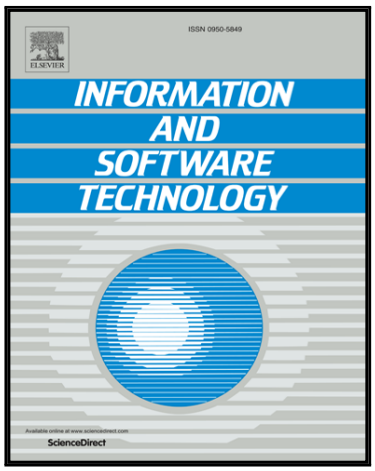

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Test Case Design for Context-Aware Applications: Are We There Yet?

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Abstract

Context: Current software systems have increasingly implemented context-aware adaptations to handle the diversity of conditions of their surrounding environment. Therefore, people are becoming used to a variety of context-aware software systems (CASS). This context-awareness brings challenges to the software construction and testing because the context is unpredictable and may change at any time. Therefore, software engineers need to consider the dynamic context changes while testing CASS. Different test case design techniques (TCDT) have been proposed to support the testing of CASS. However, to the best of our knowledge, there is no analysis of these proposals on the advantages, limitations and their effective support to context variation during testing.
Objective: To gather empirical evidence on TCDT concerned with CASS by identifying, evaluating and synthesizing knowledge available in the literature.
Method: To undertake a secondary study (*quasi*-Systematic Literature Review) on TCDT for CASS regarding their assessed quality characteristics, used coverage criteria, test type, and test technique.
Results: From 833 primary studies published between 2004 and 2014, just 17 studies regard the design of test cases for CASS. Most of them focus on functional suitability. Furthermore, some of them take into account the changes in the context by providing specific test cases for each context configuration (static perspective) during the test execution. These 17 studies revealed five challenges affecting the design of test cases and 20 challenges regarding the testing of CASS. Besides, seven TCDT are not empirically evaluated.
Conclusion: A few TCDT partially support the testing of CASS. However, it has not been observed evidence on any TCDT supporting the *truly* context-aware testing, which that can adapt the expected output based on the context variation (dynamic perspective) during the test execution. It is an open issue deserving greater attention from researchers to increase the testing coverage and ensure users confidence in CASS.

Keywords: Context Aware Application, Systematic Review, Software Testing

1. Introduction

In ubiquitous computing, the computers are merged with everyday objects that people use in their daily tasks. It is possible due to technological developments such as the continuously decreasing physical size, power consumption, production price, and ecological impact of computing devices, and due to their increasing processing power, storage capacity and communication bandwidth [1]. According to Dey and Abowd [2], Context is any information that can be used to characterize the situation of an entity (person, place or object) that is considered relevant to the interaction between a user and an application, including the user and the applications themselves. So, aiming to help the user in daily activities, ubiquitous systems must be able to capture the information about the context and use it to guide their behavior and to assist the users while they are performing their tasks. As the context information impacts the system's output, testing the context-aware behavior requires an efficient design of test cases to expose failures that can occur only in specific context situations.

ISO/IEC/IEEE 29119-1 [3] defines test design technique (also known as test case design technique) as "activities, concepts, processes, and patterns used to construct a test model that is used to identify test conditions for a test item, derive corresponding test coverage items, and subsequently derive or select test cases". Thus, once the

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