Fuzzy Rule Based Expert System for Analysis of Students' Placement in Colleges

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***Abstract*—The word "institute" comes from the Latin word institutum meaning "facility" or "habit"; from instituere meaning "build", "create", "raise" or "educate" and a student is said to be a learner, or someone who attends an educational institution. Therefore the reputation of an institute entirely depends upon the achievements of its students. Students play a vital role in its growth. The ranking of any institute basically depends upon two things. Firstly, on the result of its students and secondly, on the placements which an institute offers along with the quality of faculty working with it. The evaluation of a student depends upon number of judgments often based on imprecise data. The extracurricular activities such as technical events, arts, sports and games, have a great impact on the overall personality development of a student; hence these activities increase the chances of employability of the students, which is a good sign for sure.There are a large number of factors on which the chances of a student getting well-placed depends. If these factors are identified timely, at an earlier stage then it's good for the institute, its student and even for the parents of the students, as they can collectively work upon these factors and improve the overall performance of student. In this proposed work, a fuzzy system is designed to evaluate the chances of a student getting placed on the basis of various parameters. This fuzzy system is basically designed for 2nd and 3rd year engineering students for causing improvements upon themselves, based upon the observations and psychology of students and after great discussion with faculty of JIET group of Institutions. After all such vital discussion, four major factors were identified that may affect a student's placement. These above talked about factors include personality traits, home environment, learning environment and individual skills. Therefore, data was collected in this regard and based on its observation; a system is being developed to evaluate the chances of a student getting placed i.e. whether it's more, medium or less. The full usage of these factors was only possible by counseling the students and their faculty so that they can work upon them in the direction of growth.**

Keywords- Fuzzy Expert System; Fuzzy Logic; Memebership Functions; Linguistic Variables; Major factors; sub-factor

I. INTRODUCTION

In today's era of cut-throat competition, among various institutes, every college focuses on improving the performance of its students so that they can have a bright future. Here the performance of the student which is being talked about is totally different, from the one which is getting good marks, in academics as getting good marks is not enough i.e. it doesn't mean that student will get placed.

There are number of factors behind students' achievement like grasping power which basically includes within its ambit understanding of the nature or meaning or quality or magnitude of something, pronunciation and body language, expression of views and feelings, communication style which means exchange of thoughts, messages, or information, as by speech, writing, or behavior or might also mean the physical way someone communicates (phone, email, spoken, letter, body language) or the general type of communication (business, formal, informal, academic) or the person's individual way of interacting with others, Self-confidence i.e. confidence in oneself or one's own abilities, comes from an attitude, participation in extra curricular activities and awareness of new technologies.

It can be rightly said that sometimes the occupation and designation of a student's parent or guardian in various fields can also affect his/her level of interest or chances of selection while sitting in, for campus placements. Extra love and care or if said in raw terms spoon feeding can spoil their own brat (child). Sometimes discrimination among students on level of intelligence, grasping power etc can be held responsible for their non-satisfactory performance. Therefore the students are to be given a proper learning environment so that they can be motivated from time to time to work upon themselves. Proper guidance, motivation, mentor support is must for them.

Therefore, the proposed fuzzy expert system has been designed by considering all the contributing factors that may affect the overall performance of an engineering student at the time of his/her placement. These four major talked about factors (personality traits, home environment, learning environment and individual skills) can further be divided into sub-factors. All the major factors as well as sub-factors are assigned weightage based on their contribution in affecting placement. Then atlast, a fuzzy system is developed to evaluate the chances of a student getting placed in an industry through his/her institution itself.

The main goal of the system is to identify the factors affecting the performance of an engineering student at the time of placement and takes effective measures in the direction of growth of a student as education leads to

enlightenment, builds character and paves the way for good career.

II. LITERATURE SURVEY

Fuzzy logic theory has emerged in the twentieth century and by the beginning of the twenty-first century it was predicted to be applied extensively in many fields [4]. It has been playing a major role in many disciplines such as in agriculture for crop management, insect control, in medicines, assist physician in diagnosis of diseases and in space technology. Some expert systems have been developed to replace human experts and to aid humans.One of the application of the fuzzy logic theory is the measurement and evaluation in education system. In 2011, Ramjeet Singh Yadav and Virendra Pratap Singh [1] proposed a Fuzzy Expert System for student academic performance evaluation based on fuzzy logic techniques.They illustrated the applicaion of fuzzy logic in evaluating students' academic performance and compare this with result obtained by using arithmetic and statistics techniques and found that the results obtained using fuzzy logic offers a great flexibility and reliability.Rajiv Bhatt and Darshana Bhatt (2011) [4] applied fuzzy logic to evaluate students' performance in practical component of different subjects in engineering institutes and compare the results with classical method and found that the fuzzy based evaluation is advantageous to students who score less. Suvarna Patil, Ayesha Mulla and R.R. Mudholkar (2012) [6] has reported application of Expert System with Fuzzy Logic for finding the best student based on feedback given by the teacher. Çetin Semerci [3] explained the influence of fuzzy logic theory on students' achievement.In 2012, Mamatha S Upadhya [2] proffered the fuzzy inference system for evaluation of performance of students based on students' attendance, teaching effectiveness, facilities provided to students.These three factors are fuzzified and used as input for fuzzy inference system and output i.e students' performance is obtained as poor, medium, good or very good. Abdur Rashid Khan, Hafeez Ullah Amin and Zia Ur Rehman [5] has put some light on evaluation of teachers' performance using fuzzy logic.They developed the fuzzy expert system by considering 99 attributes (that could affect the teachers' performace) which were divided into 15 groups as input and evaluated the teachers' performance. Sirigiri Pavani, P.V.S.S.Gangadhar, Kajal Kiran Gulhare (2012) [7] has applied the fuzzy logic techniques in evaluating teachers' performance on the basis of different factor.Expert System when integrated with Fuzzy Logic nicely handles uncertain and qualitative knowledge of the problem domain. The literature reveals that Fuzzy Logic has a potential application in education as general and for performance assessment, as a particular application.

M.S. Farooq, A.H. Chaudhry, M. Shafiq, G. Berhanu (2011) [8] examined the different factors that influenced the academic performance of the students and found that the socio-economic status and parents' education played a very significant role in students' overall academic achievement. Suresh Kumar N, Prasanth MK , Ajith Sundaram (2013) [9] conducted an empirical study at the selected engineering colleges in Kerala and concluded that individual's academic abilities are influenced by individual's personality and emotional temperament. K Sudha, T. Ananda and M.Krishnaveni (2013) [10] has put light on the study of Career Guidance and Counseling Needs of Graduate Students.

In this proposed work, fuzzy system is developed to evaluate the chance of getting placement of engineering students on the basis of 32 factors which are divided into 4 groups and used as input.

III. FUZZY LOGIC

The concept of fuzzy logic was introduced by Lotif Zadeh in 1965. Fuzzy Logic is used for handling imprecise and uncertain data. The problems in real world contain complex and uncertain data which can't be handled by classical two-value theory which is restricted to "true or false" and require complete and precise information. In real time situation number of times the boundaries of demarcation are not sharp enough leading to multiple outcome dependent upon context, person and ambient conditions [6]. In that case, Boolean Logic can't be used. So, Fuzzy Logic is needed to overcome the limitation of classical two-value theory. The major advantage that fuzzy reasoning offers is the ability to reply to a yes-no question with a not-quite-yes-or-no answer.

Fuzzy logic starts with concept of fuzzy sets. Fuzzy Set is a set containing elements that can have partial degree of membership unlike in crisp set, it either includes the element or excludes it. Fuzzy Set determines upto which degree the element belong to given set. Linguistic Variables and fuzzy if-then-rules are two concepts within fuzzy logic that plays a significant role in its application.

A fuzzy set A in X is defined as a set of ordered pairs.

$$A = \{x, \mu_A(x) \mid x \in X\}$$

where $\mu_A(x)$ is called the membership function of x in A. This function maps each element of X to a membership value between 0 and 1.

A membership function is a curve which shows the mapping of an input space to a membership value between 0 and 1. There are different types of memebership functions. Some of them are piece-wise linear function, the Gaussian distribution function, the Sigmoid curve, Quadratic and Cubic Polynomial curve. The membership function used for particular input depends on the problem.

IV. ARCHITECTURE OF PROPOSED SYSTEM

The architecture of proposed fuzzy expert system is shown in **"***Fig. 1"***.**

- **Input(Crisp Value):** It is the value assigned to factors as well as sum of values assigned to their sub-factors that the student marked as affecting factor in his/her performance.
- **Fuzzification:** Fuzzification is mapping of crisp value (input) to a fuzzy set with the help of suitable

membership function. In this proposed work, the membership function used is trapezoidal membership function.

- **Inference Engine (Fuzzy Rules):** Fuzzy Rules are incorporated in the system. These rules help in inference process.
- **Defuzzification:** Defuzzification is the process of converting fuzzy set into crisp set. The output value that is obtained is a fuzzy set, so to get a single output value, defuzzification is done. In this research work, Centroid method for defuzzification is used.
- **Output:** The output for this fuzzy based system is the chances of getting placement of student.

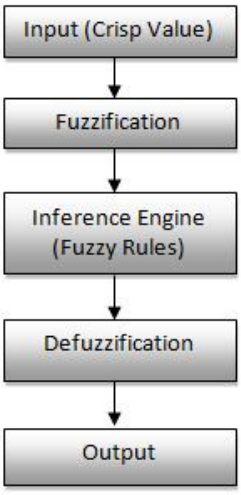

Fig. 1. Architecture of Proposed Fuzzy Expert System.

Fuzzy System for analysis of students' placement comprises of four inputs and one output is show in **"***Fig. 2"*.

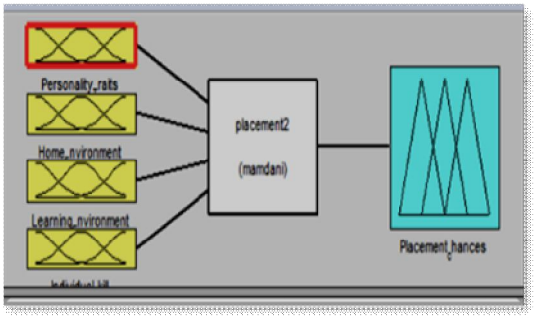

Fig. 2. Fuzzy System for Analysis of Students' Placement.

V. EVALUATION BY USING FUZZY LOGIC

Based on analysis and discussion with faculty members of JIET Group of Institutions, various number of factors are identified that may affect students' performance and consequently affect their chances of getting campus placement. Then, the identified factors are divided into 4 groups that are personality traits, home environment, learning environment and individual skill**s.** After that**,** all the identified sub factors are assigned weightage based on their contribution in affecting students' performance. Major factors are also weighted based on their role in affecting student's performance. For example**,** during analysis of students, it is found that among all the personal traits, self confidence and grasping of subject in classroom affects the most to students' performance .So, they have assigned the highest value among all the personality traits. In the same way, all the sub factors are assigned some values. The more affecting sub-factors , have been assigned value '1' and the least affecting factors have been assigned value '0.5' and rest have been kept as '0.75'. Among all the major factors, personality traits is found to be the most contributing factor that affects students' performance and least affecting factor is home environment.

After identification of all the factors that may affect the students' academic performance and consequently affect their chance of getting campus placement, an user interface is designed which is shown in "*Fig. 3"* and "*Fig. 4"*. The user (student) can mark the affecting parameter in the checkbox.

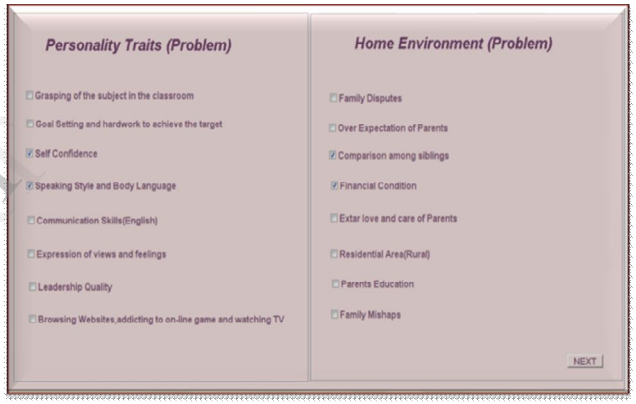

Fig. 3. User Interface I.

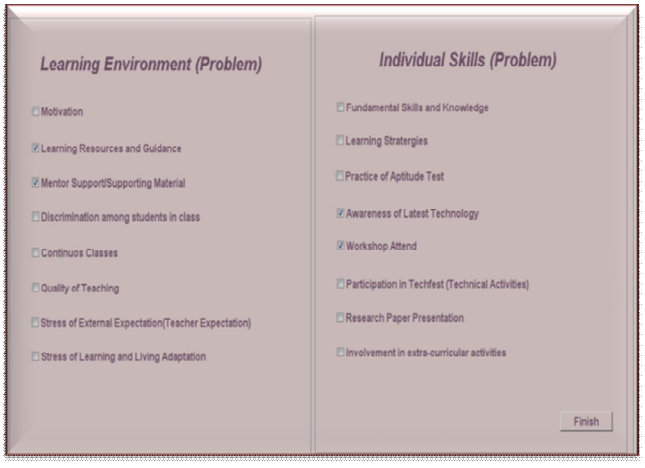

Fig. 4. User Interface II.

When the finish button is clicked, we get the value of 4 major parameters which is the sum of the values of their

marked sub-factors. After that, these values are mapped to the input of fuzzy linguistic variables.

A. Membership Functions

The input variables are fuzzified with the help of trapezoidal membership function. Fuzzy Linguistic Variables and their membership values are shown in Table I.

TABLE I. FUZZY LINGUISTIC VARIABLES AND THEIR MEMBERSHIP VALUES

Input Variables	Fuzzy Linguistic Variables and their Membership range			Fuzzy Output Variables and their Membership range		
	Good	*Average*	*Bad*	*More*	*Medium*	*Less*
Personality Traits	0-1.5	1-3	2.5-7	0-6	4-11	9-18.5
Home Environment	0-1	0.75-1.75	1.5-3.5			
Learning Resources	0-1	0.75-3	2.5-5.5			
Individual Skills	0-1	0.75-3	2.5-6			

Membership Functions for all input variables are shown in the "*Fig. 5*", "*Fig. 6*", "*Fig. 7*", "*Fig. 8*" and output variable is shown in "*Fig. 9*".

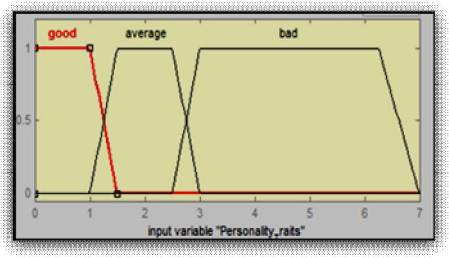

Fig. 5. Membership Functions for Input Variable 'Persoanlity_Traits'.

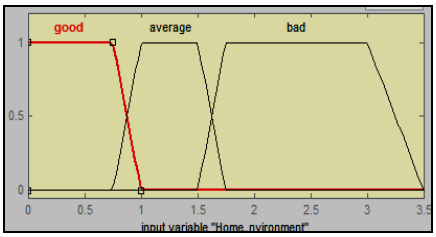

Fig. 6. Membership Functions for Input Variable 'Home_Environment'.

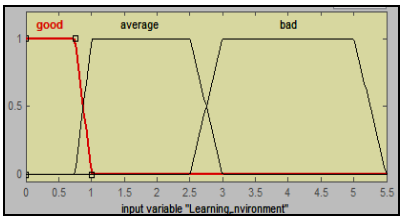

Fig. 7. Membership Functions for Input Variable 'Learning_Environment'.

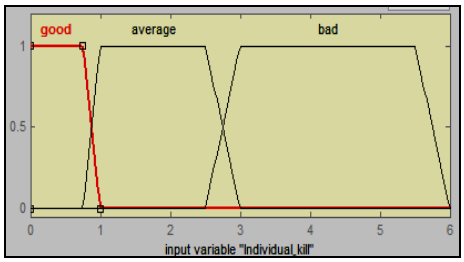

Fig. 8. Membership Functions for Input Variable 'Individual_Skill'.

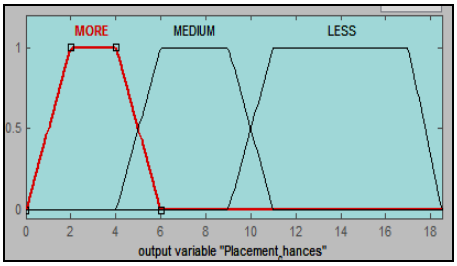

Fig. 9. Membership Functions for Output Variable 'Placement_Chances'.

B. Rule Formation

The fuzzy system draws inference by using fuzzy operators and simple if-then-rules which are stored in the knowledge base of the system. The rules are formulated by discussion with experienced faculty members who have long experience of academics. For this system, we constructed 81 rules. Some of them are as follows:

- If (Personality_Traits is good) and (Home_Environment is good) and (Learning Environment is good) and (Individual_Skill is good) then (Placement_chances is more).
- If (Personality_Traits is good) and (Home_Environment is good) and (Learning Environment is average) and (Individual_Skill is average) then (Placement_chances is more).
- If (Personality_Traits is average) and (Home_Environment is good) and (Learning Environment is good) and (Individual_Skill is average) then (Placement_chances is medium)
- If (Personality_Traits is average) and (Home_Environment is average) and (Learning Environment is average) and (Individual_Skill is good) then (Placement_chances is medium).
- If (Personality_Traits is bad) and (Home_Environment is good) and (Learning Environment is good) and (Individual_Skill is average) then (Placement_chances is less).
- If (Personality_Traits is bad) and (Home_Environment is bad) and (Learning

Environment is average) and (Individual_Skill is good) then (Placement_chances is less).

View of Fuzzy Rule Based System is shown in "*Fig. 10*".

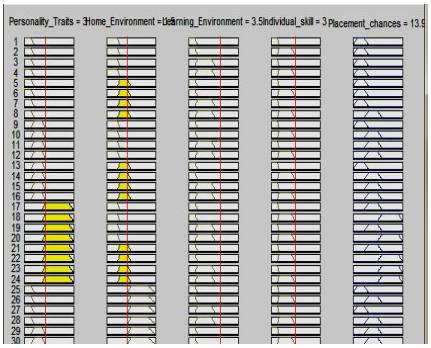

Fig. 10. View of Fuzzy Rule Base for Analysis of Students' Placement.

The surface view is shown in *"Fig. 11"*.

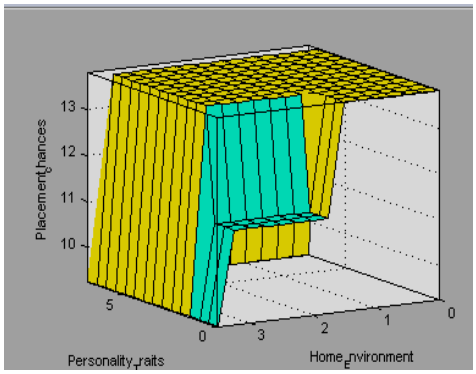

Fig. 11. Surface View for for Analysis of Students' Placement..

C. *Defuzzification*

The process of converting fuzzy set into crisp set is called defuzzification.In this, Centroid method is used. The proposed system is well tested on some students of JIET Group of Institutions.

VI. CONCLUSION AND FUTURE WORK

This expert system has been developed to identify the factors affecting the performance of an engineering student at the time of placement and takes effective measures. If these factors are identified timely, at an earlier stage then it's good for the institute, its student and even for the parents of the students, as they can collectively work upon these factors and improve the overall performance of student. This system can be implemented in any college.

As this research work includes some factors, there can be many other factors that can affect students' performance at the time of placement. Future research is needed to explore more factors affecting students' performance. This system can also be implemented by using neural network.

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