

Design of an Automated Admission Ranking Information System (AARISYS)

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Abstract

A Decision Support System (DSS) is a useful information systems tool that supports decision-making as it aids institutional admission committees in effective and efficient decision-making. Several types of admission DSS are said to have existed over time. However, for most of the admission DSS as seen from the literature reviewed, soft copies of data are obtained from a source and uploaded onto the system, whereas, the DSS can be made to obtain data directly from the source into itself, thereby speeding up system procedures. The objectives of this study, are to develop an Application Programming Interface (API) and use mathematical methods of weighted grade points for ranking and provision of information for sensitive admission analysis and decision-making. The method of inquiry used in this study was inductive, geared majorly towards consultations of research papers, relevant materials such as educational journals, publications, websites etc., and resource persons through oral interviews. This study adopts a qualitative approach, by studying admission DSS with the aim of improving the existing systems. A Use-case scenario was used as a design model and the system architectural model and program flow were demonstrated as well. Thus, the DSS developed in this study referred to as AARISYS (Automated Admission Ranking System), was implemented using scripting (PHP & JavaScript) and markup languages (HTML & CSS) with MySQL. The web-based system fetches Applicants' data from an external Database (source) via an API, store and assign rank scores. Validation and defect tests were also used and the system results were displayed. Thus, with the aid of API, admission DSS can now obtain data from sources by itself, in contrast to the methods of inputting soft copied data, as used by other DSS.

Keywords: AARISYS; Admission; Decision Support System (DSS); Application Programming Interface (API); Automated; JAMB (Joint Admission and Matriculation Board); Ranking System.

I. INTRODUCTION

Information is an important facet of human life. Its absence threatens the very existence of good decision-making. Therefore, an organization must have an automated system that aids in providing this information. These Information systems are often referred to as Decision Support Systems (DSS), which is one of the information systems useful for making decisions [1]. DSS is an integrated set of software and computer tool that allows a decision-maker to interact

directly with computers to create information that is useful in making decisions. It is designed to produce information, to help managers make better decisions [2].

Reference [3] reported the development of an admission DSS to assist in admission decision-making, while [4] developed an Admission Decision Support System that was centered on the selection of prospective organizational members using profile-matching methods. Reference [5], developed a web-based DSS to aid school entrance selection of students, using the simple additive weight (SAW) method.

Reference [6] automated the manual admission selection of ABC University using the fuzzy method. Reference [7] also developed a Machine Learning (LR) Based DSS in Predicting Undergraduate Freshmen Enrolment into University. Reference [8] developed a Decision Support System for New Student Admission Using Analytical Hierarchy Process and Simple Additive Weighting Methods, while [9] developed a Web-based admission system for advanced-level, private schools: in the case of Kilimanjaro region, Tanzania. However, comparative analysis in the literature review showed that, for most of the DSS, soft copies of data are obtained from source (via download, email or likewise) and uploaded into the system. Whereas, the DSS can be made to obtain data directly from source into itself. Thereby speeding up system procedures.

A summary of reviewed literatures is presented in Table I.

Table I Comparative Analysis of Literatures Reviewed

S/No.	Lit. Review	ATTRIBUTES OF ADMISSION SYSTEMS REVIEWED									
		API	DSS	On-line	Ranking	WGP	SAW	ML	Profile matching	For Tertiary	Non Tertiary
*	AARISYS (Article)	✓	✓	✓	✓	✓				✓	
1	[4]		✓	✓	✓		✓		✓		✓
2	[5]		✓	✓	✓		✓				✓
3	[6]		✓					✓		✓	
4	[7]		✓					✓		✓	
5	[8]		✓		✓		✓				✓
6	[3]		✓	✓	✓	✓				✓	
7	[4]			✓						✓	

This study is aimed at developing an online Admission Decision Support System with an Application Programming Interface (API) that will automatically fetch applicant’s data from an external database into the AARISYS database. Thus, use the data to provide information to support institutional admission committee members in their decision-making process.

A. Background

ICT must be adopted in so many institutions especially those of higher learning like Universities. The use of ICT in university activities might range from Automated Admission System to Registration System etc. In recent times, there has been a proliferation of private and public institutions of higher learning in Nigeria to provide education for all citizens. One important aspect of entry is the admission criteria and the methods used in the admission processes [10].

However, the existing methods of admission into Nigerian University require Applicants with Senior Secondary School Certificate (SSCE) or those awaiting SSCE results to apply for Admission into any Institution of their choice across the federation through the Joint Admission and Matriculation Board (JAMB). A nationwide examination known as the Unified Tertiary Matriculation Examination (UTME) is regularly conducted by JAMB. Candidates obtain their forms and register to sit for the UTME examination. Thereafter, the

results of the UTME examination are published, for applicants to check their scores, while the list of applicants along with their scores is sent to their respective institutions. The tertiary Institutions select students who apply to their institutions for admission based on the UTME cut-off point and other criteria prescribed by the Board. After selection, the list of students selected is sent to JAMB for verification, validation, and approval before it is published. This is for the JAMB to ascertain, that the selections are done and conform to the admission guideline spelt out [10].

Though, JAMB had spelt out guidelines for the admission selection of students into tertiary institutions, various institutions also have other criteria they consider during the selection process. These criteria could include, Catchment area, Indigene-ship, quotas, etc. Hence, these criteria vary with the institution. Although there exist, some similarities in admission criteria in Nigerian institutions, there are also distinctive peculiarities for different institutions, and it can be said that no two institutions have the same admission process. Hence, according to [11], the admission selection methods vary for two different categories in Nigeria, namely: Selection Methods for Federal Universities and Selection Methods for State Universities.

B. Selection Methods for Federal University

This entails making a selection of Applicants across the States of the Federation and International Applicants as well. The “Selections Methods” are as follows:

1) General Selections/Merit (45%):

Here Applicants, who applied to the Institution in consideration, are selected across the entire States of the Federation, including international Applicants as well.

2) Catchment Area Selections (35%):

Here Applicants, who applied to the Institution in consideration, are selected across the State that are contiguous or neighbors to the Institution.

3) Educationally Less Privilege Area Selections, ELPA (20%):

Here Applicants, who applied to the Institution in consideration, are selected across the States of the Federation that are considered backwards in education.

C. Selection Methods for State University

This entails making a selection of Applicants across the various selection Quotas following the criteria stated below:

1) General Quota (40%):

Selections here are done for all Applicants (i.e. indigenes, non-indigenes, international, and candidates with health conditions or impairments). Mostly, Applicants considered for selection are those, who applied to the particular Institution as their first choice, among the institution they are seeking admission to. All Applicants stand equal chances.

2) *Indigene Quota (40%):*

Selections here are done for Applicants who are indigenes of the Institution's State only. The selections are equitable across the Local Government Areas (LGA) of the State.

3) *Educationally Backward LGA Quota (20%):*

Selections here are done for Applicants who are indigenes of the Institution's State. Considering only LGA that are lagging and backwards educationally.

It is important to also note that during selections in the above quotas (federal and state), candidates with health conditions or impairments are also considered, for inclusiveness.

II. MATERIALS AND METHODS

A. *Materials:*

1) *Hardware and Software Specification*

For the efficient and effective implementation of the newly designed system in this study, the following minimum hardware and software specifications, are required and recommended: Windows 7, 8, 10 or 11 (32/64-bits), Web Browser (Microsoft Edge, Google Chrome etc.), XAMP control panel v3.2.4, Processor: PENTIUM 4, Intel or AMD of 1GHz or more, Hard Disk Drive: 700 MB (FREE SPACE MEMORY) or more, Minimum RAM: 256 MB or more, Keyboard and a mouse or other compatible pointing device.

2) *Development Tools*

Tools and Programming Languages used to develop the application are Notepad++ or Sublime Text (Text Editor), Hypertext Preprocessor (PHP), HTML (Hyper-Text Markup Language), CSS (Cascading Style Sheets), XAMPP v3.2.4 (simulator), MySQL, JavaScript, and Bootstrap.

B. *Methods*

1) *The logic of Inquiry*

Method of inquiry used in this paper is inductive, geared majorly towards consultations of research papers around the subject area. Information such as methods of admission in Nigeria public universities was gathered from [3] and [10]. Inquiry was also made via the office of the Head of Department, Computer Science Department, Kaduna State University and information gathered were cross validated and discussed earlier in section A.

This paper adopts a qualitative approach, with the aim of improving the existing systems. Thus, introducing the API concept in admission DSS, to enable the system fetch data into itself, rather than uploading soft copied into the system by a user.

2) *Weight Grade Point (WGP)*

This mathematical method was used for ranking, to break tie among competing applicants during admission selection, and thus aid decision making. The WGP is a method use to allocate points to each subject's grade in each applicant's SSCE results. The total Weight Grade Point for each applicant becomes the rank score, and thus used in Ranking.

Table II below shows the point for each grade.

Table II Weight Grade Point.

Grade	Weight point
A	5
B	4
C	3
D, E & F	0

Where D, E and F are given a weighted point of 0, because SSCE subjects with any of these grade(s) are not considered during the admission selection procedure. The system converted the grades of applicants into the above points and stored them in the database. Equation (1) further illustrates the summation done by the system on the WGP to generate rank scores.

$$\sum_{x=wgp1}^{wgp_n} f(x) = \frac{x \times 2}{2} \tag{1}$$

Where wgp_1 = value of the first weight grade point for subject₁ store in database and wgp_n = value of the last weight grade point for subject_n store in database.

3) *Dataset*

Sample data of applicants were collected from the Registry Department of Kaduna State University and uploaded onto the JAMB database (simulated). This database contains the Applicants' data, and it resides outside AARISYS. The AARISYS therefore, uses its API to connect to the JAMB database and fetch applicants' data into it's system, then use it to provide admission information.

4) *Model Designs*

The AARISYS Use-Case diagram was used as adapted from [3] (see Fig. 1).

Use-Case Diagram

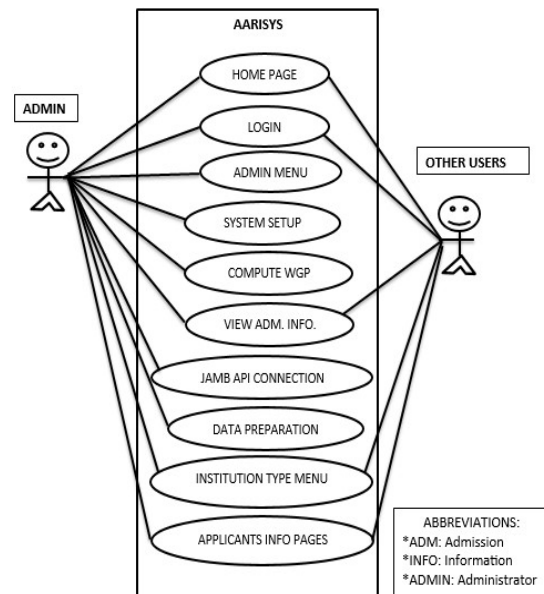


Fig. 1 AARISYS Use-Case Diagram, adapted from [3].

5) *System Architectural Model and Program Flow*

The system is modelled as a set of components with relationships between these components. These are

illustrated graphically, in the system architecture model that gives an overview of the system organization. The system architecture is presented in Fig. 2 as a block diagram, showing the major sub-systems; and the interconnections between these sub-systems [12].

The system adapted from [10] is designed to go into the cloud to fetch data itself instead of the data being uploaded by the user as in [10], where a csv data file is used.

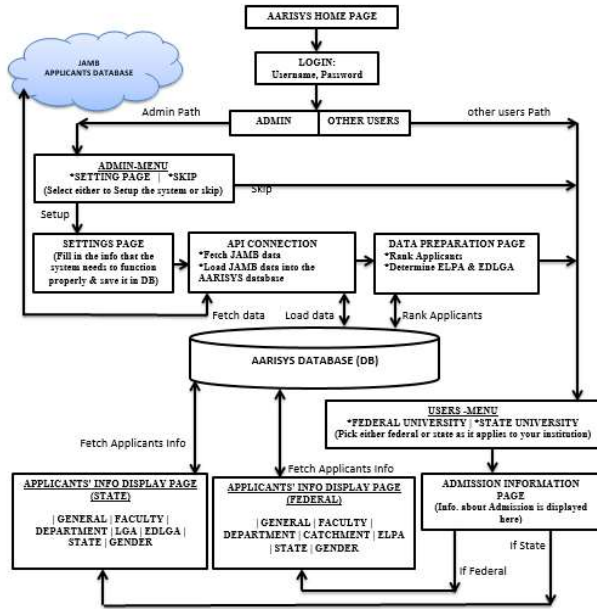


Fig. 2 AARISYS architectural diagram and program flow adapted from [10].

III. RESULTS AND DISCUSSIONS

A. System Testing

There are two distinct types of testing, which were used at different stages in the software development process, they are: Validation Testing and Defect Testing. These types of testing were at all times, constantly used during the software development in different forms and methods of testing (Component Testing, Boundary Testing and Integration Testing).

B. System Operations & Implementation

AARISYS is designed and developed as an interface (web pages) driven system, to enable communication between the user and computer. However, there are different kinds of interfaces interconnected together. The interfaces are show-case in the following:

1) Login Page:

This page restricts unauthorized access into AARISYS, to ensure that access is via logging in with username and password, as registered by the System Admin.

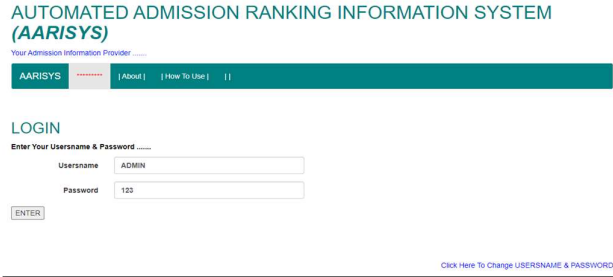


Fig. 3 AARISYS login interface

2) Administrator's (Admin) Path

(a) Settings Menu Page:

This is the first page the Admin come in contact with. Upon login, there are two buttons "System Settings" and "Skip", the Admin is required to click the "System Settings" button, to fill in details the system required during executions and submit them into the database. Whereas, if the "System Settings" is already set. The "skip" button is clicked. The system is then linked to the "Institution Type Menu Page" for onward continuity, like other users. The Settings Menu page is shown in Fig 4.

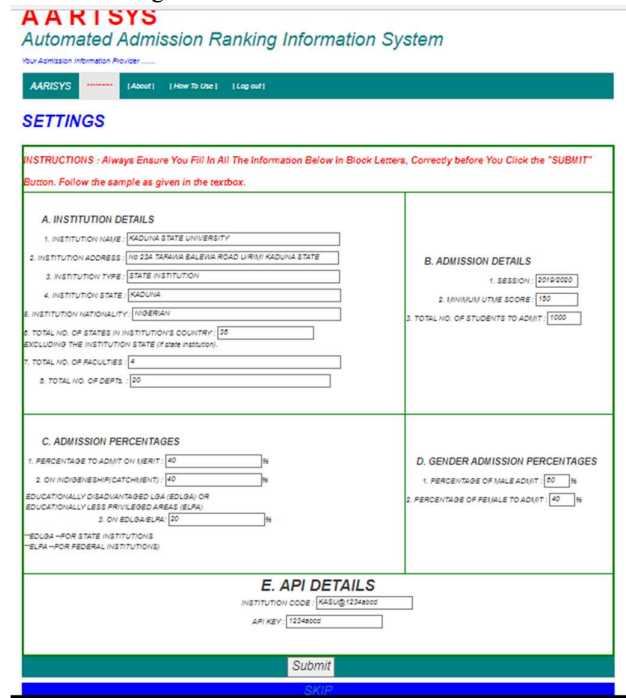


Fig. 4 Settings page

(b) API connection Page:

The API connection to fetch Applicants' data from the JAMB website, and store them in the AARISYS database is established at the click of a button (see Fig. 5).

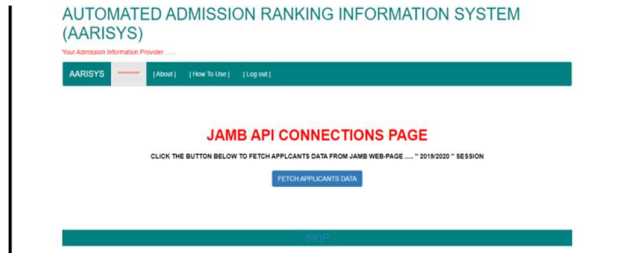


Fig. 5 API connection

(c) Data Preparation Page

On this page, the processes performed are: first, computing the "Rank Score" of all Applicants. Second, entering and storing all LGA or Catchment Areas into the AARISYS database. The third is Optionals, based on Institution type. If State Institution, the EDLGA button is responsive, else if Federal Institution, "Catchment Areas" are entered. The Data Preparation page is shown in Fig. 6.

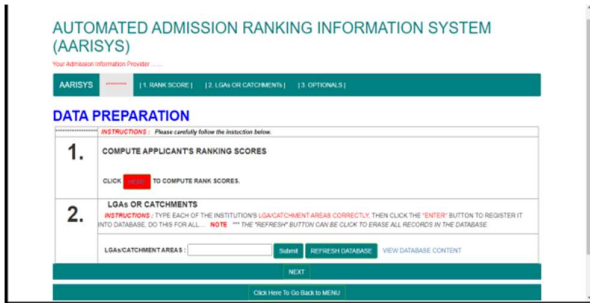


Fig. 6 Data preparation page 1

3) Other Users' Path

(a) Institution Type Menu Page:

This is the first page other Users come in contact with after login. On this page, there are two buttons (links), they are: "State Institution" and "Federal Institution". Users are expected to click their type of institution; the click is responsive to the institution type the Admin set, during the System settings.

(b) Admission Information Page:

This page appears when a user selects an Institution Type. It displays the information to be considered for admission, for the users to note, and be informed. There is a next button to click and proceed to General Admission Information Page.

(c) General Admission Information Page:

This is the first page that displays "Numerical Information" about Applicants. This page displays information holistically in four (4) different categories (State: Indigenous, non-indigenous, international and EDLGA, Federal: catchment, non-catchment, international and ELPA), and each category has three (3) groups of information (i.e. male, female and candidates with health conditions or impairments), as shown in Fig. 7.

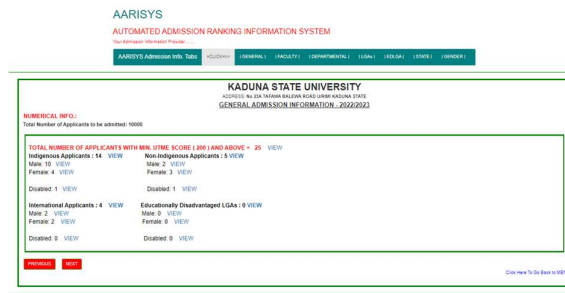


Fig. 7 General admission information page

However, the list of Applicants from the different categories (in Fig. 7) and the groups under each category can be viewed as shown in Fig. 8.

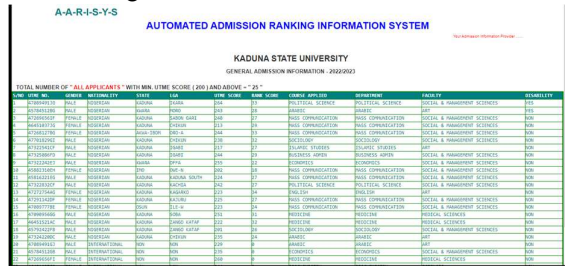


Fig. 8 View Applicants page (List)

(d) Faculty Admission Information Page:

On this page, the user selects the desired Faculty to view its information. Thus, the information is displayed in different categories, and each category has three groups (i.e. male, female and candidates with health conditions or impairments), the faculty admission information page is shown in Fig. 9.

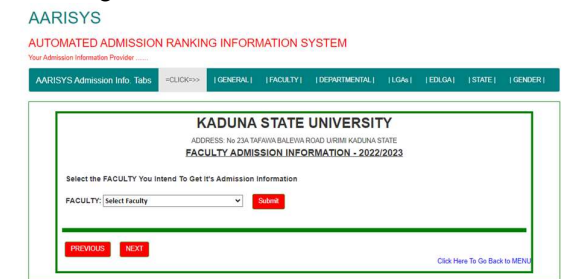


Fig. 9 Faculty admission information page

(3) Departmental Admission Information Page:

On this page, the user selects the desired Department to view its information as shown in Fig. 10.

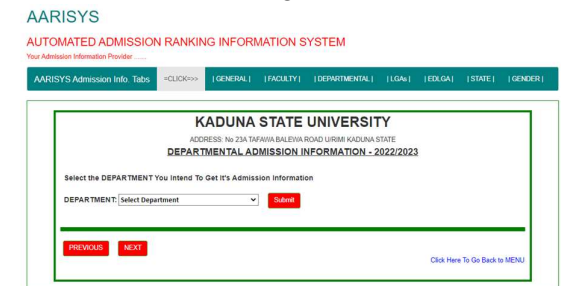


Fig. 10 Departmental admission information page

Other Admission Information Pages Include: the LGA/Catchment Admission Information Page, EDLGA/ELPA Admission Information Page, State Admission Information Page, and Gender Admission Information Page. On each of the aforementioned pages, there is a provision for the user to select LGA, EDLGA, ELPA, State, or Gender to view its admission information and the list of Applicants as shown in Fig. 7 and 8 respectively.

IV. CONCLUSION

It is undoubtedly clear, that the AARISYS developed in this study will aid in the decision-making of admitting students into institutions of higher learning, by providing information for sensitive admission analysis, and ranking competing applicants, to help break ties. The system could fetch data from the JAMB database, into the AARISYS database via an API. Hence, eliminate the procedure whereby soft copies of data are uploaded into the system by the user. This process improved the admission DSS (AARISYS), by making it obtained data directly from source into itself. It speed-up the system procedures and also discarded the uploading process. Leveraging on the level of success achieved. The following are hereby recommended for further research.

- 1) AARISYS only fetch Applicants' data from JAMB; it should be improved, to fetch Applicant's SSCE data, from West African Examination Council (WAEC) or National Examination Council (NECO), so that the admission committee can vet the result of Applicants under admission consideration.
- 2) The system should be further improved to check applicants under admission consideration who have been admitted to other institutions with aid of the JAMB admission letter printed on the JAMB Portal.

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