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## STUDY ON THE VARIOUS SOFTWARE APPLICATION DESIGN AND TESTING STRATEGIES FOR DEVELOPMENT OF GOOD QUALITY SOFTWARE

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**Abstract:** Any software application development rely on the requirement specification .Once the specification is understood properly it will be easier to design and test the application to release a defect free good quality software. Software design and testing phases are considered as the most critical and important phases which are challenging to software engineers. The design phase which is a stage after the requirement elicitation plays a major role for releasing a good quality software .It also consumes more cost in the Software Application Development . But static testing of design reviews can help in reducing the cost of software design with defect free. Testing mainly helps to minimizing faults and reduces the software cost of implementation. The testing strategies and tools with proper software testing life cycle can yield good quality software. This paper aims provide the details study on the different design techniques, hybrid approach and testing strategies implement good software application.

**Index Terms - Requirement specification, Requirement elicitation, Static testing ,Software design , software testing life cycle, Hybrid approach.**

### I. INTRODUCTION

Software application development is the implementation of software based on the specific requirements. Majority of the specifications are agile in the software. These requirements need to be implemented with proper design strategies and validated in order to get a good software application. The design strategies will helps to get both functional sections and non-functional requirements like performance, usability, compatibility, reliability, portability, maintainability and so on[1]. **Hence** Requirement Specification planning for Prototype can be used as a basis for the designing the specifications .

This will gives a proper interaction models to design of software application. The prototype modeling as a basic method which is required for all the system functionalities, such as use cases , sequence diagrams and so on. Based on these modeling approaches the modifications for the consistency among the different functions are going to be completed in the application development. But the design need to be verified properly for the implementation .The inspections and reviews are to be used for the validations of these design techniques. The Software testing plays an important role in the verification and validation of designed artifacts and interaction scenarios so an error free software application can be implemented [2].

Hence this paper intends give a different software design and testing strategies which can use for the verification of software design, validation of specifications, structural testing and specification testing. The new hybrid model is proposed for the design technique with design thinking steps for purpose of understanding on user specification and followed for prototype design ,coding and testing.

### II. LITERATURE REVIEW

In this section, main types of software design techniques and Software Testing are briefly explained. In Software Engineering the main concepts like designing means providing solution for the specifications for functionality. So the coding part can be easily completed[3]. Many software patterns are available for the architectural views to implement. The software testing is to detect errors in the code . It also enables to complete the non-functional testing like performance testing, compatibility and so on. These are carried out either manually or through the test automation[4][5].

The survey papers on automation techniques were given for the supporting the huge number of test cases with various platforms[6]. To perform the testing the test cases generated based on basic techniques like Black box, testing, White Box testing and Grey Box testing [7].Genetic algorithm and fuzzy techniques are used to optimize the test cases. The automation of testing is carried out for saving time . The test automation is mainly required for reducing time for testing .In that a tester is required to analyze the redundant test cases .So the optimization technique is required to generate test cases[8-10].

The survey gives the information of different testing techniques .The test cases generated can be automated. This paper includes different formal methods of the design techniques with proposed hybrid approach for building the agile applications. The hybrid approach helps in deriving test cases with less redundancy. The study also gives testing process that should be followed for software design and testing of complete system. It provides different methods of design , testing, and end user testing.

### III. SOFTWARE DESIGN AND VERIFICATION STRATEGIES

Software design involves complete requirements given for application development .Hence it is divided into High level design and Low level design. This design phase is required to be care fully done for the error free software .In order to achieve this proper verification is needed. The different linear software design techniques involved here are

- a) **Interaction with Method –Message Models** - In this, the call graphs are used to show interaction paths between the user and complete software system.
- b)**Use Case Specification** –In the Use case, all essential execution flows and views of the software applications can be designed with use case specifications. The user specification with cause effects can be defined for the complete system. The user interaction with system and its behaviors can be designed with this design technique.
- c) **Prototypes** - The prototypes are mainly used to imitate the software application by representing necessary interface which can be implemented.
- d)**Activity Diagrams** – Unified Modelling Language(UML) activity diagrams gives the application functions with series of actions .
- e)**User story design-** In agile software application development iteratively the specifications are converted to user story .  
Sprint : used for all software activities monitoring for Design , coding and testing of software application.  
All the above methods includes designing of software application by problem solving method. For the specified objective the design will be carried out and verified for the specifications.

The above mentioned approaches are used for the design techniques. This papers includes a new proposed frame work with linear approach and non-linear approach for providing more clarity for the software application to design. The new method for designing the software application is used with Design thinking which includes understanding user specification by non-linear way. The critical thinking on user problems and providing innovative solution for the prototype design, implementation and design.

Specifically software applications need to be implemented has to undergo the concept of Solution finding with new hybrid approach. This includes the both linear and non-linear method to be adopted for the software design. This hybrid approach will help in improving the user requirement understanding as well as good quality software production.

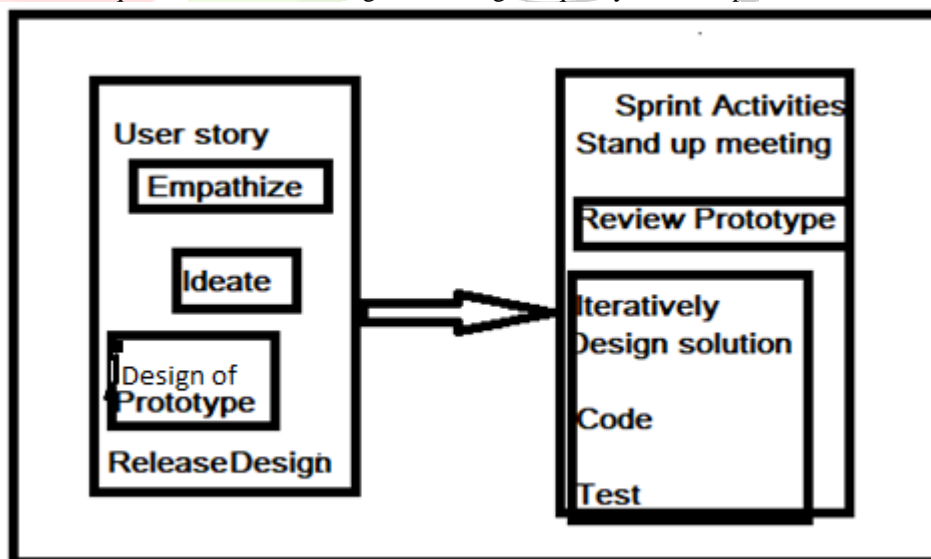


Figure 1. Block diagram for Hybrid approach using Design Thinking ( nonlinear) and Agile approach for good software design

Figure 1 gives a block diagram hybrid approach to understand the user specification for the software design .This includes more questioners for specific domain to give a better design so a better software design can be given for application

development. The user story is more understandable for the development of prototype. If the proper prototype is used for sprint in the design and development stages, many of the errors in the implementation phase are reduced. The system testing and acceptance testing becomes easy.

In order to verify these design many static testing techniques can be used. In that following strategy can be adopted.

a) **Inspection and Walkthrough:** It is process for locating errors in the design verification and code. Moderators arrange the meeting for code walkthrough. It will be a formal review with a prepared checklist and specification document.

b) **Technical Reviews:** It is also static way of identifying defects in the code. The technical specifications includes the test plans, testing methods for developing the test cases[1][2].

c) **Informal Reviews:** It is a technique in which the design document is suggested with comments that are required for software design and code.

d) **Static Analysis tools:** Once the Design and code are completed, it is important to check whether application is error free and all user specifications are implemented. The static tools help for the specification matrix and cyclomatic complexity for the design specifications. It also applies coding standards for specifications.

The necessary stage of software testing to software quality should not be understate. In order achieve this the validation of software application testing is conducted with three different ways.

a) white box testing b) Black box testing c) Grey box testing

- i. a) **White box testing :** It is a method for finding errors with respect coding done for the specifications design. The web application, enterprise applications white box testing will be used. The white box testing include statement coverage, Condition coverage, attribute declarations, control structure testing and loops, etc. The test cases has inputs to apply paths through the code and check the expected results of the code. White-box Testing can be used at the levels of the software implementation for code testing. It usually is done at the unit level for statement coverage and condition coverage. The equation 1 and 2 gives formula are used for the statement coverage and condition coverage.

$$\text{statement coverage} = \frac{\text{Number of lines which are executed}}{\text{Total number of statements}} * 100 \quad \text{--- ( 1)}$$

$$\text{Condition coverage} = \frac{\text{Number of conditions which are executed}}{\text{Total number of conditions}} * 100 \quad \text{--- ( 2)}$$

In order to achieve 100% statement coverage and condition coverage McCabes basis path testing can be used. It is help full in identifying error which is present in code . And Maximum code coverage test cases obtained during test outline writing. But it requires an domain implementation knowledge and to carry out code and statement coverage. Suppose a login form testing used can generate 4 different test cases using conditional text box with user name and password. But hybrid model can restrict user only for correct username and password. The user can be restricted for invalid username and password access. This can reduce three test case execution time.

**Black box testing:** Followed for the functional and non-functional requirement analysis. It gives very less importance for internal code written for the application. This testing method helps to cross verify the basic functionalities of the software application. It ensures that each input and outputs are working properly for expected results. The testers needs to have an understanding domain knowledge of Software functionalities .Hence the for specification software traceability matrix is used.

This particular testing follows the test case writing techniques like Boundary value testing, equivalence partition testing, State transition testing ,all path testing, Decision table testing ,cause effect testing, random testing and use case testing. The test cases can be manual or automated based on the software application .

The number of test cases written for the boundary testing is given with minimum and maximum and average point values. The equivalence partition testing is based on number of equivalent partitions done for the values which will considered for the input. Decision tables will depend on number of conditions used and its cause effect action in application.

The Test cases are monitored manually or these can also be automated. The test cases will combine all possible combination based on the requirement .The tester should take care of exhaustiveness and invalid test cases which can lead more time for testing purpose.

**Grey box testing: This particular testing is used to validate the interfaces developed in the application. The system can be tested for user level acceptance.**

The Unified Models design used for designing integration of application such as uses cases, class diagram and sequence diagrams are tested in this grey box testing. The functionalities present the application with transitions are tested here. It combines both white box and black testing methods for testing purpose. The use case scenarios can be tested comparably more than black box testing. This approach is required test between integration of different modules.

The above three strategies are generally used methods for testing the application. In order to give more effectiveness in error free application an hybrid approach can be used. The hybrid approach is combining test cases with black box and grey box cases. It helps to check error free application with respect to specification validation and interface validation.

The automation tools are also used for the specifications code coverage by capturing ,recording and playback method .The dynamic comparison will be taken case by storing results in the framework.

Non-functional testing is performed based on the software specifications with user acceptance. Mainly stress /load testing will be conducted in all phases. The performance and usability testing of applications are carried out during operation and maintenance at client's place. Acceptance testing has to be conducted in with Quality Assurance team with alpha and beta testing. The security and compatibility testing are also part of this testing. Based on functional and non-functional requirement satisfaction , quality of application is assigned. The hybrid approach of design and testing with software application can give more error free and good quality software application.

## IV. RESULTS AND DISCUSSION

### 4.1 Results of Descriptive Study on Software design techniques with hybrid design technique

The study on the traditional linear method by combining non-linear approach comparative analysis is given in the table4.1.Based on the user requirements and agility the software can adopt this hybrid approach for the effective design and testing. This hybrid approach reduces cost and time of software application development.

**Table 4.1: Descriptive Performance analysis hybrid approach with traditional method of designing**

	<b>Linear /Traditional Approach</b>	<b>Hybrid Approach</b>
Designing Specification	Prototype model with iterative strategy	Gives Prototype with more questions to understand specification and designing
Unit Testing	Importance given only for code coverage and condition coverage	Tester can generate more test cases based on understanding and Ideation of the application Reduced redundancy
Integration testing	Modules integration is tested	Adopts agility for changes adopted and reduces gray box testing
System testing	Completed only for the functionality of the system identified	Both functionality and non- functionalities are tested based on system
User acceptance	Takes More time with more changes	Requires Less time with minimum changes
Usability	It may require changes	Very less changes

Table 4.1 gives the advantages analyzed based on the current linear approach of software engineering and hybrid approach. The hybrid method of understanding the user requirement makes the software designers and testers to develop proper user application .Testing time will also be reduced by clear prototype model with non-linear strategy adoption . The user acceptance becomes very easy for such applications.

#### IV. CONCLUSION

The software applications generally relay Software requirements from clients. Based on the specifications the design and testing process takes place. Instead of using single process of design and testing an hybrid approach with design thinking phase in each and every steps of software application development helps for good software development. The acceptance becomes easier . The usability of application will more compatible when compared to traditional approach.

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