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Ontological Framework for analyzing Student's Emotional behavior performance enhancement using Fuzzy Logic

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Abstract— *Personality refers to variations in one's personal attributes subjected to various events throughout the accustomed life cycle in an individual. The projection of the individual's mind in a behavioral activity also depicts one's personality. In the paper a framework for analyzing a University Student's performance efficiency for a job at workplace has been proposed. Students have been classified psychologically for determining overall efficiency based on different aspects such as emotional level, holistic approach, confidence level, stress and time management. The psychological factors and the relationships between them is depicted as an Emotion Ontology which gives a clear understanding for the system to be developed in the future based on the framework. By improving the individual traits efficiency of a person can have ameliorations which get reflected in the person's work environment. The data set for training the proposed system is to be collected through questionnaires from which linguistic values are fed as input to the fuzzy Inference Engine along with association rules. The output of the system would also be a linguistic value with which the efficiency of the person is determined.*

Keywords— *Personality traits, Semantic feedback, Ontology, Fuzzy Logic.*

I INTRODUCTION

A. Feedback

Feedback is an informative response given for an activity done by a person and further enabling people to assess how good the activity is done. Feedback is an important tool to facilitate learning of one's potential growth and plays a crucial role in one's life. By giving feedback, an approach towards a problem, process of finding a solution, efficiency in accomplishing a task can be improved. Emotion is a state of mind in balance or imbalance, where the individual may not be mentally aware of what is happening around and thereby complicating social things further. Kulhavy and Wagner (1993) [1] introduced the concept of a feedback-triad where feedback is used for motivating a person which would thereby enhance the response and accuracy in doing

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work and making the individual work according to the line of thought causing a positive change based on the information given in feedback.

B. Ontology

Ontology is the diagrammatic representation of concepts in any domain for easy understanding. Ontology provides a relation between collections of attributes. It is a conceptualization of a domain into a human understandable, machine-readable format consisting of entities, attributes, relationships, and axioms. An ontology is drawn for framework representation and improving the relationship among entities for giving feedback.[2] Pedro Jet.al proposed an ontology to generate feedback for students while learning coding. The Ontology was used to generate the adaptive feedback for students and it represents the cause and consequences of a particular error got by a particular student during programming. Based on student's profile the ontology matches different possible causes and generates feedback correspondingly so that the students would be aware of areas they have to focus to overcome the error. There is a Web Ontology language (OWL) which is built upon W3C XML standard for objects called RDF. RDF stands for resource description framework. It is a knowledge representation data model that provides basic elements for the description of Ontologies called RDF vocabularies. There is also a Resource Description Framework Scheme which is a set of classes with certain properties using RDF. The OWL language has formal semantics for building an application. There are sub languages in the OWL such as OWL Lite, OWL DL and OWL Full.

C. Fuzzy Logic

Diagrammatic representation given by ontology is vague and may not be sufficient enough to discrete uncertain datasets. To handle this uncertain data fuzzy logic is used which takes datasets as input and produces a member function. Fuzzy can easily tolerate ambiguity and produce an accurate result. Fuzzy logic is a method of reasoning that tends to replicate human way of reasoning providing degrees of truthfulness and falsehood rather than the usual true or false obtained from the Boolean Logic. The fuzzy logic operates on all possibilities of outcome and gives required definite output. It is also called as artificial intelligence system representing generalized human cognitive abilities in the software, so that faced with a critical task; the system can find a solution. The fuzzy process can be broken down into four components namely fuzzification module, knowledge base, inference system, defuzzification, membership functions. The fuzzification module converts the input values which are in crisp form to fuzzy sets. Knowledge base stores the if-then rules and other suitable algorithms to be invoked. The inference system operates on the fuzzy sets for every rule to be invoked and provides the result in fuzzified form. Defuzzification process converts the output fuzzy value obtained from the inference system into crisp values. Membership function is used to quantify the linguistic terms and to represent the fuzzy set graphically.

The paper initially elaborates the need of feedback related to emotional factor that affects work efficiency either positively or negatively. Five factors taken into account are Emotions, stress management, time management, holistic approach, confidence. The framework i.e. the flow of the application to be designed is proposed. The complete detail of the application server, frontend backend which includes fuzzy tool in the application for deriving output as a membership function is drawn and discussed. Emotion ontology diagram

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involving all five factors is drawn and algorithms for that ontology are generated using protégé tool to improve the understanding of the system.

II RELATED WORK

The literature survey presents the various approaches using fuzzy logics and ontologies to provide feedback to the linguistic inputs given.[4] Shruti S Jamshandekar et al. carried out a study evaluating students performance characteristics such as skills, attributes, beliefs, marks using fuzzy inference system. It provides a platform to predict the future prospects of students if they are capable enough to pursue a higher level course in their current domain. It also helps the instructors to improve their teaching methods in certain field where students are finding it difficult to excel. The purpose of the study has been accomplished through a sequential mechanism consisting of selection, certification, description, aid learning. This performance evaluation has turned out to be a win win situation for both the students and the mentors thus increasing the productivity of the institution. The methodology consists of input containing a crisp value being fed into the fuzzification chamber wherein conversion of crisp value to fuzzy value takes place using two member functions preferably triangular and trapezoidal member functions. A inference mechanism has been setup to define the different types of fuzzy rules to be applied .Output membership values acts on the fuzzy sets for every rule to be invoked. Finally output is computed using a suitable defuzzification method.

[5]Fernando Bobillo et.al., proposed a latter approach, by identifying the syntactic differences that a fuzzy ontology language has to cope with, by proposing a concrete methodology to represent fuzzy ontologies using OWL 2 annotation properties instead of using existing conventional Semantic Web languages which deals with vagueness, or provides a procedure to represent such information within current standard languages and tools .They use OWL 2 annotation properties to encode fuzzy SROIQ(D) ontologies which results in discarding the fuzzy part of a fuzzy ontology, producing the same results as if would not exist moreover they identify the syntactic differences that a fuzzy ontology language has to cope with, and show how to address them using OWL 2 annotation properties.

[6]Quan Thanh Tho et.al. proposed the FOGA (Fuzzy Ontology Generation Framework) for automatic generation of fuzzy ontology on uncertainty information.

It comprises of Fuzzy Formal Concept Analysis, Concept Hierarchy Generation, and Fuzzy Ontology Generation as well as approximating reasoning for incremental enrichment of the ontology with new upcoming data and fuzzy-based technique for integrating other attributes of database to the ontology. It is inferred that FOGA can automatically generate a fuzzy ontology from uncertainty data based on Formal Concept Analysis (FCA) theory .The proposed Fuzzy Formal Concept Analysis (FFCA) can directly represent uncertainty information by a real number of membership value in the range of [0,1] so that linguistic variables are no longer needed.[7] Ritu Bansal et al. elaborated a fuzzy system SPACS that analysis the student's academic performance . This paper integrated data mining technique to inspect various datasets collected for students of a university. Here the fuzzy expert system uses an association rule mining technique that finds the hidden association among the datasets with classical Apriori algorithm. The fuzzy system consists of fuzzification, inference, knowledge base, defuzzification process. Accurate result is generated by the system and thereby reducing the calculation

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time. Except SOM it works better for all other defuzzification technique.[8] Ameet.D.Shah et al. constructed a Multi-user

Feedback support system also known as 360' Feedback system to evaluate the performance of employees by collecting information systematically from all the sources associated with their job .The stakeholders from various sources consists of her/his peers, managers, subordinates team members, customers, suppliers and vendors. The feedback has four components namely self-appraisal, superior's appraisal, subordinate's appraisal, student's appraisal and peer appraisal. The significance of the research has been to determine whether an employee is able to amalgamate with the organizational culture in the company and is able to bring in values to promote a cause for the company. Initially employees are rated based on their behaviors being effective or ineffective for each job or job type followed by the establishment of standards to be met for a specific level of performance consisting of quality, timeliness, cost effectiveness. Feedback collected is then processed by adopting a suitable algorithm for the fuzzy classifier system and a graphical representation of the feedback is being produced in the form of wave graphs. Based on this result, decision maker is even able to assess the vagueness, uncertainty, subjectivity which provides a human like decision making approach.[9] Shilpa et al. proposed a fuzzy inference system consisting of fuzzification, defuzzification, inference engine and a knowledge base. This paper considered two concepts to evaluate student's academic performance that is importance and complexity of the question which is determined by domain expert. With the accuracy matrix score matrix and importance matrix accuracy matrix, effect matrix and adjustment matrix are fuzzified. Triangular membership function use. Original scores and new scores are tabulated. A comparison table between the proposed method and classical method is made. The defuzzified value is changed to crisp (real values) into human readable form.[10] Suvarna patil et.al focused on fuzzy logic to evaluate a student's performance. The aim of this paper is to find out the best student using fuzzy based on the feedback which is so transparent. The objective is to develop a FIS (Fuzzy Inference System) consisting of four modules. They collected inputs from 50 students where teacher was allowed to give feedback on a scale of ten. The author used Mamdani's method for Fuzzy Inference. The Final Grade was calculated and then defuzzified by calculating the center of the resulting geometrical shape.[11] Tanumeet Kaur discusses the extension of a crisp ontology to fuzzy ontology by including linguistic variables in fuzzy logic in order to adapt uncertainty and ambiguity in domain knowledge. It starts off with the fuzzification of crisp ontology in association with the students domain based on the marks procured by the student in six semesters. The fuzzification provides a fair judgment and results which provides good clarity of information and provides an alternate way of evaluation. Swings in java are used to provide a graphical interface and input ontology is taken in the form of XML document containing the student attributes. When passed using a DOM parser in java , crisp values get converted to fuzzy values ,membership degrees and fuzzy values are displayed depending on the marks obtained and final result sheet was saved in an excel file. Depending on the marks obtained, linguistic variables are assigned to the students to determine accurate judgment of students overall performance.

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III FRAMEWORK OF THE SYSTEM

The proposed system is to generate feedback for the linguistic variable using fuzzy logics and make the system understand the parameter by using ontology. This section describes the main concepts of the framework propose. These five factors are chosen because of the major role they play in deciding the academic performance of students. Emotionally peaceful person can achieve the goal easily then a emotionally affected person. Emotional intelligence has a vital role in deciding one's career, growth, and control over one's self. The person with high emotional intelligence tend have less stress, highly positive, confident, manages time easily. So these five major factor which determines efficiency of a person are chose.

A. Emotional potency

Emotion is a state of mind in balance or imbalance, where the individual may not be mentally aware of what is happening around which may sometimes complicate the social relationships. Emotion plays a critical role in decision making. Negative emotions increases anxiety, hopelessness, shame. The poor decision-making effects of a given mood can hinder a student's performance and lead to bad decisions that can affect their growth.

B. Holistic Approach

Having a positive attitude towards academics is an important contributor to the success. A positive attitude might spur the amount of work put in by the students. It tends to brings out greater overall effect in progress.

C. Stress Management

Stress is common to all living beings on earth .When a student experiences high levels of stress or chronic stress, regardless of her age or grade, it can interfere with their ability to learn, memorize, and earn good grades -- as well as lead to poor physical, emotional and mental health. Stress is accountable to various factors and is evaluated using the feedback.

D. Time management

Time management skills allow people to organize their work and personal life efficiently to make the most of it. Due to various factors that consume one's time, many may quit or even give up the situation. The ability to focus can be improved by taking control of your time .It helps you to breeze through tasks quickly. Proper time management improves decision making ability.

E. Confidence

Confidence is a correlation of how well one performs in a job and how well he can relate to the people working with them .A confident person can accomplish more than he thought because he does not doubt his abilities neither bothers about others being judgmental. People feel more comfortable than ever working with others using his skills and abilities to take on new challenges and tend to push him even more to reach new heights.

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The application contains questionnaires which are to be circulated among students. The questionnaires contain questions based on the five main attributes (emotion, stress, time management, confidence, and time management) to test the student's emotional level. The user is asked to answer a list of multiple choice questions, one word questions or sentence type questions and the input given is stored in the database as shown in fig.2.An example questionnaire overview is given in fig.1.It contains questioners in the form of multiple choice question and the answers from the user to be fed into the systems. These answers are then stored in the database on clicking submit.

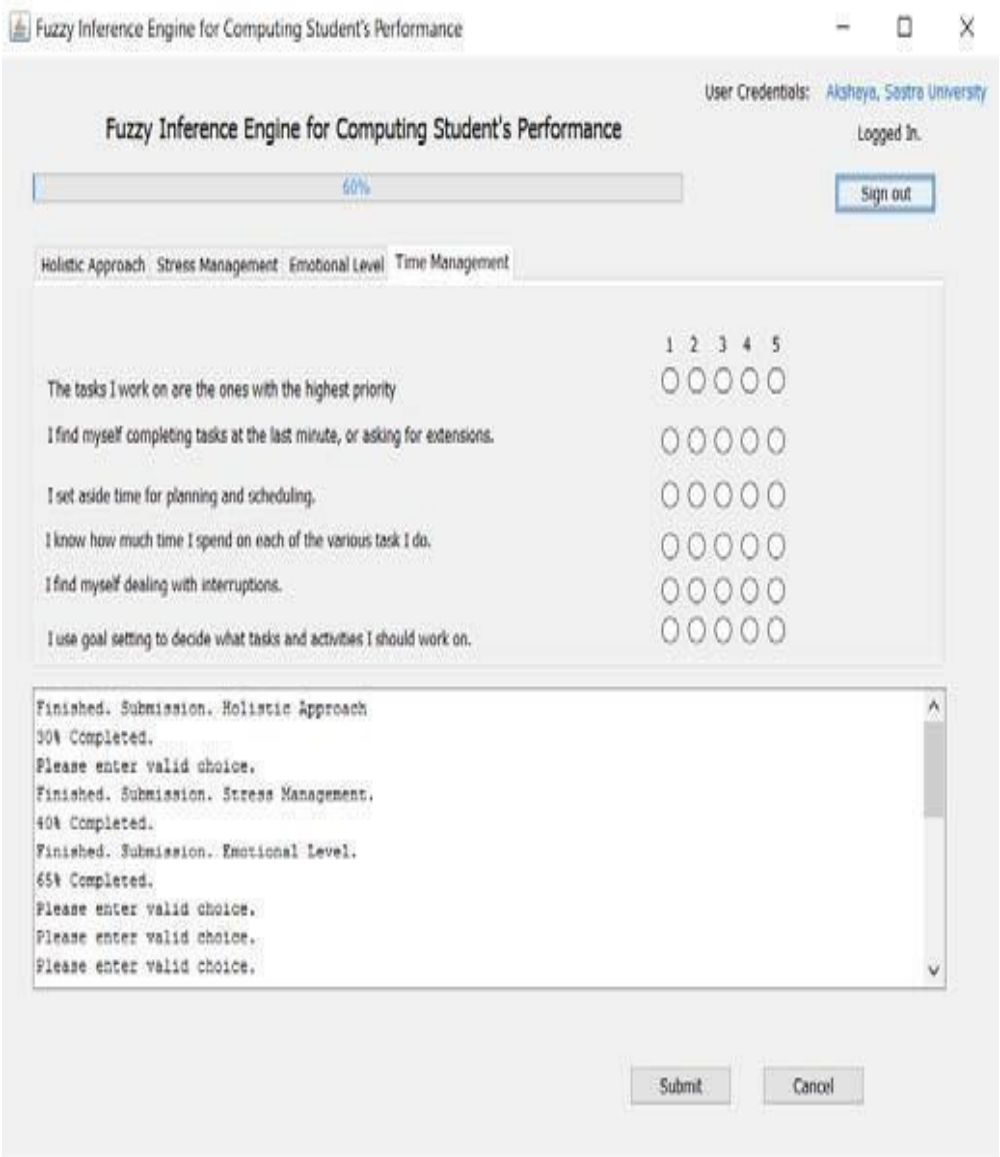

Figure 1.3 Sample Questionnaires for computing student's performance

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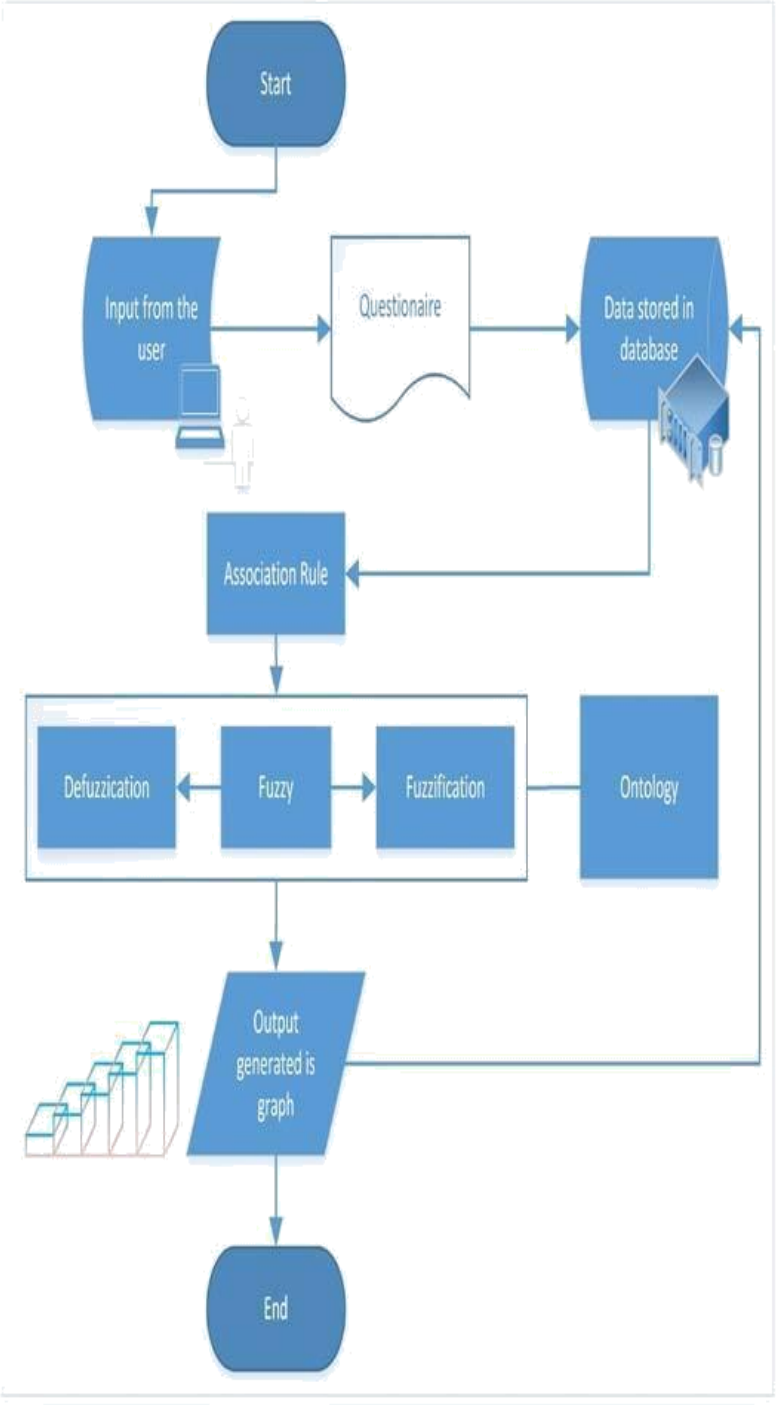

Figure 1 3.1. An architectural Framework of the feedback system

Emotional ontology

The inputs given by the users are vague linguistic variable. These linguistic variable are assigned with values between [0 - 1] Association rule (IF then ELSE) is applied to the dataset. This rule along with the input variable as a membership function is sent into the fuzzy tool.

Fuzzification: This process transforms the input variables into linguistic variable.

Fuzzy engine: Provide a solution using fuzzy logic on this linguistic variable.

Defuzzification: This process again turns the inferred values into human readable values after applying fuzzy logic. It gives an output as member function which is in the form of graph. Ontological representation of the

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parameters is drawn for which algorithm is obtained using Protégé tool. This improves the understanding of the system about the parameters used. This ontology is attached to the existing system.

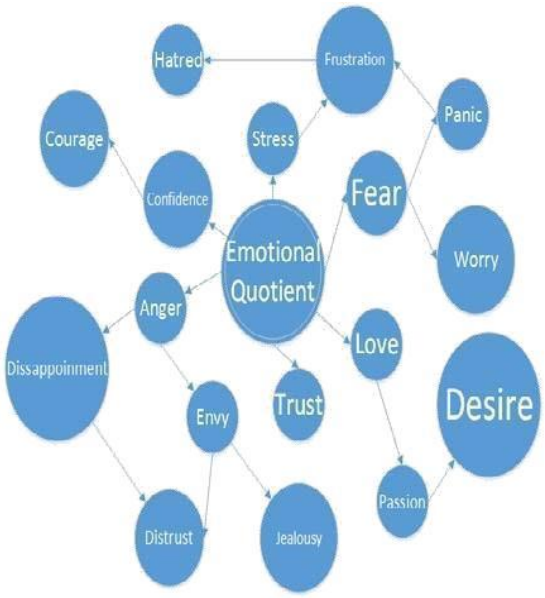

Figure 1.3.2 Emotional Ontology diagram.

Fig. 1.3.2. is an ontological representation of Emotional quotient where relationship between various emotions is mentioned. Emotional Quotient is a class and the sub classes like anger, love are further extended according to its resulting behavior. An emotion may lead to another one which will affect a student either in a bad way or good. By analyzing the chain of classes the key factor which causes these can be identified thus increasing one's potential for better performance. Categorizing emotions that decreases the performance rate and those that increases the performance rate are fear -> panic -> frustration -> hatred and love-> passion-> desire. Thereby initial stages of both categories can be identified and performance rate can be increased drastically which will result in a better working atmosphere and thus encouraging others.

OWL Code Generation:

The above Emotional ontology diagram was defined as classes and subclasses using protégé 4.3 which is an ontology tool for generating OWL Schema code that helps in graphical representation of their relationship.

SPARQL links:

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#> PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#> SELECT ?subject ?object

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WHERE { ?subject rdfs:subClassOf ?object }

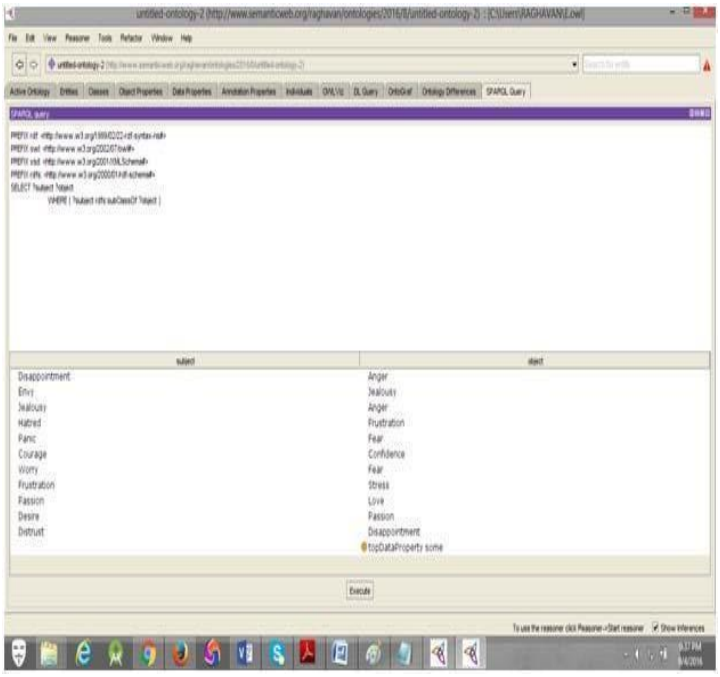

Figure 1.3.3 Screenshot of Protégé 4.3 tool for generating OWL code.

IV CONCLUSION

The current paper demonstrates a framework for delivering feedback to students on their performance on various parameters like holistic approach, emotional level, and stress and time management. As proposed earlier, the students are asked to fill in a questionnaire which contains questions to test their skills and attributes thereby judging their level of performance. The filled questionnaire is fed into fuzzy engine for fuzzification where the answers are evaluated based on the values assigned to their respective linguistic variables, later it is defuzzified and output is represented graphically. The parameters chosen are further presented in the form of ontologies for better understanding for the students as well as for the system. This will give the students a better understanding on where they stand, and aid them in capitalizing their strong zone and strengthen their weak zone. This system makes use of fuzzy logic and ontology provides greater accuracy in assessment of uncertain events.

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