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FUZZY – BASED ACCOMODATION ALLOCATION SYSTEM

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ABSTRACT

In any type of resident institution, allocation plays an important role in the welfare and upkeep of students in higher institution. In other to reduce the congestion and time wastage posed by the existing system at resumption in applying and getting accommodation, a fuzzy-based accommodation allocation system was developed which addressed these problems of the existing system by allowing each student get their allocation details before resumption. Relevant literature reviewed was carried out to get background information. The system was designed using a fuzzy inference model to make a decision. The web application was implemented using a server side scripting language; PHP (hypertext processor), alongside with a database-MySQL which was used as the relational database and Apache Server as the web server. A number of recommendations were suggested to fully implements and use the new system.

KEYWORDS: Institution, Fuzzy Logic, Allocation, Hostel.

INTRODUCTION

For every creation under the planet earth, one of the significant things is where to lay ones head and for every society to be decent there must be a planning and allocation of a place of abode. There are various ways one can be accommodated. It could be hotel accommodation, hostel accommodation or building or housing accommodation. Therefore for a resident institution, hostel is a place dedicated for students to live. Hostels are generally self-catering rather than hotels; there is less privacy in a hostel than in hotel. Sharing sleeping accommodation in a dormitory is very and far more different from staying in a private room in a hotel or bed [7].

Richard Schirrmann created the first permanent “jugendherberge” or “Youth Hostel” in Altena Castle in 1912. These first youth hostels were an exponent of the ideology of the German Youth Movement to let poor city youngsters to breathe fresh air outdoors [18].

Accommodation according to the oxford dictionary is defined as a room, building, or space in which someone may live or stay[6]. Accommodation allocation is the act or process of deciding to give a room, building, or space in which someone may live in. Computer based method of allocation is an accommodation allocation in which when a student seeks an accommodation, his or her name is been entered into the system, just for the sake of record keeping but this system is not an ideal one, due to the fact that it is time consuming and once the system crashes, the students record is lost. This is an offline system that only requires a back end meant for the administrative officer [4]

Web-based accommodation allocation systems offer great flexibility than the traditional approach i.e. the manual method of accommodation allocation, because accommodation allocation could be offered or done by students in different locations and at different times. A web-based accommodation allocation system is designed to focus on the welfare of students and how students are been allocated rooms to reduce congestion or overcrowding.

The case study employed in the research is hostel of Afe Babalola University, Ado Ekiti. The current system in ABUAD accommodation application process involves students filling a paper-based application form which takes a long time to process. At present, ABUAD students must check in for accommodation application at the Dean of Students Affairs office.

MATERIALS AND METHODS

Review of Related Works

Iraba [7] developed the Student Residence Management System to facilitate application for accommodation online and to help the staff to manage the different residence activities such as controlling booking, payments and room allocation. The Student Residence Management System was able to notify and confirm all room allocations. Room allocation confirmations were sent by email to students who were given accommodation. The web-based system was able to address problems encountered by users within the current residence administration system. The proposed system found optimal matching for user requirements, and management of residences. System implementation was carried out using PHP, MySQL, PHPMyAdmin and Apache, which are the open source applications.

Asmahani [4] developed the College Student Allocation System. Here are the traditional methods in firstly students must get the college application forms from the college officer. Next students must fill up the forms. The due date for application is fixed. They must attach together their passport size photo, and their parents' monthly salary slips. The HEP officer's faces difficulties to process the application forms. The process of key in the data takes a longer tune. The objectives of this research was to identify all the requirement specification of College Student Allocation System (CSAS), to model the design of College Student Allocation System (CSAS) based on requirement specification and to develop the prototype of the College Student Allocation System adopting web application framework that is MamboServer. This research project is about developing College Student Allocation System using Wampserver and web application framework in UiTM. This research is an improvement of the college student allocation system to make it more effective in college management the design of College Student Allocation System (CSAS) based on requirement specification. The limitation of this project is focusing on the colleges that are situated nearby the faculties.

Anjorin [3] developed Online Hotel Reservation “case study of Solton international hotel and resort”. The problem encountered in the existing system was that thousands of students file (registration) are processed manually. In a situation where a student registration file is missing and the officer in charge is making a sequential search through the file to get information about the student's. The problem becomes complex if the information is not in the specified location and this leads to searching through archives when the necessary documents are available, it often takes a long time to get them into the required format. The approach administered to curbing the problem of the existing system (manual system) was to design a website for Solton international hotel and resort, so as to reduce the cost of transportation by prospective guests in the existing system; to provide a communication medium that can serve in any place including the bedroom and to ensure accuracy. Help participants to understand technology's current potential and impact on their businesses. The system implementation was carried out using PHP, MySQL, and Apache Server. Akanfe [1] developed an Online Hotel Reservation (case study of Tamarin hotel), the problem in the previous system encountered involves the manual moving of files, in this case, a large number of guests' data or information can easily be handled. The proposed system was developed so as to give useful, accurate, timely and well-formatted information about guests. The system implementation was carried out using MySQL for the database for the day-to-day activities of booking rooms, PHP, HTML and Apache server was used as the web server. This would enable them to automate their entire business processes, by allowing them to run their businesses dynamically or interactively and rapid decision making.

Peter [14] developed a web-based classroom allocation system. Often, a manual process was used in the allocation of classrooms and keeping track of the classroom. A better way to consistently and effectively allocate classrooms is to use a computer-assisted system that will keep track of all classrooms on campus along with specific details about those rooms that can automatically suggest efficient pairings with the courses offered for a given semester. The efficiency was being judged based on many factors, most importantly being that the size of each room is used effectively. The new system accommodates the most important factors mentioned before. Other factors such as making sure that each course has a room with the required resources for that class and that the rooms should conform to departmental preferences are also considered. Meetings were held weekly with the stakeholders to cover the current progress as well as introducing new requirements. Due to the SOA of the system it made for easy segmentation of the system and an easy way to show where progress has been made. The implementation was carried out using MySQL as a backend, Amahi Server to run MySQL and the built in Glassfish web server that comes with NetBeans which were ran on Windows 7 Professional system

Concept of Fuzzy Logic

Fuzzy expert system is an expert system that uses fuzzy logic instead of Boolean logic. It can be seen as special rule-based systems that use fuzzy logic in their knowledge base and derive conclusions from user inputs and fuzzy inference process [8] while fuzzy rules and the membership functions make up the knowledge base of the system. The goal of a fuzzy expert system is to take in subjective, partially true facts that are randomly distributed over a sample space, and build a knowledge-based expert system that will apply to them certain reasoning and aggregation strategies to produce useful decisions [17].

A lot of researchers have worked on the fuzzy-logic. Akinnuwesi and Uzoka [2] developed a Framework of Web Based Fuzzy Expert System for Managing Tourism Information, Neamat and Abdeltawab [11] proposed a conceptual RM model that relies on an accurate room demand forecast model and a dynamic room pricing and allocation model. The system also attempts to combine expert knowledge with statistical models to provide a flexible and effective decision support tool for revenue maximization. Ngai and Wat [12] designed a fuzzy expert system for hotel selection. In Sanchez et al. [15] work, an expert system for forecasting menu items in a foodservice operation was developed. Cho et al. [5] argued that hotels could improve their concierge service, both human and electronic, by developing an electronic system that makes use of expert system technology. Cho's system itself engaged hotel guests in an on-screen dialogue to help them find information about hotel services and other attractions in the area. Sterling et al. [16] explained lessons learned through the sequential construction of four expert systems for menu planning. They have shown how to represent common sense knowledge about food and menus in a form amenable to successful menu planning. McCool [10] examined some considerations required for developing expert systems for the hospitality industry. Nissan [13] initiated three expert systems which were applied to the domains of real estate, room rental and hospitality management. The experience acquired in the development of an expert system called an expert system for tour advisory (ANESTA), which could act as a tourist information station for generating self-guided tour schedules as well as providing detailed transportation information was presented by Low et al.[9].

Fuzzy logic has proved useful for developing many practical applications, especially in the field of science and engineering, as it can handle inexact and vague information. Even though an abundance of research in fuzzy logic has been conducted in the past, relatively little attention has been paid to applications of fuzzy logic in allocating rooms in an institution or related industries.

This paper employed fuzzy inference engine in making decision for allocating accommodation for students in an institution.

The Fuzzy-Based Accommodation Allocation System

Mamdani style of inferencing was employed in the research involving the fuzzification, rule based, composition/aggregation and defuzzification.

Fuzzifications of the input parameter are carried out as follows:

Consider a situation of allocating room or hostel for some set of students in a tertiary institution with emphasis on school fees (including accommodation fee) and type of accommodation demanded.

The universe of discourse 'S' is the set of student to be given accommodation

Suppose there is a fuzzy subset 'FeePayment' defined by a membership function 'Fee_P(x)' as follows:

$$\text{Fee_P}(x) = \begin{cases} 0 & \text{if } \text{FP}(x) < n \\ \text{FP}(x)/m & \text{if } n < \text{FP}(x) < m \\ 1 & \text{if } \text{FP}(x) \geq m \end{cases} \quad (1)$$

where FP is the fee_Payment, n is the least amount to be paid and m is the highest amount to be paid.

Fee_P is first condition for the accommodation to be allocated for the student. The rule will be fired if the payment is less than n that is the membership function is zero and otherwise if greater than or equal to m.

Also, suppose a fuzzy subset 'Accom_Required' is defined by the membership function 'Accom_R(x)' as follows

$$\text{Accom_R}(x) = \begin{cases} 0 & \text{if } \text{A_R}(x) < t \\ \text{A_R}(x)/p & \text{if } t < \text{A_R}(x) < p \end{cases} \quad (2)$$

$$1 \quad \text{if } A_R(x) \geq p$$

Where $A_R(x)$ is the Accommodation_Required, t is the smallest accommodation to be paid for and p is the largest accommodation to be paid for.

$Alloc_R(x)$ is the second condition for the accommodation to be allocated for the student. The rule will be fired if the accommodation is less than t that is the membership function is zero and otherwise if greater than or equal to p .

The fuzzy inference engine extracts and evaluates rules from the rule base and produces fuzzy outputs. Below is the fuzzy diagram for allococomodation.

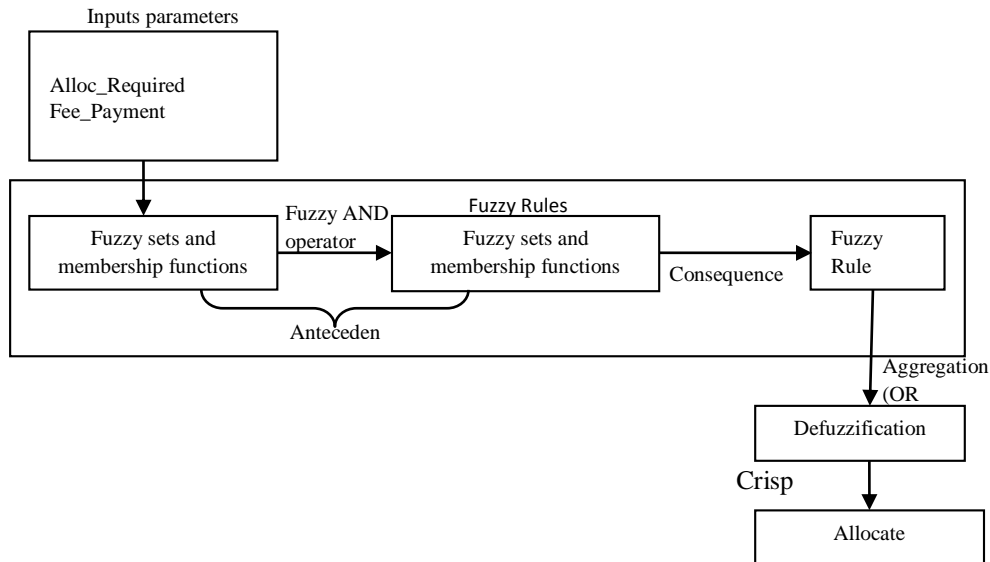


Fig. 1: the fuzzy-based allocation system diagram

An “IF THEN” Ruled based is then computed for the premise and applied to the conclusion part to determine the allocation of the accommodation. Consider the following definitions:

A = If ‘A_R’ is Min and ‘FP’ is Max then ‘A’

B = If ‘A_R’ is Max or ‘FP’ is Max then not ‘A’

Where A_R = accommodation required; FP = fee payment; and A = allocate.

The ‘min’ composition rules which is based on the principle of fuzzy logic operator ‘and’ is adopted as follows

If there are rules ‘ R_s ’, $s = 1, 2, \dots, n$, then the output signals of the rules ‘ R_s ’ is represented by the set; $\{O(R_1), \dots, O(R_n)\}$.

The aggregated output signal is computed by; $\min \{O(R_1), \dots, O(R_n)\}$.

It should be noted that $0(R_s) \leq 1.0$; $s = 1, 2, \dots, n$,

Defuzzification involves conversion of the linguistic variables to numerical or crisp values; this work adopts the centroid defuzzification method given as follows:

$$Z = \frac{\sum_{i=1}^n \alpha_i y_i}{\sum_{i=1}^n \alpha_i} \quad (3)$$

where z is the crisp value and can be used for decision making, α_i is the fuzzy implication (firing strength) of the i th rule $\mu(\alpha)$ is the degree of membership of the allocation value, y_i is the consequent of each rule.

A Decision Support Engine which has a Cognitive Filter and Emotional Filter as Sub Components.

The cognitive filter analyses the alternative output reports of the inference engine on the basis of the objective feelings of the network administrator. The emotional filter analyses the output reports of the cognitive filter on the basis of the subjective feelings of the network administrator. Basically, the decision support engine enforces a standard which serves as the basis for the comparative analysis of all the alternative output reports of the inference engine.

RESULTS AND DISCUSSION

Implementation of the System

The use of MYSQL database and Apache server combined with the use of programming language (such as PHP) and an output interface (such as HTML) makes the design of accommodation allocation system creation an easy one.

Welcome Home Page

This page shows links to other pages such as Admin page and Student registration page. It is the master page where all other pages are being displayed. It serves as content-place-holder. It is the only static page in the application where all other pages are dynamic pages.

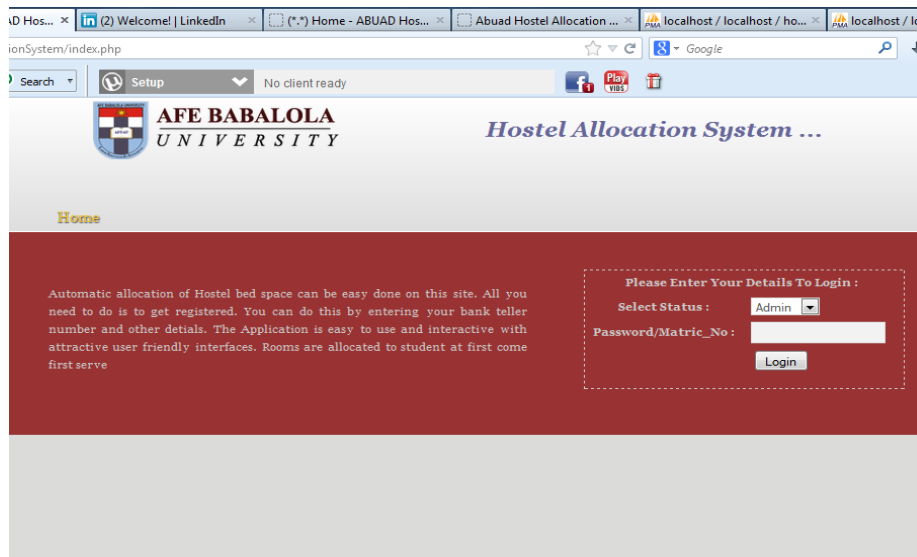


Fig. 2: Home page

Student Login Page

Students are expected to login to register for accommodation by entering their password which is their matric number. Then click on login to gain access into the system.

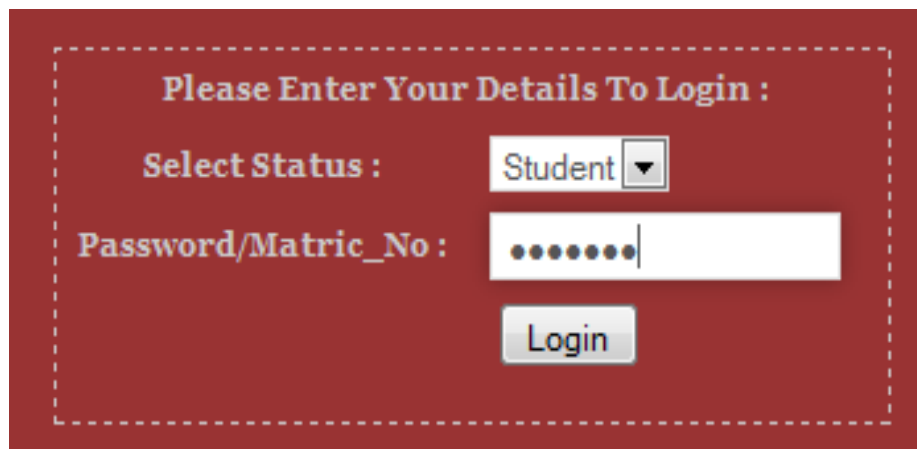


Fig. 3: student login page

Confirmation Page

The view or confirmation allocation page allows the student to view the details of his/her allocation of the online registration as soon as he or she submits the form.



Fig. 4: Confirmation page

Print Page.

After the whole processing of allocation, the student is permitted to print the allocation form.



Fig. 5: print page

CONCLUSIONS

At the end of the research, this system tends to solve the problem that arises from the existing system. The system reduces congestion; time wastage and ease stress on the part of both the students and the administrator.

This web application provides facility to conduct online accommodation allocation. It saves time as it allows number of students to apply for allocation at a time and it displays the slip for your allocation and automatically generate the room and wing you are being allocated to. The decision of fuzzy based allocation of accommodation was found to be better than non-fuzzy based.

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