

Fuzzy based automated tool for organizations continuous assessment to achieve CMMI standards

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Abstract - In recent years, the number and variety of applications of fuzzy logic have increased significantly. The applications range from consumer products such as cameras, camcorders, washing machines, and microwave ovens to industrial process control, medical instrumentation, Security Software's, decision-support systems, and portfolio selection. The main objective of this work is the development of an automated tool for monitoring and easy assessment of organizations to check their level of maturity in software development. The suggested framework would serve as an upper layer technique of other existing techniques. It has been observed as showing maximum benefits with lowest computational overhead. It is flexible enough to be used for minor, average and even large integer of requests. Our proposed automated tool focused not only common process areas but also at any stage any other process area can be used and accommodated in future with small changes.

Keywords - Capability Maturity Model Integration (CMMI), Standard CMMI Appraisal Method for Process Improvement (SCAMPI)

I. INTRODUCTION

A correct definition of logic is that it concerned about the correct reasoning. When we read the logic we can say clearly that principles of reasoning is not similar to the the thinking of reasoning. Logic is something like discipline and it take us to the correct reasoning. In 1990 Davis gave a statement that in ideal environment requirements will be independent to the design of the system. As what the system should do as don't need to focused on that how the system should do but we knew that this this is not always true as there are some limitations in it. As the understandings of what and how always different from person to person.

Good software is always full fill client's requirements and this is happen if and only if the requirements will be strongly clear. All projects need their own requirements for obtaining better results. But if we will provide inaccurate or incomplete requirements we can say that the output will also be bad. In 1995 Brooks gave a statement that only requirement engineering is one of the difficult task that the whole development process depend on this, So this can take us the correct way in development or incorrect way.

Out of twenty process areas we used only thirteen process areas that are main common and important for study and assessment. We choose only twelve process areas because the main reason is that these are the most common and all these used in mostly companies and satisfy the company demands and requirements, business goals.

II. LITERATURE REVIEW

In literature we learnt that there are number of studies that have been conducted to investigate the issues related to Software Process Improvement frameworks.

William N. Robinson et.al (2006) introduced a new framework that clearly indicates that as the days passing software becoming necessity. The main objective of this developed framework that it will clearly monitor the software development activities and services. Also it will specify the analysis face of the requirement. One of the main function of this developed framework that it has the capability that it will raise alerts when any of the service fails to implement or successfully implemented. The framework demonstrated in different plate forms with analysis of ebXML specification. Whenever the framework deployed in any software development process it will generates alerts that the software successful or fails to produce results. A detailed summary presented that introduce the analysis of the monitoring framework. It also provides the real time feedback on the provided requirements.

Kamalesh Panthi et.AI (2008) introduced a framework for an integrated evaluation system is developed in this study using logical ordering process for different decision making. A framework developed in this study then applied to assess the sustainability of the sixteen chosen water facility projects in Nepal.

Rita C Nienaber (2007) et.AI proposed a introduced a new framework that very much support in the different SPM (Software Project Management) processes. Mostly research efferots in software project management industry always focuses on only academia and industry relvent but the software project have been always very much high or intensive rate of failure the projects as the basic reason is that software project always do not compy or focus in traditional standard measurements of for achievement. For this reason always budget of the whole project and a time frame as well as requirement specification is very much important. So there is one recommendation in this paper that a very much need to introduced a new standards/methods for improvement of the project management activities. Why we need these methods as advancement or globalization in computing technologies has

been totally changed the software process and software project management environment. One of the most important reason that why we need the new methods as today software project and software development as well as software deployment using distributed and colaburative environment so for this reason the traditional project management are totally bypassed. In this paper the authors of this paper focuses to improve the project management process because we can use this tool as a investigation tool. The authors proposed and discussed in this paper that this framework can support the software project management. In initial phases the whole research promise that after successfully adopt of this framework our project budget and all the process will be coverd up timely.

Emilie M. Roth and Carolyn B. Mervis (2004) presented that we can use Fuzzy set theory an alternate method in mathematics for the purpose of representation of the model in degree level with appropriate examples and in natural categories. The obtained results that were received after rating studies of the mathematic model that correctly described the basic operations in fuzzy set theory and that contains union as this model do not exactly define the relationship, any monotonic simple function. In 1984 Zadeh commented that the said fuzzy set theory, cannot specify the linkage among different values that categories. As the said model or theory does not take the attribute from directly into account.

Sajjad Ahmed *, M.Yaqoob Wani, Gohr Zaman (2013) Fuzzy based Framework introduced for quick and fast understanding and also easy evaluation of any organization to check maturity level. This method is totally meant keeping in mind the smaller organizations or those organizations that are newly introduced Capability Maturity Model Integrations, for the assessment of organizations maturity. It helps to know the SSMEs, their level of maturity in each process area. This method was applied to five Small software organizations to assess their process activities (as shown in figure 1). For this reason a trial was applied to the organizations and it stated that 80% score indicate the good success of any organization. A higher score indicates that they are above the average level in each process area and their maturity level is high when comparing to other organizations.

III. PROPOSED FRAMEWORK

We introduced an online tool for better and continuous assessment to achieve CMMI standards and proposed figure 1. User of this online tool will provide the organization basic information and Name field will be optional and at the end designation of that concerned person. When the basic information submitted to the online tool after select area of interest, the user needs to choose one process area for further processing.

After selection of process area the proposed tool will automatically upload the further sub process area/process activity that user select first. When select sub activity at that time developed tool will visible and generate a message that upload questions. At that stage the user need to press upload questions tab. Questions will be uploaded and visible, now it's the time to check the maturity level of that person and his Organization. When we complete the first process area questions then we move to the next sub process area and further step be step we must complete all process area. After that we move to the next Main process area and his sub area's and similarly all the questions.

The user of this tool will click on the tab View Results and then a new window will open and it will specify the user maturity level with obtained scores. This score was initially generated for that specific user not whole organization. But when press another tab the laying vacant on the right most top side of the new window it will explain the whole organization maturity level and all the employees obtained marks.

At the end the user will press a tab name Full Graph and here also a new window page will open that will specify the whole organization maturity level but not only that organization but it will also provide comparison with other organization in a graphical view point. When we see here at the top of the graphical representation there mentioned organizations/companies names and obtained scores. Hence after viewing the results we can now in position to say that which organization provide best results and the employees of that organization capable with all other process areas and solve other problems accordingly.

This framework can support organizations in continuous assessment. It helps to assess their maturity level periodically. It also helps to improve organizations to attain Capability Maturity Model Integration standards.

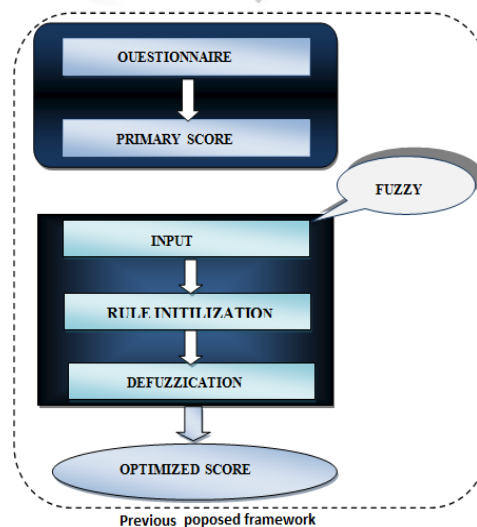


Figure 1: Proposed Framework

IV. TOOL USED FOR EVALUATION

For keeping in mind the problems faced by the organizations we designed a framework, and for test purpose we distribute it five different Pakistan software small to medium organizations in two major areas of Pakistan. With the help of this framework we are in the position that we can identify the weakest areas of different companies and after performed this we can suggest that particular organization they can improve this area and after that they can get maximum results. Software Companies details with employee's strength are given below in table. Extended Maturity questionnaire was used as the tool for carrying out the assessment. SCAMPI is a common appraisal and assessment method. A person trained and certified in SCAMPI is essential to carry out the assessment. It is an overhead to the organization. Extended maturity questionnaire is an inexpensive tool that was used to collect data. The collected data was processed and analyzed to find out the results.

A total of 50 questions were formulated to cover the 13 process areas. The process areas and the number of questions raised are given below.

Table 1

Project Planning (PP) :	4 questions
Project Monitoring and Control (PMC) :	4 questions
Risk Management (RSKM) :	4 questions
Requirements Management (REQM) :	4 questions
Requirements Development (RD) :	4 questions
Technical Solution (TS) :	4 questions
Validation (VAL) :	4 questions
Product Integration (PI) :	4 questions
Process Management:	4 questions
Organizational Training (OT) :	4 questions
Organizational Process Definition + IPPD (OPD) :	4 questions
Organizational Process Focus (OPF) :	4 questions
Process and Product Quality Assurance (PPQA) :	4 questions

V. QUESTIONNAIRE

EMQ was taken as the tool for data collection as we knew that it is simple, easy to handle. We designed a 5 scale EMQ with 5 answers,

- Achieved
- Partially Achieved
- Does Not Apply
- No
- Don't Know.

EMQ's were updated in our developed tool minimum of four persons in each organization; sufficient time was given to finish the questionnaire. Then they gave answers to the automated tool. Questionnaire was given to mainly Software developers and team leaders and project manager / project leader. Based on the individual answers about each process area, marks were allotted and a final score was calculated for each process area from the four questionnaires. Similarly, all process area scores were calculated and finally they were summed up for a final score of the corresponding organization automatically updated in our software and we can just view the result only pressing total results tab.

VI. SOFTWARE USED

In implementation phase we used MATLAB and implement our code in this power full tool and after complete comparison and implementation to our proposed framework and generated results. After that we also can see the surface view of the comparison of the organizations. We proposed a new online tool that organizations can easily and freely access to our developed tool and with this tools they can easily check the whole process that were used in the completion of a software. Although with this tool we can also show our results graphically for easy understanding.

Matlab

MATLAB is a power full tool that was developed by Math Works and the main objective of this tool that we can plotting functions and implementations of the algorithms. In simple we can say that this tool is used for classification of the data and division of the data. For this purpose Mean and entropy tools as always well made by this tool.

Mamdani Model

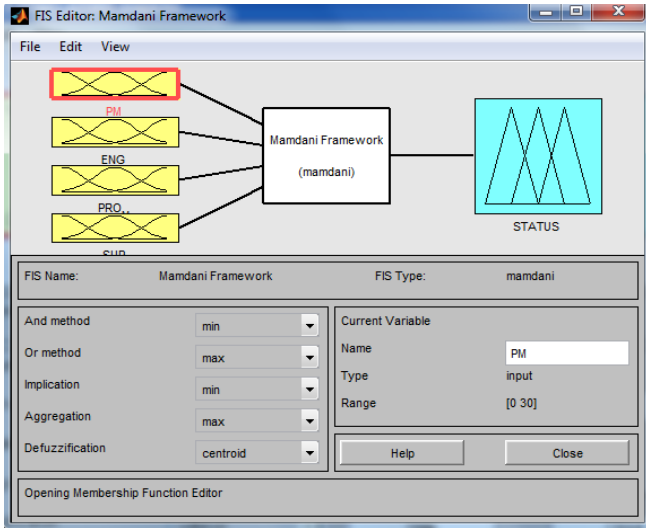


Figure 1: Input output variables through FIS editor

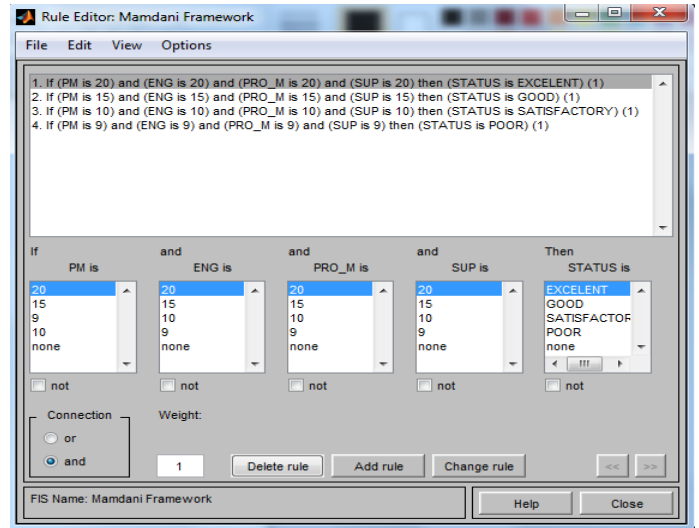


Figure 2: Rule initialization process using Mamdani rule editor

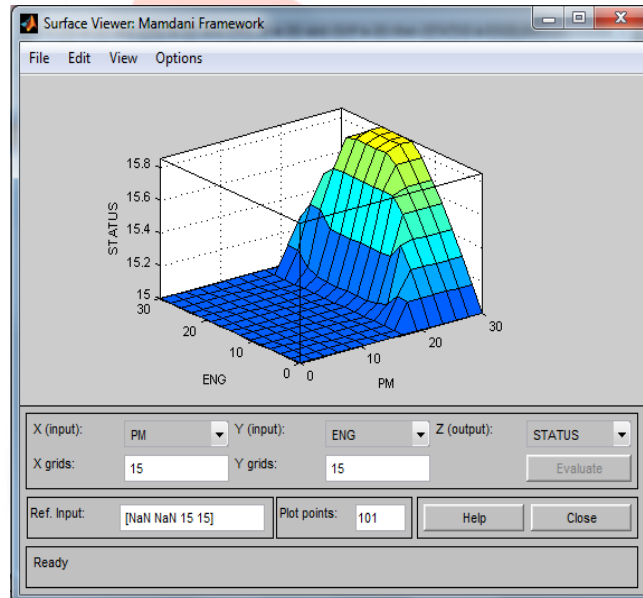


Figure 3: Mamdani Surface view

Mamdani

Mamdani inference method that was introduced in 1985 and it is similar to the Sugeno in many respects. The main objective of this inference method is that we can say that this process fuzzifying the inputs with the help of fuzzy operators that can help to simulate the inputs. One of the major difference in both of the sugeno and mamdani methods we can say that only in membership functions as when we take membership functions we can say that it will be linear but not in mamdani case. Previously some of the authors used the sugeno method but not mamdani method so that's why we applied the mamdani method for the implementation phases.

VII. PROPOSED AUTOMATED TOOL IMAGES

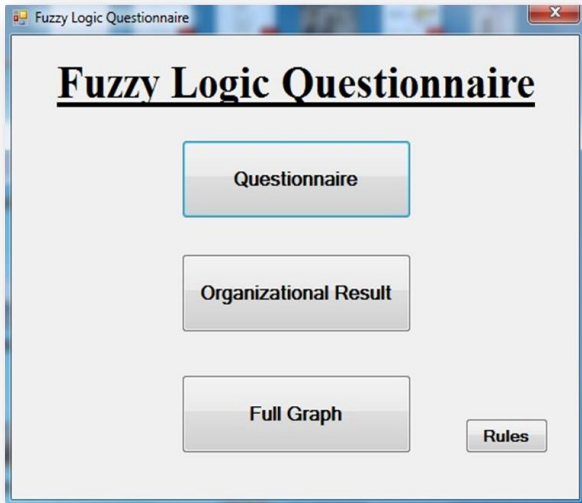


Figure 1: Home page of developed online tool

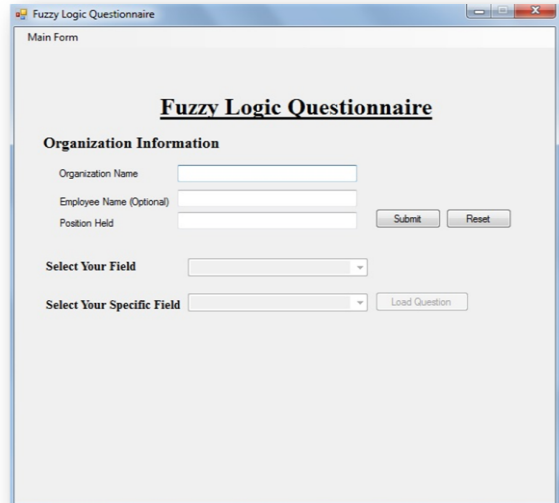


Figure 2: User login window



Figure 3: Selection of field



Figure 4: Selection of sub field

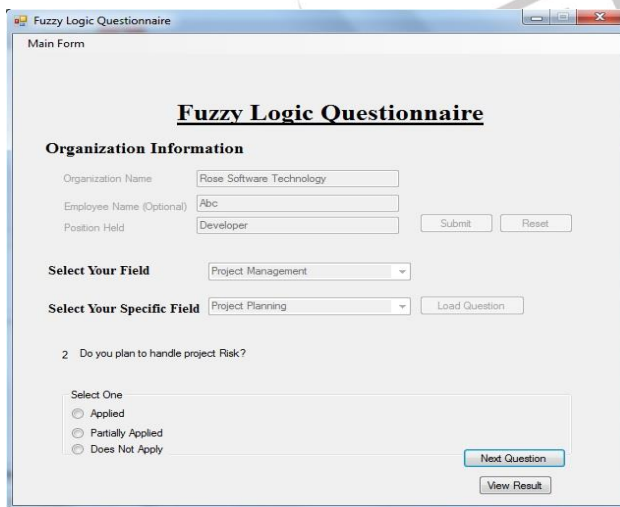


Figure 5: Generation of questionnaire according to the specific field

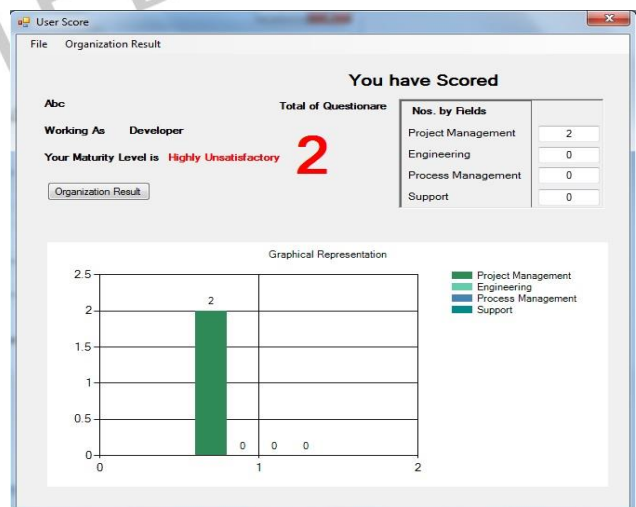


Figure 6: Graphical representation of individual assessment

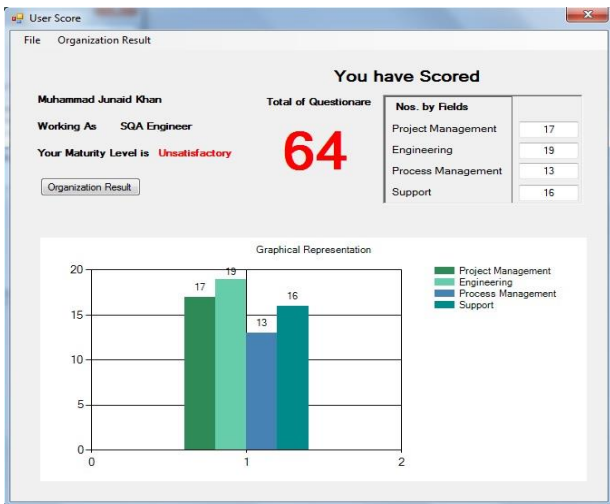


Figure 7: Graphical representation of whole assessment

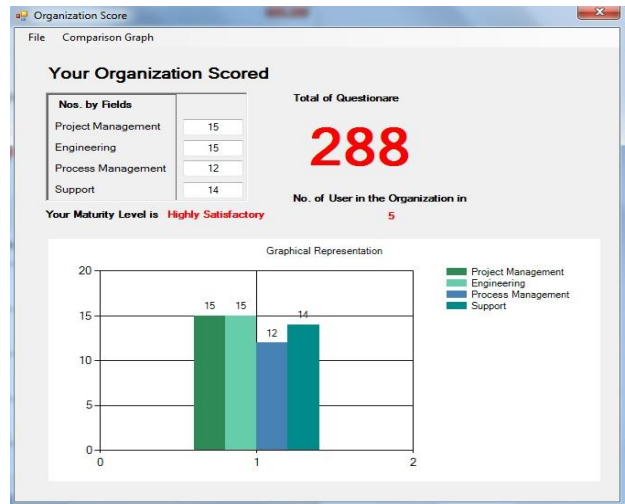


Figure 8: Complete organizations assessment

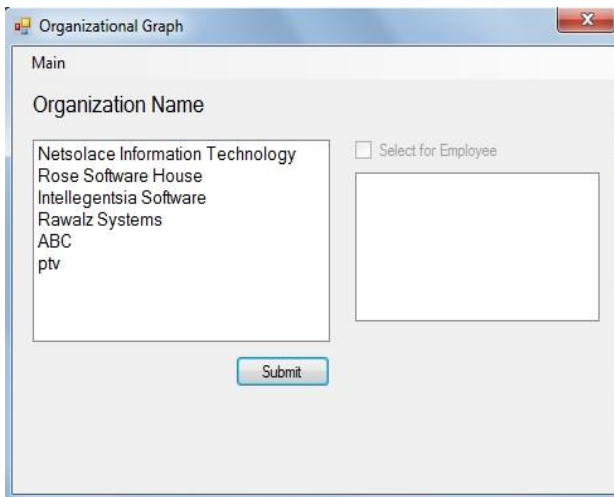


Figure 9: Organizations Name tab

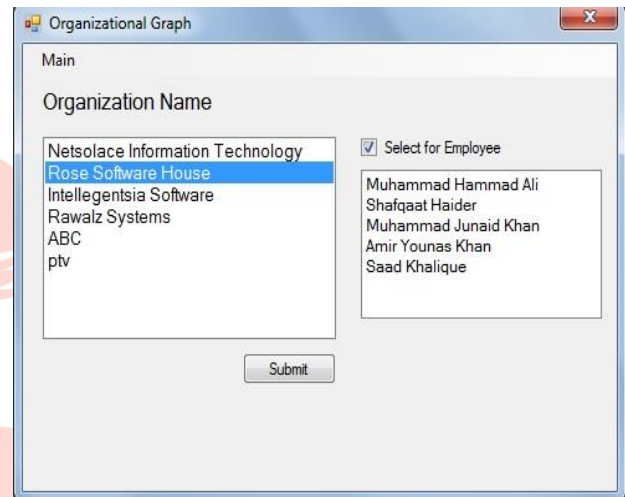


Figure 10: Employees details tab

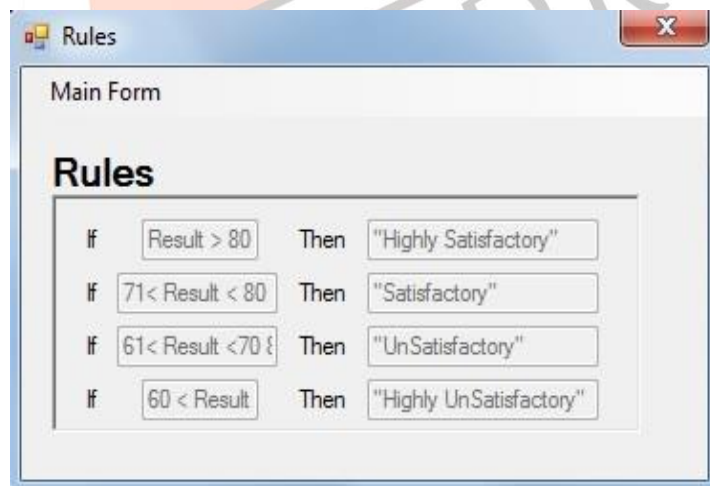


Figure 11: Rules of assessment in proposed tool

VIII. CONCLUSION

Our developed automated tool with standard process areas is presented in this paper. By giving the site assessment of parameters the developed tool will be able to monitor the performance of that particular organization according to the capability maturity model integration (CMMI) standards. After getting response from different organizations it was obviously come to know that they were giving little bit attention on process improvement phases. In the same way they also accept that they were neglecting completely Capability Maturity Model Integrations rules and instructions. These organizations were influenced by the

knowledge and capability of senior most personalities in the organization. The proposed tool will help organizations to assess their maturity level periodically.

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