



**FACULTY OF MECHANICAL AND MANUFACTURING
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**Bachelor of Manufacturing Engineering Technology (BMMW)
with Honours**

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**Faculty of Mechanical and Manufacturing Engineering
Technology**



Autonomous Maintenance For Lathe Machine (Model: Optimum D-420)

Amirul Aizat Bin Adzman

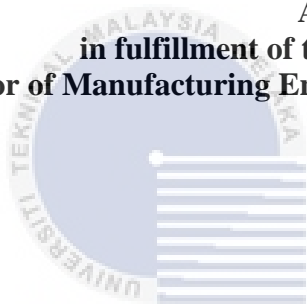
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Autonomous Maintenance For Lathe Machine (Model: Optimum D-420)

AMIRUL AIZAT BIN ADZMAN

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology (BMMW) with Honours



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Faculty of Mechanical and Manufacturing Engineering Technology

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DECLARATION

I declare that this Choose an item. entitled “ Autonomous Maintenance For Lathe Machine (Model: Optimum D-420)” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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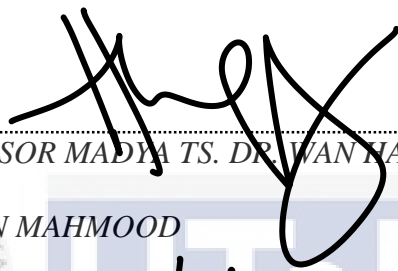
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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology (BMMW) with Honours.

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Date :

18/1/2022

DEDICATION

Alhamdulillah

Praise be to Allah for providing me with the strength, direction, and knowledge necessary to accomplish my research.

&

To my adoring parents and families, I want to express my gratitude for their unwavering support.

&

To my supervisor, Professor Madya TS. DR. Wan Hasrulnizam Bin Wan Mahmood for guiding and advising me throughout this project.

&

To everyone who has helped me along the way

ABSTRACT

This project is performed based on analysis of autonomous maintenance for Lathe Machine (Model: Optimum D-420). Analysis of abnormalities for lathe machine is a way to detect fuguai or abnormalities that occurring on the lathe machine (Model: Optimum D-420). Therefore, autonomous maintenance like a flow of programme approach will help to prevent the lathe machine from breakdown by reacting faster and know how to do the maintenance personnel to prevent long-term breakdown. However, that will be affected the cost of sustain maintenance for the lathe machine. AM also represents for the user to understand and appreciate the function of the machine. Thus, the benefit of this approach is that it reduces maintenance costs and time by detecting and identifying which parts should be maintained and which maintenance actions should be performed. Although, the problem will occur if the machine cannot be used in the learning centre and it will impact all new users who want to learn on how to operate a lathe machine. The reason for the knowledge of autonomous maintenance and function of the lathe machine is to make sure to fulfill all the requirements that the user wants. From this research, the process of proposing best practices for eliminating fuguai as require in the basic AM programme by using fuguai tags or (F-tags). F-tags represent to place area where abnormalities are found on the lathe machine. Besides, the F-tags are divided into three categories such as physical, safety, and function of the problem description. It also states the machine type and the date of abnormalities. Lastly, autonomous maintenance is a preventive maintenance method that emphasizes the "man-machine" interaction in order to successfully conduct the following tasks such as cleaning, lubricating, and tightening. The approach supports the maintenance engineering team in implementing an autonomous maintenance strategy with their production assets in a precise way.

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Keywords: Autonomous Maintenance (AM), *Fuguai*, Lathe machine, *Fuguai* tags (F-tags)

ABSTRAK

Projek ini dilakukan berdasarkan analisis penyelenggaraan autonomi untuk Mesin Larik (Model: Optimum D-420). Analisis keabnormalan bagi mesin pelarik adalah satu cara untuk mengesan fuguai atau keabnormalan yang berlaku pada mesin pelarik (Model: Optimum D-420). Oleh itu, penyelenggaraan autonomi seperti pendekatan aliran program akan membantu untuk mengelakkan mesin pelarik daripada rosak dengan bertindak balas lebih cepat dan mengetahui cara melakukan kakitangan penyelenggaraan untuk mengelakkan kerosakan jangka panjang. Walau bagaimanapun, itu akan menjejaskan kos penyelenggaraan berterusan untuk mesin pelarik. AM juga mewakili untuk pengguna memahami dan menghayati fungsi mesin tersebut. Oleh itu, faedah pendekatan ini ialah ia mengurangkan kos dan masa penyelenggaraan dengan mengesan dan mengenal pasti bahagian mana yang harus diselenggara dan tindakan penyelenggaraan yang harus dilakukan. Walaupun, masalah akan berlaku jika mesin tidak boleh digunakan di pusat pembelajaran dan ia akan memberi kesan kepada semua pengguna baharu yang ingin belajar tentang cara mengendalikan mesin pelarik. Sebab pengetahuan penyelenggaraan autonomi dan fungsi mesin pelarik adalah untuk memastikan untuk memenuhi semua keperluan yang dikehendaki pengguna. Daripada penyelidikan ini, proses mencadangkan amalan terbaik untuk menghapuskan fuguai seperti yang diperlukan dalam program AM asas dengan menggunakan tag fuguai atau (F-tag). F-tag mewakili untuk meletakkan kawasan di mana keabnormalan ditemui pada mesin pelarik. Selain itu, F-tags dibahagikan kepada tiga kategori seperti fizikal, keselamatan, dan fungsi huraian masalah. Ia juga menyatakan jenis mesin dan tarikh keabnormalan. Akhir sekali, penyelenggaraan autonomi ialah kaedah penyelenggaraan pencegahan yang menekankan interaksi "man-machine" untuk berjaya menjalankan tugas berikut seperti pembersihan, pelinciran dan pengetatan. Pendekatan ini menyokong pasukan kejuruteraan penyelenggaraan dalam melaksanakan strategi penyelenggaraan autonomi dengan aset pengeluaran mereka dengan cara yang tepat.

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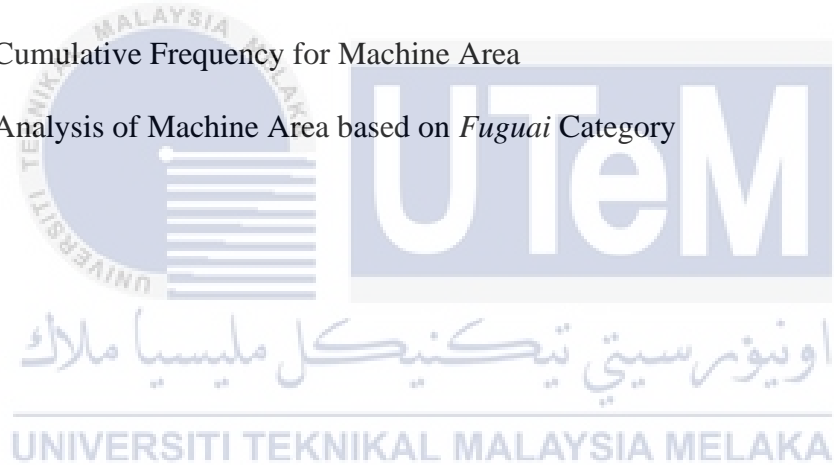
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LIST OF SYMBOLS AND ABBREVIATIONS

AM	-	Autonomous Maintenance
<i>Fuguai</i>	-	Abnormalities
F-tags	-	<i>Fuguai</i> Tags
PM	-	Preventive Maintenance
KPI	-	Key Performance Indicator
SOP	-	Standard Operating Procedure



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CHAPTER 1

INTRODUCTION

1.1 Background

Autonomous Maintenance (AM) is fundamental to the Japanese word, Jishu Hozen is a maintenance method in which machine operatives monitor, adjust, and conduct small maintenance routines on their machines continuously. This can be done more willingly than assigning a professional maintenance technician to undertake protection and maintenance regularly. It is one of the major contributions of the Japanese industry to industrial maintenance. AM programme plays a critical role in the maintenance of involves empowering plant students in conducting equipment checks and basic maintenance tasks that would normally be performed by an engineer with referring to (SOP) standard operating procedure (Y. Chen, 2021). AM also can develop the knowledge and ownership of the users to make them able to face more complex problems related to safety quality and productivity. According to S. Ferreira (2020), AM is one of the purposes to provide users of the lathe machine with knowledge and responsibility for basic maintenance tasks like cleaning, lubrication, and inspection. P. Guariente (2017) stated initial cleaning and inspection implement AM, and the user of the lathe machine must start cleaning and inspecting the machine for failures. Through cleaning, the user can inspect the machine to find *fuguai* on the machine.

In addition, it ensures that the machine is restored to its best performance by identifying and eliminating signs of *fuguai* machine function. Cleaning in hard-to-reach areas is important to discover hidden abnormalities in machine functions. After using the

fuguai tag, the user can use the tag on the part that looks *fuguai*. Initial cleaning and inspection must be accompanied by the maintenance department. It represents a maintenance method in which machines and users can undertake basic maintenance tasks without maintenance personnel (N. Sihag, 2019). This pillar emphasizes the need for users to be educated and competent of doing simple maintenance tasks, allowing trained maintenance professionals to focus on higher-value activities and technical improvements.

Next, users are responsible for maintaining their machines to keep them in good condition. Then, AM programme calls for continuous equipment activity, flexible users to manage or repair other equipment, the elimination of source faults by active employee involvement, and the stepwise implementation of AM operations. Moreover, the effectiveness of AM is to aim at each step of equipment and human terms. The purpose of the AM's activity pillar as with others is focused on the elimination of losses. By cycling through continuous improvement, the optimal process conditions can be established for the exposure elimination and control of hidden defects. AM also increases the availability of high skill in task maintenance, reduction in labor cost, and reduction in unplanned maintenance.

At Fakulti Teknologi Kejuruteraan Mekanikal dan Pembuatan (FTKMP), Universiti Teknikal Malaysia Melaka (UTeM) has a lot of machines that use variety types of lathe machine, such as Optimum D-420 and GH-1440W. It is important to apply for AM programme in the lathe machine since it can shorten user's task and work, plus it can identify the *fuguai* of the lathe machine. Students are the most useful of lathe machines at FTKMP, especially those who are new in UTEM and not familiar with AM and the machine. Because of that, they need to be educated on what is AM and how to eliminate *fuguai* for lathe machines by AM approach properly in their learning centre.

1.2 Problem Statement

This project will be more focusing on eliminating *fuguai* as require in AM programme for lathe machine (Model: Optimum D-420). The Optimum D-420 is one of the machines that regularly used in the laboratory of FTKMP in UTeM. The machine's operation may be harmed if the maintenance is not conducted properly and it might cause a lot of errors, plus the cost of sustain maintenance can be affected with a large amount of money. If the machine cannot be utilized, it will have an impact on all users who want to learn on how to operate a lathe machine. Most lathe machine users are individuals who are new to UTeM, which can be referring to new students. It is critical to apply proper maintenance on the lathe machine to have good quality and maintain the performance of the machine from time to time. AM is a concept that encourages or trains users to do daily routine maintenance tasks such as cleaning and inspecting (J. Alhilman, 2019). Hence, to avoid the machine becomes more problematic in the upcoming, (AM) should be applied. Different theories exist in the literature regarding maintenance management also constantly encountered with an effort to be identified as a less important aspect of complex organization management (Antosz, 2018) and reduce the number of accidents and increase the morale of the employees (Sharma, 2018).

1.3 Project Objectives

The specific objectives of this project are:

- a) To investigate the *fuguai*/abnormality for the lathe machine (Model: Optimum D-420).

- b) To determine appropriate an AM programme for the lathe machining in the learning centre (Model: Optimum D-420).
- c) To propose best practice for eliminating fuguai as require in the basic AM programme especially for lathe machining learning centre (Model: Optimum D-420).

1.4 Scope of Project

The emphasis of this project is concentrating on the establishment of an AM programme that will be developed by the student and the user of the lathe machining (Model: Optimum D-420) learning centre at FTKMP. The model of the lathe machine that will be used for this project is Optimum D-420 since it is currently use in the learning centre machine of FTKMP in UTeM. This project is conducted under the guidance of a laboratory assistant that will propose to appropriate an AM, which are the development of safety for operations, the practice of inspection schedules, quick react of the problem for reducing the abnormalities and zero product defects, are addressed in this project. This project will take about a year to complete, started from March 2021. The data collection will acquire from primary and secondary sources. A detailed explanation about data collection will be found in Chapter 2 and Chapter 3.

1.5 Scope of Project

The importance of this study are as follows:

- To propose the well-maintained for the lathe machine in the learning centre of the UTeM (Model: Optimum D-420).
- Exposed the student to evaluate the best practice and detects an abnormality for the lathe machine (Model: Optimum D-420).
- Provide a safe and clean environment for the lathe machines in the learning centre of UTeM.
- Will be a reference for academic studies which is related to AM programme.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Autonomous Maintenance (AM) programmed require that every user of the lathe machine can react quickly inspect the fuguai to maintain their machines and equipment. According to Pinto et. al. (2020) stated that AM procedure and Preventive Maintenance (PM) plans have been developed with a well-defined schedule. For example, it will be responsible for simple tasks such as measuring pressure and tension, adjusting sensors, lubricating, and cleaning. In addition, technical training will prepare them to spot any changes and troubleshoot them quickly. In other words, users are encouraged to keep their assets in top condition. Similarly, J. Furman (2020) found that a step in AM is a preparation of employees, initial clean-up of measures, take countermeasures, fix tentative standards, general inspection, standardization, and autonomous management. There have been several published examples showing the impact of user and related maintenance in optimizing less time, response time, and efficiency.

In conventional maintenance programs, a machine or a section of equipment can run until it fails or achieves preventive maintenance (PM), and then maintenance is responsible for fixing it. The AM implementation is following the completion of this training programmed, which includes knowledge of basic analyst will work and normal daily maintenance (Yassin, 2020). So, it can also provide AM for requires system by users to do basic maintenance such as lubrication, safety inspections, fixture and cover protection tightening or securing, washing, and inspection to serve as first thing as maintenance workers

in avoiding breakdowns and responding quickly if a specific failure has been observed using the "eyes and ears" of seeing and listening to the machine's motion, or rhythm. Since AM gives users a few responsibilities and special training as well as certain system modifications to make cleaning and maintenance will be easier. This would help the users get a greater understanding of how to handle and even improve the facilities of the lathe machine.

2.2 Autonomous Maintenance

In the new era of technology which is most organizations are investing a lot of money in hiring, training, and developing highly skilled maintenance teams to determine why critical assets fail and then perform renovations. Furthermore, AM also aims to free these technicians from performing low-skilled tasks such as inspection, lubrication, and minor adjustments. Among other things, AM brings four major benefits to the organization. Firstly, the biggest benefit is to reduce labor costs. This includes reducing the inefficiencies associated with travel time and waiting availability. Shrestha (2018) found that many companies around the world have been modernizing and using more and more technological resources to meet their customers and better manage the supply chain. It can be seeking to increase the competitiveness and the efficiency of deliveries and availability of products.

Then, AM also keeping the user always beware of the machine and a problem can be greatly reduced. Besides, another benefit of AM is that it increases the availability of highly skilled maintenance personnel, so they may be inclined to more critical needs. One study by Huang et. al. (2017) the tendency among manufacturers is to spend in the installation of high-quality machines, the hiring of high-skill personnel, or the use of advanced maintenance technologies in order to increase product quality and production effectiveness.