

INTEGRATED COMPONENT-BASED MODEL AND CODE GENERATION
IMPLEMENTATION STEPS FOR EMBEDDED REAL-TIME SYSTEM
DEVELOPMENT

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I declare that this thesis entitled “*Integrated Component-Based Model and Code Generation Implementation Steps for Embedded Real-Time System Development*” 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 : 17th OCTOBER 2012

To my beloved wife, Qairul Azhani Azmin

To my son, Muhammad ZulQarnain Mohd Zulkifli

*To my fathers, Hj. Mohd Zaki Mohamad and Dr. Hj. Azmin Mohd Noor
and my mothers, Hjh. Zahrah A Bakar and Hjh. Mastura Ashaari*

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ABSTRACT

Modelling and implementation of Embedded Real Time (ERT) system are becoming more complicated to develop and be reused because of the increasingly complex designs and codes. The complexity is due to the functionality increment factor, resulting in the growing scale of the developed systems and to meet users' needs and demands. The current development approach based on Object-Oriented (OO) does not match the current requirements of the system. The OO approach has numerous flaws, thus, Component-Based Software Engineering (CBSE) has been selected to resolve these problems. However, the current CBSE approach also has some drawbacks such as lack of ERT standardized modelling, specific development methodology and tool adaptation for code generation. The problems concerning the established ERT system development methodologies, Methods for Component-Based Real-Time Object-Oriented Development Testing (MARMOT) show that its ability to tackle ERT system modelling and implementation using CBSE strategy have not fully provided the required standard modelling language and development tool adaptation. Thus, an integrated component model, comprising MARMOT and a modelling profile known as Modelling and Analysis for Real-Time and Embedded (MARTE) is proposed. The new model can be adapted to the CBSE approach standard modelling. In addition, the model can improve the existing MARMOT software process. Besides that, a 'code generation implementation steps' was also proposed as a development tool application. In these steps, IBM Rational Rhapsody® development tool was applied as a tester due to its code generation capability. The modelling and implementation results were measured and compared with result from the previous MARMOT approach. The findings showed that the proposed integrated component model and implementation steps have reduced the development complexity and produced functioning generated codes.

ABSTRAK

Dewasa ini, pembangunan sistem masa nyata terbenam (ERT) menjadi semakin kompleks disebabkan pertambahan keperluan dan kehendak pengguna. Ini secara tidak langsung mengakibatkan pembangunan sistem menjadi semakin sukar disebabkan oleh rekabentuk yang rumit dan saiz kod yang bertambah, mengurangkan kebolehan untuk proses guna semula. Kekangan Pembangunan Perisian Berasaskan Objek (OO) menyebabkan Pembangunan Perisian Berasaskan Komponen (CBSE) telah dipilih bagi menyelesaikan masalah-masalah ini. Walaubagaimanapun, CBSE juga mempunyai beberapa kelemahan seperti tidak menggunakan model berpiawaian, tidak mempunyai metodologi pembangunan perisian yang tepat dan kekurangan adaptasi perisian penjaan kod. Oleh itu, pemilihan MARMOT untuk menyelesaikan masalah permodelan and implementasi sistem ERT berasaskan kepada komponen walaupun ianya tidak mengaplikasi model yang berpiawaian. Hasil integrasi antara MARMOT dan MARTE memberikan kelebihan terutamanya membantu pempiawaian model mengikut pendekatan CBSE. Satu proses pembangunan perisian yang dinaiktaraf daripada model tersedia dihasilkan bagi membantu penggunaan model komponen yang baru. Selain itu, satu langkah implementasi penjaan kod telah dihasilkan untuk tujuan kebolegunaan pada perisian. Perisian permodelan IBM Rational Rhapsody® telah dipilih berdasarkan kepada kebolehannya menyokong pembangunan sistem ERT, terutamanya fungsi penjaan kod. Hasil permodelan dan implementasi kajian kes dikira dan dibandingkan dengan hasil yang terdahulu, iaitu dengan menggunakan pendekatan MARMOT. Keputusan perbandingan menunjukkan model yang diadaptasi membantu meningkatkan tahap gunasemula komponen dan menghasilkan kod yang boleh berfungsi.

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