A Sinhala Based Programming Assistance Tool For Java Programmers

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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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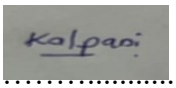
DECLARATION

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is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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.

Sign: 

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ABSTRACT

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This research presents an extensive programming assistance tool, which is implemented especially for native Sinhala-speaking Java programmers. The tool provides several features to overcome challenges faced by Java programmers, including real-time code generation, diagram creation based on user queries and repository assistance for Java-related projects. It utilizes advanced NLP techniques and large language models (LLMs) to convert Sinhala queries into Java code, visualize code flow through diagrams, generate detailed reports from repository data and provide answers according to user given queries. Additionally, the tool incorporates a transformer-based translation model that converts Sinhala queries into English for code and diagram generation. The tool demonstrates high reliability and technical accuracy, with an overall translation accuracy of 95.79%, indicating strong alignment with reference translations. These capabilities significantly enhance the accessibility and productivity of Sinhala speaking developers. The system provides precise and contextually relevant responses to programming queries related to specific repositories by integrating large language models (LLMs) with a Retrieval-Augmented Generation (RAG) architecture. Core functionalities include repository assistance, enabling users to clone, query, and obtain targeted insights into codebases. Response generation is powered by LLMs, including GPT-3.5-turbo, GPT-4-turbo, GPT-4o-mini, GPT-4o, and ChatGPT-4o-latest. To evaluate the system's effectiveness, the tool was tested using the RAGAS (Retrieval-Augmented Generation Answer Scoring) framework, assessing performance across three key metrics: answer relevance, answer similarity, and answer correctness. This study demonstrates how such tools can democratize iii programming education, overcome language barriers, and increase inclusivity in technical learning, ultimately contributing to the growth of Sri Lanka's technology sector.

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