ABSTRACT

The rapid increase of computer based systems in modern engineering field is helping the gradual replacement of traditional systems with software based systems. The increasing complexity of software applications is making conventional methods and tools of software development insufficient. Delivering high quality software for real-world applications is difficult within the deadline period of user demand. A wide range of software engineering paradigms have been recently devised either to make the engineering process easier or to extend the complexity of applications that can feasibly be built. Major changes are taking place in large-scale software intensive systems development and updation. To meet many challenges, software development must be able to cope with complexity and to adapt quick changes. If new software products are each time to be developed from scratch, these goals cannot be achieved. The key to the solution to this problem is reusability. From this perspective, component based software development appears as a promising technique for solving the problems mentioned above. This technique consists of modular design and development of applications based on software components, developed independently and suitably combined to compose the final application.

Component based software development consists of the following sequence of processes: component selection, component adaptation, component assembly, software evolution and maintenance. This research focuses on the quality improvement of Component Based Software (CBS)
systems by tuning the component selection and assembly process and also improving the reliability of CBS through Quality Function Deployment.

Component selection process is a process of determining “Fitness for use” of previously developed components that are being applied in a new system context. It is a process of selecting components when many competing products exist. In many organizations the selection process is typically not defined in a proper way. Each project finds its own approach to it, often under shorter schedule and budget pressure. Component selection is a major challenge to CBS developers, due to the multiplicity of similar components on the market with varying capabilities. Although several approaches and criteria have been proposed for component selection, there is no well defined procedure to select optimized components. In this work, an optimized approach is proposed based on Genetic Algorithm that enables the selection of software components both considering functional and non functional requirements to find the best combination of components. This approach uses a modified genetic algorithm to conduct evolutionary search of the solution space in an effort to find the right components.

Component assembly is the process of designing a software system from off-the-shelf components and combining them to form a functional system. Components are chosen such that the user defined specifications should be satisfied. During assembly the engineer must be concentrated with the functional and non functional properties of the components and also how they interact as a system. So, correct automatic assembly of software components is required for large software systems and it is considered an important issue of component based software development. Integrating a
system with reusable software components introduces a set of problems in integration and also in functional properties. One of the main problems is related to the ability to properly manage the interactions between the components. In this work, a new technique is proposed to assemble the components based on component dependencies. The algorithm is highly suitable for rapid development of large software systems.

In component based software development, the total software system reliability depends on its components reliability. Reliable functioning of software system is paramount concern to the millions of users who depend on the software system everyday. Unfortunately most of the systems still fall short of user expectation of reliability. So a framework is developed to improve the reliability of component based software system based on its known component reliability. The role of quality assurance is to ensure that the quality of procedures and processes result in a product that fully meets the user’s requirements. Quality function deployment is a well-known planning methodology for translating user needs into relevant design requirements. So to minimize the bugs in the software and also to manage the software development process, it is planned to apply the quality function deployment technique in a systematic manner to manage the software development process.

This research work deals with investigation of the problems of component based software development in order to decide how to select the component, how to assemble them and how to manage the software quality. Case analysis for all the above approaches is done by applying the proposed techniques in component based Enterprise Resource Planning (ERP) software.
After applying the proposed research technique in the ERP software, the quality and reliability improvement of the software is achieved to a significant level. It is believed that this work will help to educate the practicing engineers in establishing component software as an efficient and proven engineering discipline.