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An Innovative RTM Providing Test Maintenance in An Automated Scripting New Frameworks

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***Abstract*— In the software testing domain clients and the business community have gained maturity to understand the benefits of implementing a test automation Framework. Test automation is a process of performing software testing activity by utilizing various test automation tools. Test automation Framework plays a vital role in the success or failure of any software automation project .In This research work implementing development framework RTM(Relational Traceability Matrix) automated scripting it is the mapping between test case and use case, the RTM is used as a test planning tool to help determine how many tests are required ,what types of test are required ,whether test can automated or manual and if any existing test can be reused using the RTM scripting in this way helps ensure that the resulting test are most effective, in the existing methodology only done with traceability of test cases ,In this research work done realize to implement RTM automated scripts module before going to the market once again the user can test into the main functionality, RTM is used to map requirements to test cases in order to ensure all requirements are closed. In this research work implementing reduction in test cycle time ,money saving ,better faster testing rapid validation of software changes with each new release of application in possible automation testing offers a level of consistency which is not achievable through the use of manual testing, enhance productivity and reusable test scripts are possible.**

Keywords :- *RTM-Requirement traceability matrix, Automated scripting, Requirement test cases, TM-Trace matrix, Functional requirements, Design specifications.*

I. INTRODUCTION

A traceability matrix is a document that co-relates any two-baseline documents that require a many-to-many relationship to check the completeness of the relationship. It is used to track the requirements and to check the current project requirements are met. Requirement Traceability Matrix, RTM captures all requirements proposed by the client user and development team user and their traceability in a single document delivered at the conclusion of the life-cycle. In other words, it is a document that maps and traces user requirement with test cases. The main purpose of Requirement Traceability Matrix is to see that all test cases are covered so that no functionality should miss while testing.

A. Requirement Traceability Matrix – Parameters

Requirement ID
Risks
Requirement Type and Description
Trace to design specification
Unit test cases
Integration test cases
System test cases
User acceptance test cases
Trace to test script

B Types of Traceability Matrix

- Forward Traceability – Mapping of Requirements to Test cases.
- Backward Traceability – Mapping of Test Cases to Requirements.
- Bi-Directional Traceability - A Good Traceability matrix is the References from test cases to basis documentation and vice versa.

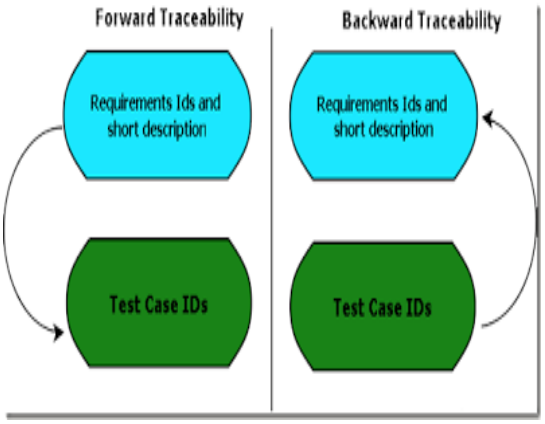

Fig 1. Flow Design

C Traceability Matrix from Software testing perspective

- A requirements traceability matrix is a document that traces and maps user requirements [requirement Ids from requirement specification document] with the test case ids. Purpose is to make sure that all the requirements are covered in test cases so that while testing no functionality can be missed.
- This document is prepared to make the clients satisfy that the coverage done is complete as end to end, this document consists of Requirement/Base line doc Ref No., Test case/Condition, and Defects/Bug id. Using this document the person can track the Requirement based on the Defect id

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D Benefits of using Traceability Matrix

1. Make obvious to the client that the software is being developed as per the requirements.
2. To make sure that all requirements included in the test cases.
3. To make sure that developers are not creating features that no one has requested.
4. Easy to identify the missing functionalities.
5. If there is a change request for a requirement, then we can easily find out which test cases need to update.
6. The completed system may have "Extra" functionality that may have not been specified in the design specification, resulting in wastage of manpower, time and effort.

E Test script

A test script is a set of instructions (written using a scripting/programming language) that is performed on a system under test to verify that the system performs as expected. Test scripts are used in automated testing.

II. RELATED WORK

The author described in this paper [1] Serena Software, Inc., San Mateo the present invention relates to a testing tool for testing of complex software systems having a plurality of interrelated system components and a suite of test scenarios for testing the performance of the plurality of interrelated system components. The testing tool includes an Automated Multidimensional Traceability Matrix system for determining linkages between interrelated system components, a means for identifying a change in one or more of the interrelated system components, a means for applying the Automated Multidimensional Traceability Matrix, a means for executing all of or a subset of the test scenarios associated with the interrelated system components that may be affected by the change and a means for evaluating the results of the executed test scenarios.

In paper [4] *B. Ramesh* ; *M. Jarke* A Simple Meta *Model* of *Requirements Traceability* This paper, in contrast, follows an empirical approach. Focus groups and interviews conducted in 26 major software development organizations demonstrate a wide range of traceability practices with distinct low-end and high-end users of traceability. From these observations, reference models comprising the most important kinds of traceability links for various development tasks have been synthesized. The resulting models have been validated in case studies and are incorporated in a number of traceability tools.

In paper [11] Gotel, O. and A. Finkelstein (1994), "An analysis of the requirements traceability problem," It is well known that poor requirements definitions will lead to systems that fail to satisfy user requirements. Much lip service has been paid to "the requirements problem" but little has been done to "template" a process likely to yield cost-effective requirements definitions

In paper [12] *Arlington*, VA. *RTM Requirements and Traceability Management* (*Product Overview*), the results of which are contained in this document, is that development of a model of traceability could be geared toward the needs of stakeholders at various stages of the systems development process. A variety of stakeholders are involved in the systems development process, including project sponsors, project managers, analysts, designers, maintainers, testing personnel, and end users. An empirical approach is used in this research to identify stakeholders' needs. Our study explores the information needs of various stakeholders.

In paper [14] *Stehle, G. (1990), "Requirements Traceability for Real Time Systems," In Proceedings of Euro CASE II,* traceability relationships help stakeholders understand the many associations and dependencies that exist among software artifacts created during a software development project. The extent of traceability practice is viewed as a measure of system quality and process maturity and is mandated by many standards. This paper introduces model traceability, reviews the current state of the art, and highlights open problems. One issue that impedes wide adoption of traceability is the overhead incurred in manually creating and maintaining relationships. We review the latest research advancements that address this issue through the automatic discovery of trace relationships.

In paper [16] Francisco A. C. Pinheiro Requirements tracing is inevitable. We do tracing when we search information and it is difficult to imagine a software development environment without some tracing aids. For medium to complex systems we should have a traceability model and traceability aids should be in place. In these systems we have a quite complex web of relationships. It is common to have several requirements coming from the same source as well as a single requirement having more than one source. It is also common to have one requirement deriving several others as well as several requirements collapsing into a single one. The diversity and huge amount of information dealt with when developing large software systems point to the need for automated support to development practices, including traceability. This chapter presents the concept of requirements tracing and discusses several aspects related to traceability. Particular importance is given to the informal aspects of requirements tracing and to the non-functional nature of requirements traceability.

III. PROPOSED METHODOLOGY

The frame work that shows many to many relationship performed requirements and test cases Multiple references and multiple test cases and test scripts throughout the project Lifecycle list of project and product deliverables are created and these are developed based on agreed project & product requirements.

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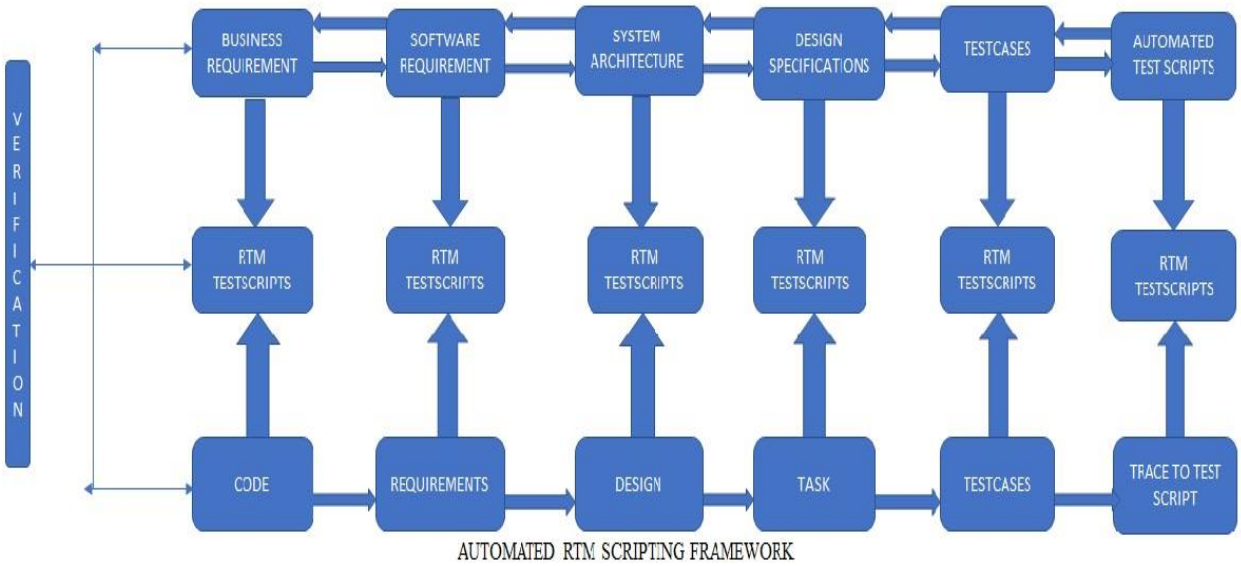

Fig 2 . Automated RIM Scripting Framework

Project Charter is one of the key deliverable of project initiation where Business Need and high level project and product requirements are documented. Later, high level form of requirements gets elaborated during the detailed planning of scope with the help of "Collect Requirements" and "Define Scope" Processes, and then team develops a list of project and product deliverables as per agreed scope. Below mentioned diagram reflects how high level requirements elaborated in detailed one and based on those product deliverables are developed: From this flow you can see Product requirements change its form from Business Need and project objectives to detailed solution requirements, test strategy and test scenarios to product design to verify product development.

A Business Requirement Document (BRD)

This document is provided by Client with high level business Requirements. Suppose for Train Booking Application it shows below 2 requirements

- *BR_1 Train Booking Module*

It should allow user to book one or more tickets, one way or round way for future dates

- *BR_2 Payment Module*

User should able to make payment for booked tickets via Credit / Debit Card or through Reward Points.

B Functional Specification Document (FSD)
The business requirements into functional requirements that can be implemented in this research

Suppose above 2 business requirements in BRD have more detailed functional requirements:

- BR_1 Reservation Module

- FR_1 : One Way Ticket booking

  It should allow user to book one way ticket

- FR_2 Round Way Ticket

  It should allows user to book round way ticket

- FR_3 Multicity Ticket booking

  It should allows user to book one way or round way ticket for multiple cities

- BR_2 Payment Module:

- FR_4: By Credit Card

  It should allows user to make payment by Credit Cards.

- FR_5 By Debit Card

  It should allows user to make payment by Debit Cards.

- FR_6 By Reward Points

  It should allows user to make payment by Reward Points.

C Test cases or test scenarios for each functional requirement.

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Table-1

TESTCASE ID	TESTCASE DESCRIPTION
TC 01	Verify if user is able to book one way ticket
TC02	Verify if user is able to book multiple one way ticket
TC03	Verify if user is able to book round way ticket
TC04	Verify if user is able to book multiple round way ticket
TC05	Verify if user is able to book one way for multiple cities
TC06	Verify if user is able to book round way ticket for multiple cities
TC07	Verify if user is able to pay by master card
TC08	Verify if user is able to pay by visa card
TC09	Verify if user is able to pay by Debit card
TC010	Verify if user is able to pay fully by reward points
TC011	Verify if user is able to pay partially by reward points

D Requirements Traceability Matrix

Table-2

REQUIREMENTS TRACEABILITY MATRIX					
Project Name :online Train Booking Application					
Business Requirement Document BRD		Functional Requirement Document FRD			Test case document
Business requirement-ID	Business requirement business use case	Functional requirements -ID	Functional requirement use case	Priority	Test case-ID
BR-1	Reservation module	FR-1	One way ticket booking	High	TC-01 TC-02
		FR-2	Round way ticket	High	TC-03 TC-04
		FR-3	Multicity ticket booking	High	TC-05 TC-06
BR-2	Payment module	FR-4	By credit card	High	TC-07 TC-08
		FR-5	By debit card	High	TC-09
		FR-6	By reward points	Medium	TC-010 TC-011

D Requirement Trasablity Matrix Sample

Table-3

Requirement		Req-1	Req-2	Req-3	Req-4	Req-5	Req-6	Req-7	Req-8	Req-9	Req-10
Test cases	Totals	1	2	4	2	2	5	5	5	2	4
TC-1	3	X		X							X
TC-2	1		X								
TC-3	1		X								
TC-4	2				X	X					
TC-5	2				X	X					
TC-6	3						X	X	X		
TC-7	3						X	X	X		
TC-8	3						X	X	X		
TC-9	3						X	X	X		
TC-10	3						X	X	X		
TC-11	1									X	
TC-12	1									X	
TC-13	2			X							X
TC-14	2			X							X
TC-15	2			X							X

ISSN No: - 2456 - 2165

IV. CONCLUSION

In this research work is successfully implementing RTM provides test automation scripting framework to develop and automated testing solutions to these unique challenges while continuously in evolving in effectiveness a successful automated testing framework can be build by reusing in the new research framework ensure the current project requirement are met, track every change made to the requirement ,RTM helps avoid implementing unnecessary requirement ,helps control cost and prevent project delay, Each test case is mapped to the each requirement therefore hundred percentage test coverage can be found out using the RTM and there is less chance missing any requirement in testing .

V. ENHANCEMENT WORK

RTM using ATRT(Automated test and Retest) that enables the Rapid and affordable delivery of higher quality software ATRT is an automated capability that can be applied across the entire system lifecycle resulting in broader testing coverage Increased efficiency and improved quality, ATRT test manager equips software developers and testers to complete more tests in less time while improving quality.

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