



## Design of a Fuzzy Expert System as an Intelligent Assistant for Thesis Supervisor's Educational Counseling

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**Abstract.** Nowadays, much of educational affairs of university students are done electronically which obliterates the necessity of physical presence of students in university. However, there are some cases in which supervisor-student interactions with regard to educational, advisory and counseling issues require physical presence of students in the university. The present study introduces an intelligent expert system as an assistant to the supervisor which has solves the problem. The database of this system is rule-based and is devised in such a way that uses a faultless inference engine which yields to future developments. The inference engine of the system employs forward chaining and works on the basis of deductive and inductive inference. Cost reduction, synthetic knowledge and greater availability are among the advantages of this system.

**Keywords:** Expert system, fuzzy logic, educational counseling, supervisor

### 1. INTRODUCTION

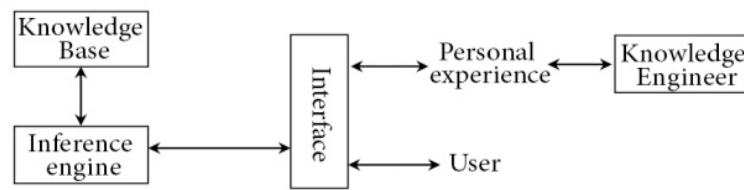
With the development of IT technology, knowledge-based decision-making partner systems have reached greater significance and are applied in many administrative, social, economic, and medical issues [1]. In this regard, expert systems function as significant applications of artificial intelligence. The greatest advantage of these systems is that they are based on knowledge. In these systems, the expertise of the specialist is transferred to the computer and the computer simulates inferences made by specialists. Expert systems have found great use in as diverse areas as industry, control, space navigation, medical diagnosis, decision making and so on [2].

In the educational system of a university, college students need counseling with respect to the selection of course units, continuing their studies as well as obtaining information about their future job opportunities. In the absence of counseling, these students might get confused in the process of selecting the best courses, the best curriculum in a semester due to their inadequate information about the courses requirements which might negatively affect their planning for future educational career or job applications. Each selection on the part of students requires knowledge, experience and relevant skills. The present study strives to introduce a knowledge-based expert system for student counseling which can help them make the best decisions, select the appropriate courses, and work for future job opportunities. Given the fact that the traditional ways of problem solving could not easily solve these problems as well as the absence of a definite algorithm, expert systems seem to be the best problem solving device [3].

The basic components of an expert system are shown in figure 1 below:

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**Figure 1.** The structure of an expert system [4].

### 2. THE SUGGESTED EXPERT SYSTEM

The potential and early evaluation of the system is based on Bachman algorithm. Table 1 shows the results of the assessment of the potential of the system in the form of correlations.

**Table 1:** The results of Bachman potential assessment in different parts of the system.

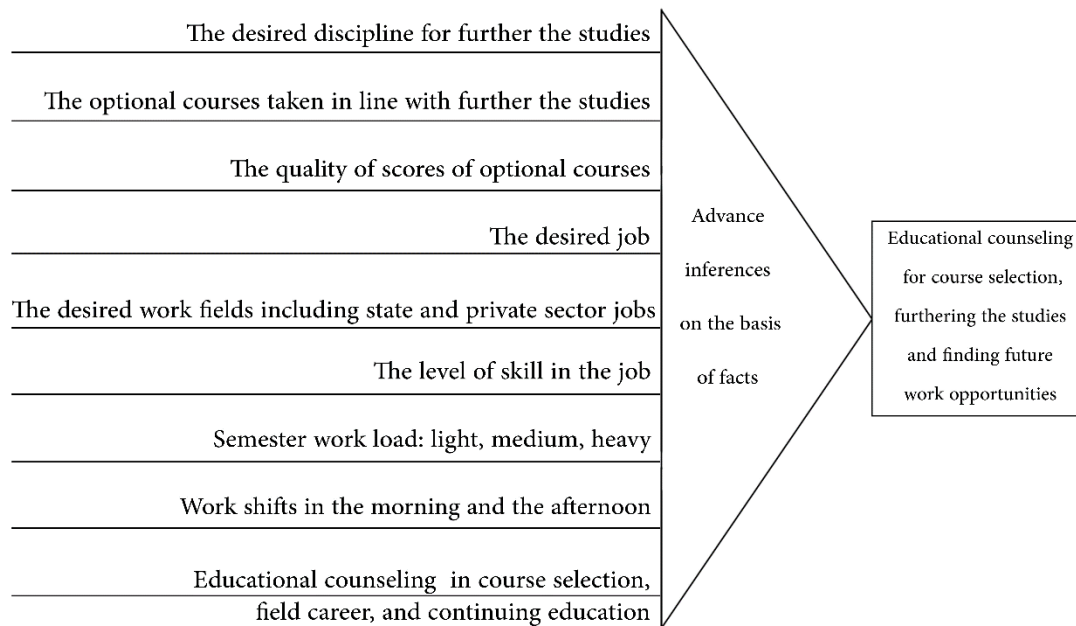
results	Furthering studies	Future job opportunities	Course selection
Expert knowledge requirement	3	3	3
The need for indefinite knowledge	3	2	2
The cost of designing knowledge database	1	2	1
Precise and definite algorithm	2	2	1

The suggested system can offer advice to the students in areas such as question answering, intelligence course selection, furthering the studies and future job opportunities through connecting the database to the knowledge base. The suggested system, using database and knowledge base, could supplement the present systems with intelligent decision making procedure and could function as an appropriate substitute for supervisor’s counseling services.

The only shared component between the proposed system and the present educational systems is course selection procedure. The proposed system, over and above observing the educational regulations, offers a perfect weekly timetable in the output section of course selection unit in which appropriate class hours in line with the personal life of the student, work load, the types of courses offered, and furthering the studies and future job opportunities are delineated. The present advice systems are incapable of offering advice to students in these areas due to their lack of expertise and impossibility of acquiring new knowledge and experience.

Table 2 illustrates Mockler chart of the proposed expert system with three components of course selection, furthering the studied and future job opportunities.

**Table 2.** Mockler chart [5].



**2.1 Knowledge Base**

The design of knowledge database as a key component in knowledge-based expert systems which is highly significant in the diagnosis and proper solution of problems was done in a rule-based procedure which could be easily promoted in the future without any concomitant error in inference engine. If P then Q rule was used in designing of the system including two components of RHS and LHS which stand for establishment and storage parts respectively[5]. In the proposed system, all input, intake and analysis parameters are considered as facts of the system in the inference process of inference engine. A significant part of knowledge in the expert system is heuristics in nature which draws on the experiences of the expert, books and other scientific sources to establish the system in a rule-based procedure.

The database of the proposed system, over and above the knowledge base, includes tables, full information of the chart such as the degree of difficulty and time consumption, the density and condition of each course unit, full information with regard to course units offered in each semester such as the exam hours and so on. The database enjoys 5 tables for the courses. The establishment of the system enjoys a multilayered programming. The knowledge base, database a coding of the systems are interwoven.

**2.2 Inference Engine**

The inference engine offers techniques for problem solving. Owing to the diagnostic (advance) nature of problem solving, advance inference chaining is used in simulation of argumentation and expert decision making. In this procedure, the inference engine starts with the section of “IF” related to the first rule and fact and goes on to achieving the result in the “THEN” section [6].

### 2.3 User Interface

The success of an expert system relies heavily on the quality of user interface. The user interface of the expert system is incorporated in the system in order to be used by the user. C# programming has been used in the design of the user interface due to its high graphic capability and flexibility.

### 2.4 Fuzzy Logic

Einstein's description of the inadequacy of the laws of classic logic in mathematics is of great help when we talk about the true or wrong interpretation of things and phenomena in the real world. The emergence of fuzzy logic has helped science in many disciplines. The application of fuzzy logic in software science could be summarized as follows: Fuzzy logic has gone beyond the logic of 0 and 1 values in classical software science and has opened a new perspective to the world of computer and software. This is because fuzzy logic uses the unlimited space between 0s and 1s in the process of its argumentations and application. The proposed system offers the best and the most precise inferences. The fuzzy nature of the new logic has a great effect in the manner of response. The facts of the system are recorded and analyzed according to fuzzy logic. Also, popular fuzzy terms such as low, high, probably, rather high and so on are used in obtaining the facts in the system. The indeterminacy of the system is tackled with the use of fuzzification of facts as well as the use of Bayesian probability functions to decrease the errors of the system to the minimum levels. Inferencing is done together with distribution [7].

## 3. CONCLUSION

The introduction of the designed expert system as an intelligent assistant for thesis supervisors for educational and professional counseling is a new developmental stage in the process of mechanization of universities. The system enjoys advantages such as high flexibility, cost reduction, high speed in response, as well as high availability. The system allows promotion to higher levels in knowledge database without any concomitant problem in the inference engine. Moreover, the system allows the use of an operator for incorporating any changes and required updating of courses in the curriculum. Finally, the system is capable of transmitting its expertise to any discipline or synthetic knowledge and could be a symbol for working in secure and multipurpose working environments.

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