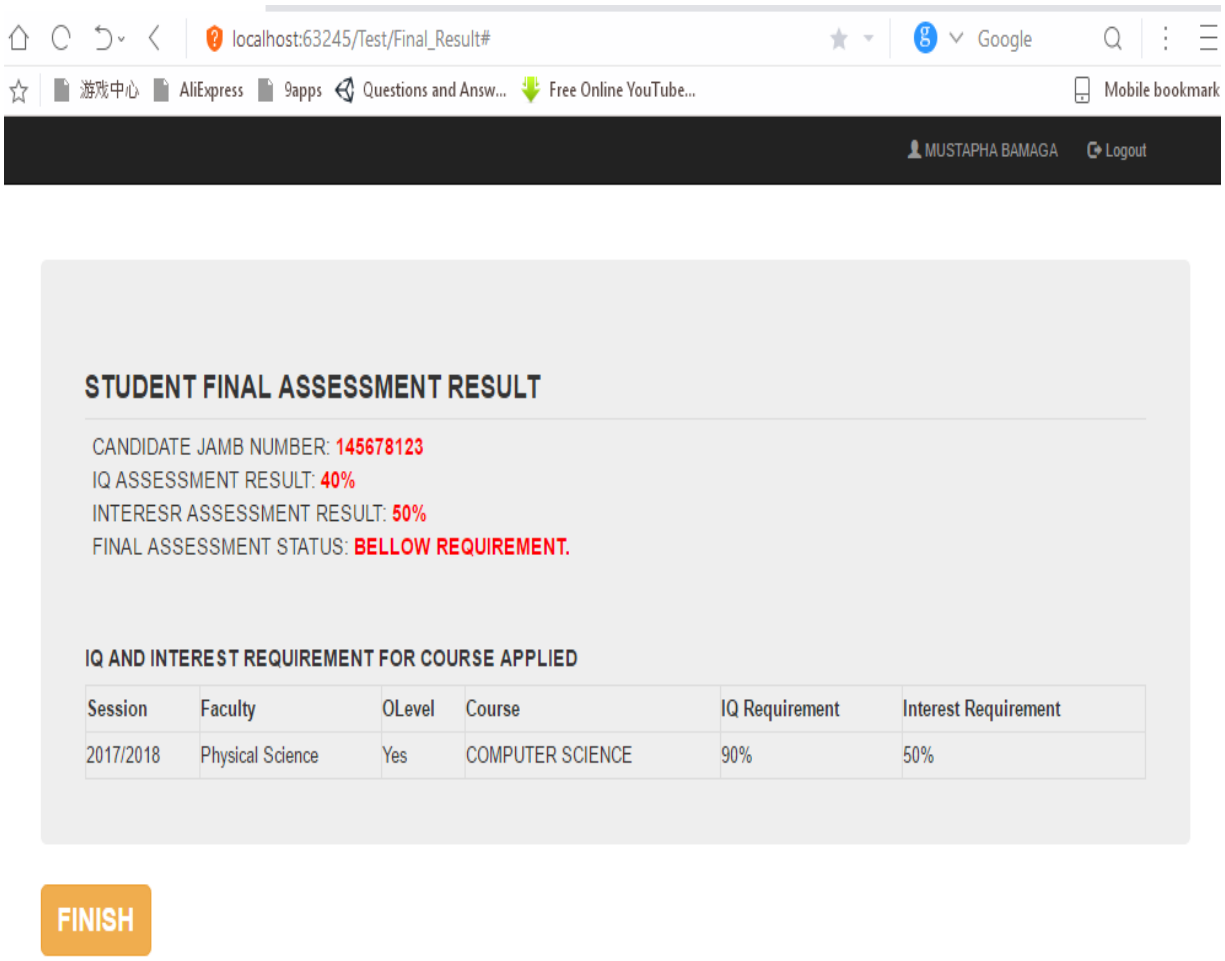


Figure 4. 7: Final Assessment Result Form.

4.3.8 Course Requirement Loading Form

The Course Requirement Loading Form is only available to the system admin, the page is designed for adding the IQ and Interest assessment requirement for each course from all the departments and faculties. See figure 31.

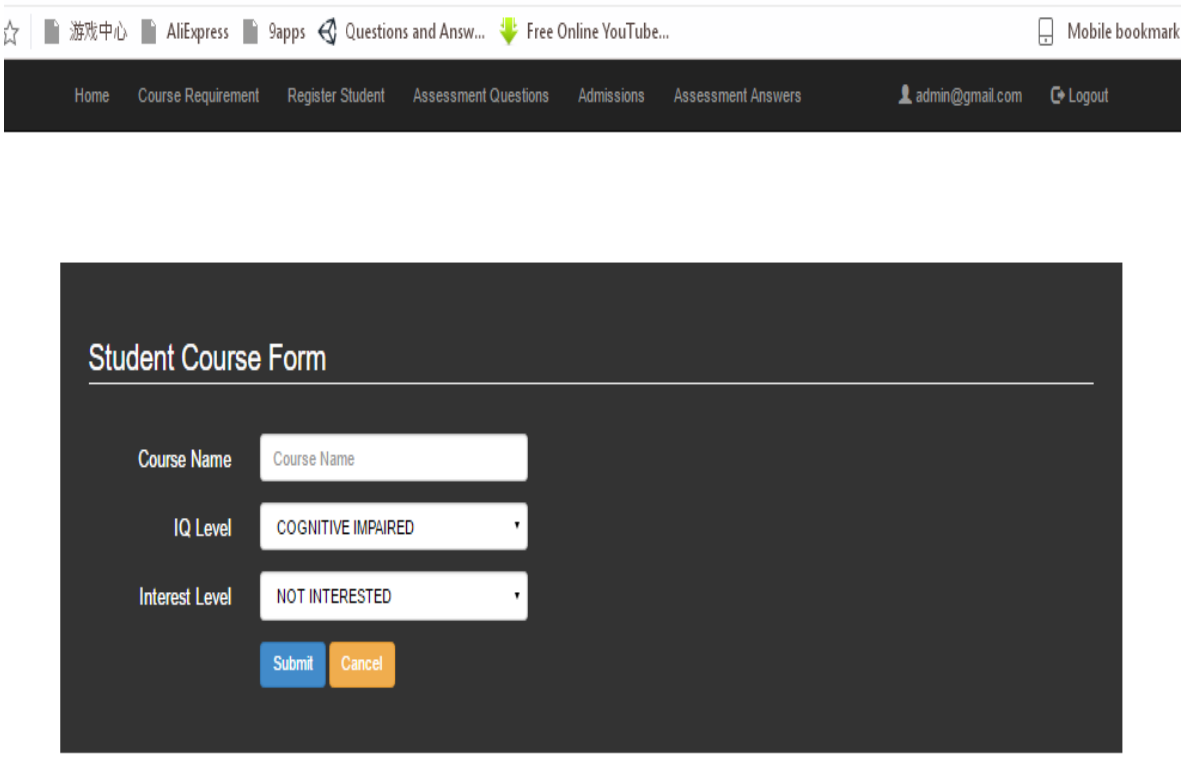
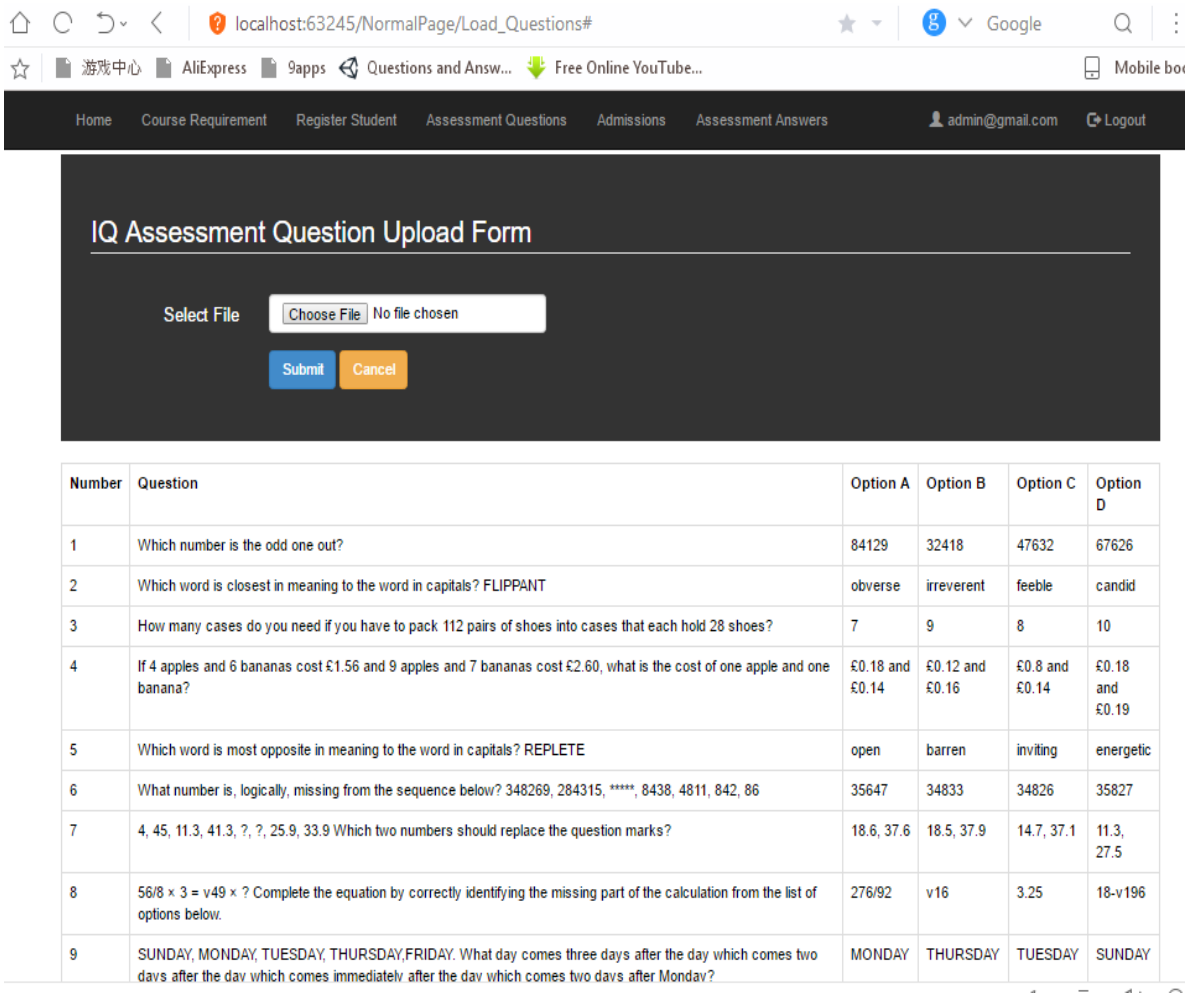


Figure 4. 8: Course Requirement Loading Form

4.3.9 IQ Assessment Question Loading Form

The IQ assessment questions loading form as can be seen in figure 32 is used by the system admin for loading all the questions and their options into the back end database. All questions and their options are first prepared in an excel sheet before loading them via the IQ assessment question loading form. Once the questions are loaded successfully the page automatically display the questions and their options to the admin for review.



Number	Question	Option A	Option B	Option C	Option D
1	Which number is the odd one out?	84129	32418	47632	67626
2	Which word is closest in meaning to the word in capitals? FLIPPANT	obverse	irreverent	feeble	candid
3	How many cases do you need if you have to pack 112 pairs of shoes into cases that each hold 28 shoes?	7	9	8	10
4	If 4 apples and 6 bananas cost £1.56 and 9 apples and 7 bananas cost £2.60, what is the cost of one apple and one banana?	£0.18 and £0.14	£0.12 and £0.16	£0.8 and £0.14	£0.18 and £0.19
5	Which word is most opposite in meaning to the word in capitals? REPLETE	open	barren	inviting	energetic
6	What number is, logically, missing from the sequence below? 348269, 284315, *****, 8438, 4811, 842, 86	35647	34833	34826	35827
7	4, 45, 11.3, 41.3, ?, ?, 25.9, 33.9 Which two numbers should replace the question marks?	18.6, 37.6	18.5, 37.9	14.7, 37.1	11.3, 27.5
8	56/8 × 3 = v49 × ? Complete the equation by correctly identifying the missing part of the calculation from the list of options below.	276/92	v16	3.25	18-v196
9	SUNDAY, MONDAY, TUESDAY, THURSDAY,FRIDAY. What day comes three days after the day which comes two days after the day which comes immediately after the day which comes two days after Monday?	MONDAY	THURSDAY	TUESDAY	SUNDAY

Figure 4. 9: IQ Question Loading Form

4.3.10 Admission List

The Admission list form displayed the list of admitted student, that successfully taken the test and been assigned a slot based on their performance on the IQ and Interest Assessment result. The user is expected to select the department from the dropdown in which he/she want to view the list of admitted student and click the view button to load the list of students. See figure 33 for details.

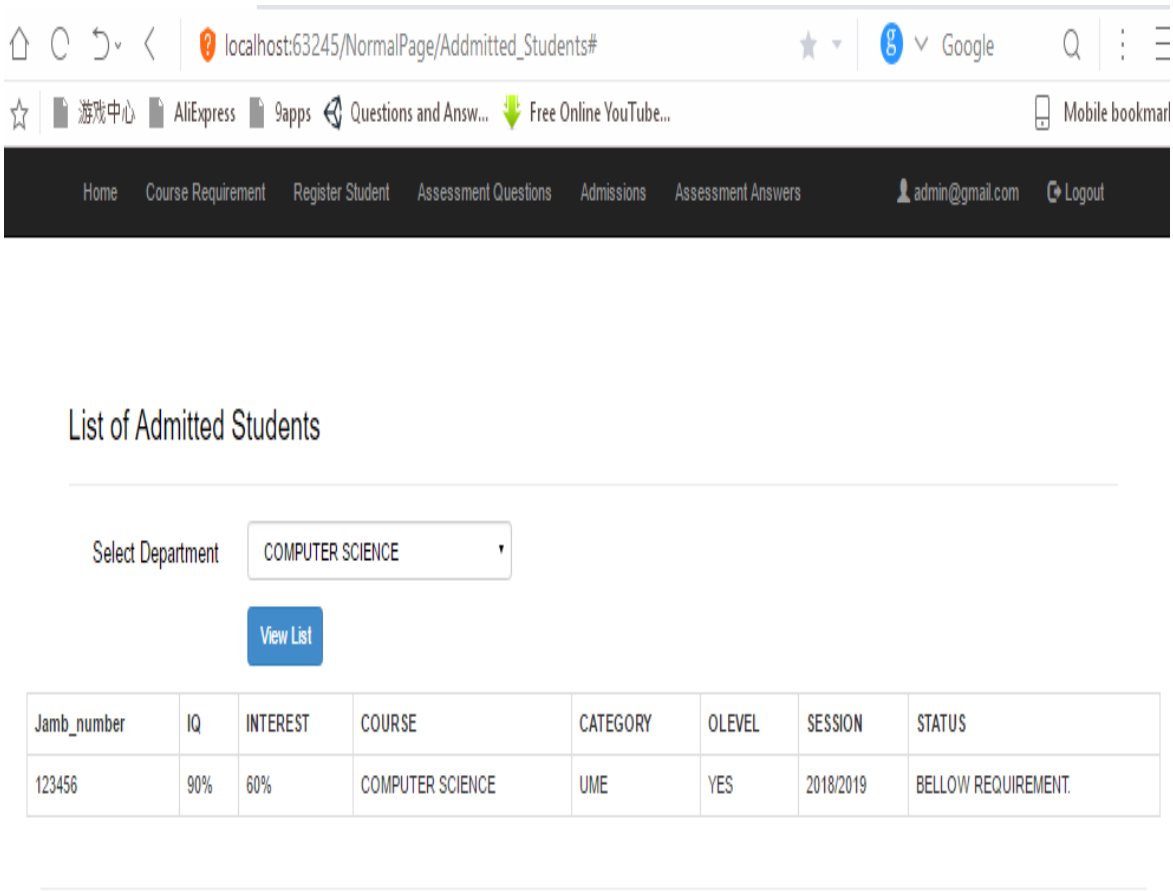


Figure 4. 10: Admission List Form

4.4 Functional and Non-Functional Requirements

For a successful implementation of the system, there are certain functional and non-functional requirement that need to be in place for the system to perform effectively

Functional requirements

Functional requirements are related with detailed functions, tasks or actions the system must support. The functional requirements of the system are as follows:

i. Students and System Admin should be able to have access to the system once they provide the required username and password.
ii. The system should be able to detect all invalid users trying to have access to the system and block them.
iii. The users should be able to access the system at any point in time (24/7).
iv. The system should be user friendly, it must not be difficult to operate and navigate from one page to another

Non-functional requirements

i. The system should be based a browser based application for easy access
ii. The front end and backend application should be hosted on a server so that users can have access at any time at optimum speed.
iii. The system should perform very well at all times and should be easy to recover after system down time.
iv. The system should be able to keep up to-date information at all times.

User requirements

i. Ability to store and retrieve record from the database.
ii. Ability to perform complex queries on the record with little effort.
iii. System reliability at all times.

System requirements

The system requirements are divided into Hardware and Software.

The Hardware system requirements are:

i. Central Processing Unit (CPU): Intel (R) or Any
ii. Installed memory (RAM): 4.00 GB.
iii. Monitor: Super VGA (AGP 32MB).
iv. Internet Connection
v. Web Browser (Firefox, Chrome, Internet Explorer etc.)

The Software system requirements

i. System type: 64-bit Operating System (Windows 7, 8 or 10).
ii. Database engine: Microsoft SQL Server 2005 and 2012.
iii. Database Management Studio
iv. Domain Name and hosting account

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The aim of this thesis is to design an intelligent model for student admission into tertiary institutions. The objectives include studying the existing admission process in to tertiary institutions. Identify requirements for applicant's placement, define a fuzzy membership function for each input parameter and fuzzyfy each record and to define a rule-based model for candidate's admission placement and will conclude by demonstrating the model using ASP.net MVC technology. A database system is designed to tackle the problems of students seeking placement into tertiary institution. In the course of the research, related literatures were reviewed by the researcher.

Before the design, a comprehensive analysis of the existing system was carried out. The results were used to bring out all the required variables and entities for the actualization of the system. The variable and entities covers both the front end, middle end and the back end requirement. The design was started by the use of Unified Modelling Language (UML) tools, the front end of the application was design using Active Server Pages (ASP) using MVC pattern, the Middle end was design using an object oriented programming (C#) and finally the backend which is the database was design using Microsoft SQL Server Database.

5.2 Conclusion

The design if fully implemented will offer a secured and reliable means of student placement, then the current traditional method of student placement criteria being used by the University. The design will eliminate the current inability of the University to give student seeking for placement the right course, and to the students they will be able to go for the course they wish to study based on their performance.

5.3 Recommendations

In this research, the scope was limited to only the student placement process being used in MAUTECH, Yola. The scope of the study could be considered in future. In addition to these:

i. Full Implementation of this student placement process should be considered.
ii. This study did not cover all the security implementation process of this model.
iii. Feasibility study to determine the cost of implementing such system should also be considered.

5.4 Contribution to Knowledge

This research thesis has contributed to knowledge by providing educational institutions an intelligent approach to admission and course placement. By applying fuzzy logic in handling the vagueness associated with most admission selection criteria, the admission system will be void of personal interest and sentiments of staff.

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APPENDIX A

```
using System;
using System.Collections.Generic;
using System.Configuration;
using System.Data;
using System.Data.SqlClient;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace IQ_CBT.Test
{
   public partial class Result : System.Web.UI.Page
   {
      String consett = ConfigurationManager.ConnectionStrings["conn"].ConnectionString;
      protected void Page_Load(object sender, EventArgs e)
      {
         if(HttpContext.Current.Session["student_jamb"] == null)
         {
            Response.End();
         }

         double Fuzzy_CI = 50.00;
         double Fuzzy_BAI = 60.00;
         double Fuzzy_AI = 70.00;
         double Fuzzy_AAI = 80.00;
         double Fuzzy_GIFTED = 90.00;
         double Fuzzy_VERYGIFTED = 100.00;


         //String consett = ConfigurationManager.ConnectionStrings["conn"].ConnectionString;
         SqlConnection conn = new SqlConnection();
         conn.ConnectionString = consett;
         SqlCommand cmd4 = new SqlCommand();
         cmd4.Connection = conn;
         ConnectionState previousConnectionState = conn.State;
         if (conn.State == ConnectionState.Closed)
         {
            conn.Open();
         }

         cmd4.CommandType = CommandType.StoredProcedure;
         cmd4.CommandText = "IQ_Mark_Calculation";
         var mm = HttpContext.Current.Session["IQResult"];
        // gen = Convert.ToInt32(mm);
         SqlParameter usernames1 = new SqlParameter("@jamb_number",
HttpContext.Current.Session["student_jamb"].ToString());
         cmd4.Parameters.Add(usernames1);
          SqlParameter QResult = cmd4.Parameters.Add("@Result", SqlDbType.Int);

         QResult.Direction = ParameterDirection.ReturnValue;
         cmd4.ExecuteNonQuery();

         double myval = Convert.ToDouble(cmd4.Parameters["@Result"].Value) * 5;

         string mdm = "";
         if(myval < Fuzzy_CI)
         {
            mdm =  " " + " BELLOW REQUIREMENT.";
         }
```

```
        else if (myval >= Fuzzy_CI && myval < Fuzzy_BAI)
        {
            mdm =  " " + "COGNITIVE IMPAIRED.";
        }
        else if(myval >= Fuzzy_BAI && myval < Fuzzy_AI)
        {
            mdm =  " " + "AVERAGELY INTELLIGENT.";
        }
        else if (myval >= Fuzzy_AI && myval < Fuzzy_AAI)
        {
            mdm = " " + " ABOVE AVERAGE INTELLIGENCE.";
        }
        else if (myval >= Fuzzy_AAI && myval < Fuzzy_GIFTED)
        {
            mdm =  " " + "GIFTED.";
        }
        else if (myval >= Fuzzy_GIFTED && myval < Fuzzy_VERYGIFTED)
        {
            mdm = " " + "VERRY GIFTED.";
        }
        else
        {
            mdm = " "  + "YOU SCORE BELLOW REQUIREMENT.";
        }
        HttpContext.Current.Session["Results"] = myval ;
        COG.Text = mdm;

        results.Text = HttpContext.Current.Session["Results"].ToString() + "%";
        student_jamb.Text = HttpContext.Current.Session["student_jamb"].ToString();
    }

    protected void home_Click(object sender, EventArgs e)
    {
        try
        {
            SqlConnection conn = new SqlConnection();
            conn.ConnectionString = consett;
            SqlCommand cmd5 = new SqlCommand();
            cmd5.Connection = conn;
            ConnectionState previousConnectionState = conn.State;
            if (conn.State == ConnectionState.Closed)
            {
                conn.Open();
            }
            cmd5.CommandType = CommandType.StoredProcedure;
            cmd5.CommandText = "AssessmentResult_Proc";
            cmd5.Parameters.AddWithValue("@jamb_number", student_jamb.Text.Trim().ToString());
            cmd5.Parameters.AddWithValue("@iq_result", results.Text.Trim().ToString());
            cmd5.Parameters.AddWithValue("@add_stat", COG.Text.Trim().ToString());
            cmd5.ExecuteNonQuery();
            Response.Redirect("~/Test/Interest_Test1.aspx");
        }
        catch (Exception gh)
        {
            error.Text = "" + gh.StackTrace.ToString();
        }

    }
}
    }
```

```
<%@ Page Title="" Language="C#" MasterPageFile="~/Site.Master" AutoEventWireup="true"
CodeBehind="Load_Questions.aspx.cs" Inherits="IQ_CBT.Page.Load_Questions" %>
<asp:Content ID="Content1" ContentPlaceHolderID="MainContent" runat="server">
    <br /><br /><br /><br /><br />



        <div class="container" >

        <div class="col-lg-12 col-md-12 col-sm-12 col-xs-12">
         <div class="registrationform1">
            <div class="form-horizontal">
              <br />

              <fieldset>
                <legend>IQ Assessment Question Upload Form <i class=""></i></legend>

             <div class="form-group">
              <asp:Label runat="server" ID="error" CssClass="btn btn-danger btn-lg"  Visible="false"
ForeColor="White" ></asp:Label>
              <asp:Label runat="server" ID="success" CssClass="btn btn-warning btn-lg"  Visible="false"
ForeColor="White" ></asp:Label>
            </div>

                <div class="form-group">
                  <asp:Label ID="Label2"  Font-Size="Medium" ForeColor="White" runat="server" Text="Select
File" CssClass="col-lg-2 control-label"></asp:Label>
                  <div class="col-lg-10">
                    <asp:FileUpload ID="excel_File" runat="server" required="true" ForeColor="Black"
placeholder="Select File" CssClass="form-control"
                      ></asp:FileUpload>
                  </div>
                </div>



                <div class="form-group">
                  <div class="col-lg-10 col-lg-offset-2">
                    <asp:Button ID="btnSubmit" runat="server" CssClass="btn btn-primary" Text="Submit"
OnClick="btnSubmit_Click" />
                      <asp:Button ID="btnCancel" runat="server" CssClass="btn btn-warning" Text="Cancel"  />
                  </div>
                </div>
              </fieldset>
            </div>
          </div>

            <br />
            <asp:GridView ID="GridView1" runat="server" Width="100%" ForeColor="Black" CssClass="table
table-bordered" AutoGenerateColumns="False" DataKeyNames="QuestionNum"
DataSourceID="SqlDataSource1" AllowPaging="True">
              <Columns>
                <asp:BoundField DataField="QuestionNum" HeaderText="Number" ReadOnly="True"
SortExpression="QuestionNum"></asp:BoundField>
                <asp:BoundField DataField="Question" HeaderText="Question"
SortExpression="Question"></asp:BoundField>
                <asp:BoundField DataField="Option1" HeaderText="Option A"
SortExpression="Option1"></asp:BoundField>
                <asp:BoundField DataField="Option2" HeaderText="Option B"
SortExpression="Option2"></asp:BoundField>
                <asp:BoundField DataField="Option3" HeaderText="Option C"
SortExpression="Option3"></asp:BoundField>
```

```
                <asp:BoundField DataField="Option4" HeaderText="Option D"
SortExpression="Option4"></asp:BoundField>
            </Columns>
        </asp:GridView>

        <asp:SqlDataSource runat="server" ID="SqlDataSource1" ConnectionString='<%$
ConnectionStrings:conn %>' SelectCommand="SELECT * FROM [IQ_Questions_Tbl] ORDER BY
[QuestionNum]"></asp:SqlDataSource>
    </div>
    </div>


</asp:Content>



sing System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace IQ_CBT.NormalPage
{
  public partial class FirstPage : System.Web.UI.Page
  {
    protected void Page_Load(object sender, EventArgs e)
    {
      if (HttpContext.Current.Session["student_jamb"] != null)
      {
        jamb_number.Text = HttpContext.Current.Session["student_jamb"].ToString();
        username.Text = HttpContext.Current.Session["email"].ToString().ToUpper();
        fullname.Text = HttpContext.Current.Session["fullname"].ToString().ToUpper();
      }
      else
      {

        Response.Redirect("~/Login.aspx");
      }
    }

    protected void Unnamed_Click(object sender, EventArgs e)
    {
      Response.Redirect("~/Test/IQ_Test.aspx");
    }

    protected void exit_Click(object sender, EventArgs e)
    {
      Response.Redirect("~/Test/Final_Result.aspx");
    }

    protected void interest1_Click(object sender, EventArgs e)
    {

      Response.Redirect("~/Test/Interest_Test1.aspx");
    }

    protected void interst2_Click(object sender, EventArgs e)
    {
      Response.Redirect("~/Test/Interest_Test2.aspx");
    }
```

```
}
  }
```

APPENDIX B

Complete M-File code

```
[System]
Name='Student_Ad_System'
Type='mamdani'
Version=2.0
NumInputs=4
NumOutputs=1
NumRules=3
AndMethod='min'
OrMethod='max'
ImpMethod='min'
AggMethod='max'
DefuzzMethod='centroid'

[Input1]
Name='UTMEResult'
Range=[150 400]
NumMFs=3
MF1='poor':'gaussmf',[53.08 150]
MF2='good':'gaussmf',[53.08 275]
MF3='excelent':'gaussmf',[53.1 371]

[Input2]
Name='IQAssessment'
Range=[0 100]
NumMFs=7
MF1='verypoor':'gaussmf',[7.078 0]
MF2='poor':'gaussmf',[7.078 16.67]
MF3='mediumpoor':'gaussmf',[7.078 33.33]
MF4='fair':'gaussmf',[7.078 50]
MF5='mediumgood':'gaussmf',[7.078 66.67]
MF6='good':'gaussmf',[7.078 83.33]
MF7='verygood':'gaussmf',[7.078 100]

[Input3]
Name='InterestAssessment'
Range=[0 100]
NumMFs=7
MF1='verypoor':'gaussmf',[7.078 0]
MF2='poor':'gaussmf',[7.078 16.67]
MF3='mediumpoor':'gaussmf',[7.078 33.33]
MF4='fair':'gaussmf',[7.078 50]
MF5='mediumgood':'gaussmf',[7.078 66.67]
MF6='good':'gaussmf',[7.078 83.33]
MF7='verygood':'gaussmf',[7.078 100]
```

[Input4]
Name='OlevelResults'
Range=[0 100]
NumMFs=6
MF1='F':'gaussmf',[8.493 0]
MF2='E':'gaussmf',[8.493 20]
MF3='D':'gaussmf',[8.493 40]
MF4='C':'gaussmf',[8.493 60]
MF5='':'gaussmf',[8.493 80]
MF6='A':'gaussmf',[8.493 100]

[Output1]
Name='Admisioon'
Range=[0 100]
NumMFs=2
MF1='Rejected':'trimf',[0 25 50]
MF2='Aproved':'trimf',[50 75 100]

[Rules]
1 1 1 1, 1 (1) : 2
2 6 6 4, 2 (1) : 2
3 7 7 5, 2 (1) : 2