Evaluation of Infrastructure as Code (IaC) Approaches for Automated Provisioning and Configuring of IoT Devices in Smart Factory Environments

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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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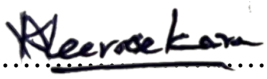
DECLARATION

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is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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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Date: 10/11/2024……..

ABSTRACT

Evaluation of Infrastructure as Code (IaC) Approaches for Automated Provisioning and Configuring of IoT Devices in Smart Factory Environments

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The Internet of Things (IoT) area is gaining with time and predictions are showing that Industrial IoT (IIoT) will gain more and more in the future. Here this research was done to find out the best Infrastructure as Code (IaC) tool from model-driven, Terraform and code-centric Ansible for automatic configuring and provisioning IoT devices in large-scale IIoT systems such as automated factory environments.

This research has shown the use of IaC within IIoT to automatically provision and configure components of the IIoT system alongside improving productivity, less human involvement in provisioning and configuring components, minimising the errors in device provisioning, cost-effectiveness with increased portability and maintainability of the large scale IIoT system with the benefit of the IaC. Furthermore, the research assessed Terraform and Ansible by analysing the elapsed time, resource utilisation, scalability, and error rate, in provisioning and configuring as well as reconfiguring using a prototyped simulated environment for a factory. Also, the research is contributing to the design and development of a cross-platform IaC script generation and execution application including the monitoring capabilities. This tool is named “KFactory Device Provisioner and Configurator”. This application allows to generation of IaC provisioning scripts and executes those with monitoring capabilities as users’ need via a Graphical User Interface (GUI). The tool also has a system monitoring tool that is very helpful to view the variation of CPU usage, Memory usage and inbound-outbound Network usages in a GUI.

Furthermore, the tool also collects the provision data to create a Machine Learning (ML) model to predict and show the expected provisioning time, reconfiguring time, CPU, Memory and Network

inbound and outbound usages according to the scale of the provisioning tasks based on the host system’s capabilities.

Moreover, with the conclusion of this research, the researchers are encouraged to come up with a fine-tuned, production-grade IaC solution for automatic provisioning and configuring IoT devices in large-scale IIoT systems with reduced deployment time, optimized resource utilizations, having scalability, having low error rate, and reduced reconfiguring time.

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