
# Enhancing the Software Development Life Cycle through Integration of Generative Artificial Intelligence

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I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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# DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Sri Lanka Institute of Information Technology or to any other institution for assessment for any other purpose.

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# ABSTRACT

## Enhancing the Software Development Life Cycle through the Integration of Generative Artificial Intelligence

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The Software Development Life Cycle (SDLC) is a foundational framework in software engineering, yet its documentation process spanning Business Requirement Documents (BRDs), User Stories, Test Cases, and Automation Scripts remain highly manual, inconsistent, and resource intensive. This study presents a Generative Artificial Intelligence (GenAI)–driven framework designed to automate and integrate SDLC documentation from end to end, enhancing traceability, efficiency, and quality across all stages. The proposed system employs Retrieval-Augmented Generation (RAG) in combination with FAISS-based semantic **retrieval** and LangChain orchestration to extract structured requirements from BRDs, generate standardized User Stories, derive Test Cases, and produce executable Cucumber and Selenium scripts. Both qualitative and quantitative methodologies were adopted: interviews with Business Analysts (BAs) and Quality Assurance (QA) engineers identified documentation challenges, while experimental evaluation measured performance and accuracy. The results demonstrate that the framework reduces documentation time by over 90%, ensures 100% traceability between SDLC artifacts, and achieves over 95% accuracy in generated outputs. Compared to general-purpose LLMs such as ChatGPT and Gemini, the proposed approach delivers structured, consistent, and production-ready documentation with minimal human intervention. This research contributes a validated and scalable model for AI-assisted SDLC automation, offering a significant step toward intelligent, traceable, and self-sustaining software documentation pipelines. The findings have both theoretical and practical implications, supporting the broader integration of Generative AI within enterprise software engineering and quality assurance practices.

***Keywords: Generative Artificial Intelligence, Software Development Life Cycle, Business Requirement Documents, User Stories, Test Case Generation, Test Automation, Selenium, Cucumber Scripts.***

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