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Research paper

Selecting a College Academic Branch- a Design Decision Taking System for Student Career Selection

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Abstract

Student advising is an important task that every advisor must participate for his/her career. This paper defines the essentiality of the software, decision taking system for students to select their academic branch interests. By developing this software student interact with the system and specifies their interested jobs and based on their interests the system gives some suggestions from these suggestions the student should take decision in choosing their academic branch. A research is conducted by certain students in university, a set of questionnaires are given to students which asks about their interests and career possibilities. Set of results were taken by considering these questionnaires and compared with the results of computer system, a drastic change in the results was observed. The results obtained when students interacting with computer system are more efficient than the questionnaires given by the counselors. The computer system which is developed is more efficient when compared to manual counseling which takes more time to interact with students and analyze the results and say the correct career which a student has to choose.

Keywords: *Academic Advising; Career choice; career guidance; Decision Support; Manual advising; Web Advising.*

1. Introduction

Students who are entering into graduation are showing interest in joining the courses like engineering, science and technology courses etc. [11] which are currently most serious issues confirmed by national science foundation. Career selection is one of the most important activities in every individual's life [1]. For selecting a career the faculty members of an institution must give advices to the student in which branch he/she should choose. These effective advising consists of providing current information and technologies. The selection of academic branch will lead to an acceptable career for students who are entering into graduation. Higher education is a powerful tool for the students to build a knowledge based society of present century. Computer system which is called an expert systems, assesses the academic major of a student has gained great influence than the manual counseling which is given by the advisors in an institution or universities. The students do not know their real capacity and abilities for choosing the career options [2]. The students who are entering into higher education do not know the capabilities of the faculty. So a decision support system is an expert system which is helpful to choose their interested branches and according to these interests a career is selected [3]. In universities or any educational institutions faculty in those institutions do counseling to the students and help them to complete the registration process. A perfect planning should be done from both students and teachers. Academic advisors discover many problems, opportunities, improvements and discover new courses as technology increases and which may be useful for the students to cope up in the industry.

Many of the universities or institutions in the world are using automated counseling systems which are also called as web based counseling systems [4]. These web counseling systems are more useful and helpful for the students and faculty in which they assist the students to take better selection of the branches which lead to interesting career opportunities.

The system allows the faculty to enter the student information and also it allows faculty to enter the grades of students for assignments and exams. This system provides details of the courses which a student registered and the backlogs information is also displayed for the student future reference. This decision making system also have some questions which are asked in various areas and measure the capacity of the student in these fields and the intelligence level is measured [2]. Most of the institutions develop this decision making systems in rule based model. Some rules have been used in designing this expert system known as CLIPS rules. The total number of students who are entering into different academic degrees are increasing year by year. Here is the table which represents total number of students entering into different degrees. As mentioned in the table 1.0, these are the reports of students who are entering into different courses every year. These students may choose their degree based on his/her interest or based on the interest of their parents. If student does not choose his branch according to his/her interest, then his career is effected and he can't do job with interest. Some develop computerized systems using artificial intelligence techniques for problem solving abilities in a more efficient way. The methods which are used in problem solving are logical programming, fuzzy logic, neural networks, hybrid intelligent systems etc.

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Year	Student Enrollment								
	Ph.D.	MPhil	M.Tech	B.Tech	PG Diploma	Diploma	Certificate	Integrated	Total
2012-13	95425	30374	3448151	23890309	194072	2207551	191871	95664	30154417
2013-14	107890	31380	3822219	25500325	276502	2285576	187340	125002	32336234
2014-15	117301	33371	3853438	27172346	215372	2507694	170245	141870	34211637
2015-16	126451	42523	3917156	27420450	229559	2549160	144060	155422	34584781
2016-17	141037	43267	4007570	28348197	213051	2612209	166617	173957	35705905

The methods which are used to solve the problem are mainly dependent on the type of the problem and whether the database has explicit data on the current problem [5]. Here we are using some artificial intelligence techniques to counsel a student for his/her academic branches which makes him to give best in his academics and get careers best job.

1.1. Academic Advising:

In the present days student detention is one of the important factor for a counselor to advise the student not to do that mistake and choose their interested branch [4]. Some people play an important role in advising students about their career, those persons are called as mentors/advisors/counselors. Many universities/institutions are using newly developed technologies for academic counseling so that faculty can involve more time in planning about student's career development rather than wasting so much of time on paper based advising system. Successful advising involves knowledge base of the students who are requiring advice. In addition to this counselor should have sufficient knowledge about the academic courses and curriculum requirements within a university/institution. A person who has complete knowledge on all these activities will give correct and accurate guidance to the students who are entering into higher education [4]. So far students are the key persons to select their career choices but now the percentage of the job seekers and the persons who are willing to do jobs in their particular branch are decreasing. So the concept of academic advising came forward. Students are willing to do job for every lower salaries and this may affect their future life. In previous academic advising is done by faculty members of an institution. Some questionnaires are given to students and they have to fill those forms and submit it to the faculty, then that faculty advises branches for which the students suits for. The general questionnaires format is as shown in figure 1.0

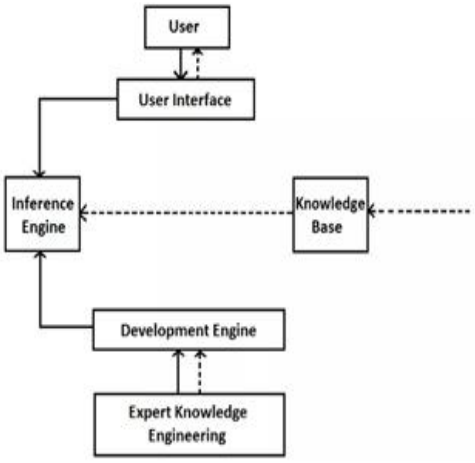
Name of the student:
Name of the counselor:
Branch which he wanted to choose:
Branch which the counselor suggested:
Questions:
a) What is your percentage in Intermediate?
b) What is your interest of study?
c) Is programming an interested subject to you?
d) Do you like to have electronics as a main subject?
e) What are your hobbies daily?
f) Give some sample examples of jobs you prefer?
g) Are you willing to work as software engineer?
h) What jobs are you interested in (government/private sector)?

1.2. Expert Systems:

An expert system is a computer system which contains large amounts of data in it and it emulates decision making just like a human being. Expert system is a knowledge base that has knowledge on domains and uses inference rules which adopt human knowledge. Expert systems do not adopt human capacities. Expert systems are designed to solve many complex problems which a human expert can solve. The term intelligence has many rules called cognitive rules which include problem solving ability, learn and understand the problems. It solves large complex problems by reasoning through knowledge and is represented by mainly if-then rules. These are the first successful machines which are developed in artificial intelligence (AI) techniques.

Expert system represents the knowledge of human expert in heuristic form. The main concept of expert system is to store the knowledge of the human expert in a machine and used whenever needed. Expert systems are used to give advice to different people who are working/studying or any other in a more systematic way. Expert systems are built with knowledge of different streams such as engineering, arts, sciences etc. From the survey it is known that problem solving capabilities of expert systems are better than human experts. This expert system is divided into two parts which are knowledge base and inference engine. First part knowledge base represents facts and rules. The second part which is inference engine applies these facts to improve new facts from already existed facts. Experts systems are examples of knowledge- based architectures. These are the first commercialized systems to use this knowledge based architectures. Knowledge based architectures are basically categorized into two parts which are knowledge base and inference engine. Knowledge base represents facts around the world. Inference engine is an automated reasoning system which evaluates the current state of the knowledge base. Inference engine has two modes which are: forward chaining and backward chaining. An expert system is built in the process of knowledge base that knowledge is taken from particular domain in engineering those which are taken from human advisors. Figure 2.0 shows the general working of the expert system. User interacts with an interface (system) and the queries which are requested by the user are given to the inference engine. In the same way knowledge base which contains all the information also interacts with the inference engine. There is another component expert knowledge, which contains all the unknown information about different disciplines and this is communicated with the development engine. The information which is collected from the expert knowledge component is given to the development engine and this interacts with inference engine which delivers information to the user.

Figure 2.0



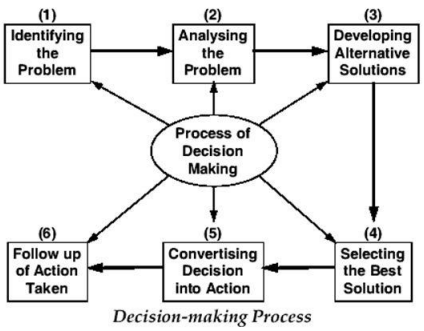
1.3. Design of Expert System:

Knowledge based system is a computer program which is used to support human decision making, most of which are developed on PC. The knowledge base covers questions based on particular

domain and will provide answers to these questions based on that knowledge. In the design of a knowledge base, certain rules are involved. These rules are mostly IF/THEN rules. IF portion is known as rule premise. THEN portion is known as rule conclusion. Firstly when the program runs the rule premise is tested. Some sample rules are as follows. [6]
If mortal and immortal then false i.e. not (mortal and immortal)
If odd and even then false i.e. not (odd and even)
If vowel and consonant then false i.e. not (vowel and consonant)
If adult and minor then false i.e. not (adult and minor)
etc. The main goal of this paper is to develop a computer assisted program for academic counseling which is useful for newly joining students in different branches of higher education. The design of this system includes one advisor, one knowledge expert and several students who are entering into their graduation program. The system consists of eight basic rules. Each rule is concerned with one class. Here we consider certain departments like computer science, mechanical, electronics and electrical. The students are requested to solve these questions which include subject knowledge. When student answers different questions, this system suggests particular career path like which branch is suitable for him/her.

1.4. Decision Making Systems:

Decision making is playing very important role in every individual life. For a student to select a career decision making plays a crucial role. In previous counseling through human experts is used but later the number of students studying increased and the time to counsel for a human is increased. Then some people decided to develop a decision making system in which the human expert's knowledge is included in the system. Every faculty related to their branch suggests student to join in their branch only. But no one understands the career interests of the student. Questionnaires are made ready to interact with the students, these are developed in the form of a system. Various questions are asked to the students about his/her career interests and the system analyzes these answers and decides the career path of the student through some rules. Decision making system is an information retrieval system which is used for many business or organizational activities. Decision making systems are either fully computerized or human expert or combination of both. A decision making system includes knowledge base. It is designed as an interactive software system which helps decision makers to solve complex problems from raw data and give desired outputs which help in decision making. This decision making is a cognitive process which results in certain actions among several choices in career selection. We develop decision support system in cognitive models which is replacement of human expert. Decision making system is mainly used in business and management of student activities. Some Decision making systems are developed using rule based systems which applies artificial intelligence techniques and some are developed using predicate rules in artificial intelligence. In decision support systems different categories are analyzed which a human expert can do. The questionnaires are inculcated inside the system and it asks several questions and analyzes the mental ability of the student and suggests the career path. Basic format of interactions with decision making systems is shown in figure 3.0. In general sense problem is identified and analyzed. Different solutions are developed for the identified problem from these solutions a best solution is taken. The taken solution which is in the form of action is converted into decision and these decisions are checked again and again whether the taken action is converted correctly into decisions are not is tested. The whole process is monitored by the decision making system which involves all these actions and the result is computed within the system. The result is displayed basing on the prediction of the system.
Figure 3.0



Decision-making Process

1.5 Career Counseling:

Career guidance and career counseling is one and the same in terms of choosing a career. Career counselors are who gives advice to the students based on their domain knowledge and helps the students to choose their own career. These counselors help in taking decisions of complex problems, in difficult situations. The main focus of counselors is on general topics like career exploration, career change, career development and other related issues. Counseling is substituted with the word guidance in British language and is made popular by giving certain suggestions to students about their career. In UK they call career counseling as career guidance or career advice. Career guidance or counseling helps in assessing variety of professional activities that help people in dealing with career based decisions. So based on these career counseling has become one of the most important issues in every students life. Students does not know what is the correct path to take in their life, they either listen to their parents words or go with their friends decisions. These affect student's life badly and they may move to wrong paths. Career counselors help in making decisions to students in suggesting right career path for each and every student. Career counselors can additionally support students in getting suitable jobs.

2. Literature Survey

Ankit Mundra & Ashutosh Soni [1] career decision making is one of the important role in student's life to select their interested career option. Many of the students does not opt their career as their own, the career is suggested based on the interests of their parents. If the career which is opted is wrong then it reflects the future life of the student. He may not study with interest and the student spoils his/her career. The proposed a system which helps in counseling students, for career selection. Now a day's most of the students are considering engineering as their major career objective and it is discussed in this paper through certain comparisons.
P. Clay Rowell, A. Keith Mobley, Gulsah Kemer, and Amanda Giordano [7] proposed a system for the college students who face a lot of problems in selecting their career. Many types of difficulties arises due to lack of information about certain branches, lack of communication with faculties, lack of information about certain ways to obtain information, insufficient information, lack of knowledge on selecting process etc. As student strength is increasing year by year, the counseling approaches for the students become tough. So an alternative way is to design and develop and expert system which maximizes the effectiveness of the career decision making abilities.
Fawzi Albalooshi, Safwan Shatnawi [8] proposed a system which is a computerized system which assesses academic information of a student about previous educational information, transcript records and present registration plans. This system is multidisciplinary in which each department can include their objectives, subjects and plans with administrator privileges. This system can be used anywhere and everywhere and thus overcoming the time barriers, which are major disadvantages in human counseling.

Vasile paul bresfelean, nicolae ghisoiu [9] Studies in universities are not just to teach and listen but there should be some knowledge sharing between each other. The decision making in an institute must be well planned and resolved with particular information. Quality is the first step to maintain in every institute, it is the step of success in gaining popularity among others. Higher educational organizations are subjected with pressures for improving quality in their education. So, universities have to give more funds and buy more infrastructures which take decisions from the teaching staff and non-teaching staff, students and other officials in decision making process. In this paper the author discussed about several things in area of decision making and they involved decision making systems to take every student in right path.

Olawande Daramola, Onyeka Emebo, Ibukun Afolabi, Charles Ayo [10] When the student is approached to the counselor, he/she must suggest the correct career path for the student. The quality which the student received is important for him to make a successful life. If the advising which is given by the advisor is good then the outcome is totally good, while if the advising is bad then the outcome will be bad and this leads in destroying the student's career. Human advising requires patience and perseverance, commitment towards the work, genuinely saying the correct decision path for a student. These qualities may not always be maintained by the human advisors because one or other time they may lose patience and cannot explain the problem in which the student is lagging behind. Based on the institutions advice the rules may change from particular time to time. Keeping all these problems, they developed an expert system which can take complex problems and give solutions to the problems like human expertise. Students in universities are advised to interact with the system answer the questions given by the system and then the system gives the correct output. The aim of this research is to minimize the time and effort of the student and gives the student correct decision to which course he has to register.

3. Comparison between Previous Decision Making and Modern Decision Making

Decision making issues in olden days makes managers, employer's time taking which are leading to modern approaches of decision making models. Decisions are mainly involved by single individual or with a group of people who have responsibility of using resources correctly. An effective counselor is one who involves in solving problems and knows how to respond for those problems in time. Making the right decision and generating solution to the problem is one way to say that the person who is counseling is good counselor or not. It involves the decision making tools to properly involve other desirable features into it. The decision making process involves more factors of traditional decision making models such as [12].

- For developing decision making system we must use our own knowledge and some knowledge from domain experts also.
- There must be involvement of different end users to know peoples requirements.
- Individual major domains.

4. Why Decision support System for Higher Education?

Decision making in higher education is very important because it is the first step for every student to develop appropriate knowledge on the subjects what they want to choose and improve their subject in related major. The aim to implement DSS is to develop appropriate tools for analysis of the student information and relevant branch data in today's world for students to choose their correct career. The role of such tools in improving student's career is as follows:

To manage present day activities of educational institution activities, process the resources viz teaching and learning, curriculum activities, syllabus and all other management services.

To gather information on research and education in present days.

To develop combined environment activities, supervise its activities and measure the cause of their objectives.

Giving feedback for frequent development and monitoring of this system.

The decision support system must depend on the existing information of the institutions and databases which consists of the data which is available for starting counseling activities. Other data is collected from surveys and questionnaires which are also important for measuring the quality of the institution. Other quality factors includes the performance of faculty members, university learning system, rules and different regulations followed by university, surveys conducted by the graduates, master's degree holders and PhD students, employers, departments and other different management activities. The information which is collected is used to evaluate quality, perform analysis and suggests alternatives for the future work. This system is developed to keep in practice for different departments and head of the institutions [12].

a) Implementing the syllabus:

It describes about the implementation of the syllabus for each and every course.

b) Analyzing and Tracking:

Analysis of the academic courses and syllabus frequently and this analysis mainly focus on the staff, infrastructure facilities, etc.

c) Communicating and Controlling:

For the education process to be more successful communication and controlling of various activities are important issues to be faced in every institution.

d) Performing educational activities:

This tells about implementation of various educational activities which are involved in general education/training process and describes the current position of the system.

There are some types of decision making problems in the educational institutions which are:

i. Planning different decision program for the students which leads to formation of new curriculum for long term graduation students. This curriculum includes syllabus, combination of practical and theoretical education, etc.
ii. The curriculum and syllabus is separated for each branch and academic year.
iii. Defining the requirements for the achievements of the syllabus preparation in specialized branches, necessary financial support, software, etc.

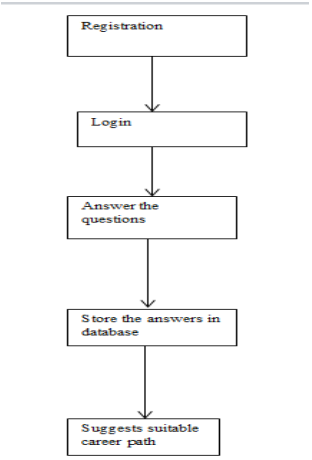
DSS is designed to support different decisions taken by the university should be applicable for university policies and should help training programs offered within the universities.

5. Working of the System

The purpose of the system is to schedule different sessions to students and tell about the availability of courses present in university. The student involves multiple sessions in which various modules in which the student have to interact which each and every module so that the capabilities of the student are assessed. With this there is an administrative module which contain student database, courses database etc. The system gives list of branches which student has to register and chooses one of the eligible courses in the given list. We design an expert system which suggests the student career choice by asking questions to the students. It suggests the students which branch to choose and helps the student to be in right path. The student information is stored in the database for future retrieval. This database contains percentages of secondary education and interests of the students which he wants to study. It contains registration page and a login page in which the student gives his interested career. This is single user interface in which server and client reside in one system. The client system takes the

details of the student and the server system feeds the information in the database. The work flow of the system is given as form of a pseudo code in which the user follows certain steps for choosing his/her best career. Figure 4.0 shows the working of the entire system

Step 1: Registration
Step 2: Login to the system
Step 3: Answer the questions which the system asks
Step 4: Store it in the database
Step 5: Suggest the career path for the student.
Figure 4.0



5.1 Mapping of Suitable Branches:

Students have different opinions in selecting their branches. Based on the Percentage which they gained in their higher secondary education the branch of the student is decided by their parents or by the faculty members. But branch selection must be done based on the interests of the students and the knowledge they had on subject. Students may be of different types who do experiments with new electronic goods, who have creative thinking in developing certain software, who are interested in mechanism etc. In previous days a counselor interacts with the student and gives questionnaires to him/her. The student answers these questions, then counselor analyses these answers and suggests suitable branches. This is regular process of selecting a student's branch. A new idea is developed with expert system which raises certain questions and students who are ready to enter the graduation programs. Students interact with expert system, answers the questions displayed by the expert system. A table is taken which suggests suitable branch for the student based on certain comparisons. The table 2.0 below indicates the relation between the analysis of the expert system and percentage of marks obtained in higher secondary education. When the student interacts with the expert system, it analyses and provides score for the student. Basing on this score and the academic percentage the branch which the student has to study is known. Student may know his/her predicted branch and basing on his/her interest he can join the course which he wanted.

Table 2.0:

S.No.	Analysis score (Expert system)	Percentage of higher secondary education	Suggested branch
1	>10	95	Computer related
2	<=10 & >8	97	Computers/electronics related
3	<=8 & >3	89	Any other

Here the knowledge of the student is assessed basing on his previous knowledge. He does not know anything about the branch he chooses and the subject knowledge on the branch he wants to join in. Here the minimum questions student can attempt are for 15. If student attempts 15 questions he/she is considered to be hard working and can be suitable for that branch which requires more patience and learning ability to study. These are called the psychological factors which are required for the student for further assessment when he enters into the branch.

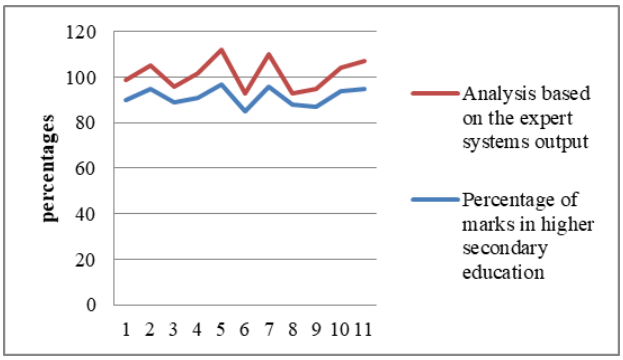
6. Result Analysis

A group of higher secondary education completed students are taken and conducted sample tests in developed decision support system. Students interact with the decision support system and certain questions are displayed on the screen. Basing on the answers given by the student the system suggests suitable branch.

Table 3.0:

S. No.	Register number assigned	Percentage of marks in higher secondary education	Analysis based on the expert systems output	Suitable Branch
1	15030072	90	9	Computers/electronics related
2	15030078	95	10	Computers/electronics related
3	15030158	89	7	Any other
4	15030168	91	11	Computer related
5	15030258	97	15	Computer related
6	15030264	85	8	Any other
7	15030274	96	14	Computer related
8	15030562	88	5	Any other
9	15031004	87	8	Any other
10	15031267	94	10	Computers/electronics related
11	15031321	95	12	Computer related

We considered certain students who completed their secondary education and entering into graduation. We made some students to interact with the system and they answered for the questions asked by the expert system. The analysis was made and certain branches were allotted to students. A graph (graph 1.0) is plotted which contains percentages on y-axis and marks on x-axis.



In this graph there are some outliers who has more percentage but the analysis marks are less. So by removing that outlier a table (table 4.0) is again drawn.

S. No.	Register number assigned	Percentage of marks in higher secondary education	Analysis based on the expert systems output	Suitable Branch
1	15030072	90	9	Computers/electronics related
2	15030078	95	10	Computers/electronics related
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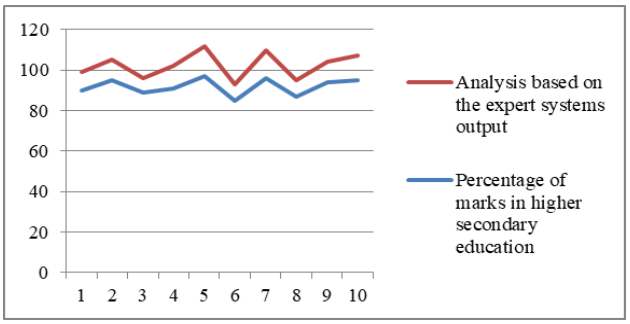
6	15030264	85	8	Any other
7	15030274	96	14	Computer related
8	15031004	87	8	Any other
9	15031267	94	10	Computers/electronics related
10	15031321	95	12	Computer related

Removing the outliers from the table a graph (graph 2.0) is drawn again



7. Conclusion

The students who completed their higher secondary education must enter into graduation courses which they do not have choice to decide according to their interest. In this paper we have developed an expert system which considers students interests and based on their interests a branch is selected. We developed a rule based expert system which has certain rules. The students interact with the system and results are obtained. The results which are obtained by the system is compared with percentages and basing on those comparisons branch is suggested to the student. If the student is interested with the suggested branch he/she may join that branch or may join another based on the interest he/she has.

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