



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF LAWNMOWER MACHINE USING
PID CONTROLLER WITH IOT MONITORING SYSTEM**

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



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2020

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Tajuk: Development Of Lawnmower Machine Using Pid Controller With Iot
Monitoring System

Sesi Pengajian: 2019/20

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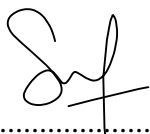
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ABSTRAK

Teknologi semakin berkembang dan dunia semakin maju. Terdapat pelbagai jenis mesin rumput telah dicipta mengikuti perkembangan teknologi semasa. Projek “Development of Lawnmower Machine using PID Controller with IoT Monitoring System” adalah salah sebuah projek mesin rumput yang dibina bagi memudahkan kerja-kerja memotong rumput lebih mudah dan mesra pengguna. Objektif yang perlu dicapai dalam projek ini adalah untuk menghasilkan satu mesin rumput yang mudah bergerak. Seterusnya adalah mereka bentuk pengawal kawalan berkadar-kamiran-terbitan untuk mengawal pergerakan mesin pemotongan rumput. Akhir sekali adalah mengintegrasikan system dengan *Internet of Thinking (Iot)* untuk memantau aktiviti mesin pemotongan rumput dan menganalisis pergerakan mesin rumput. Mesin rumput ini akan dikawal menggunakan pengawal berkadar-kamiran-terbitan bagi mengawal pergerakan mesin dan Arduino sebagai otak utama bagi memberi isyarat kepada berkadar-kamiran-terbitan dan *Internet of Thing (IoT)*. Kebanyakan teknologi kini menggunakan sistem kawalan *Internet of Thinking (Iot)* di mana sensor atau objek berinteraksi dengan internet. *Internet of Thinking (Iot)* ini sangat diutamakan bagi memudahkan pengguna mengawal mesin rumput ini dengan lebih mudah. Dengan adanya mesin rumput ini kerja-kerja pemotongan rumput adalah lebih mudah dan pengguna akan lebih memelihara kawasan rumah mereka dengan lebih kerap dan rumput-rumput akan lebih kemas.

ABSTRACT

Technology development become wide and the world is moving forward. Lot of lawnmower have been create during the revolution of technology in this world. “Development of Lawnmower Machine using PID Controller with IoT Monitoring System” is one of the lawnmower machines that make mower works become easy and friendly use. The objective that has to be achieve is to design and construct hardware for lawnmower. Next is to develop design of PID controller to control the movement of lawnmower movement. Lastly is to integrate the system with IoT monitor the activity of the lawnmower machine and analysis the movement of the lawnmower movement. This lawnmower is control using Proportional-Integral-Derivative (PID) controller to control the movement of the lawnmower and Arduino is the main brain for this project. Arduino give the signal to PID and IoT during the work operation. Most technologies use Internet of Thing (IoT) where sensor or object interact with the internet. Beside that IoT make the user easier to monitor the lawnmower and with the help of IoT, user can do multiple works in one time by using the mobile apps to monitor. With this lawnmower, the mowing work is easier and users will take better care of their home area more often and the lawn will be more tidy.

DEDICATION

To my beloved parents

Thank you for all the support that you give. I am grateful to have you guys for support me and give me the strength to go thru this whole time completing my project.

To my Supervisor

Thank you for your advice, knowledge, and support. Your words and patience give me strength throughout the project for complete this bachelor's degree Project (BDP).

To my Friends

اونيومر ستي تیکنیکا ملسيا ملاك
Thank you for all your help and advance.

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ACKNOWLEDGEMENTS

Alhamdulillah thanks to Allah for give me His blessing and the good health and strength to completing this project. I would like to express my gratitude to my supervisor Ts.Dr Syed Najib Bin Syed Salim for his guidance, patience, support and encouragement to this project. Beside that the feedback, time and advice that he give to me during this project is mean a lot to me.

Next, I would like to thank all my family especially my parents, who give me endless support with valuable motivation to make me keep moving in completing the project. A million thanks also for my parents pray and money to ensure I manage to finish this project in time.

Last but not least, I would like to thank all my friend for their support and advice all the way from the beginning to the end of this project. I appreciated all the help and support each of you with your encouragement along this bachelor's degree project (BDP). Thank you for everything.

TABLE OF CONTENTS

TABLE OF CONTENTS	x
LIST OF TABLES	xiii
LIST OF FIGURES	xiv
CHAPTER 1	17
1.1 Background	17
1.2 Problem statement	19
1.3 Objective	19
1.4 Scope of the project	20
1.5 Thesis Outline	20
CHAPTER 2	22
2.1 Previous Related Work	22
2.2 Types of Lawnmower	26
2.2.1 Cylinder or reel mower:	26
2.2.2 Rotary mowers:	27
2.2.3 Gasoline Powered Mower:	28
2.2.4 Electricity Lawnmower:	29
2.3 Design Controller in Lawnmower	30

2.4	Monitoring system of Lawnmower	33
CHAPTER 3		37
3.1	Introduction	37
3.2	Project Flow	38
3.2.1	Stage 1: Literature Review	39
3.2.2	Stage 2: Structure	39
3.2.3	Stage 3: Controller Design and Monitor	40
3.2.4	Implementation and analysis	40
3.3	Phase 2 Flowchart	41
3.3.1	Design Model	42
3.3.2	Hardware Development	43
3.3.3	Software Development	54
3.4	Design and Simulation	56
3.4.1	Monitoring system using IoT	56
3.4.2	Design Controller using PID.	59
3.5	Implement and analysis.	59
3.6	Circuit Design	60
3.7	Hardware connection to circuit	61
3.8	Summary	62

CHAPTER 4	63
4.1 Introduction	63
4.2 Results	63
4.2.1 Controller Design	63
4.2.2 Ultrasonic Sensor	66
4.3 Blynk	68
4.3.1 Create App	68
4.4 Full Project	76
4.5 Limitation	79
CHAPTER 5	80
5.1 Introduction	80
5.2 Conclusion	80
5.3 Recommendation	81
5.4 Commercialization relevancy	82
REFERENCES	83
APPENDICES	85

LIST OF TABLES

TABLE	TITLE	PAGE
Table 3. 2:	Ultrasonic Sensor Specification.....	45
Table 3. 3:	Arduino Uno Specification.....	46
Table 3. 4:	Motor Drive Specification.....	48
Table 3. 5:	Wi-Fi Module Specification.....	49
Table 3. 6:	Dc Geared Motor Specification.....	50
Table 3. 7:	Dry Cell Battery Specification.....	51
Table 3. 8:	Lawnmower Metal Blade Specification.....	52
Table 3. 9:	Wheel Specifications.....	53
Table 4. 1:	Initial value of K_p, K_i , and K_d	64

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2. 1:	Early cylinder (reel) mower	23
Figure 2. 3 :	A horse on an Australian golf in 1930s. (https://en.wikipedia.org/wiki/Lawn_mower)	24
Figure 2. 4:	Commercial lawnmower in use 1930 in Berlin (https://www.wikiwand.com/en/Lawn_mower)	25
Figure 2. 5:	A rotary mower (https://www.shutterstock.com/search/rotary+mower)	27
Figure 2. 6:	Ransome’s Motor Lawnmower (http://www.burkes-peerage.net/articles/scotland/page16-1121.aspx)	28
Figure 2. 7:	Corded rotary lawnmower). (https://en.wikipedia.org/wiki/Lawn_mower)	29
Figure 2. 8:	Cordless and rechargeable rotary lawnmower (https://en.wikipedia.org/wiki/Lawn_mower)	30
Figure 2. 9:	Finite state acceptor diagram of controller.(Wasif, 2011)	31
Figure 2. 10:	Block diagram of hardware architecture.(Series and Science, 2016)	32

Figure 3. 1: Project Flowchart	38
Figure 3. 2: Phase 2 Flowchart	41
Figure 3. 3: Design Machine modelling	42
Figure 3. 4: Design machine measurement.....	43
Figure 3. 5: Sweeper Robot Body Structure	44
Figure 3. 6: Pinout of ESP8266	49
Figure 3. 7: Dc Geared Motor with Encoder	50
Figure 3. 8: Dry Cell Battery	51
Figure 3. 9: Lawnmower Metal Blade	52
Figure 3. 10: Wheel	53
Figure 3. 11: Mat Lab Software.....	54
Figure 3. 12: Arduino Ide Software	55
Figure 3. 13: Blynk Application	56
Figure 3. 14: Block diagram of monitoring system.....	57
Figure 3. 15: Monitoring system of IoT.....	58
Figure 3. 16: Block Diagram of PID system	59
Figure 3. 17: circuit design of lawnmower	61
Figure 3. 18: Hardware Conection.....	61

Figure 4. 1:Transfer function of PID	64
Figure 4. 2:PID simulate using MATLAB.	65
Figure 4. 3: Graph for PID movement of lawnmower.....	65
Figure 4. 4:Reading ultrasonic in Arduino.	66
Figure 4. 5: MATLAB coding for ultrasonic.....	67
Figure 4. 6: Ultrasonic graph respond.	68
Figure 4. 7: Blynk Future.....	69
Figure 4. 8: On button to share project.	70
Figure 4. 9: QR code.....	70
Figure 4. 10: Auth Token.....	72
Figure 4. 11: Widget Box	73
Figure 4. 12: Future Blynk for lawnmower	74
Figure 4. 13pop up notification from Blynk.....	75
Figure 4. 14: Pop up notification	75
Figure 4. 15: Structure of lawnmower	76
Figure 4. 16: Below picture of lawnmower	77
Figure 4. 17: Grass before lawn.....	77
Figure 4. 18: Grass after lawn.....	77

CHAPTER 1

INTRODUCTION

1.1 Background

Over the years, technology revolutionized has creates amazing tools and resource, putting useful information at our fingertips. It also provides quicker ways to communicate and work even from a distance. This is how Lawnmower machine using PID controller with IoT maintaining system been create. Throughout the years, lawnmower have been releasing with a various design and modern technology. Starting from cylinder (reel) mower which use the manpower to push the mower and cast-iron wheels that transmit the power. Then Silent Mower (silent cutter) has been create with the price increase at that time because of the upgrade technology. In 1890, Side- Wheel Push Mower is the lighter and affordable mower that day. Early in 1900s Ransomes start to create steam lawn mower. (Nimkar *et al.*, 2017)

However, it does not last longer because of the air pollution and the machine took a long time to fire up the boiler. In short amount of time, the fifth design of lawnmower has been designed and create. Gas Powered lawnmower has been eye catching people when it be the first mower that people could ride behind the animal. Started 1930 with new upgrade technology, lawn mower has been introducing with much smaller, light and more efficient. Industries like plastic also start to growth and make a plastic component for lawnmower in 60s. Back to

1995 the first dollar robotic lawnmower have been introduces to world.(Khodke, Kukreja and Kotekar, 2018)

Since the exiting autonomous lawnmower are not affect and cause a lot waste of energy, this innovation is create. A lawnmower which useful for people, it will integrate with IoT monitoring system. This lawnmower would help to reduce human power and people who do not want to deal with a small thing and got no time to clean up their home area. Furthermore, it will be design in light weight and way safer. With the fast speed of technological evolution now, people start to control their machine using their smart phones. One of the technical communications is The Internet of Thinking (IoT). IoT can be define as interconnection device to people , animal or object that ability to exchange data over network without involving human-to-human or human-to-computer interaction.(Zhao, Jegatheesan and Loon, 2015)

IoT application on device need to ensure that data/messages have been received and acted upon properly in timely manner. For example human monitored constantly and appropriate actions are taken automatically.(Lee and Lee, 2015).This is when we control our machine using an app from device and see what happened due the working process. It will show the result or any obstacle that come toward the machine and with this technology also we can control the speed of our machine. The purpose behind this is to make people easier to monitoring the machine using mobile app.

To control the speed of lawnmower, the best controller needs to be chosen for the machine. PID is one of the best controllers because of the simple structure and robust performance in a wide range of operating condition. PID controller can provide good closed-loop response characteristic, tuning using relatively simple

design rules and easy to construct either using analog or digital components. Thus, the movement of the lawnmower system is control by PID controller that implement using Arduino.

1.2 Problem statement

With technological advancement there also arises the need to check the impact of machine on the environment as well as on man. For example, people need to use their strength to mower their grass at home. Beside that if they have a big area of grass mowed, they will need more than one day to finish cut them. Pollution is the major concern with the conventional gas-powered lawnmower.

Beside that we can use this machine even when we do two or more work in one time. For example, sometimes we need to do two work in one time such as laundry and cleaning the house. Thus, by using the apps, we can monitor our robot using our phone and do laundry at the same time.

1.3 Objective

The main objective of this project is:

1. To design and construct hardware for lawnmower.
2. To develop design of PID controller to control the movement of lawnmower movement.
3. Integrate the system with IoT to monitor the activity of the lawnmower machine and analysis the movement of lawnmower movement.

1.4 Scope of the project

For this project will be develop and construct the model of the lawnmower with a friendly design which can use easily and ability to mow a smallll area of grass within approximate time a human could or even way faster than that. Beside that the movement of the lawnmower system is control by PID controller that implement using Arduino. The controller uses to control DC motor speed and Math Lab software is used for simulation. It will be integrating with IoT monitoring system which using application in mobile phone. This will make people easy to monitor the activity of machine using mobile apps.

1.5 Thesis Outline

This thesis is organized as follows:

Chapter 2 provides a literature review regarding the previous work of lawnmower, control system and monitoring system of lawnmower. The structure, and technique from previous work have study. In order to investigate the improvements that had been achieved, the discussion is divide into some categories.

Chapter 3 deals lawnmower structure, software, and hardware implementation. Fist the structure will be elaborate with all the component that used based on the design model. Each component will be explained in detail at hardware implementation. To conclude this chapter, we have done a lot of research and planning on how to complete this project. We have few major things that we need

to complete for this project to work properly. First, we need to procure all the hardware from the body down till the motors and the blades. Then we need to install the hardware and wire it properly just as the schematic diagram. Once the wiring is done, we need to move on to the programming side of the project using both MATLAB and Arduino. MATLAB will be used to collect the data and Arduino will be used to setup the software to act as a median for Blynk app for our mobiles.

Chapter 4 shown the results of PID, ultrasonic sensor and Blynk apps from the lawnmower that have been tested. The proposed technique is demonstrated and analysed through the experimental work. The movement and monitoring system is discussing in detail. Graph of

Chapter 5 summarize the summary, recommendation, and commercialization relevancy for this project.

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CHAPTER 2

LITERATURE REVIEW

This chapter is about research and studies of various field that are involved in this project. Beside that to get more information based on the previous work of lawnmower and what is the controller use in lawnmower and how the monitoring system would help the machine works.

2.1 Previous Related Work

Lawnmower is a machine that useful for people nowadays. Over the years, there have been numerous developments in lawnmower technology. A lawnmower is a machine to cut grass surface to an even height. But with technological advancement there also arises the need to check the impact of machine on the environment as well as on man. Human effort is another factor that need to be reduced. (Dutta PP *et al.*, 2016) In 19th century, mechanical mowing became possible by an English engineer named Edwin Budding. Budding's noticed from watching a machine in local cloth mill working, which used the cutting cylinder mounted on bench to trim clothes for smooth finish, is like his overgrown grass at home that he had to cut with a scythe.

Through Budding's ingenuity he developed a cylinder or reel type of mower which a series of blades arrange around a cylinder with a push handle.(Khodke,

Kukreja and Kotekar, 2018) These early machine was made of cast iron which transmitted power from the rear roller to the cutting cylinder and featured a large rear roller with cutting cylinder (reel) in the front.(Okafor, 2016) Furthermore people found in using the mower themselves it was a healthy exercise to do. For a considerable length of time, grass was sliced by labourers who strolled through fields or fields wielding little, small, sharp scythes. In expansion to being tiring and moderate, manual cutting was inadequate the sickles functioned admirably just when the grass was wet.



Figure 2. 1: Early cylinder (reel)

mower

[\(https://blogs.lt.vt.edu/mattkhistblog/2017/02/09/the-invention-of-the-lawnmower/\)](https://blogs.lt.vt.edu/mattkhistblog/2017/02/09/the-invention-of-the-lawnmower/)

Silent Messor (meaning silent cutter), was introduced by Thomas Green and Son of Leeds in the 1850s, that cutting cylinder used the chain drive to transmit power from rear roller. (Khodke, Kukreja and Kotekar, 2018) The rise in popularity of lawn sport helped prompt the spread of the invention. In 1860, manufacturing of

lawnmower started to take of the industry. 1863, Ferrabee's company making eight model of lawnmower over 5000 machines product in various roller size. With the cusses of lawnmower industry, in 1885, fifty thousand lawnmower from America has been ship out to every country that was on the globe .(Wild, 2008).

In the end of 19th century, they start to think to gain more power to make the lawnmower become more efficient and less the human energy (meaning more non-human power) behind the mower. More than ten years have been took to think for this idea and the best thing would be to hook up a horse to the mowing machine.



Figure 2. 2 : A horse on an Australian golf in 1930s.

https://en.wikipedia.org/wiki/Lawn_mower

However, the wife complained about the horse trampling her favourite roses. Then six years after the lawnmower drawn animal someone got the idea of using a steam power. The first steam lawnmower patented by James Sumner of Lancashire which burning a petrol and/or paraffin (kerosene) as fuel. However these were heavy machine and it took long time to fire up the boiler than it did to actually cut the lawn.(Khodke, Kukreja and Kotekar, 2018).After various advance the machine were sold by the Stott Fertilizer and Insecticide Company of Manchester and