

Intelligent Decision Support System Model for University Admissions: A Case Study of Nigerian Universities

Okafor Ugochukwu Osbert¹, Dr. Ugah John Otozi²

¹Department of Computer Science Education, Federal College of Education (Technical) Umunze, Anambra State
yugo4ugo77[at]gmail.com

²Department of Computer Science, Ebonyi State University, Abakaliki
ugahjohn[at]gmail.com

Abstract: *Tertiary institutions entrance admissions today is an intricate evaluation procedure that is placed much more than merely matching test scores and departmental admission requirements. Today, every entry assessment, admission and enrollment analysis are dependent on the viewpoint of individual tertiary institution, whereas very little survey are dependent upon post primary school performances of candidates. This paper designed a computerized multi-criteria admissions processing system (ACMCAPS) for tertiary institutions, which provides optimal tertiary admissions processes to Nigeria examinations candidates in higher institutions without bias. This system is a computer-based system that enables admission processes in different department to offer students admissions with respect to multi-criteria adopted in Bayes Model to enhance admission processes, make rational decisions and eliminate favoritism and baseness during admission exercises.*

Keywords: Computerized, Multi-criteria, Admission, Process, Tertiary, Institution

1. Introduction

Primarily, there exists no certain consent among Nigerian elites over the best route to gain admission into Nigerian tertiary institutions. In recent years, innovations in information technology witnessed rapid trends in the development of information management system (IMS) that possesses the capabilities to support human resources (Margaret, 2012). These IMS such as personnel management systems (PMS), Transaction Processing Systems (TPS) that are designed to handle a large volume of routine and recurring personnel and transactions activities such as employee recruitment, promotions, sales, purchases and balances are seen as Decision Support Systems (DSS). According to Susan (2018), decision support systems are computer technology solutions that provide aid to buttress complex decision making and problem solving by organizational management. They are interactive computer-based systems that deploy computer communications, data, documents, experts' knowledge, and models to solve problems and make decisions. These systems use human knowledge called knowledge engineers captured to solve problems that ordinarily need human expertise, (Margaret, 2012).

Over the past decades, technological innovations involving software applications are touching our lives in divert aspects more than we are knowledgeable of computerized information systems. This era has been portrayed by swift and ever changing technological trends where enhancement in expertise and equipments have involved deep control on all fields of human activities especially in decision making processes such as university admissions. In Taban and Draku (2015) means enrolling procedures of organizational perception utilized to admit students into respective departments in an institution to optimize national resources and societal goals. It is the procedures that consider students qualifications into

respective institution or university for improving societal goals. Tertiary institutions' admissions has become a fundamental way of people's basis for working life, students' admission is the process of determining exact capacity of students for various departments in the institution (Fong and Biuk-Aghai, 2009). Furthermore, Samer (2012), opined that students admissions into university is the procedures in exam candidates to the university starts with the completion of student admission form by the perspective student and corresponding examination procedures for courses of their choices. It is a process involving the recruitment of a significant group of students who desire an enrollment into courses in the university.

Traditionally, students' admission into higher institutions in Nigeria adopts predefined proviso guidelines such as percentage of seats reserved based on Caste (called Quota) such as Community or student background area called educational less advantaged zones and Student's overall examination marks such as Student's O' Level Results and entrance examination results such as joint admission and matriculation board examination (JAMB) results and post-university and tertiary matriculation examination (POST-UTME) results. These determining factors are utilized by the university council and admission board to make decisions for university admissions. This paper designed a computerized multi-criteria admissions processing system (ACMCAPS) for tertiary institutions, which provides optimal tertiary admissions processes to Nigeria examinations candidates in higher institutions without bias. This system is a computer-based system that enables admission processes in different department to offer students admissions with respect to multi-criteria adopted in Bayes Model to enhance admission processes, make rational decisions and eliminate favoritism and biasness during admission exercises. It is a system that uses these multi criteria such as senior secondary school

results (SSCE or WAEC), entrance examinations results such as Joint Admission and Matriculation Board (JAMB) and Post-University and Tertiary Matriculation Examination (POST-UTME), and Caste (Quota) called educational less advantaged zones. The system utilizes the Bayes' decision Theorem to eliminate favoritism, delay or poor admission processes in tertiary institutions. This system's decision processes is quick, reliable and efficient and unbiased in admissions decision processes.

2. Related Literature

Over the years, advisory systems were developed to support decision making in more unstructured settings with no single definite answer (Kaklauskas, 2015).

In these formless settings, the supportive advisory systems are more effective in providing advice used by the decision maker as a part of the iterative problem solving process. The advice is not the final, but it supports decisions by decision makers in an organisations.

Furthermore, there has been a drastic advancement in the use of human intelligence and business information for decision support ((Pupkov, BVVBV). This prodigy is due to the ever evolving availability of varying technologies to provide solutions to complex problems. These complex decision making problems very often require considering enormous amount of information distributed among many variables. These variables have helped analysts to utilize computational intelligence techniques such as artificial neural networks, fuzzy logic systems, genetic algorithms, advanced statistical methods, and also traditional statistical and financial analysis methods to implement systems to solve different problems from different fields of life. This phenomenon indeed has resulted in the need of intelligence Decision Making Support Tools to assist in Complexity of the decision making process, need for accurate evaluation of multiple alternatives and forecasting capabilities especially in an uncertainty, and data analysis involving experience and expertise (knowledge) (Miquel and Karina, 2011).

Thus, an intelligent decision support system (IDSS) is an intelligent information system that reduces the amount of time where decisions are made in a given domain and enhances the uniformity and excellence of such decisions. It is the use of artificial intelligence (AI) tools and standard that provides direct access to expertise and their flexibility of supporting learning and decision making processes. It is the integration of numerical or statistical models in a single system to provide higher accuracy, reliability and utility in making decisive decisions. These intelligent decision support tools are intelligent systems that utilize artificial intelligence (AI) and knowledge management techniques (Kaklauskas, 2015).

Moreover, intelligent decision support systems (IDSS) are interactive computer-based systems that utilize data, expert knowledge and models for supporting decision-makers in solving multifaceted, vague and unstructured problems by integrating artificial intelligence techniques (Ahmad and Khan, 2012). In these systems, the inclusion

of AI techniques to develop computer based systems that imitate human qualities. These systems are projected to enhance the capability of operators and decision-makers to better perform their duties and work together. Intelligent Decision Support Systems have the abilities to obtain, refine, store and utilize the inference of its knowledge base to support effective decision making (Ahmad and Khan, 2012).

According to Runki, Archer and Basudeb (2012), However, intelligent decision support systems is a system that utilizes intelligent and knowledge-based methods to promptly collect information and process it thereby assisting in making decision. These systems provide supportive decision-making by utilizing intelligent behavior such as learning and reasoning through implementing rule-based expert systems, knowledge-based systems or neural network systems. Intelligent decision support systems maintain a wider range of decisions including those with uncertainty and create estimates of the level of confidence in the decisions it gives. It can process complex problems by utilizing domain-specific proficiency to evaluate the rationale of executing its decisions.

Intelligent decision support system such as E-admission system is a system that makes admission process possible to finish up on itself by allowing students to study in the right college according to the marks obtained (Mirji, Deshpande, Walunj, and Ambavane, 2014). This system selects and presents only colleges in which the student can get admission. It will promptly make the process faster and easier, and also reduces the manual power in performing the entire task and improves the quality of the work. This system has immediate feedback mechanism that tries to answer all the queries of the students and provides immediate response after getting any request from students. The computerized Private Students' Admission System is a centralized system that manages the admission of private students at Muni University with easy management of admission process (Taban and Draku, 2015).

3. Methodology

Interview and observation were the methods used to obtain data for this paper. The top management officers of higher institutions in Nigeria with much emphasis on Universities were consulted and interviewed on the operations and activities involved in universities. The interview was focused on admission processes, categories of admissions with respect to cut-off marks and the utilization of federal character policy system (the quota system). The information gathered provided the researcher the required information utilized during the analysis of both the existing system and the proposed system. For observation, some universities were visited and a critical observation of their processes and operations were critically observed with a view of obtaining relevant information for analysis was obtained.

Furthermore, Object Oriented Analysis and Design (OOAD) methodology was used. It is a methodology that

makes programmers to think in terms of objects because it helps programmers to represent some actual thing or event. This methodology was used because it is characterized by Encapsulation (combining a record with the procedures and functions that manipulate it to form a new data type: an object), Inheritance (defining an object and using it to develop a hierarchy of descendant objects, where each descendant inherits its ancestors' code and data), and Polymorphism that modern programming languages use, especially in rapid application development techniques. The technique enabled the adoption of ASPX technology, HTML technology, and relational database in implementing the system goals.

4. Findings

Admission into tertiary institution in Nigeria has been in existence since the inception of tertiary institutions in Nigeria. Although, Nigeria had witnessed a monumental growth in admission processes since the creation of Joint Admission and Matriculation Board in 1978, but the typical approach in Nigerian Admission processes into Universities and other higher institutions is completely manual. The university admission processes has no digitalized system for admission processes.

In this manual system, the university admission processes typically involves sections or units in the university such as Admissions Office, University Departments, Faculty Office and Vice Chancellor (VC) Office. However, these sections or departments constitute several evaluations that aimed at developing decisions for candidates' admissions for respective departments of the university. The departmental offices and faculty offices are collaborated with the admissions office strategies to achieve university decisions for admissions with respect to VC's and university directives of the admissions.

Conventionally, university stakeholders, staff and candidates' overall scores and grades are the main criteria taken for university authorities to manually calculate, cross-check, select and come up with decisions on who are qualified for admissions or not. This manual approach of operation sometimes is biased in nature such that the admission officers can in other way bypass some vital procedures just because the stakeholder is a big player in the institution and they may not want to disappoint the person. The manual approach is not only time consuming but it is sometimes error prone because most at times, some candidates are admitted into wrong departments

because of fear of unknown and the power of "I Know Who is Concerned".

However, trying to reconcile the appropriate and adequate admissions worthiness of any candidate not some observations, stakeholders' power, and admissions officers' capacity is complex due to its biased nature of who you know.

The critical analysis of this system reveals that this manual method is a system that should be removed because it is prone to errors and inefficient. Thus, the data flow diagram of this system with its functionalities is illustrated in figure 1.

The figure 1 depicts the fundamental data flow diagram of Admissions processes obtained from the interviews and observation from Nigerian Universities. The major problems identified in this study are:

1. A thorough study of admission processes in Nigeria for new students into universities in this research reveals that admissions offices in collaborations with Vice Chancellors of universities process admissions for approval by ink and paper before publications. This approach is highly tedious, time consuming and delays efforts to maximize time as some universities run out of time before new academic sessions begins. Thus, these factors affect efficiency in appropriate allocation of candidates to the appropriate courses.
2. It was also observed that the existing approach is filled with bias as it is characterized by who-knows-who and lacks transparency in overall processing time. Candidates and parents are forced to pay high in order to secure admissions for their children. This approach lacks transparency processes that reflect the federal character policies. Unified Tertiary Matriculation Examination (UTME)

In this study, the researcher also observed that the admissions of students into some departments are given preferences. It is revealed that this preferential treatment affect the transparency needed in admission processes. This approach does not utilize the actual candidates' overall of scores from their UTME and POST-UTME results as some candidates get admissions with low grades even within the same region with respect to federal character policy. This treatment results to bad feeling among candidates and parents which leads to public critics of some people in the society.

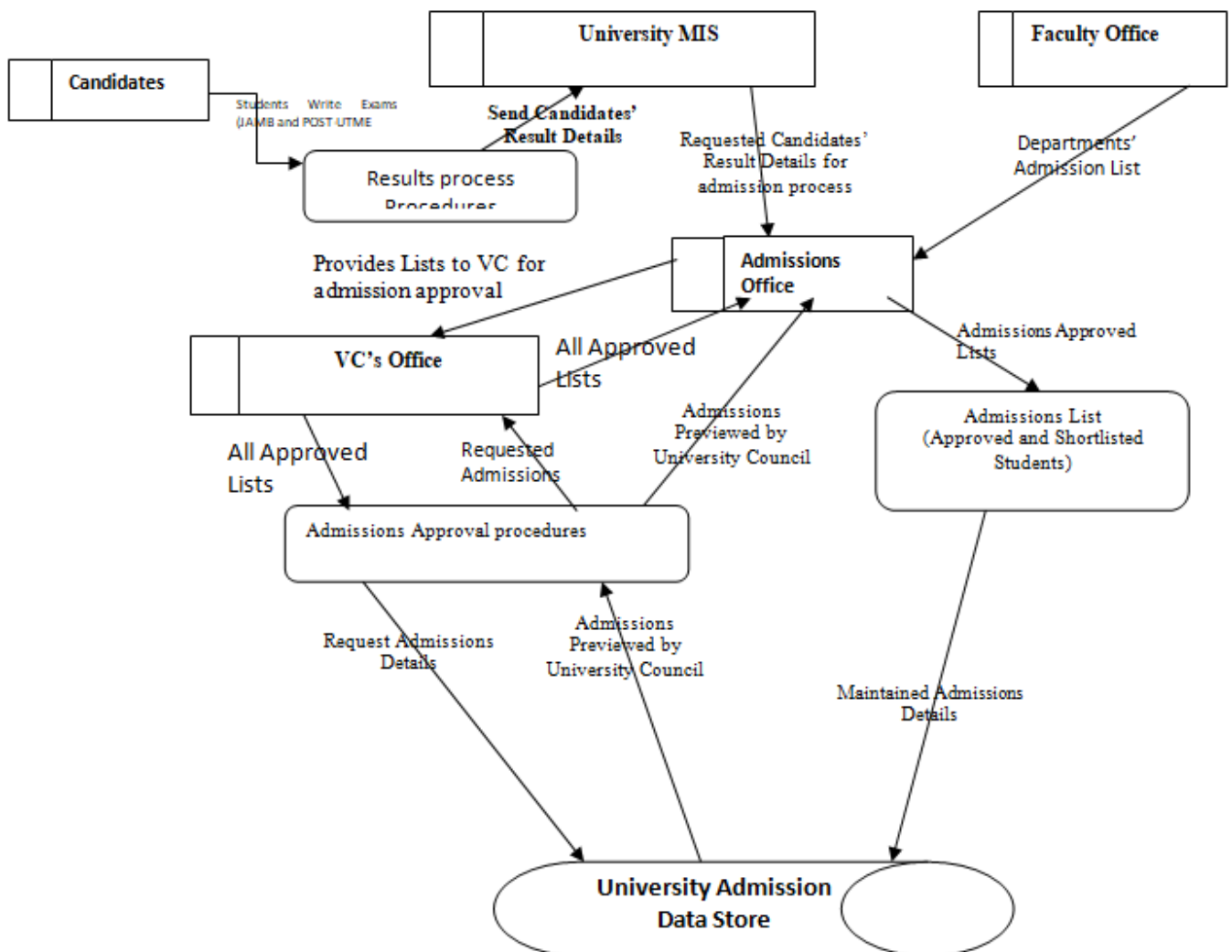


Figure 1: Data flow diagram of Existing System

Thus, the proposed intelligent decision support system for university admissions is a system that consists of the following major components:

- i. **The Management Operations:** This subsystem has the capacity to capture some of the required parameters for university admissions such as federal character policies, quota system, and candidates' results. This functionality also triggers action for further confirmed parameters such as university staff kids for accurate determination and decision of the system. These parameters are sent to the database and are retrieved during admission processes in collaboration with the system's knowledge base to enhance proper evaluation of candidates' admissions chance using the Bayes' decision model.
- ii. **Electronic Admissions Check and Builder:** The electronic admissions check and builder component functionality checks all the parameters from the database and knowledgebase for the best admissions criteria that best matches candidates' qualifications. This functionality ensures free, unbiased and undistorted admissions processes and generates admissions lists that best suit respective courses. This component has sub-modules that interacts to generate decisions for respective candidate admissions evaluations.

- iii. **Electronic Admissions List System:** This functionality of the proposed system holds the successful candidates during admissions processes. It ensures that every detail that ensured respective candidate for getting admissions are secured in the database. This functionality provides the university authorities the ability to track admissions details. This functionality also enables admissions officers to publicize the admission lists.

- iv. **Feedback Subsystem:** This subsystem is the functionality that enables the stakeholder, university authorities, candidates and parents the ability to capture either missing details or information of candidates or clarification of admissions details. The functionality ensures that any missing details of any candidate would be supplied by the candidate online and not through any university staff, stakeholder or VC of the university.

These functionalities help minimize bias, sales, or highjack of admissions or admissions processes by any group of individuals. It also helps to reflect the transparency of admissions processes by Nigerian universities. The above description is illustrated shown in figure 2.

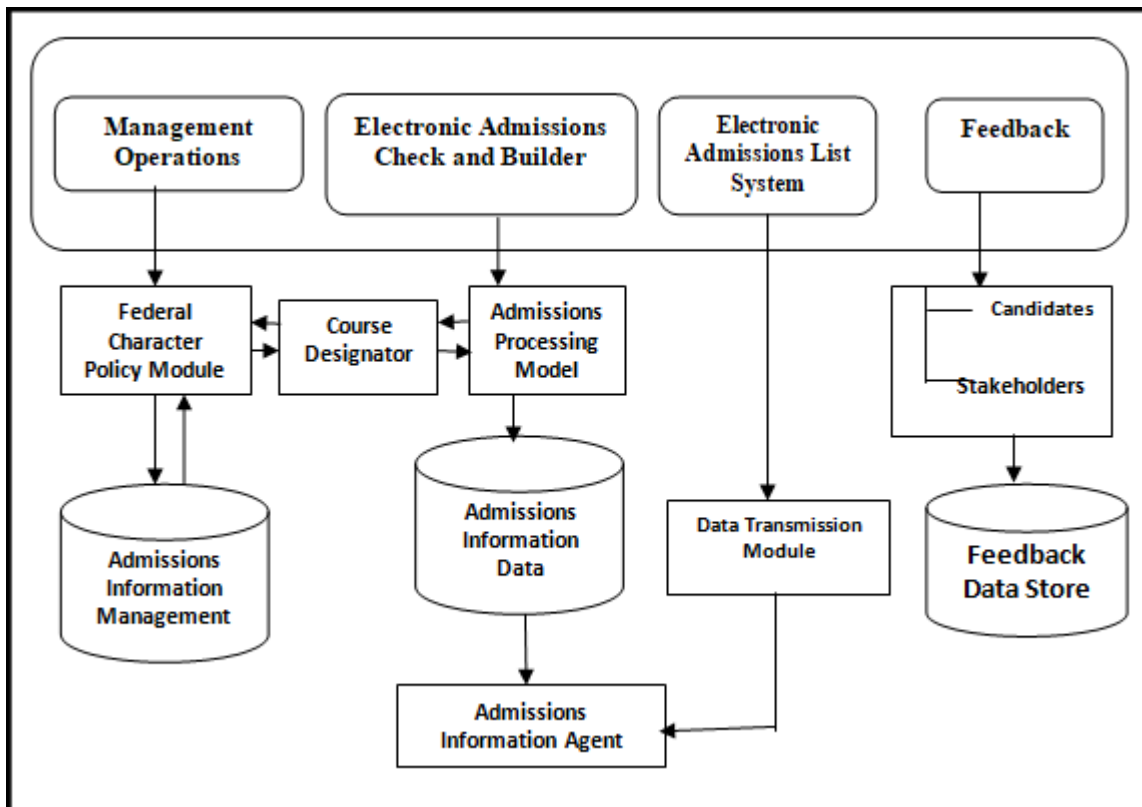


Figure 2: Proposed High Level Models

The high level model shown in figure 2 consists of the subsections: administrative module called Management Operations, electronic Admissions Check and Builder, electronic Admissions List Subsystem. These subsystems enhance quick candidates' details that form part of the systems intelligence for efficient admissions processes and management. These integrated modules enable admissions officers to quickly process admissions and publish admissions list.

Thus, the Intelligent Decision Support System for University Admissions encompass the following subsystems which helped in creating the systems

knowledgebase that guides the system in generating the inference. It involved breaking down the sources of admissions processes including federal character policy details and examinations results details that affect candidates' admission. These include:

- i. **Federal Character Policy and Quota System:** The federal character policy and the quota system are the parameters describing the region, status, and other relevant information of the candidates' socio and geo-political zone. These are the policies that affect candidates' admissions due to location. This is illustrated in figure 3.

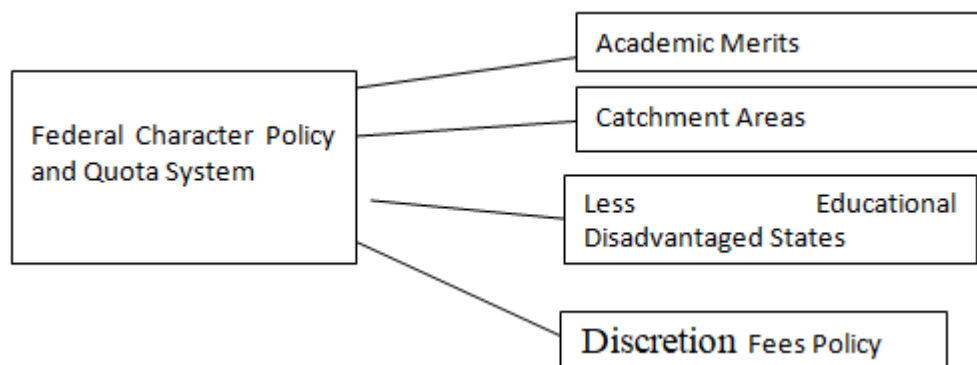


Figure 3: Sources of Federal Character Policies and Quota System for Admissions Processes

- ii. **Candidates' Examination Results:** The resultant performance of every candidate determines the chance of getting admissions into any Nigerian university. These performance criteria include the students overall performances in all examinations that

concerns respective courses applied for admissions. These parameters gave rise to the structure used in the development of this system. This structure is illustrated in figure 4.

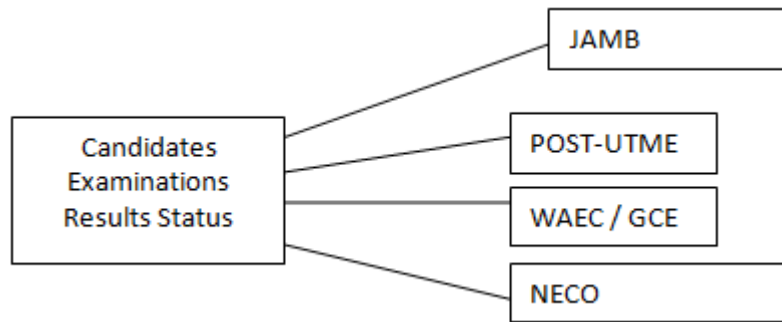


Figure 4: Sources of Candidates Results for Admissions Processes

Thus, these parameters constituted the required elements for the Intelligent Decision Support System for Nigerian University Admissions processes (IDSSNUA). These parameters are structured to provide a class hierarchy for the development of the knowledge base, Bayes’

probability structure, explanation subsystem and the inference engine of the proposed IDSSNUA for efficient and effective admissions processes. This class hierarchy diagram is shown in figure 5.

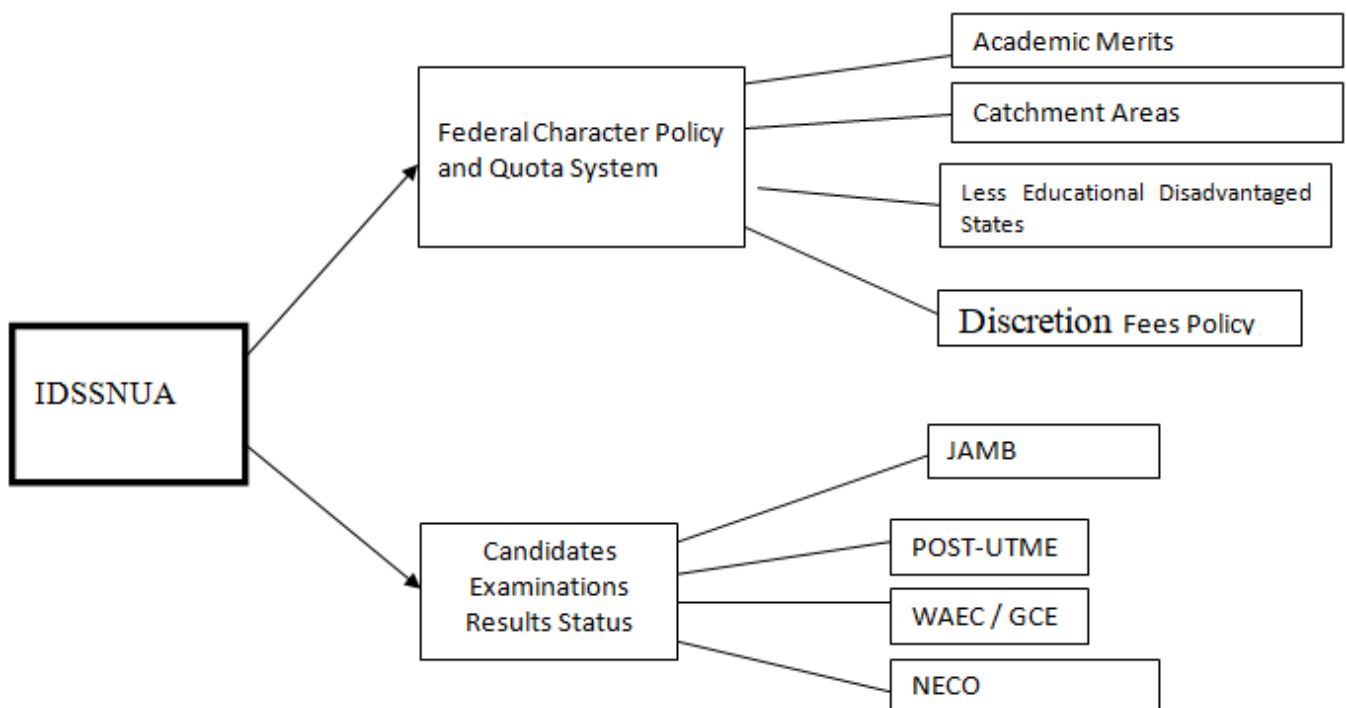


Figure 5: Parameter Class Hierarchy of Candidates Admissions status

Figure 5 shows modules (architectural components) that enhance the Bayes’ decision model deployed for admission processes in Nigerian Universities in the system. This technique uses the class hierarchy of federal character policy, quota system and candidates examination results performances to explicitly map the domain knowledge base with the associated facts (Input data) that performs discrete admissions processes with differential decisions. This Bayes’ decision model helps the system to

accurately and efficiently map candidate for admission in respective courses. It is a system that contains heuristic knowledge of stakeholders’ experiences, university regulations, university authorities’ experiences and candidates’ results performances.

The model in figure 2 was then designed as and the use case is shown in figure 6

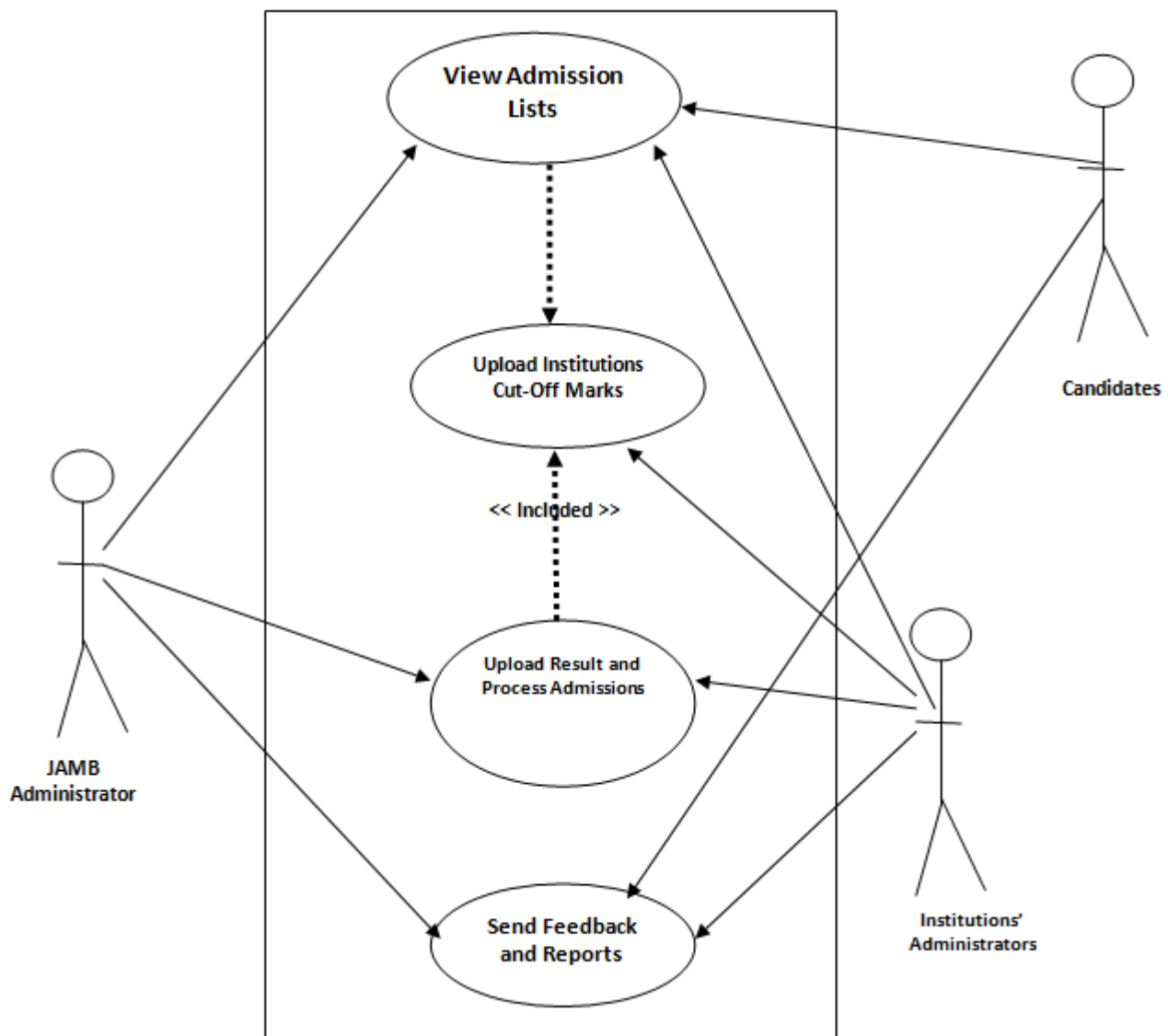


Figure 6: Use Case describing the intelligent decision support system for tertiary institutions

5. Discussion

The intelligent decision support system for tertiary institutions admission processor is a system that provides the required admissions' human resources management the platform to improve tertiary institutions admissions processing without bias. This system provides admissions officers, stakeholders and other institutions' human resource management like lecturers the podium to have free and fair admissions process in the institutions. The design of this intelligent decision support system for tertiary institutions admission process involved the adoption of federal character policy that involves all the categories of federal government stakeholders, states, institution's catchment areas, and staff quotas to ensure that the admission processes do not pass through back doors any more.

6. Conclusion

The quest for unbiased admissions processing for Nigerians triggered the need for a robust tool using Bayes' Decision Model to assist admissions resource

management for efficient, bias-free and none purchasable admissions in our society and to instill transparency in the admission system.

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