Model Driven Approach to Secure Optimized Test Paths for Smart Samsung Pay using Hybrid Genetic Tabu Search Algorithm

Nisha Rathee, MDU Rohtak, Rohtak, India
Rajender Singh Chhillar, MDU Rohtak, Rohtak, India

ABSTRACT

Smart mobile pay applications on smart devices have been considered as the most efficient and secure mode of contactless payment. To safeguard customer credit/debit card details, testing of mobile pay solutions like Samsung Pay is most important and critical task for testers. Testing of all the test cases is very tedious and a time-consuming task, therefore optimization techniques have been used to identify most optimized test paths. In this article, a hybrid genetic and tabu search optimization (HGTO) algorithm is proposed to secure optimized test paths using activity diagram of the smart Samsung Pay application. The proposed approach has been implemented using C++ language on the case study of the Smart Samsung Pay and an online airline reservation system. The experimental results show that the proposed technique is more effective in automatic generation and optimization of test paths, as compared to a simple genetic algorithm.

KEYWORDS

Genetic Algorithm, Hybrid Genetic Tabu Search Optimization (HGTO) Algorithm, Smart Samsung Pay, Tabu Search Algorithm, Test Path Optimization, UML Activity Diagram

1. INTRODUCTION

Smart mobile pay applications on smart devices have been considered as most efficient and secure mode of contactless payment (‘UL Transaction Security’, n.d.). Testing of mobile pay solutions is very critical task. Good software testing requires revealing maximum number of errors in minimum amount of time and with minimum cost. Generally, test case generation after the accomplishment of coding phase is a time-consuming task in Software Development Life Cycle (SDLC). Therefore, testers have started identification of test cases at early stage that is at the designing phase (Gantait, 2011). After getting all the software specifications, testing can be done using Unified Modelling Language models. This type of testing technique is known as Model based testing. Model based testing detects highly critical parts of the coding at design phase and therefore helps in developing quality software product in less time with relatively small testing effort (Jena, Swain, Mohapatra, 2015). As model-based testing can be performed at designing phase of the software development, therefore both the approaches: testing and coding can be done simultaneously, and reducing the development time and cost of the tester and developer (Li, Zhang and Kou, 2010). Model based testing generally uses unified modelling language for the graphical representation of software specifications. UML diagrams

DOI: 10.4018/IJISMD.2018010104

Copyright © 2018, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
describes characteristics of software specification in static and dynamic nature. Static behaviour of software system is represented by class, component and deployment diagrams whereas activity, sequence and state diagrams represent the dynamic nature of software systems. (Sabharwal, Sibal and Sharma, 2011). In this article, the proposed approach has been implemented by UML activity diagrams. UML Activity diagram describes flow of activities of the instances, so that corresponding procedures can be performed in the same sequence (Linzhang, et al., 2004). In computer science, and related subjects, an “algorithm” is considered as set of instructions used for solving a problem (Bagheri, Akbarzadeh & Sarae, 2008) (Shrivastava & Bhatnagar, 2011). Nature-inspired metaheuristic algorithms like genetic algorithm, ant colony optimization algorithm, firefly algorithm, cuckoo search algorithm and bat algorithm are becoming powerful in solving modern global optimization problems (Yang, 2010). Genetic Algorithm (GA) is metaheuristic optimization algorithm inspired from natural evolution process (Raza & Vidyarthi, 2009). Model based testing also uses evolutionary search techniques such as GA and Tabu search algorithm for the optimization of test paths. For optimization of test paths, a hybrid technique using hybridization of Genetic algorithm and Tabu search algorithm have been proposed in this paper. The proposed methodology is implemented using UML activity diagram and the case studies of Samsung Pay, online airline reservation system, ATM withdrawal system and library management system. The proposed approach has been compared with Simple Genetic Algorithm (SGA) using four case studies: Smart Samsung Pay, Online Airline Reservation System, ATM Withdrawal System, and Library Management System. The comparison is done based on number of iterations and the execution time. The fitness function used in proposed algorithm and in SGA is total cost of corresponding test path. This paper is divided in to five sections. Section 2 gives brief introduction of Samsung pay, genetic algorithm and Tabu search algorithm, Section 3 describes the related work done by researchers in this field and section 4 illustrates the proposed approach and section 5 describes the implementation of the approach. The paper has been concluded in section 6.

2. BASIC CONCEPTS

2.1. Samsung Pay

Samsung Pay is a contactless mobile pay service which is very simple and secure to use. User can add credit and debit cards by manually entering the card details or by scanning the card. Without carrying cards physically, users can purchase almost everywhere by using this facility. In order to make contactless mobile payment, Samsung Pay uses Magnetic Secure Transmission (MST) and Near Field Communication (NFC) (Samsung Pay, n.d.). Samsung Pay is more secure for contactless payment as it follows three levels of security: 1) User’s authentication is verified by verifying user’s fingerprints or by registered Samsung pay account pin. 2) Instead of using card number, random token is used in each transaction which safeguards the card details of payee 3) User’s mobile phone is constantly monitored for vulnerabilities with advance Samsung KNOX special feature.

2.2. Genetic Algorithm

Genetic Algorithm is meta heuristic search technique inspired from natural evolution, natural selection and inheritance in chromosomes (Banga, Singh and Kumar, 2011). Genetic algorithm follows the series of operations as: generation of initial population, evaluation process of chromosomes, selecting the best fit individuals, performing crossover and mutation for regeneration of populations, as illustrated in pseudocode given below (Jena et al., 2015). As an evolutionary algorithm, the Genetic algorithm can avoid local optimal solutions and converge to a global one (Zukhri & Paputungan, 2013). The possible solutions to the problem are considered as initial population which is a set of chromosomes. The population is then evaluated using some basic operations and this process is called as evaluation. By using some selection criterion, GA will select best fitted chromosomes based upon their fitness value, this operation is called as Selection. To have better or new population, crossover and mutation
13 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:
www.igi-global.com/article/model-driven-approach-to-secure-optimized-test-paths-for-smart-samsung-pay-using-hybrid-genetic-tabu-search-algorithm/208640?camid=4v1

www.igi-global.com/e-resources/library-recommendation/?id=163

Related Content

A Systematic Approach for Designing Educational Recommender Systems
www.igi-global.com/chapter/systematic-approach-designing-educational-recommender/77757?camid=4v1a

An Evaluation of a Pure Embedded Domain-Specific Language for Strategic Term Rewriting
www.igi-global.com/chapter/evaluation-pure-embedded-domain-specific/71817?camid=4v1a
Towards a Framework for Weaving Social Networks Into Mobile Commerce
www.igi-global.com/article/towards-framework-weaving-social-networks/58511?camid=4v1a

Redesigning a SAD Course to Promote Problem-Based Learning
www.igi-global.com/chapter/redesigning-sad-course-promote-problem/21092?camid=4v1a