Evaluation of Requirement Defects: An Implementation of Identification Technique

Sandeep Kumar Nayak, Raees Ahmad Khan, and Mohd. Rizwan Beg

***Abstract*—There are various techniques involved in identification of defects in developing software but could not find a successful identification process in early stages. A concrete and cost effective technique for defect identification in early stage is high indispensable in modern era of software application and implications. In this study, we are attentive over an effort to commence an appropriate defect identification technique having two major components i.e. Requirement Inspection Participants (RIP) and Requirement Inspection Method (RIM). Although RIP is executed through author, moderator, reader, inspector and recorder, but RIM is covered through plan development, outline design, preparation and reporting to deliver overall requirement defect. After mutual course of action in identification, the inspection technique may be competent to deliver a significant output in the form of requirement defect. The implementation of defect inspection technique would also be appreciated by industry, software developers and innovators in future.**

***Index Terms*—Requirement inspection technique, requirement inspection method, defect identification, requirement defect.**

I. Introduction

Decades have been passed for improving the reliability of the developed software by many organizations in the software industry but some sort of deficiency is still a big problem. Therefore it was necessary to hire the best and innovative human resources to deliver the reliable software, but there is hardly ever a criterion for selecting the defined one. To avoid lacks of reliability, most of the organization reused software instead of developing it anew. Unfortunately, few organizations are capable to develop wide-ranging software that can be used without noteworthy modification.

Subsequently, the ultimate scheme promotes the acceptance of improved software development processes that may lessen the quantity of requirement defects at early stage and their variability by time. Early stage inspection may identify fifty percent of defects [1]. In this paper we are analyzing some of the existing methods as well proposing a modified inspection technique to detect the requirement defects as soon as possible for the betterment of developing software.

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II. Defect Detection Techniques and Their Limitations

Although defect detection at later stage and correction activities consume more than fifty percent of the labor to create software [2] yet a small number of requirement reading techniques like perspective based reading, ad hoc technique and checklist based reading have been introduced for detecting defects at early phase of Software Development Process [3]. Checklist method and scenario based method have been used for detecting defects through comparing the checklist of original context with the experimental context [4] where in an another experimental comparison of three defect detection method (Ad-Hoc, Checklist, Defect Based Scenario) analyzes the performance of defect detection rate[5]. Decision Tree, Multi Layer Perception and Radial Basis Functions are used for defect prediction at testing phase [6]. Defect Based Reading and Perspective Based Reading are the family of reading technique where defect detection focused on state machine notation and natural language respectively [7]. There is some declaration for early stage testing techniques over another:

- Internal threats like language, team members, elite group and instrumentation are the limitation of Checklist method and scenario based approach [4].
- Ad-hoc technique is cost effective but lower in performance [5].
- Requirement specification document may not be the representative of real software problems [4].
- There is insignificant differences among ad-hoc, checklist and scenario based method [5].
- Scenario based method consists limited set of questions and a detailed set of instructions [5][8] .

Due these limitations of defect detection techniques, further the inspection technique is broadly defined for requirement defect identification.

III. Inspection Technique for Requirement Defect Identification

This study is the extension of our previous work [9], [10] in which inspection technique has been mentioned for identifying the requirement defects. Here inspection technique is executed through two major components Requirement Inspection Participants (RIP) and Requirement Inspection Method (RIM) as mentioned in Fig. 1.

A. Requirement Inspection Participants

In Requirement Inspection Technique five participants used to play vital role through executing their individual

responsibilities well to identify defects at early phase as in Table Ⅰ .

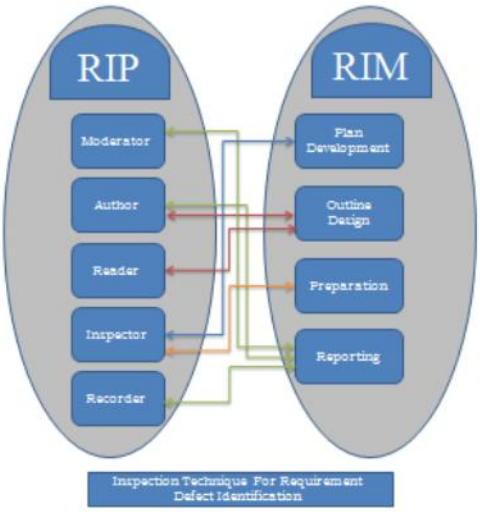

Fig. 1. Inspection technique for requirement defect antification

TABLE I: INSPECTION PARTICIPANTS AND THEIR ROLES AND RESPONSIBILITIES

Participants	Roles and Responsibilities
Moderator	•Moderator is responsible for managing overall inspection tasks. •Moderator will plan for Requirement Document Classification. •He will also deliver the proper inspection process schedule. •Moderator will collect all relevant requirement data. •He will also be responsible for issuing Requirement Inspection Report.
Author	•Author is responsible for generating the Requirement Inspection criteria. •Author will provide the Requirement Description for the proper inspection. •Author will also justify the participants role for according to the given inspection criteria.
Reader	•Reader is the leading participant during inspection meet for requirement object revision. •Reader will collect all interpreted sections of the objects for inspector. •Through collecting all objects Reader will emphasize each vital fact for defect identification.
Inspector	•Inspector is responsible for introducing all the requirement objects and identified the defects. •Inspector will frame question for inspection.
Recorder	•Recorder is responsible for collecting all type of Requirement Defects. •He will also deliver the details of Requirement Document. •He will provide proper Decision support for identified defects and recommendations. •He will also collect all inspected defect and requirement residue.

B. Requirement Inspection Method

After assigning the requirement inspection task to the participants, they are responsible to follow an appropriate method assigned to them for inspecting the requirement document as mentioned in Table Ⅱ.

TABLE II: INSPECTION METHOD AND RESPECTIVE ACTIVITIES

Method	Activities
Plan Development	• Authentication of Requirement Document • Availability of Role Participant • Schedules structuring
Outline Design	• Task classification among participants • Provide Requirement document for inspection • Inspection meeting and Defect Registration
Preparation	• Technical participants must be instructed for separate learning of requirement document and to find potential defects through review process.
Reporting	• Acceptance on identified defects • Defect Classification

C. Functioning of Technique

The Functioning of Requirement Inspection Technique starts with plan development where the requirement document will be selected for orientation program. It selects the inspector and assigns the inspection work. Outline Design used to interact with Author for registering the defects and Reader for paraphrases requirement document. In Preparation, the Inspector will frame questions individually for each inspecting document where rework may also be occurred. Finally, Reporting will provide overall requirement defects. Author and Moderator will take joint decision for re-inspection if there is any need of it else the status of requirement statement will be close.

Through Inspection Technique half of the overall defects may be identify in the first pass and if second pass is needed then rest of the defects will also be identified.

D. Defect Assessment and Deliverables

Requirement defects must be contained in a tabular form within the database which may follow a template of specific attributes (Table Ⅲ) such as:

Above mentioned specimen in the template is given only for one type of defect within functional requirement domain. Here, stored defect is assigned severity and priority for further preventive action [10].

There are some indicators to assess overall requirement defect and signal to stop inspection:

- Number of Defects Detected: when number of Found Defect $\leqslant$ 1 Defect per functional statement of requirement document
- Participants Error: Less than 5 defects a day
- Defect Storage Time: Less than one hour
- Response Time: Less than one second
- Fault Tolerance: At least 80% of failure avoidance.

TABLE III: DEFECT TEMPLATE WITH SPECIFIC ATTRIBUTES

Defect Position	Defect Occurrence Time	Defect Indicator	Defect Cause	Defect Identification Cost	Defect Severity	Defect Priority	Defect Definition
Function Requirement	2:00 hours of Inspection	Functional Actor Missing	Inadequate Requirement Collection	Inspector's Effort & time taken in defect identification	Critical Severity (S1)	Urgent (P1)	a) Actor executes the operational Task. b)Preventive action required immediately.

IV. Discussion

Requirement defect inspection against quality software entails recording of defects within the requirement defect database, therefore this study exposed the process to analyze requirement defects and their measurement.

There are three protocols necessary for the inspection process to be succeeded:

- The participants must receive training before they take part in their first respective inspection.
- There must be sufficient time available for the plan development and preparation before the inspection process takes place.
- The participants in RIP must have respective skill to perform the inspection process.

There are some specific and required characteristics for the better execution of the Requirement Defect Inspection technique:

- Define good requirement gathering technique.
- Find only requirement faults and so failure defects.
- Better Database Management to contain Requirement Defects [9].
- The status (Open or Close) of requirement must be clear.
- Projection of expected defect.
- Requirement Inspection Participants must be trained in respective area.
- Define a better metrics on the length of time for defect detection.
- Starting and Ending status of defect identification must be defined.

V. Conclusion and Future Work

Inspection technique is much cheaper than some other commonly known methods of identifying defects, such as testing and customer findings. It is a formal review process applicable to any type of artifact and uses defined entry and exit requirements, participant roles and responsibilities, measurement activities, specific actions. This technique provides a finest way to identify the requirement defects so that preventive action may be taken as early as possible. Currently we are developing a concrete algorithm which will act as a technique for defect mitigation, and a metric which may capable to estimate the reliability of requirement after defect mitigation.

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