

DESIGN OF AN ONLINE EXPERT SYSTEM FOR CAREER GUIDANCE

S. Saraswathi¹, M. Hemanth Kumar Reddy², S. Udaya Kumar³, M. Suraj⁴, Sk. Khaja Shafi⁵

¹Professor, Information Technology, Pondicherry Engineering College, Pondicherry, India

²Student, Information Technology, Pondicherry Engineering College, Pondicherry, India

³Student, Information Technology, Pondicherry Engineering College, Pondicherry, India

⁴Student, Information Technology, Pondicherry Engineering College, Pondicherry, India

⁵Student, Information Technology, Pondicherry Engineering College, Pondicherry, India

Abstract

This paper focuses on the construction of an online Expert System which guides the students for the selection of their undergraduate courses after the completion of higher secondary school education. The system is online in the sense that it will provide up-to-date information to the students. The proposed system takes the necessary details from the user (student) as input. The system will have the knowledge-base which contains the details about the colleges in Pondicherry. This information is acquired from web pages using pattern matching and jSoup parsing technique and the knowledge-base is constructed automatically without manual efforts. Rules are framed and an inference engine is developed which makes the Expert System. The constructed knowledge-base can be queried with domain related queries and the Expert System provides the most relevant details for the query.

Keywords: Artificial Intelligence, Expert system, Inference engine, Knowledge-base, Rule based system

1. INTRODUCTION

A proper undergraduate course selection is an important decision in the life of higher secondary students. Every year thousands of high school students in every country face the challenge of choosing their most suitable university/college course. It is a difficult and time consuming task because many factors contribute towards taking the accurate decision like student interest, marks in high school, financial status of the parents etc. Many students should approach some human experts who has knowledge about the colleges and courses. With today's increasing number of colleges and courses the details provided by a human expert may not be fully sufficient to judge whether a college/course will suit for a particular student. Artificial intelligence methods like **Expert Systems (ES)** can help and save time in this domain because an ES can provide a fast expert advice based on the knowledge from its knowledge base component.

The programs that attempt to emulate the behaviour of human experts are known as Expert Systems. These are usually confined to a specific field. Expert System is a branch of Artificial Intelligence that attempt to replace human experts. Expert systems can either support decision makers or completely replace them.

Regarding the domain of career guidance, Expert System technology seems to be the most successful method of computerization because the dialogue between human advisor and the student can be conveniently emulated by the dialogue between the ES and the student, and the reasoning of the academic advisor can be successfully automated by the

reasoning power of ES; particularly the rule-based ES. A rule based ES captures human knowledge using If-Then rules in a rule-based knowledge base. In this work design & development of an Online Expert System for guiding the high school students in selection of their under graduate courses has been discussed.

The literature review of the Expert System design for the student major selection has been discussed in section 2. The third and fourth section deals with proposed method of constructing the Expert System for career guidance. Finally, the results are analysed.

2. RELATED WORK

The existing system is an Expert System with an Object Oriented Data Base for the University Undergraduate Major Selection. A knowledge base was developed and various rules are framed using Kappa-PC method. A user interface was developed between the system and the user.

M. Ayman Al Ahmar[1] has developed a prototype rule-based Expert System with Object-Oriented (OO) modelling techniques for guiding high school students in selecting suitable undergraduate university majors. The system has a graphical user interface with simple menus. The architecture used in the design of the system resulted in a successful software system that is easy to maintain, modify, and extend.

Shervan Fekri-Ershad, Hadi Tajalizadeh, Shahram Jafari[2] designed an automatic Expert System that helps the university department head to choose best lecturer for each course among

of the volunteer respectively. Decision trees are made based on facts which are extracted from human experts who are really heads of university departments in first phase. The designed system is a rule based system. In the second phase, rule sets are extracted from each decision tree and the best lecturer for each course is chosen.

Muhammad Zaheer Aslam, Nasimullah, Abdur Rashid Khan, Gomal University[3] designed and developed a rule based Decision Support System that will help students in selecting the best suitable faculty/major decision while taking admission in Gomal University, Dera Ismail Khan, Pakistan. The basic idea of their approach is to design a model for testing and measuring the student capabilities like intelligence, understanding, comprehension, mathematical concepts plus his/her past academic record plus his/her intelligence level , and applying the module results to a rule-based decision support system to determine the compatibility of those capabilities with the available faculties/majors in Gomal University.

3. MODULES OF THE PROPOSED SYSTEM

The striking feature of our system is the dynamic updating of the college information without manual effort. This information is acquired from web pages using pattern matching and jSoup parsing technique. A knowledge base is developed from the obtained information. The knowledge base is constructed based on the set of rules.

The If-Then rules of the rule-base can be classified into two categories:

- (1) University Admission Requirements Rules, and
- (2) Students Preferences

The former rules are concerned with the academic conditions that the universities apply to accept students in various branches like high school scores, grades in specific courses, the high school graduation year etc. In the later, the list of students preferences will be enquired and then based on those preferences the knowledge base will be developed. On the basis of the details from the student and the knowledge base the information about the colleges & courses will be provided to the students.

There are 5 modules.

1. Web Information Extraction
2. Structuring extracted information
3. Developing Rule based knowledge-base
4. Details from the User through an user interface
5. Providing the required information to the user

First step is to extract the information about various colleges and to store it in the knowledge-base. Then rules are framed based on the knowledge-base and the facts. The developed system will get certain details from the user as input and based

on his requirements and the eligibility criteria for the colleges, the user will be provided with the needed information.

3.1 Web Information Extraction

Under this module, information extraction from the web sites of all the colleges in Pondicherry is done. All the knowledge that is necessary and available in the web sites have been extracted and stored. The web information extraction has been done in java.

From the college sites the important information is extracted. To extract the necessary information from the colleges, the tags which correspond to the particular type of information are used. For example, if we need placement details from a college, the tag name which correspond to placement field from that college is to be chosen. The tag name varies with colleges because all the colleges will not have the same kind of web page alignments. With the proper tags all the relevant useful information is extracted and stored in a text file format.

3.2 Structuring the Extracted Information

The web information extracted from the web sites of the colleges will be in a random order. It depends on the college website format. In order to have all the information from colleges in a particular order the tags from each website are cross checked and the corresponding matching tags are aligned in an order. The aligned data is then stored in the knowledgebase so as to frame the rules of expert system.

The structured format of the extracted information will be as shown below:

College General Details:

- About PEC
- Campus Life
- Administration
- Gallery
- Academics
- Undergraduate
- Postgraduate
- Research
- Scholarships
- Admissions

Departments:

- Electronics & Communication Engg.
- Computer Science Engg.
- Information Technology
- Electrical & Electronics Engg.
- Electronics & Instrumentation Engg.
- Civil Engineering
- Mechanical Engineering
- Chemical Engineering
- Science & Humanities

- Mathematics
- Physics
- Chemistry
- MCA

Facilities:

- Placements
- Alumni
- Campus Life
- Hostels
- Amenities
- Dispensary
- Students' Council
- Department Students' Council
- Sports
- Extra-Curricular
- Cultural Festival
- Spic-Macay
- NSS
- Welfare Fund
- Training & Placement
- Temples
- ATM & Banking
- Guest Houses
- Special Lectures
- Alumni
- The Sports complex has a Badminton court and table tennis. There are two basketball courts and two volleyball courts adjacent to the football & cricket ground.

3.3 Developing Rule based Knowledge-Base:

In this module design of the Expert system by constructing the following components[7] corresponding to the ES has been done.

1. Knowledge-base
2. Inference Engine
3. User Interface

Knowledge-base will have all the extracted information that is necessary about the colleges. All the information needed may not be present in the web-sites. The missing information will be manually collected and entered into the knowledge-base. The system holds a collection of *general principles* which can potentially be applied to any problem - these are stored in the *knowledge base*. The knowledge base has been constructed using the concept of ontology.

This information is processed by the *inference engine*. Inference Engine is a knowledge processor which is modeled after the expert reasoning. The inference engine developed is a rule-based reasoning. The essence of a rule-based reasoning system is that it goes through a series of cycles. In each cycle, it attempts to pick an *appropriate* rule from its collection of

rules, depending on the present circumstances, and to use it as described above. Because using a rule produces new information, it's possible for each new cycle to take the reasoning process further than the cycle before. This is rather like a human following a chain of ideas in order to come to a conclusion.

3.4 Data Representation: Relational Knowledge-Base

For Example: If: The student's high school certificate type is Literary and grade is greater than or equal to 60% and less than 65%

Then: Add the following majors to the student's allowable majors list: Accounting, Management, and Sociology and Social Work

The overall architecture of the expert system will be as shown below:

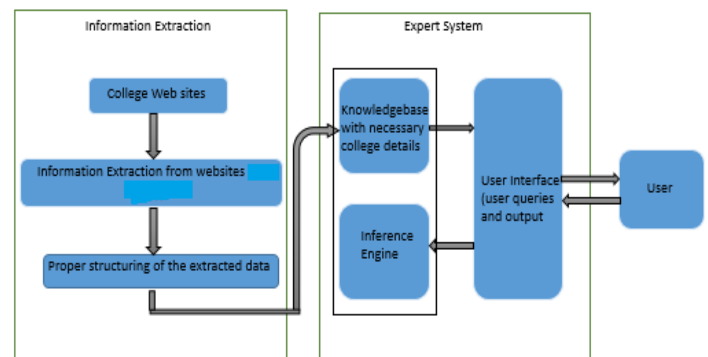


Fig 1 Architecture of Expert system

Advantages of Rule Based System:

1. The principle advantage of production rules is notational convenience - it's easy to express suitable pieces of knowledge in this way.
2. This would seem to be a purely declarative form of knowledge representation. One gathers pieces of knowledge about a particular subject, and puts them into a rule base. One doesn't bother about when or how or in which sequence the rules are used; the production system can deal with that.
3. When one wishes to expand the knowledge, one just adds more rules at the end of the rule base.
4. The rules themselves are very easy to understand, and for someone (who is expert in the specific subject the system is concerned with) to criticise and improve.

3.5 Details from User through a User Interface:

The user communicates with the expert system through the user interface. It allows the user to query the system, supply information and receive advice. The aim is to provide the same form of communication provided by the expert. With

the help of user interface, necessary queries will be collected from the user. These queries are mapped with the rules from expert system. The queries will be on the region in which the student comes, which stream the student opt for, which branch the student prefers, fees he can pay, 12th percentage, whether he has reservation or he belongs to general category, whether hostel facility needed, current age as on date. All the queries that are collected from the user will be stored in a knowledge-base. All these queries will be the input for our domain.

3.6 Providing the Required Information to the User

In this module the student will be provided with the information regarding the colleges which he can get based on his requirements. Apart from the user query knowledge-base we will have the college knowledge-base details and the rule production system. After cross verifying the user details with the system the best suitable college for the student will be suggested in the output screen. The output will be in such a way that the student will be given with all the flexible options for him so that he can choose among them.

4. PERFORMANCE ANALYSIS

The constructed expert system is queried with 5 types of queries related to our domain from the user perspective. The corresponding results are compared, one from that of a web and the second result from that of the proposed system viz dynamically updated expert system for student guidance.

The test queries are categorized as follows:

- Type A – College types, branches present in the college and colleges situated in various regions
- Type B – Based on the percentage of the students, the colleges and corresponding branches the student can get will be tested
- Type C – Analysis from the past years statistics of colleges
- Type D – Comparison of two colleges and its facilities
- Type E – College placement details and other facilities present

From the possible number of queries under each type a sample of 10 queries is given as input and results have been obtained from the implemented proposed system and the corresponding results are analyzed.

Some of the example queries are:

- The colleges in Pondicherry with Hostel
- Placement details in a particular branch in a college
- Colleges for only women
- College ranking based on placement factor
- College ranking based on faculties
- Compare two colleges and their facilities
- Cut-off for a particular branch last year
- Which branch has more demand presently

Display the cut-off marks for IT branch in various colleges

A survey has been conducted on the developed system with various users (students) in Pondicherry to analyze the performance of the Expert system.

Table 1 shows the users rating on the Expert system after their analysis on the system. From the analysis, it is identified that the proposed system provides the best results within the concerned domain.

Table 2 shows the accuracy of the Expert system for each type of test queries. The accuracy has been measured in comparison of the human expert results.

Table 1 Survey Rating

Rating of Expert System	Percentage of users
1	5
2	15
3	20
4	25
5	35

Table 2 Accuracy Measurement

Type of query	Accuracy (in percentage)
Type A	95
Type B	89
Type C	85
Type D	81
Type E	87

Rating from 1 to 5 is given and a graph is plotted based on the obtained ratings from the users. Also, accuracy of the system has been checked based on the test queries and graph is plotted.

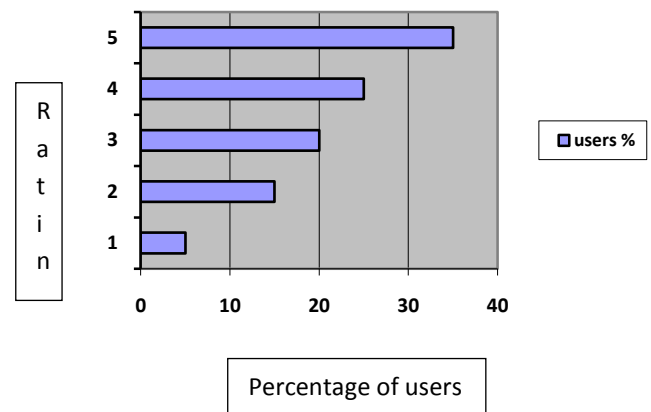


Fig 2 Performance Analysis Survey

Figure 2 shows the performance analysis of the developed Expert system. X-axis has the users who were involved in the survey and Y-axis represents their rating on the Expert system.

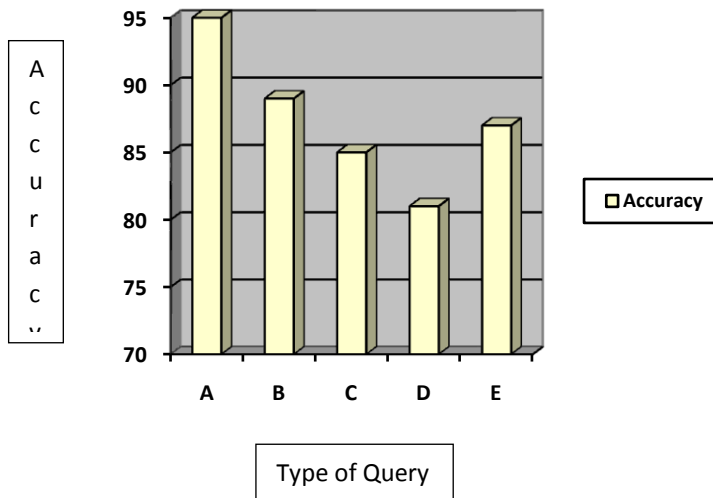


Fig 3 Accuracy Measurement

Figure 3 shows the accuracy of the developed Expert system based on various types of test queries. X-axis has the type of queries and Y-axis represents their accuracy percentage.

5. CONCLUSIONS

The proposed system generates assuring results and it reduces a great deal of human effort in the extraction of knowledge and providing the students correct information which helps them in choosing the right path, updating the details frequently to provide the up-to-date information. The dynamic updating of details is also one of the significant features where the outdated contents of knowledge-base are automatically pruned and new values are updated thereby enhancing the accuracy and reliability of system. The future enhancement could be extending this system to handle complex queries by making the system to accommodate all possible information apart undergraduate courses alone.

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BIOGRAPHIES



Dr. S. Saraswathi is the Professor, in the Department of Information Technology, Pondicherry Engineering College, Pondicherry, India. She is the Head of the Department. She completed her PhD, in the area of speech recognition for Tamil language. Her areas of interest include speech processing, artificial intelligence and expert systems



M. Hemanth Kumar Reddy is final year student of Department of Information Technology, Pondicherry Engineering College, Pondicherry, India. His areas of interest are Artificial Intelligence, object oriented programming



S. Udaya Kumar is final year student of Department of Information Technology, Pondicherry Engineering College, Pondicherry, India. His areas of interest are Object Oriented Programming Concepts, Artificial intelligence and Computer Networks



M. Suraj is final year student of Department of Information Technology, Pondicherry Engineering College, Pondicherry, India. His areas of interest are Artificial Intelligence and Data Structures



Sk.Khaja Shafi is final year student of Department of Information Technology, Pondicherry Engineering College, Pondicherry, India. His areas of interest are object –oriented Programming concepts and networks.