ENHANCING THE ATTRIBUTES OF SOFTWARE QUALITY OF COMPONENT BASED SOFTWARE USING SOFT COMPUTING TECHNIQUES

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ABSTRACT

Quality of the software is essential for maximizing the confidence level in developing software as well as in the software engineering field. Quality of software products plays an integral part in the success of any business. Characteristics of quality related to software would be gauged for testing the quality of the software. Software quality includes most essential characteristics and features of a product or activity that would be on the basis on the meeting the desired requirements. Software quality attributes plays a main role in success of any project. Thus such type of attributes has to be gauged or estimated for successful project. There are many attributes there are estimated the quality of the software in terms of characteristics such as correctness, integrity, interoperability, scalability, trackability, tailorable, reliability, maintainability, portability, efficiency, flexibility, reusability, usability and so on. The main objective of the research is to enhance the software quality attributes of component based system using soft computing techniques. This study develops a model for enhancing the attributes of software quality using artificial neural network. Software quality attributes selected for this study are reliability, reusability and maintainability. This study proposes a model to enhance the software quality attributes of CBS. It was found out that the proposed model outperforms well than the existing techniques such as neural-fuzzy, genetic algorithm and neural network.

Keywords: Software quality, Component based software, Component based software development, Soft computing techniques, Reusability, Maintainability, Reliability, component based development and Component based software engineering, Software metrics and quality attributes

1.1 Introduction:

According to Mishra and Mohanty (2011) the main objective of any successful and effective software project would be developing quality software within resource, cost and time constraints. This could be reached only through effective and efficient management of process of software development and it contains different phases during the software entity development. Sedigh-Ali, Ghafoor and Ali (2001) stated that for developing a component from the scratch would be expensive and could take long time for finishing which would even loose the market due to crucial applications with
strict restrictions in the time constraints. All such problems could be resolved through an approach namely CBD (component based development). CBSE (Component based software engineering) assists in reduction of time and cost and thus enhances the software quality. Pande (2012) added about the benefits of component based software development. There are numerous advantages in CBS (component based software) development such as wider usability; effective complexity management, maximized productivity; minimized time to time and greater consistency degree.

Ambros, Lanza and Robbes (2010) mentioned that the software metrics is referred as quantitative measures which give the basis for effective management of process of developing the software. They are used for enhancing the software quality and productivity. They quantity various attributes of project, development process and resource of the software. Honglei, Wei and Yanan (2009) referred that the software metrics is categorized into three such as product metrics, procedure metrics and project metrics. Product metrics measure the program’s quality information. Such metrics concentrate on reliability, complexity, reusability and maintainability of part or the entire developed software program. Project metrics provide information about the project’s actual situation (Ambros, Lanza and Robbes, 2010). Such metrics encompass effort, costs, quality and risks. These are used for enhancing the project’s development process. Procedure metrics gauge the time and cost resources that an effort of program development would take. Procedure metrics are useful for management and administration of the project (Honglei, Wei and Yanan, 2009).

Luders, Lau and Ho (2002) and Schmidt (2003) discussed about the quality attributes are referred as the extra-functional attributes or non-functional attributes properties. Quality attributes rely on the quality of the component and they do not rely on the functionality of the component. Apart from these, it infers about the component characteristics. In addition to that, it was stated by Reussner,
Schmidt and Poernomo (2003) that the properties of the component focus on the concentrate accessible values which represent the characteristics. Few attributes of quality are represented in the component level while other represented in the application level. The major goal of CBS engineering was concentrating on developing tough components for software system.

Kaur et al (2010) stated that in soft computing the issue is denoted in such a manner that system state could somehow be measured and compared to certain desired state. It includes methods that perform in a surroundings which subject to imprecision and uncertainty. The major components of soft computing techniques such as probabilistic reasoning, fuzzy logic, genetic algorithms, neural computing. Fuzzy logic is based on the imprecision, representation of aspects and approximate reasoning that are known qualitatively. Probabilistic reasoning like Bayesian Belief networks has major character that is its potential for updating previous result measures by conditioning them with evidence that would be new available. Evolutionary and genetic computing offer approaches to computing on the basis on analogues of natural selection like optimization methods on the basis on particle swarm or ant colony. Neural computing relies on the perceiving the self-organizing structures, neural networks and learning systems and deploying the models from available data.

1.2 Problem Identified:

Analyzing the CBS dependencies is a main part of the software research for various software quality attributes. Software products have to be scalable, correct and reliable (Sedigh-Ali, Ghafoor and Ali, 2001). In order to verify such qualities it is significant to test the software at various conditions and therefore software testing is essential component in the process of developing software (Preiss, Wegmann and Wong, 2001 and Mishra and Mohanty, 2011). Further, attributes of software quality also plays a significant role in enhancing the success of the project. Therefore such attributes has also to be
measured for successful project. Therefore, this study intends to focuses on improving the attributes of software quality of component based software using soft computing techniques. This study also develops a model using soft computing techniques.

1.3 Aim:

Aim of the research is to enhance the software quality attributes of component based software using soft computing techniques, namely, ANN (Artificial Neural Network), genetic algorithm, neuro-fuzzy and neural network.

1.4 Research Objectives:

Objectives of the research are as follows:

i. To estimate the software quality attributes of component based software using soft computing techniques, namely, ANN, genetic algorithm, neuro-fuzzy and neural network.

ii. To develop a model for enhancing the software quality attributes using soft computing ANN technique of soft computing.

iii. To compare the software quality attributes of component based software using existing techniques such as, genetic algorithm, neuro-fuzzy and neural network.

iv. To enhance the software quality attributes of component based software using soft computing techniques, namely, ANN, genetic algorithm, neuro-fuzzy and neural network.

1.5 Limitations of the Study:

Limitations of the study are as follows:

i. Findings of the study are limited to the soft computing techniques alone

ii. This study focuses only on the attributes of software quality for developing a model

iii. This study exclusively considers about enhancing the reusability and reliability of component based software using soft computing techniques.
2. Literature Review:

Aggarwal et al (2005) utilized a fuzzy-based approach for measuring the maintainability of software by focusing on the average life span of variables, average quantity of live variables, average comments ratio and cyclomatic complexity. The inputs and outputs of fuzzy-based approach were used for measuring the maintainability of the software. Combination of 81 rules was applied for making the FIS for predicting the maintainability. For validating the proposed model, this study considered 10 software project of methodology that is based on procedure. The criteria for selecting the projects were on the basis on defined set of available inputs in projects’ data set. By introducing some errors in proposed projects, maintenance time was used for correcting the system. Further the maintainability was gauged with data sets and fuzzy model. It was found out a strong relationship between maintenance time and maintainability.

Singh et al (2011) developed a model based on 4 parameters to estimate the one of the attributes of software quality namely reliability such as neural network, fuzzy logic and neuro-fuzzy. It was found that neuro-fuzzy technique was found to be powerful tool for tackling the significant issues in the software engineering. Likewise according to the study by Jatain et al (2012) focused on the some components of software quality attributes. In this study, fuzzy rule based for assessing the reusability component system for real time projects. Rathod, Parmar and Teraiya (2012) estimated the reliability of CBS using ANN (Artificial Neural Network). It was found out that using ANN approach, reliability of CBS would be estimated easily. In addition to that, it was noted that, error could be reduced up to 99 per cent when compared with the existing techniques. Thus it was concluded that the Reliability of CBS could be estimated easily through artificial neural network approach.

Tyagi and Sharma (2014) examined adaptive neuro fuzzy model to estimate the
reliability of CBS systems. Accurately estimating the reliability of CBS system is complex since it relies on two factors such as glue code reliability and component reliability. Techniques of soft computing could assist to solve issue whose solutions are unpredictable or uncertain. Two fundamental elements related to soft computing are fuzzy logic and neural networks. This study proposed a model to estimate the estimate reliability of CBS system referred as an ANFIS (adaptive neuro fuzzy inference system) that is on the basis on these two fundamental soft computing elements and compared its performance with fuzzy inference system (FIS) for unique data sets. From the findings of the research, it was observed that the ANFIS enhances the reliability evaluating the technique of fuzzy inference system.

Kumar, Kumar and Sharma (2013) applied the neuro-fuzzy approach for building the framework of reusability assessment across software component releases. Reliability is the significant attributes for the success of any CBS product. If developed CBS is not highly reusable, then it would not be recommended for the integrating any project since it would maximize the complexity rather than easiness in developing the software. This study has utilized soft computing technique for predicting the reusability of software component prior it finishes the development of its own. Moreover, it was noted that if the proposed approach is used in the process of software development then the completely developed software would possess the index of high reusability. Thus it can be concluded that the neuro-fuzzy approach which is used particularly for the process of software development would performs better.

Mewada, Sinhal and Verma (2013) examined the ANFIS (adaptive neuro-fuzzy inference system) based software evaluation. Accurate estimation the effort leads to other assessment accurately and efficiently such as staffing, cost, schedule and budget. Effort software component plays an important role in the project management of the software. To predict the software effort, this study
developed ANFIS based technique would facilitate the stage of software planning to make its decision related to evaluating the other software resources. ANFIS based technique was deployed successfully for predicting the effort of software. The same technique was compared with existing NN (neural network) based techniques as well as compared with other models. Effort of software does not rely on the project size it would encompass various other parameters such intermediate constructive cost model attributes. Thus ANFIS based techniques have to be tuned for predicting all such attributes hybrid ANFIS has to be explored. It was found out that design of the efficient model for software effort evaluation using ANFIS for uncertain datasets and it indicates that such technique outperforms with appropriate outcomes. Thus it can be summarized that the proposed ANFIS model would outperform well in terms of uncertain datasets as well as produces the sufficient outcomes.

Tyagi and Sharma (2014) proposed a heuristic model to estimate the CBS system reliability using ACO (Ant colony optimization). Majority of the models of software reliability for CBS system rely on either architecture of the system or reliability of the component and glue code reliability. It is significant to optimize the paths usage by obtaining more accurate assessment of CBS system reliability. This study proposed a heuristic algorithm namely ACOREL algorithm. ACOREL algorithm is the direct extension of ant colony optimization. It was found out that proposed algorithm outcomes in determining the most used path and then based on such reliability of path, application could be evaluated. Thus it was concluded that the ACOREL algorithm performs well than other existing techniques used in the research.

Kumar, Kumar and Sharma (2014) predicted the maintainability from project metrics data analysis using ANN. The proposed metrics for maintainability is able to forecast the maintainability of component or module with good accuracy. Further, maintainability is forecasted using four metrics with a component or module.
The model is deployed using ANN of soft computing. Various attributes and algorithms of ANN architecture were applied in validation and experimentation. The conclusion were made on the basis of the least root mean squared error (RMSE) of combination of learning algorithm, neural network architecture and neurons frequency. In terms of maintainability prediction, better outcomes are obtained with 15 neurons, trainbr learning algorithm and feed forward back propagation algorithm. Thus it can be concluded that the outcomes are done based on least root mean squared error of combination of learning algorithm, neural network architecture and neurons frequency.

Lal and Kumar (2014) designed and analyzed the reliability for CBS system by using approaches of soft computing. Studying about the reliability model was used for determining the reliability of the CBS, is conducted for viewing the possibility for incorporating with fuzzy logic for determining the component reliability. Reliability of software is integral part in quality of the software. Modelling the software reliability is matured to the point that outcomes could be acquired by implementing appropriate model to the issue. New approach was proposed for determining the reliability of CBS system. The outcomes acquired by using proposed and existing approach could be compared and it would be determined that the proposed approach is better traditional one. Thus it was concluded that the outcomes acquired by using proposed and existing approach could be compared and it would be determined that the proposed approach is better traditional one.

2.1 Research Gap:

There are also studies and researchers that focused on the component based system using different techniques. Singh et al (2010) examined the software engineering and the survey focused on reusability based on software component. This study also examined the significance of reusability in the software component. There are also studies that concentrated on estimating the component reusability by
determining quality attributes of component a fuzzy approach (Jatain and Gaur, 2012). Authors also carried out an investigation to design and analysis of reliability for component based software system by using approaches of soft computing (Lal and Kumar, 2014). There are also studies that focused on estimating the reliability of component based system using artificial neural network (Rathod, Parmar and Teraiya, 2012). Authors also focused on the applying neuro-fuzzy approach for building the reusability assessment framework across software component releases-an empirical evaluation (Kumar et al, 2013). Tyagi and Sharma (2014) focused on the heuristic model to estimate the reliability of component-based software system using ant colony optimization. In addition to that, Tyagi and Sharma (2014) concentrated on the model of adaptive neuro fuzzy to estimate the reliability of component based software systems. There are also studies that focused on the maintainability prediction from project metrics data analysis using soft computing technique namely artificial neural network that is an interdisciplinary study (Kumar, Kumar and Sharma, 2014). Mewada, Sinhal and Verma (2013) carried out an investigation to analyze the ANFIS (adaptive neuro-fuzzy inference system) based software assessment or evaluation. However, there has been no specific study that focused on the enhancing the attributes of software quality component based software system using soft computing techniques. Therefore this study tries to bridge that gap by concentrating on the enhancing the attributes of software quality component based software system with respect to soft computing techniques. In addition to that, this research also compares the attributes of software quality of component based software system with existing techniques. Apart from these, this study mainly develops a model for software quality attributes specifically using soft computing techniques.

3. Research Methodology:
For enhancing the software quality attributes there are numerous effectual techniques. There is a maximizing demand for enhancing the attributes related to software quality of CBS. The main intention of the study is to enhance the attributes of software quality of CBS using soft computing techniques. The proposed study adopts soft computing techniques to enhance the software quality attributes of CBS. The proposed study develops a model for attributes of software quality using soft computing techniques. It was noticed that effort of software does not rely on the project size it would encompass various other parameters such intermediate constructive cost model attributes.

Main attributes of software quality were taken for measuring. Attributes selected for this particular study are reliability, reusability and maintainability. The proposed model was deployed using ANN (Artificial neural network) techniques of soft computing. The proposed model would be a direct extension of the artificial neural network. The proposed model namely expanded artificial neural network.

Limitations seen in the existing artificial neural network would be resolved in the proposed model that is in the expanded artificial neural network. The proposed methodology used various attributes and algorithms presented in the architecture of artificial neural network. The factors selected for the software quality attributes were grouped into the attributes of artificial neural networks. Attributes that have been selected for the study were developed by the artificial neural network sets as low, medium and high. The value of the software quality attributes were measured by using the proposed model. And then the outputs of the attributes would be categorized. Enhancement of the attributes of software quality would be compared with the existing techniques such as genetic algorithm, neuro-fuzzy and neural network.

4. Discussion:

In order to identify the efficiency of the proposed model it is significant to compute the software quality attributes of CBS system using neuro-fuzzy, neural-
network, genetic algorithm and more. Reasons for adopting the techniques of soft computing would assist in solving issue and obtained solutions would be unpredictable or uncertain. From the analysis, it was found out that, proposed model outperforms well than existing techniques such as neuro-fuzzy, neural-network, genetic algorithm and so on. For ensuring the accuracy of the software it is significant to test the reliability of the software. Reusability plays a significant part in the software quality. It enhances quality, reduces costs, and maximizes productivity and interoperability. Maintainability also plays a main role in attributes of software quality. It is significant to ensure whether system has to be modified or enhanced to remove the defects as well as adapt or enhance the performance to unique environment.

5. Conclusion and Future work:

In order to improve the software quality attributes there are numerous effectual techniques. There is a maximizing demand for enhancing the attributes related to software quality of CBS. But there is no specific technique that provides the enhanced version of estimating the attributes of software quality. The main intention of the study is to enhance the attributes of software quality of CBS using soft computing techniques. Apart from these, it was stated that reasons for adopting the techniques of soft computing would assist in solving issue and obtained solutions would be unpredictable or uncertain. The proposed study develops a model for attributes of software quality using soft computing techniques. This study selected the main attributes in the software quality such as maintainability, reliability and reusability. From the findings of the study, it was found out that, proposed model outperforms well than existing techniques such as neural-network, neuro-fuzzy, genetic algorithm and so on.

Future work would be based on enhancing the attributes of software quality of component based software using any specific soft computing techniques namely artificial neural network. The future work
would develop a model based on the fuzzy logic and enhance the attributes of software quality of component based software.

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