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Investigation of Aspect Oriented Programming Support for Crosscutting Concerns
Case Study: Account Reconciliation System

برمجة السمات لتطبيق المفاهيم المتقاطعة
دراسة حالة : نظام تسوية الحسابات

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{اللّهُ لا إِلَـهَ إِلاَّ هُوَ الْحَيُّ الْقَيُّومُ لا تَأْخُذُهُ سِنَةٌ وَلا نَوْمٌ لَّهُ مَا فِي السَّمَاوَاتِ وَمَا فِي الأَرْضِ مَن ذَا الَّذِي يَشْفَعُ عِنْدَهُ إِلاَّ بِإِذْنِهِ يَعْلَمُ
مَا بَيْنَ أَيْدِيهِمْ وَمَا خَلْفَهُمْ وَلا يُحِيطُونَ بِشَيْءٍ مِّنْ عِلْمِهِ إِلاَّ بِمَا شَاء وَسِعَ كُرْسِيُّهُ السَّمَاوَاتِ وَالأَرْضَ وَلا يَؤُودُهُ حِفْظُهُمَا وَهُوَ
الْعَلِيُّ الْعَظِيمُ}
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المستخلص

تهدف هندسة البرمجيات الى انتاج انظمة حاسوبية ذات جودة عالية. في البرمجة كائنية المنحى "Object Oriented Programming (OOP)" يمثل كل مفهوم بوحدة منفصلة تسمى (صنف) تحوي كل هياكل البيانات والإجراءات المتعلقة بالصنف. ولكن هناك بعض المفاهيم يستعصى حصرها داخل صنف واحد. هذا النوع من المفاهيم يسمى المفاهيم المتقاطعة "Crosscutting concerns" و الذي يؤثر سلبا على جودة المنتج البرمجي الكائني و يجعل تطويره معقدا. لتلافي هذه المشكلة استحدثت برمجة السمات "Aspect Oriented Programming (AOP)" لتساعد في برمجة المفاهيم المتقاطعة.

هذه الدراسة هي دراسة تطبيقية تختبر صلاحية ال "AOP" لحل مشكلة المفاهيم المتقاطعة عن طريق تطبيقه في نظام معاملة الحسابات البنكية والذي يحوي العديد من المفاهيم المتقاطعة كالتحكم بالدخول للنظام, التحقق من مستخدميه , معالجة الاخطاء و التحقق من المدخلات و المخرجات من والى النظام.

أوضحت هذه الدراسه أن "AOP" تمكنت من تحقيق زيادة في جودة المنتج البرمجي في بعض الخصائص كقابليته للفهم والقراءة والصيانة واعادة الاستخدام, بينما في الجانب الاخر اثرت سلبا على صحته و اختباريته.

Abstract

Software engineering seeks the realization of concerns in computerized systems. In object-oriented programming (OOP) each concern is realized by a separate entity (class). But there are some concerns such as logging, security, and so forth, which need to be realized using many entities. These types of concerns are called “Crosscutting concerns”. The implication of the crosscutting concerns compromise software modularity in terms of lower productivity, poor quality, and that they make the evolution of the designed systems very complicated.

Aspect-oriented programming (AOP) overcomes these problems by modularizing the crosscutting concerns through explicit abstractions called aspects and composition mechanisms for composing the aspects with the software components.

This thesis investigates to what extent AOP is a practical solution for the mentioned problems. The thesis contains a case study for implementing AOP approach in developing ARS **(**Account Reconciliation System**)**. The Aspect oriented based ARS represents a foundation for a modular version for bank accounts which contains crosscutting concerns treated as aspects. These concerns are Logging, Access control (Authentication and Authorization), Error handling, Transaction management and Input/output validation.

Our case study shows that the AOP has the potential to increase the quality of a software implementation with regard to its modularity, maintainability, readability, understandability, and reusability. However, AOP may cause problems with the structural complexity, correctness and testability of a software implementation.

LIST OF ACRONYMS

AOP	Aspect Oriented Programming
ARS	Account Reconciliation System
DBMS	Database Management System
IDE	Integrated Development Environment
OOP	Object Oriented Programming

POP	Post-object programming
SOC	Separation of Concerns
SQL	Structured Query Language

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