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# **Automated Support for Consistency Management and Validation of Requirements**

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*A thesis submitted in fulfilment of the requirements for the degree of Doctor of  
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# Abstract

The requirements engineering phase of software development remains presents many challenges to researchers and practitioners alike. Among them, the management of consistency across multiple representations is particularly complex yet it lacks effective tool support. The thesis proposes an automated support mechanism to enable users (Requirements Engineers) to manage the consistency and validation of requirements. We have investigated existing approaches, developed a novel technique, and realised this technique as an automated support tool called MaramaAI (Automated Inconsistency Checker).

We have taken an an iterative approach to our work. We began by developing a lightweight extraction approach that allows an accurate and quick extraction of essential requirements (abstract interactions) from natural language requirements and the generation of Essential Use Case models from them. We then used automated traceability with visual support to check the consistency of requirements in three different forms: textual natural language requirements, abstract interaction and Essential Use Case, as well as to further validate the correctness and completeness of requirements. We also extended the automated tool to provide end-to-end rapid prototyping support embedded in the tool for validating requirements consistency in a form usable by both requirement engineers and clients to confirm the consistency of requirements.

We have evaluated the tool's efficacy and performance especially on the extraction process, and also evaluated the user perception on the tool's usability and user-perceived strengths via a substantial usability study and applied the tool to several case studies. The results were positive, and demonstrate that MaramaAI can be used to manage the consistency and validation of requirements in various domains of applications.

## Dedication

I dedicate this thesis to my husband Ahmad Fadzil Mohamad, my father Kamalrudin Jantan and my mother Nya Lily Baba.

**“Your endless Prayers, love and support have gotten me here”**

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*To John & John: You're really great! You have given me such a great time while going through this tough process!*

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*To my hubby: Yang, this PhD is yours!*

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Finally, I would like to share this quote which has always been with me for almost three years to keep up the high level of enthusiasm in completing my research:

***"Forget mistakes. Forget failure. Forget everything except what you're going to do now and do it. Today is your lucky day."*** *Will Durant*

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