ASPECT-ORIENTED MODEL-DRIVEN CODE GENERATION APPROACH FOR IMPROVING CODE REUSABILITY AND MAINTAINABILITY

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I declare that this thesis entitled "*Aspect-Oriented Model-Driven Code Generation Approach for Improving Code Reusability and Maintainability*" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 15/05/2014 ……

To my beloved parents, wife Irum, and our children Shuja and Rameen

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ABSTRACT

Software development teams always need methods that can help in producing high-quality software with reduced development effort and delivery time. Model-Driven Engineering (MDE) as well as Aspect-Oriented Software Development (AOSD) techniques help in reducing the delivery time, and also positively contribute to quality of the produced software. Through the use of AOSD techniques in combination with MDE, an integration of excellent abstraction mechanisms of MDE and capabilities of AOSD with regards to modularity and composition of concerns can be perceived, which is expected to enhance the positive effects of both techniques. To this end, different integration approaches have appeared in literature, but aspect-oriented code generation has advantages over the other approaches. Consequently, a number of aspect-oriented code generation approaches have been offered, but all such approaches lack several features mandatory to materialize a workable integration of aspect technologies in the context of MDE. To address these issues, this research was conducted to present an approach for aspect-oriented model-driven code generation, which focuses on elaborating the conceptual relationship between design models and the implementation code, and exploits the same to obtain aspect-oriented code that is more reusable and maintainable. The key outcomes of this research are the elaboration of the conceptual mappings between elements of visual design and constructs of the code, mapping of the visual models to implementation-specific text-based models, and a technique for generation of aspect-oriented code. The applicability of the proposed approach is shown by the use of case studies, whereas the quality of the approach is measured using reusability and maintainability metrics. A comparison of the proposed approach with existing approaches substantiates its efficacy in terms of reusability and maintainability of code, showing an outperformance of other approaches by the proposed approach against 78% of the employed quality metrics.

ABSTRAK

Pasukan pembangunan perisian sentiasa memerlukan kaedah yang boleh membantu dalam menghasilkan perisian yang berkualiti tinggi dengan mengurangkan usaha pembangunan dan masa penghantaran. Kejuruteraan berpandukan model (MDE) dan teknik Pembangunan Perisian Berorientasikan Aspek (AOSD) membantu dalam mengurangkan masa penghantaran dan juga menyumbangkan kepada kualiti perisian yang dihasilkan. Dengan penggunaan teknik-teknik AOSD yang digabungkan dengan MDE, gabungan ini dijangka boleh memperbaiki kesan positif kedua-dua teknik dengan integrasi mekanisma pengabstrakan MDE yang baik dan kemampuan AOSD dari segi kemodularan dan komposisi yang boleh diamati. Untuk ini, pendekatan-pendekatan integrasi yang berbeza telah muncul di dalam literatur, tetapi penjanaan kod berorientasikan aspek mempunyai banyak kelebihan berbanding pendekatan yang lain. Walaupun, pelbagai pendekatan penjanaan kod berorientasikan aspek telah ditawarkan, tetapi kesemua pendekatan tersebut kurang dari segi ciri-ciri mandatori untuk membolehkan integrasi teknologi aspek di dalam konteks MDE dilaksanakan. Bagi menyelesaikan kekurangan ini, kajian ini telah dijalankan untuk menunjukkan satu pendekatan penjanaan kod berorientasikan aspek dan berpandukan model, di mana ia fokus kepada penghuraian hubungan konseptual di antara reka bentuk model dan pelaksanaan kod, dan mengolah kedua-duanya untuk mencapai kod berorientasikan aspek yang mempunyai kadar kebolehgunaan semula dan kebolehselenggaraan yang lebih. Penghasilan utama kajian ini adalah penghuraian pemetaan elemen-elemen reka bentuk visual dan pembinaan kod, pemetaan model visual untuk model berasaskan teks dan perlaksanaan-spesifik dan teknik untuk penjanaan kod berorientasikan aspek. Kebolehgunaan pendekatan yang dicadangkan ini telah ditunjukkan melalui kajian kes, manakala kualiti pendekatan diukur menggunakan metrik kebolehgunaan semula dan kebolehsenggaraan. Perbandingan di antara pendekatan yang dicadangkan dengan pendekatan-pendekatan sedia ada berkaitan keberkesanannya dari segi kebolehgunaan semula dan kebolehsenggaraan kod, menunjukkan pendekatan yang dicadangkan mengatasi pendekatan-pendekatan lain sebanyak 78% dengan menggunakan metrik pengukuran kualiti.

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