Optimizing Edge Computing and IoT for Affordable and Portable Vibration-Based Machinery Condition Monitoring Solutions in Sri Lankan SMEs

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is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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

RangaPrabhashi

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ABSTRACT

This research focuses on developing an affordable and portable system for monitoring the condition of machinery in Sri Lankan SMEs, utilizing Edge Computing and IoT technologies. The study is conducted in three stages. First, vibration data is collected from sensors attached to gearboxes to monitor for anomalies. In the second stage, the collected signals are processed using wavelet transform to extract relevant features from the data. Finally, machine learning classifiers are employed to identify anomalies, with a comparison of models including Convolutional Neural Networks (CNN), Random Forest (RF), and Autoencoders (AE). The goal was to create an effective solution for early detection of machinery issues, reducing unexpected maintenance costs, and improving operational efficiency in SMEs. This research aims to support SMEs in Sri Lanka by offering a cost-effective method to prevent machinery failures and enhance business modernization. Using IoT, signal processing, and machine learning models combination for gearbox fault detection along with the Python GUI interface called Gearbox Monitoring System (GMS) significantly improves predictive maintenance in the industrial sector. Provide reliable anomaly detection by implementing the RF model in the application, which can help prevent costly downtimes and improve the longevity of machinery.

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