Information technology of developing test kits based on software requirements

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ABSTRACT

The article presents an advanced information technology of developing test kits based on software requirements using regulated cascading decision charts, providing the increase of coverage completeness by the projected test kits of software requirements and the accuracy of the tests themselves. The article presents an advanced information technology of developing test kits based on software requirements using regulated cascading decision charts, providing the increase of coverage completeness by the projected test kits of software requirements and the accuracy of the tests themselves.

Keywords: information technology, software, testing, development, test kit, decision chart.

I. FORMULATION OF THE PROBLEM

Modern information and communication systems (ICS) are characterized by a high level of complexity of the components being developed, and, above all, by their software (SW). In its turn, the specified development complexity may have a significant impact on the quality of the final software product.

One of the defining phases of the SW life cycle at which the control of its quality is realized is the testing phase of the SW. Software testing is the consistency check between the actual and the expected behavior of the software product carried out on a finite set of test kits. And the expected behavior, as a rule, is represented directly in the form of the SW requirements. In the future, this article deals with the problems of the development of the test kits based on the requirements for object-oriented software of an ICS information subsystem.

Developing test kits is among the most time-consuming and intellectual activities during the SW testing. The process of designing test kits itself is offered to be considered within the framework of the appropriate information technology.

One of the effective approaches to the development of test kits for testing systems depending on the adoption of logical decisions are the methods based on the use of decision charts (DCs) [1]. However, the existing apparatus of DCs has some drawbacks preventing from its effective use in this capacity, for example, their descriptive capabilities are somehow limited, the complexity of identifying the type of unreported cases in the DCs, etc. Thus, there is a need in improving the information technology of test kits development based on SW requirements, in particular with the use of DCs, as well as direct improvement of the apparatus they are based on [2].

II. ANALYSIS OF THE LITERATURE

On the studied subject the research by Lipaeva V. V., D. McGregor and D. Sykes, Stepanchenko I. V., S. Kaner and J. Falk, Tamre L., L. Crispin and J. Gregory, Glenford Myers and others are known [1, 2 - 8]. At the same time, their proposed technological approaches use either informal methods of test kits description (for example, a method based on applying a user scenarios), or method focused on a fairly narrow classes of problems (for example, the state models), or which do not contain the control methods and means of the developed tests' correctness (for example, a method of all pairs), etc., which, in its turn, does not allow to obtain an effective and simple enough description of passable test kits for practical usage to verify compliance with the requirements for the software of the ICS information subsystem.

III. THE PURPOSE OF THE ARTICLE

The purpose of the article is to improve the information technology of test kits development based on SW requirements of the ICS information subsystem using the improved DCs (the regularized cascading decision charts (RCDCs)) allowing to increase the completeness of coverage by the projected test kits of the software requirements for the software as well as the accuracy of the tests themselves.

IV. MAIN PART

Information technology of test kits based on the SW requirements of the ICS information subsystem is proposed to be formally regarded as a system of function-processes, which are somehow related to each other, and implement the methods and techniques that ensure the development and quality control of the respective test kits. To visualize the structure of information technology of the test kits development based on the SW requirements for the ICS information subsystem (ITDT), it is proposed to use the system modeling methodology IDEF0. The context diagram of the top-level describing the field and borders of ITDT presentation are shown in Figure 1.
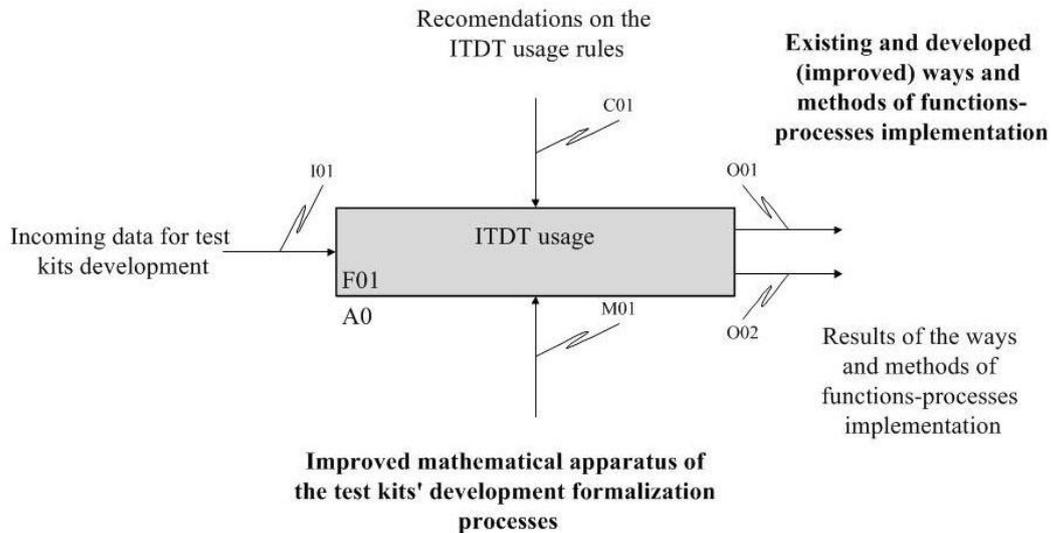

Figure1. Context diagram of the top-level, describing the field and borders of ITDT presentation

Upper subsidiary diagram describing the function-processes of ITDT is shown in Figure 2.
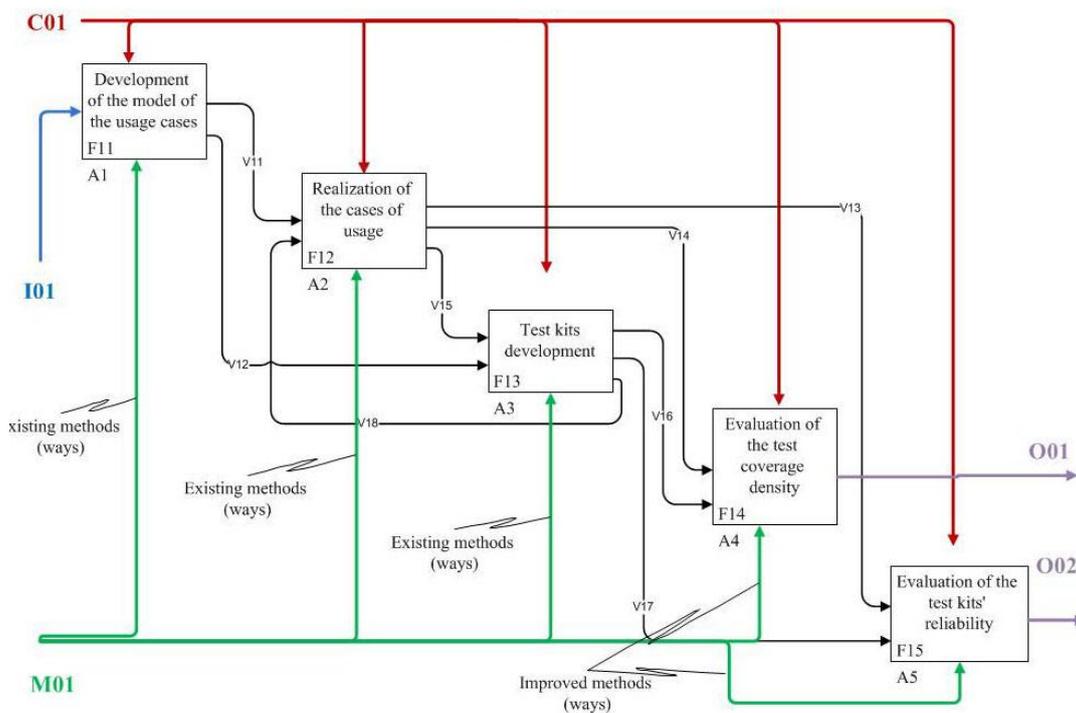

Figure 2. Upper subsidiary diagram describing the basic function-processes of ITDT

Let's consider the content of the function-processes of the proposed ITDT:
1. For a formal submission of requirements for the information subsystem ICS as a whole and, in particular, for its SW in accordance with the object-oriented technology (OOT) a model of cases usage as a set of

cases usage, of a plurality of actors and a set of relations between the elements of the previous sets are being developed.

2. The realization of cases usage by describing all or some of the scenarios that make up the cases usage in the form of models' interactions of software objects is realized.
3. The process of the test kits development is based on software requirements for the ICS information subsystem using an appropriate development method based on RCDCs developed by the author.
4. Evaluation of the coverage density by the developed test kits of the software requirements for the software and additional evaluation of the test coverage density is provided based on the analysis of the control flows.
5. Evaluation of the test kits' reliability developed using the method of the test kits development based on software requirements of the ICS information subsystem using RCDC are provided.

The novelty of this method of developing test kits based on the SW requirements of the ICS information subsystem within the framework of the third in the third function-process of ITDT is as follows:

- expanding the descriptive features of DC by modifying the DC apparatus in the form of RCDC allowing to specify the order on a set of conditions and actions of a specific DC based on the introduction of the consecution matrix to describe the cases of its usage with the acyclic scenarios and specific actions for the composition and recursion of RCDC to describe the hierarchical cases of usage [9];
- diligence in redundancy and inconsistency of a DC from the composition of the RCDC through the use of the Boolean matrices of masks and solutions; checking the completeness of the DC based on the detection of the situations unaccounted in the DC describing the conditional part of the test cases using an algorithm for finding the roots of the logical equation as well as checking the correctness of the consecution matrix and its compatibility with the DC [10];
- the development of the process of the conversion of the RCDC in the test set the flow of control procedures of a test kit on the basis of the generalized method of decision tree;
- to formalize the process of developing of the test kits in the form of the development of a series of interrelated entities "requirements for software based on the model of the cases usage in the notation of the OOT → scenarios of the cases usage based on the cooperation models in the notation of OOT → test kits and test cases in the form of the regularized cascading decision charts → control flows based on the operations models in the OOT notation".

The structure of the developed method of the test kits' development based on the requirements for SW of the ICS information subsystem using the RCDC is shown in Figure 3.
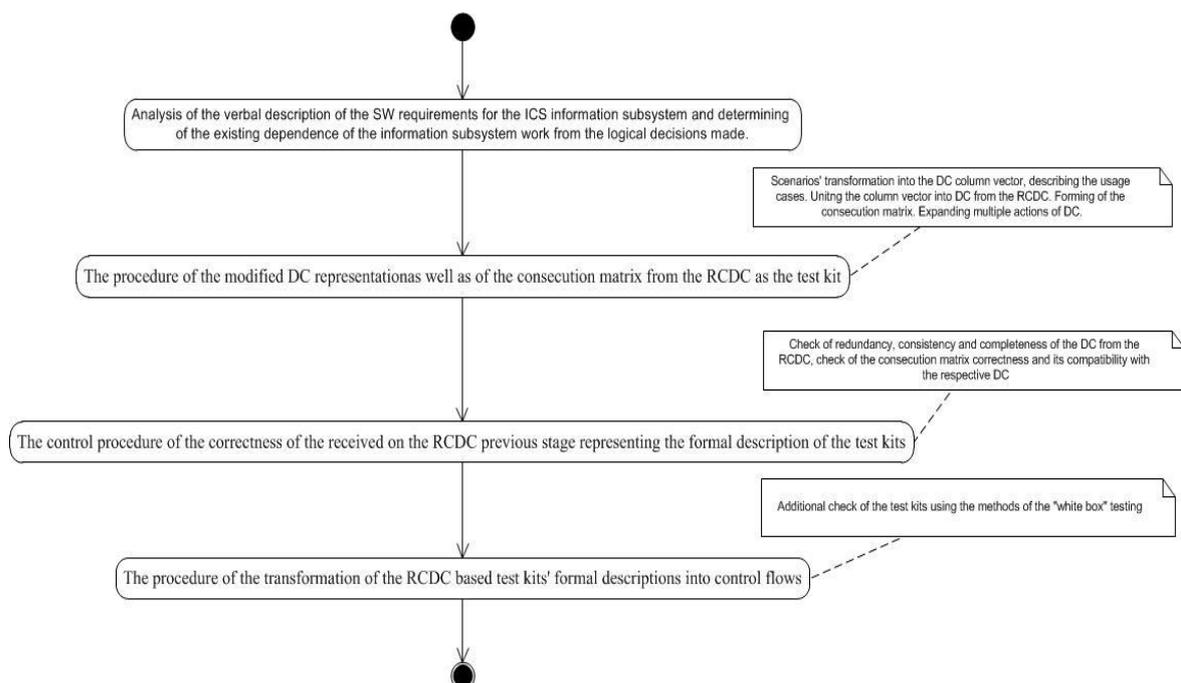

Figure 3. The structure of the method of test kits development based on the requirements for ICS information subsystem using the RCDC

V. CONCLUSIONS

The proposed improved information technology of the test kits development based on the SW requirements allows the following:

1) by modifying the apparatus of a DC based on the introduction of the consecution matrix as part of the RCDC and specific actions for the composition and recursion of the RCDC to ensure the test coverage completeness rate increases practically twice based on the analysis of the control flows and the index of completeness of test coverage of the requirements for the software by the test kits developed under the improved technology increase in 1.5 times;

2) by the developed redundancy verification procedures, as well as of contradictory and completeness of the DC from the RCDC, the correctness of the consecution matrix and its compatibility with the DC, as well as of the algorithm of RCDC conversion based on the generalized method of the decision tree and, together with the modification of the DC apparatus provides the twice increase of the indicator of the test kits reliability developed under the advanced technology.

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