UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF ALERT MESSAGES ALGORITHM FROM A MACHINE FAILURE IN A MANUFACTURING PROCESS BY USING MQTT (MESSAGE QUEUE TELEMETRY TRANSPORT)

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

by

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I hereby, declared this report entitled DEVELOPMENT OF ALERT MESSAGES ALGORITHM FROM A MACHINE FAILURE IN A MANUFACTURING PROCESS BY USING MQTT (MESSAGE QUEUE TELEMETRY TRANSPORT) is the results of my own research except as cited in references.

Signature: .....

Author : NOR ATIKAH BT MOHAMAD RADZI

Date: 7 FEBRUARI 2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electroninc Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

Signature: .....

Supervisor: TS. KHAIRUL ANUAR BIN A RAHMAN

ABSTRAK

Projek ini dicipta bertujuan untuk digunakan di industri bagi memudahkan pekerja atau orang yang mengendalikan mesin yang perlu sentiasa dipantau. Selain itu, ia juga bagi memudahkan untuk mengetahui apabila berlakunya kerosakan dan ingin membuat penyelenggaran terhadap mesin tersebut. Oleh itu, dengan menggunakan MQTT protocol: Node-RED yang akan diaplikasikan kepada mesin dan juga aplikasi Telegram dimana mesej amaran akan diterima apabila berlaku kerosakan atau memerlukan penyelenggaran. Node-RED amat mudah digunakan dan senang difahami bagi mencipta satu sistem dimana data dapat dikumpulkan, dianalisis dan boleh dipamerkan oleh sistem tanpa sebarang gangguan. Ia juga mudah untuk diubahsuai dan boleh digunakan dalam pelbagai bentuk. Kertas kerja ini akan membentangkan segala proses dan cara bagaimana menggunakan Node-RED dengan gabungan aplikasi Telegram untuk mendapatkan hasil capaian tersebut.

ABSTRACT

This project is created to be used in the industrial to facilitate workers or people operating the machine that need to be constantly monitored. In addition, it also makes it easy to know when the damage is occurring and to do the maintenance on the machine. Therefore, by using MQTT protocol: Node-RED will be applied and connected to the machine as well Telegram application where alert messages will be received in the event of a malfunction or maintenance. Node-RED is easy to use and easy to understand to create a system where data can be collected, analyzed and displayed by the system without any interruption. It is also easy to customize and can be used in many forms. This paper will outline all the processes and ways to use Node-RED with combination of Telegram applications to obtain such results.

DEDICATION

To my beloved parents, family and friends who stays with me through my darkest and happiest times.

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Throughout the making of this bachelor degree project. There are many whom I would like to thank for the help, enthusiasm and support provided by them directly and indirectly. Special thanks to my Project Supervisor, TS. Khairul Anuar Bin A Rahman, I convey my gratitude towards him for being the most helpful and give enormous guidance along the duration of the project implementation. This would be impossible if I had not received mentoring and guidance from my beloved supervisor. I am thankful for everyone involved in the completion of this project; my family members and my beloved friends for their love, affection, encouragement and moral support during this project.

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CHAPTER 1

INTRODUCTION

1.1 Background

The industrial growth has rapidly increase as year goes by and being demand to use the new technologies and it makes the biggest changes in technological development in the history mankind. With this advanced technology, manufacturing production has changed from becoming more intelligent. With the opportunities upcoming, the perks of normal or old manufacturing industries showing the decreased substantially. By erasing market limits and the rise of the Internet, new conditions are made for the advancement of new structures of creation frameworks.

As a result, industrialized nations exceptionally give a lot of attention to this new innovation of manufacturing technology where it is high innovation region. When facing various unpleasant situations that happens in industrial production, it is certainly to take measures and acknowledge what kind of failure is occurring. MQTT protocol is utilized in this technology in an Internet of Things environment where it assists with improving in quality of service for residential, commercial and industrial clients. MQTT is in no way, shape or form an answer for all issues in the systems administration of IoT gadgets and programming, yet numerous applications are utilizing MQTT more achievable than with different conventions, for example, HTTP.

1.2 Objectives

The main objective for this project is to develop an alert messages algorithm that can identify failure that occur during manufacturing process through mobile phones and laptops without any circumstance where can receive it in just a short span of time. Additionally, it helps to maintain the service in troublesome conditions shortening interference time ranges. In the meantime, to get real time data enabling collaboration and real time safety monitoring directly receiving through digital devices.

1.3 Problem Statement

During manufacturing operations, there are a lot of undesired situations that have been faced which are the machines started to fail or having technical issues without production teams monitoring where it becomes a problem because they need to identify first which part is failure or broken. Other than that, whenever they need the data or to monitor the machine, they need to attend at the field to monitor it and to get the data by their own where it consumes a lot of time span and might be a bit difficult if the process to get the data is longer than expected.

For improving the processes, the development of alert messages by using MQTT protocol enables detailed monitoring and the real-time collection, distribution and access of assembling significant data anytime and anyplace with the help of communication devices such as laptop and mobile phones. Real-time data can transform the captured data from processes or still underway items and change them into an action plan.

A straightforward system can empower over the facility and ensure that the association can settle on progressively exact choices like role-based opinions, continuous real-time warnings and getting notify and constant real-time tracking and observing. (Burke *et al.*, 2017).

The self-optimization from this development can anticipate and recognize quality deformity inclines sooner and can assist with distinguish between human or machine for low quality. This can lead to deduction rates and lead times as well as increased fill rates and revenue. Improved quality procedures can lead to high quality items with fewer defects and reviews. It can also provide real benefits to employee well-being and environmental sustainability. Greater freedom of procedure can help lower human potential, including industrial accidents that can cause injury. (Burke *et al.*, 2017).

1.4 Scope Project

The scope of the project is determined by the objectives or goals of the project. The scope of this project are as follows:

- Manufacturing machine in the lab at UTeM.
- Manufacturing machine at industrial company.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter has explains the several related works in utilizing MQTT (Message Queue Telemetry Transport) based on the research and the new technology that has been used in industrial and manufacturing. Other than that, shows the comparison of different IoT protocols where MQTT protocol is recommended and better than other IoT systems.

2.2 Related Works in Utilizing MQTT – Node-RED

Understanding the significances of IoT, numerous individuals are chipping away at this theme and everybody is attempting to build up the easiest answer for the most problems that are begging to be addressed and issues in the shortest possible time.

Paper "IoT sensor integration to Node-Red platform"(Lekić and Gardašević, 2018) presents a basic IoT application that transmits information gathered by temperature and humidity sensors associated with a Raspberry Pi by means of a Node-RED interface to an IBM Bluemix Cloud and afterward the gathered information can be gotten to by the client through a straightforward cell phone. The motivation behind the essayist is to show that it is so natural to incorporate IoT sensors on the Node-RED stage. (Ferencz, 2020).

Another article presents an IoT based home automation system (Kodali and Anjum, 2018), otherwise called a savvy home framework, which utilizes a Node-RED interface and a MQTT representative to actualize a straightforward and simple to associate interface between various gadgets. The paper centers around showing that it is so natural to associate various gadgets to the Node-RED interface and to normalize transmission with the MQTT dealer without expanding framework costs. (Ferencz, 2020).

Above all, the utilization of Node-RED as an IoT flow-based programming device for overseeing home automation frameworks is turning out to be increasingly across the board and is progressively getting around in the business. For instances, an examination was done on how it could be utilized in the field of smart transport and logistics, where real-time data processing and representation is significant. (Sicari, Rizzardi and Coen-Porisini, 2019).

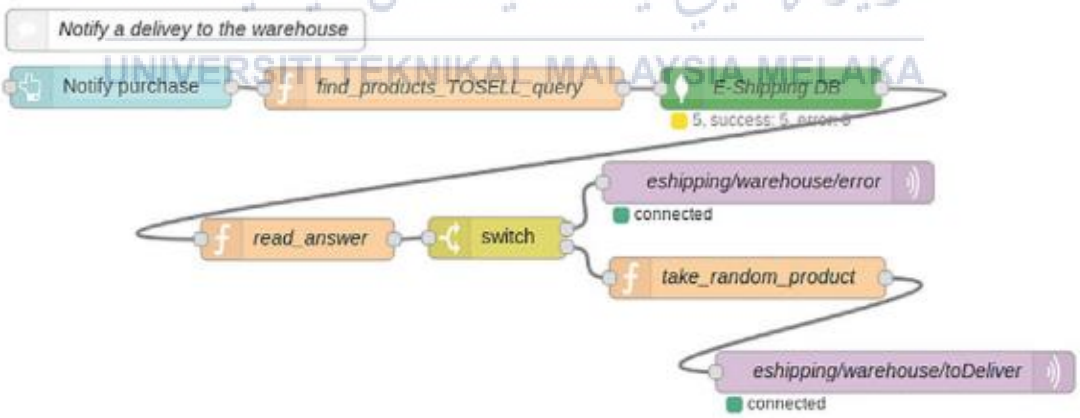

Figure 2.1: Node-RED flow – warehouse delivery notification.

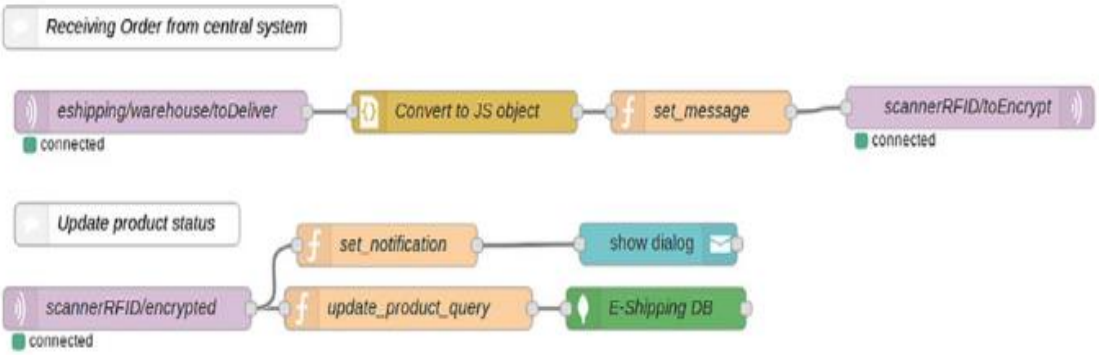

Figure 2.2: Node-RED flow – purchase order notification.

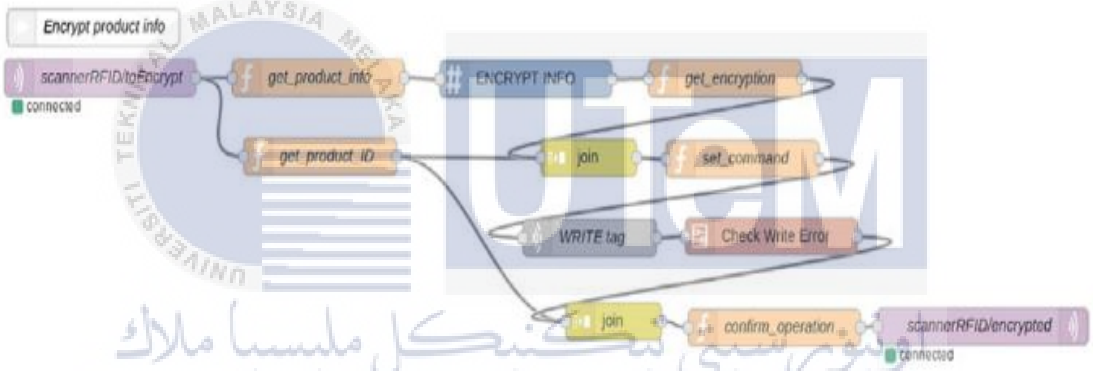

Figure 2.3: Node-RED flow – scanner product.

Also, IoT gadgets from shrewd production lines in the business are creating a lot of data that should be stored, took care of and investigated. This approach likewise raises the chances of utilizing data flow-based programming models, for example Node-RED and AI or information digging for information investigation. (Ferencz, 2020).

2.3 Machine-to-Machine (M2M)

M2M technology is an entire idea that includes transmission among machines, permitting process computerization between cell phones and machines (Mobile to Machine), and furthermore among men and machines (Man to Machine). These machines go from little electronic gadgets (for example communication / diversion individual gear) to estimation/control hardware (for example sensors, and keen meter or actuators) and furthermore from savvy electronic names, smaller scale processors implanted in home appliances, vehicles or workplaces, to PCs or multiplex network situated everywhere. (Eslava, Rojas and Pereira, 2015)

M2M helps connection between its own gadgets and data focuses paying little mind to their area; this innovation additionally encourages transmission with different sort of gadgets and with individuals in different places using individual specialized gadgets immediately (in a composed manner). Throughout M2M connection, it is conceivable to offer various types of administrations in the area of telemetry and tele-control (for example vehicle-to-vehicle connection, remote utility expense monitoring), telemedicine and tele-help, security administrations and corporate/local remote-control applications. This speaks the beginning of the self-appointed Internet of Things. (Eslava, Rojas and Pereira, 2015)