Hostel Accommodation Allocation Using Rule-Based Techniques: A Case Study for Universiti Sultan Zainal Abidin

Abd Rasid Mamat, Anis Faridah Abd Razak, Mohamad Afendee Mohamed, Norkhairani Abdul Rawi, Mohd Isa Awang, Mohd Fadzil Abd Kadir, Fatma Susilawati Mohamed

Faculty of Informatics and Computing, Universiti Sultan Zainal Abidin, Malaysia

Abstract: The placement of students is a vital issue for the university or college especially in the main cities. This problem becomes more critical if the placement is not systematic, efficient, and transparent. Accordingly, the idea of the development of a rule-based expert system using PHP and MySQL makes the management of student placement more transparent and systematic. The main module of this system is where the user will display on the interface of list of rules on placement. Next, the system will make a conclusion based on the conditions entered by the user whether it's worth the placement or not. Finally, using this expert system, can bring out potential benefit including speedier, correct the process the placement the student, minimize the offense, transparent, and thus potential of the time saving.

Key words: Rule-based technique • Student placement • Hostel allocation • Expert system • Inference engine

INTRODUCTION

Universiti Sultan Zainal Abidin (UniSZA) has three main campuses with around 10,000 students in total. The placement of hostel for the student is very limited making all students compete with each other to successfully get the placement. In order to get the place in UniSZA’s hostel, there are several conditions that have been set and need to be fulfilled by students which will be checked by UniSZA Hostel Department. Managing the placement of the students in itself is a lot of works, consume so much time and other resources. In practice, student selection for placement involved several processes and parties. Students must complete the application form and show proof of joining activities and taking up responsibilities by attaching all relevant documents. To increase chances of getting placement, students must join all activities that are organized by the university or outside entities.

Meanwhile, hostel department is responsible for verifying the application and documentation submitted by students. The data need to be validated with the assistance from the association or club or organizer. Not only that, the level of involvement of students in the association or club or activities are also entitled to different points or marks, of which is finally used to calculate the merit. Lack of timely communication lead to disrupted or take more time for the placement process. Other problems that may occur are the mistakes of placement for unqualified students. The problems originated in such scenarios are considerably serious as that will encourage the disbelief among students in the system. In this research, we propose a rule-base expects system for easing the work of allocating hostel accommodation among students. The system is expected to smoothen the task and most importantly guarantee the fairness is assigning room only to those who deserve.

Many researchers have studied the expert system within this particular domain. The authors in [1, 2] have developed an expert system used to advise undergraduate students on the course selection. In [1], the system is used to represent the course selection rules and validate request from students. This system runs as a web based application. Student Residence Management System to facilitate application for accommodation online is reported in [3]. The aim of this system is to manage the different residential activities such as controlling booking, online payments and room allocation. This system is also able to notify and confirm all room allocations. Room allocation confirmation is sent by an email to a student who is given an accommodation. Meanwhile, in [4] a College Student Allocation System is developed in UiTM. The author reported the system had improved the task of allocating student accommodation and making it more efficient for a college student to use as well as for college management.
Moreover, [5] proposed a fuzzy-based accommodation allocation hostel system. The system was designed using a fuzzy inference model to make a decision for allocation. The system reduces congestion, time wastage and eases stress both from the students and the administrator.

The rest of the paper is organized as follow, the overview of the student hostel allocation system and the development of the system in provided in the Materials and Methods section. The result of this project in the form of system user interfaces and successful test are given in Result and Discussion section. Finally, the Conclusion section summarizes the findings of this paper.

MATERIALS AND METHODS

In this section, we discuss the building block of our expert system. It is divided into two parts, the architecture the expert system and the development of the expert system. The expert system is one of the areas of artificial intelligence and is also known as knowledge based system [6]. Ruled based expert system contains knowledge base, database, inference engine, explanation facility and user interface [6, 7]. The knowledge base contains the knowledge domain useful for problem-solving. The knowledge is represented as a set of rules. Each rule specifies a relation, recommendation, directive, strategy or heuristic and has the IF (antecedent) THEN (consequent) structure. The database includes a set of facts used to match against the IF (condition) parts of rules stored in the knowledge base. The inference engine carries out the reasoning such that in the end the expert system reaches a solution. It links the rules given in the knowledge base with the facts provided in the database. The explanation facilities enable the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed. An expert system must be able to explain its reasoning and justify its advice, analysis or conclusion. The user interface is the means of communication between a user seeking a solution to the problem and an expert system. The communication should be as meaningful and friendly as possible. These components are essential for any rule-based expert system [8].

The systematic development methodology is essential to produce a successful expert system development. The development of the proposed expert system follows the methodology shown in Figure 1. This methodology is adopted from [9, 10]. To enable the development process to run continuum, these methodologies can be divided into seven steps and are briefly explained next.

**Identify the Problems, Analysis the Domain Problem and Knowledge Acquisition:** One of the requirements that students needs to fulfill in hostel placement is the total merit score. Merit score is entered by Student Affairs Department (Activity Unit) after they received a name list from all secretaries of Club and Associations, secretary of Uniform Unit and secretary of program. To calculate merit for 10,000 students is such a burden and it is difficult to maintain the integrity as errors may happen in the key-in process. The calculation of merit based on student involvement in associations or clubs and at which level such as secretary, head or members. Merit calculations are also calculated based on student representation in sports and at what stage such as faculty, university, state or national level.

The techniques that are used to identify the problem and acquire knowledge are via conducting interviews, by providing questionnaires and later studying the answers with the respective experts. The knowledge acquisition about the students is used to decide whether the student is qualified for placement or otherwise. These knowledge are used for calculating the merit according to the involvement in activities. Besides that, the students year such as first-year students, final years student, student special condition such as disable student are also used. Some examples questions are the following.

- Does the student is foreign students?
- Does the student is first-year students?
- Does the student is final year students?
- Does the student are Bachelor in Medic and Surgery?
- Does the student are Diploma in Nursing
- Does the student involved in the association such as of SUKSIS, PALAPES and MPP. If yes, at which level?
The different level of position such as the head of project, secretary, committee members and member of the project get the different merit.

Does the student active in Sport. If yes in which level? Faculty, University, State or Country.

Specification of the System & Tools for Development:
This step is related to the whole process of the eMerit System. The specification of the system is viewed based on the process flow and data flow. The process flow refers to how the experts and knowledge engineer view the system based on the process that are represented in Context Diagram (CD). Meanwhile, the data is viewed based on the data flow and is represented by Entity Relationship Diagram (ERD). The tools that are used for development are PHP- Hypertext Pre-processor and MySql server as a database [11, 12]. The PhP is used for development whereas MySql contains the facts that are to be matched against the rules in the knowledge base. The development tools uses backward chaining (goal-driven reasoning) as it inference mechanism. Based on user's as well as developer's view points, the system includes the following main features:

- Easy for the future modification and expansion by constructing the system based on modular approach.
- Apply the concept of usability - user-friendly and easy to use.
- Provide the facility of data modification.

Construction of the Knowledge Base: In this step, the knowledge acquired from the previous step is converted into IF-THEN rules, before it gets coded using the development toolkits. The aim of the resulting system is to have all the rules in the knowledge base evaluated until the possible outcome appears. The general form of rules adopted in this paper can be described as following:

\[ \text{IF } x_1 \text{ AND } x_2 \text{ AND } \ldots \text{ AND } x_n \text{ THEN } y_1 \text{ OR } y_2 \]

The rules are usually expressed in two parts which is the IF part called antecedent or premise (or condition) and the THEN part called consequent or conclusion (or action) [13]. If the rules is of multiple structures (usually combination of rules using AND or OR operator), it can be reduced into a list of simple rules [14]. An example of simple and multiple rules are as follows:

- IF antecedent
- THEN consequent
- IF antecedent1
- OR antecedent2
- :
- OR antecedentN
- THEN consequent
- IF antecedent1
- AND antecedent2
- :
- AND antecedentN
- THEN consequent

Accordingly, knowledge can be represented in a various form such as rules, semantic net, Frames, script and object oriented [15]. In this study, we represent the knowledge is according to rules. The rules that are obtained from this research are:

Rule 1:

\[ \text{IF you disorder student (with verification) THEN Qualified for placement of the hostel.} \]

Rule 2:

\[ \text{IF you Final Year student THEN Qualified for placement of the hostel.} \]

Rule 3:

\[ \text{IF you foreigner student THEN Qualified for placement of the hostel.} \]

Rule 4:

\[ \text{IF you Bachelor in Medic and Surgery student THEN Qualified for placement of the hostel} \]

Rule 5:

\[ \text{IF you Diploma of Nursing student THEN Qualified for placement of the hostel} \]

Rule 6:

\[ \text{IF you involved in SUKIS AND your position is Head THEN your merit } = X_1 \]

Rule 7:

\[ \text{IF you involved in PALASES AND your position is Secretary THEN your merit } = X_2 \]

Rule 8:

\[ \text{IF you involved in SUKIS AND your position is Committee Member THEN your merit } = X_3 \]

Rule 9:

\[ \text{IF you involved in SUKIS AND your position is Member THEN your merit } = X_4 \]
Rule 10:

IF you involved in PALAPES AND your position is = Head THEN your merit = $X_i$

Note that $X_1$, $X_2$, $X_3$, $X_4$, and $X_5$ have different values and these values are dependent on the level of student engagement in clubs or association. For the future possible expansion, the existing rules can be modified or deleted or replaced easily within the system.

Prototype System: The prototype of e-Merit System has its inference engine implemented using PHP and MySQL. Based on the prototype, the experts can test whether the rule-based system is providing the result as expected by the human experts. If the result shown is not as expected, the module involved is deemed for refinement.

Testing and Validation: This is an important step of an expert system development process which is to ensure the performance reach the target as planned. It is an imperative process is conducted by experts before the system is deployed or used by the users. The testing process involved program debugging, error analysis, successful link among the module or menu, input acceptance, output generation and so on. Meanwhile, the validation concerns with the diagnosis of how closely the expert solution system match those of human expert [16]. The main objective of this step is to ensure the prototype is free form erroneous and the results of every process are as expected.

RESULTS AND DISCUSSION

In this section, the discussions of the result are directly related to the functionality of the system. The GUI of the expert system is captured and is shown as in Figure 2 to Figure 4. Figure 2 represents the login module for users to access the system. The rules of hostel application that are filled by the student is illustrated in Figure 3. These rules are checked against the rules in the database. The secretary also fills up the information about student's participation in an association or club and attaches the proof using form shown in Figure 4.

Fig. 2: The Login Form for the users

Fig. 3: Application Form (Rule Based) for Hostel Accommodation
Fig. 4: Activity Form for club

CONCLUSION

A rule-based expert system has been proposed for student placement process at University Sultan Zainal Abidin (UniSZA), Terengganu. The system consists of several modules such as student module, organizer module (club and association) and admin modules. Using this expert system, it can be very beneficial in terms of speedier process of allocating student placement the student, minimizing the error and faulty assignment and thus significantly saves resources.

REFERENCES
