A Reusable Test Case Management System Based on Exploratory Testing

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Abstract. The research is mainly based on the concept of technologies of software exploratory testing, Questing Patterns (Q-Patterns) and reusable test case, taking a reusable test case as an example, this study is devoted to the development of a feasible reusable test case management system based on exploratory testing in rapid prototype development method, which the process of design, storage, reuse and management of test cases could be implemented positively in the first system version. Furthermore, further work for technical improvement in the next version of this system is put forward.

1. Introduction

Design and execution of test cases is an important part of the software testing process, the quality on designing and reuse degree of test cases become an important means to ensure the quality of software testing [1]. The reuse of test cases is also a key technology of test reuse [2]. With the development of software applications, the software has the characteristics of fast release, frequent changes, miscellaneous interfaces, heavy experience, openness and so on [3]. A large number of test cases are generated during software testing process, which plays a crucial role in ensuring the quality of software, therefore, the development of a reusable test case management system improves efficiency in testing and ensures software quality positively. As a free-style and heuristic testing idea, software exploratory testing is available for testing on rapid development environment, which is favoured by increasing software testers.

This paper devotes to the development of a feasible management system for reusable test case rapidly which is based on exploratory testing. The structure of the paper is organized as the following: Section 2 explains the concept of related technologies. Section 3 describes the software rapid prototype development process of this reusable test case management system based on exploratory testing. As an example, a reusable test case of “input course information” and its reuse process of this management system are given in Section 4. Section 5 concludes the paper and puts forward the further work.

2. Concept of related technologies

2.1. Software exploratory testing

Software exploratory testing is a kind of testing idea or testing thinking style based on experience that is not limited by any idiographic testing technique [4]. Accurately, exploratory testing prefers to a test idea of exploratory, which can be freely applied to any phase of testing activities, and it is not
restricted by a certain testing method [2]. Table 1 demonstrates the name of each exploratory testing method.

| Method                        | Name                      |
|-------------------------------|---------------------------|
| individual feature            | arrogant American tour    |
|                               | super model tour          |
|                               | clubbing tour             |
|                               | bad neighbour tour        |
|                               | couch potato tour         |
|                               | rained-out tour           |
|                               | supporting actor tour     |
|                               | antisocial tour           |
|                               | saboteur tour             |
|                               | obsessive-compulsive tour |
|                               | intellectual tour         |
|                               | money tour                |
|                               | test one get one free tour|
|                               |                           |
| multiple feature              | landmark tour             |
|                               | FedEx tour                |
|                               | prior version tour        |
|                               | garbage collector’s tour  |
|                               | museum tour               |
|                               | back alley tour           |
|                               | longer businessman tour   |
|                               |                           |
| exploration based on system interaction | business district |
|                               | slum                      |
|                               | historical district       |
|                               | hotel zone                |
|                               | tourist area              |
|                               | entertainment area        |

2.2. Q-Patterns
Q-Patterns refer to the testing of queuing patterns, and a series of questions are listed in this template which involves all aspects of the software that to be tested. Q-Patterns were put forward in [8]. The Q-Patterns summarizes a series of related questions. These questions may be a unified test method for a certain type of user or software problem, or they may be multiple test methods for a certain same problem [8]. Similarly, a Q-Pattern contains related exploratory testing methods, which aims at those similar testing applications and software modules with similar functions for different applications.

2.3. Reusable test case
The importance of reusable test case is self-evident. Reuse of design idea, case content, operation steps, and the information which is generated during the test process are included in reusable test case. Generality, validity, independence, standardization and integrity are the characteristics of a reusable test case.

2.4. Paging display for data sheet
The technology of paging display for data sheet is to complete the function of paging display of a large amount of data automatically [9]. The role of this technology is retrieve data from the database, and then displays it in pages. Generally, the database is read and loaded to the data GridView control to complete the visual effect on the paging display data.

3. Software rapid prototype development
Software rapid prototype development method is used in developing of this management system for reusable test case. In this section, only the rapid development of the first system version is described in this paper.

3.1. Rapid requirement acquisition
Figure 1 demonstrates an existing reuse process of test case [2] [10]. This reuse process could be fully applied in reusable test case designing which is based on exploratory testing. Figure 2 demonstrates the major workflow of this management system for reusable test case. In Figure 2, content of the related document includes existing testing experience and knowledge, defects or failure information
which was found in similar software products on the market, industry standard on software application, etc. Q-Patterns and related document stimulate testing ideas for designing reusable test case.

3.2. Design of the Q-Patterns
Application of Q-Patterns in this reusable test case management system plays a beneficial role in software exploratory testing. The exploratory testing methods in a Q-Pattern are all opening, it aims at a certain aspect of test problems, matching with different test cases, and forming a positive mechanism of test case reuse. Moreover, Q-Patterns are allowed to be modified and improved by testers through their own experience and test practice, and they could be adapted to new environments and applications positively [8]. Table 2 demonstrates a Q-Pattern template of user login in this system. In database of this system, Q-Patterns are coded by XML.

| ID   | 007 |
|------|-----|
| Name | user login |
| Q-Pattern content | A user inputs account and password, clicks the login button. |
| Software exploratory testing method | bad neighbour tour steps:  |
|   | couch potato tour steps:  |
|   | supporting actor tour steps:  |
|   | obsessive-compulsive tour steps:  |
|   | ......  |

Figure 1. A reuse process of test case.

Table 2. A Q-Pattern template of user login.
3.3. Design and implement of the system prototype

Figure 3 demonstrates the design architecture of three layers for this system. For this architecture, architecture of B/S is supported and data processing is hierarchical. When the front-end page data changes, the corresponding middle-layer interface is called only, and whatever changes in the back-end, it will be compatible which the system interface remains the same [11]. Java with Eclipse platform and SQL-Server 2015 are used to develop the system.

4. Application

In this section, as an example, the application of a reusable test case of "input course information" of this management system is given. This test case is belonging to a "course management" module of an educational network resource management platform. Table 3 demonstrates this reusable test case. The test case is a reusable test case, which is stored in the reusable test case management system, and its reuse process is demonstrated as Figure 1. Related Q-Patterns are extracted which are matched with this test case through the reusable test case management system. Exploratory testing methods are added for the test case for detecting hidden bugs positively. Figure 4 demonstrates a derived graph of the reusable test case of the first system prototype which is developed rapidly, although the design effect is rough. Exploratory testing idea, process of reuse and management are fully embodied in this reusable test case management system.

| ID   | Test Case Name | input course information |
|------|----------------|--------------------------|
| 005  | Abstract       | Teacher user logins on interface of the course teaching information and inputs the course information of the corresponding course. |
|      | Test Type      | functionality testing    |
|      | Precondition   | Teacher user enters the course information display interface successfully, which has displayed a list of courses undertaken by this teacher. |
|      | Steps          | 1. Select the corresponding course name. 2. Click "Input" button. 3. Input integer values in the fields of "Theory", "Experiment", "Exercise", and fill in the blank of "Introduction to Course Content". 4. Click "Submit" button. |
|      | Expected Result| Conclusion Pass□ | Fail□ |

Table 3. Reusable test case of "input course information".
5. Conclusions and further work

Due to the limitation of time and technology, the user interface of this system prototype is very rough in the first version, and the function of user management is not perfect, which needs to be improved in the next version. Furthermore, research work needs to be further improved in the future.

From my own perspective, firstly, the management of exploratory testing methods for test scenarios should be optimized, and more detailed requirement of test business is divided [12]. Secondly, with the increasing test cases are designed, stored and reused in the system, growing Q-Patterns and test result data will be accumulated. It is indispensable to integrate the bug statistics software for further analysing, statistics and management of test cases and Q-Patterns, even data mining, and optimize matching methods. Thirdly, in regress testing phase actually, a large number of test cases need to be maintained, and the related testing data which is stored in the system is prone to lost. Therefore, non-relational database of Redis will be used to replace the relational database of SQL-Server, which expands the test suite and improves system performance [12].

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