Requirement Engineering Research

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Abstract— The requirement validation is vital for every successful software development. In this process, the requirements from the users are checks and analyzed with its consistency, completeness and correctness. The validation of requirements is a very vast research area in software engineering. In this presented article, some quality research approaches are cited for the software engineering researchers and software professionals

Keywords- requirements; requirement engineering; requirement elicitation; requirement verification and validation; software development; specification

I. INTRODUCTION

Software engineering is a systematic approach to the development, operation and maintenance of software. It includes techniques and procedures, often regulated by a software development process, with the purpose of improving the reliability and maintainability of software systems [1]. The discipline of software engineering includes knowledge, tools and methods for software requirements, design, construction, testing and maintenance. There are various research areas in software engineering as Requirement Engineering, Reuse Engineering, Object Oriented Software Engineering, Client Server Software Engineering, Empirical Software Engineering, Measurement and Usability Engineering etc. Requirement Engineering (RE) is one of the challenging and thrust research areas in software engineering. Most of the recent research practices introduced and experimented in requirement engineering have been discussed subsequently. Requirement engineering is a process of providing user requirements that can be further used to implement in software development. Requirement engineering is a condition or capability needed by a user to solve a problem to achieve objectives, or a condition that must be met or possessed by a system or system component to satisfy a contract, standard specification or other formally imposed documents. It can be a documented representation of a condition or capability [2].

Requirement is an important milestone for developing quality software products. It is observed that the most common problems associated with software development are related to requirement. A statistical analysis on requirement engineering has reported that there are three most cited factors -incomplete requirement and specification, changing requirement and specification and lack of user inputs, these factors caused project to be challenged. Therefore, a correct, consistent and complete way to collect, understands, specify and verify user requirement is important and necessary for software development. Requirement engineering is a systematic approach to elicit, organize and documenting the requirements of the system. It is a process that establishes and maintains the relationship between a customer and the project team on the changing requirement of system. Requirement engineering is a particularly critical stage of software process as errors at the stage inevitably led to the later problems in the software development process. Requirement engineering is the process for identification and then translation of stakeholder's needs to the system requirement. On observation, it is found that detecting and repairing errors in the maintenance stage is more expensive as compared to requirement engineering phase. Thus, the requirement engineering is a key process to the success of producing high quality software products. Many researchers are interested in analyzing the requirement engineering practices because this area has a great attention and future scope.

The presented research tries to highlighting various research topics such as requirement elicitation, requirement specification, requirement verification and validation. Also, it analyzes the requirements required for designing, developing, testing, implementing and maintaining the system or software product. In the following of synopsis, we present a literature review of the latest research trends in the area of requirement engineering. Next, we present research proposal in the selected area. A bibliography in the latest research on requirement engineering is also included at the end of the synopsis.

II. LITERATURE REVIEW

The purpose of requirement engineering is to ensure that product development team produces a system that satisfies user needs. It is also stated above that the basic goal of requirement engineering is to capture the requirements from user and implement them in software development activities. The impact of requirement engineering in software development has very vast research scope. The requirement engineering process mainly focuses on two aspects, namely; requirement development and requirement management. Requirement development aspect includes elicitation, analysis, specification, verification and validation

activities. In requirement development, we identify the expected user classes for the product and analyze the information received from the user. Requirement management is a critical activity that comprises of sub-activities related to the management of requirements, including the evolution of requirement over time and across product families. This view of requirement engineering for software development is a very significant field of research having good amount of research work and has a great scope of software development with more reliability and satisfaction.

The success of system development depends upon the fitness for the needs of its users and business environment [3, 4]. Many researchers have already presented their research work on requirement engineering practices. The designer of information system and programmers often begin designing and programming the incumbent system too early, before they actually understand the users or stakeholders needs. Also, they observe that the future system to be effective, it has to be balanced between the technical worldview of designers and programmers as well as social worldview of users and customers [5]. From literature survey, we found that the carefully identified and extracted software requirement is a key issue for project success [6]. At the same time, the cost of correcting an error after delivering the system is an order of magnitude higher than the cost of correcting a similar error during the requirement analysis phase [7]. Since requirement often change during development, it is important to control the changing requirements [8]. Numerous software measures for the requirement management activities have also been found in literature survey. A set of requirement indicators have been observed which are compatible with the measurement practices of the Capability Maturity Model (CMM) for software [9]. A number of researchers have made state of the practice surveys that are used for developing large information system with the help of requirement engineering. Some of the researchers have given a depth analysis for managing information system for industries. They have also made survey and clarified the fundamental problems in requirement engineering practices [10, 11].

Software developers, especially system analyst performing analysis, play an important role in requirement engineering process. There have been various research problems and future research direction related to requirement engineering such as technological enhancement, modeling, requirement reuse, globalization of requirement engineering process etc. have been observed in literature survey [12, 13]. On the other hand, the importance of requirement engineering practices on classified software packages has also been found in literature [14]. Empirical evidences exist in literature also demonstrate that organizational issues are important in requirement engineering process [15, 16]. Some researchers have introduced anti- requirement [17]. It is a requirement of the malicious users that subverts existing requirements. It is dangerous for organizations those develop software products. Various research finding have recognized the importance of incorporating customer requirements into the innovation process [18]. The ultimate goal of innovation is to satisfy the customer requirements. It can be performed by envisioning the customer requirements, offering new values or creating new demands for requirements.

For the last decades, many of the researchers investigated and integrated the security analysis and requirement engineering practice. Security is one of the most important requirements for a system to produce accurate and secure software product with high quality [19, 20]. Some researchers have also been interested in improving requirement engineering practice and defining requirement engineering process because of their confidence that requirement engineering can be the key to develop a successful system [21, 22]. However, implementation of requirement engineering work products throughout the organization and convincing user to apply requirement engineering practices in software development process is considerable challenges [23, 24, 25]. For the last some decades the requirement engineering has given a significant attention to developers and researchers for designing quality software products. The success of the organization-wide adoption of requirement engineering practice depends on human, social, cultural, global, personal, organizational, technological, and economical issues [26, 27, 28].

III. RESEARCH AREA RELATED TO RE

It is observed that requirement engineering is a practice used to first identify and then translate stakeholder's needs to system requirement [29]. It is also analyzed that the cost of fixing requirement defects later in the development phases is much higher than the cost of identifying and fixing it in the early stages of the development. In order to perform requirement engineering, the system requirements must be properly identified, analyzed and reviewed early in the software development process. Requirement engineering is a process that focuses on discovering, analyzing, documenting and managing system requirements. Also, we observed that the requirement engineering is a process for determining stakeholder's needs during the development of software intensive systems [30, 31].

Research on requirement engineering practices indicates that requirement engineering process critically influences the success of software development process. Therefore, we put our research proposal related to investigation of the effectiveness of requirement engineering practices in software development processes can be observed. Requirement engineering is the important process of software development that can be employed in all phases of SDLC. Requirement engineering outcomes can be used in all aspects of SDLC, such as project

planning, risk planning, quality planning, release planning and configuration management etc. Requirement engineering practices performed in an undisciplined way generates requirements that are incomplete, inconsistent, conflicting and unduly complex. The requirement identified in this way, may generate software defect that can be difficult to detect and debug during system testing and later stages of software development process [32]. Also, these are more expensive to fix than programming defects [33, 34]. We will try to find good quality requirements that can help us to discover aforesaid problems. It ensures that the good quality software product satisfies the customer needs. Finally, our research work will focus on following issues:

- The effectiveness of requirement engineering practices for software development processes. It can be performed by involving the analysis of requirement management and requirement development techniques. These techniques emphasis on elicitation, specification, verification and validation of requirements.
- The Impact of requirement engineering in SDLC phases such as design, implementation etc. literature review indicates that the quality of requirement engineering practices influences the success of software development processes.
- Analyzing the security requirement engineering for an organization. Security is one of the most important aspects of requirement engineering for designing quality software. The security requirement can be applied in an organization for designing accurate and secure software products.
- Analyzing and extracting useful information according to the business and technological needs for an organization to produce quality software products. Information requirement engineering is another sub-area of requirement engineering research, which provides tools, framework, and techniques to the organization to develop software that satisfies the market needs.
- Measurement analysis of proposed requirement engineering process framework for designing quality software products. It may present the framework based on system dynamics model as well as performance analysis for measuring the requirement engineering process performance in term of quality, cost and schedule adherence.
- Proposed research work can also be extended in various research application areas related to requirement engineering.

IV. ROADMAP TO RE RESEARCH

Time framework of RE research can be is planned as follows. Survey of literatures on latest research areas in requirement engineering will takes more or less first six month. Thereafter formulated problems can be solved by partitioning into sub-problems subsequently. The problem associated with effectiveness of requirement engineering practices for software development processes and impact of requirement engineering in SDLC phases will be solved in next coming months. Then the problem related to analyzing the security requirement engineering and information requirement engineering for an organization will be investigated. In continuation, effort is to be make to solve problems associated with measurement analysis of proposed requirement engineering process framework for designing quality software products. Furtheremore, research outcomes will analyzed and formulated with the available techniques. Finally research work is documented in quality manner. Further, research work can be extended on requirement engineering in subsequent years.

V. CONCLUSION

Requirement engineering practices with its illustrative framework, sequential description process, methodologies, and performance measurement for requirement engineering practices will be presented with their usefulness in the business organizations and for the community of information system users. The procedure to perform requirement engineering practices such as requirement development and requirement management throughout software development phases will be presented. Security requirement as well as information requirement engineering processes for the development of good quality software will be discussed. The practices of requirement engineering can be used to implement in software development activities for designing quality software products.

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