UNIVERSITI TEKNIKAL MALAYSIA MELAKA

The intelligent control lawn mower technology for modern accommodation

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree in Electronic Engineering Technology (Electronics Industry) Hons.

By

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DECLARATION

I hereby, declared this report entitled “PSM Title” is the results of my own research except as cited in the references.

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Name **: ……**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology Industrial Electronic (Hons.). The member of the supervisory is as follows:

.....

(Project Supervisor)

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ABSTRAK

Laporan ini membentangkan kaedah reka bentuk sistem kawalan pintar mesin pemotong rumput. Reka bentuk yang diterangkan di sini dibuat supaya mampu berdaya saing dan secekap kaedah lain yang kini berada di pasaran, contohnya mesin pemotong rumput yang dijana oleh tenaga solar, kuasa elektrik elektrik dan sistem enjin. Bagi setiap kaedah yang dinyatakan di atas, penyelidikan mengenai sumber utama untuk menjana kuasa untuk memberi tenaga mesin pemotong rumput telah dilakukan dan maklumat terperinci diperolehi dalam pelbagai literatur. Laporan ini memberi panduan yang akan menjadi berguna kepada seseorang yang berminat untuk membina sistem kawalan mana-mana mesin jenis yang berkonsep sama seperti mesin pemotong rumput. Objektif utama projek ini adalah untuk mereka bentuk sistem kawalan mesin pemotong rumput yang memudahkan dan mesra pengguna. Terdapat 2 fokus utama kajian mengenai laporan ini, iaitu penggunaan bahan untuk mereka bentuk mesin pemotong rumput yang menggabungkan semua ciri-ciri dari pelbagai jenis mesin pemotong rumput dan reka bentuk alat kawalan. Alat kawalan jauh mesin pemotong rumput telah direka dan dibina oleh banyak jurutera selama ini. Terdapat banyak variasi alat kawalan jauh utntuk mesin pemotong rumuput kerana bagi memperbaik sistem pemotong rumput yang asas.. Kegunaan telefon pintar sebagai pengawal melangkah lebih jauh dengan mewujudkan versi yang mesra pengguna.

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ABSTRACT

This report presents a design method of the Intelligent Control system of lawn mower. The design described here is made such that the cost of a final product is economically viable and as efficient as other solutions that are currently available. Such as lawn mower may be powered by solar energy, conventional electric and internal combustion engine. For each type of energy source mentioned above, the research of the sources compatible for generating power to energize the lawn mower has been done and the information or detail is obtained in various literatures. This report provides the guidance that will be helpful to a person who interested in developing a control system of any type machine that similar to a lawn mower. The main objective for this project is to design the control system of lawn mower which is counter the limitation and friendly uses. There have 2 stages of the study case focus on this report, that is material of design a lawn mower that incorporates all of the features from various types of lawn mowers and design of controllers. The remote control lawn mower has been designed and built by many engineers throughout the years. There are many variations of the remote control lawn mower, as people across the nation have attempted to advance the basic lawn mower by implementing the remote control aspect. The uses of smart phone as a controller went a step further by creating an even friendly version of the mower.

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DEDICATIONS

This report is dedicated to my beloved parents, who educated and supported me throughout the process of doing this project.

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I would like to thank to my most precious parents, Mohd Razali bin Embong and Zurinah bte Jamaludin, whom have always supported me in my life with a great love. Special thanks to my project supervisor IR. Nik Azran bin A.B Hadi, along with all lecturers in Universiti Teknikal Malaysia Melaka (UTEM) who has guided me, provided a great knowledge, suggestion, opinion to complete the research of this project. I am equally grateful to my both sisters Munirah binti Mohd Razali and Alia binti Mohd Razali to lend hand in financial aid.

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CHAPTER 1

INTRODUCTION

1.0 Overview

In this section will introduce the basic information about the project such as background, problem statement, objective and scope of the project. It also covers the explanation of the project idea and the uses in real life.

1.1 Background

The intelligent control lawn mower technology for modern accommodation is a project that is designed to cut the grass using a controller to control the lawn mower and connected to the microcontroller as the main operation of the lawn mower. This project functions to enable people to move the lawn mower without the need to manually move the machine itself, which can be hazardous if the machine is not properly handle. Furthermore, this technology features no need special controller, just link with our smart phone to control it. The project is operating in an area that has a flat surface where the lawn mower can move smoothly without any difficult. This hazard can be dangerous as it can cause the user to cause injury or even accident if the user is not handled carefully.

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With this project, the user can remote the lawn mower from a safe distance and avoid any hazards that can occur when manually handle. In addition to this project, this project will also provide a few sensors surround the machine which enables the user to detect any objects that are near to the lawn mower. This object can either be non-living or not-living object which doesn't only affects the machine but also cause an accident.

1.2 Problem Statement

1. **The pollution release in environment**

   In this century, too much pollution creates by a human being that harm the world day by days. Normal lawn mower use engine to rotate the blade and create a loud noise, and the combustion of engine is causing air pollution. This project will be the solution to counter our prohibited attitude.

2. **Burden when using the lawn mower**

   Mowing the lawn with a heavy weight is an inconvenience and very troublesome. This is because cutting the grass requires very large energy consumption depending on the environment and the type of lawn mower. Be that as it may, while we use the lightest model of normal grass cutter it will leave and effect to our body after finish cut the grass.

3. **Hazardous if not properly use**

   The previous lawn mower is a heavy duty type and need the right technique to handle because if use the wrong technic, it can cause accident and harmful.

4. **The normal lawn mower is difficult for maintenance**

   A normal lawn mower requires periodic maintenance such as changing the engine oil and need to service the carburetor after the quiet time use. In fact, the some of the lawn mower use cable wire to accelerate the engine and this cable

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usually broke. The more often maintenance the more cost needed. This project is the option to save our cost in a long term.

1.3 Objective

1) To develop the basic concept of lawn mower operation.
2) To simulate and develop an Arduino application in order to control the movement of the lawn mower easier way.
3) To construct and implement Intelligent Control, Lawn Mower in both hardware and software with friendly users and easy maintenance.
4) Create the mowing machine that low energy consumption and reduce pollution when operate.

1.4 Scope

This project is focusing on designing the lawn mower with able cut the grass efficiently. This project will remotely control the lawn mower using a controller device to give the signal to the microcontroller receiver after the voltage supply is generated to the main controller. The project can be monitored by 10m range, which used Bluetooth system as a medium Tx/Rx. Microcontroller which has program will link to the main body of this project, where it can control the DC motor and allowing the main body to move based on command that received from the controller. The microcontroller only used 5v to operate and reduce the power consumption. The sharp blade is used to able the lawn mower to cut the grass smoothly. Furthermore the project has extra emergency precaution which is a sensor that allows the project to react when encounter object which stop the operation of a project to protect it from any self-damage. But based on the scope of the project, the project itself is also limited within the following scope such as:

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1. The speed suitable for handling the Lawn Mower
2. The type of DC motor to use
3. The suitable power source
4. The design of the Lawn Mower
5. The range of the signal medium
6. The place suitable for lawn Mower

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CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This section will cover the research of component and system involve to develop this project. The main research is to master the knowledge of a lawn mower concept. The selecting of component has to be precisely careful to make this project successful. The research source is referring to the published books, journal and article.

2.1 Hardware

The hardware of this project is for the most part as indicated by the pattern and reasonable in these current times. That is mean it must be less wire or cable uses. In today's chance the idea of robots is seen as an approach to diminish the man power and build the profitability without bargaining the quality and exactness of the work. This project considers the use of a robot which can be worked remotely utilizing Bluetooth innovation. Incorporating equipment and programming is the key to this project.

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2.1.1 Arduino microcontroller

Taking into account (Yusuf Abdullahi Badamasi 2014): "Arduino is an open-source prototyping platform which simple to build and to use equipment and programming". It can read or write data and send to most gadgets and even to the other peripherals electronic gadget to command it. An Arduino used C language to build a program.

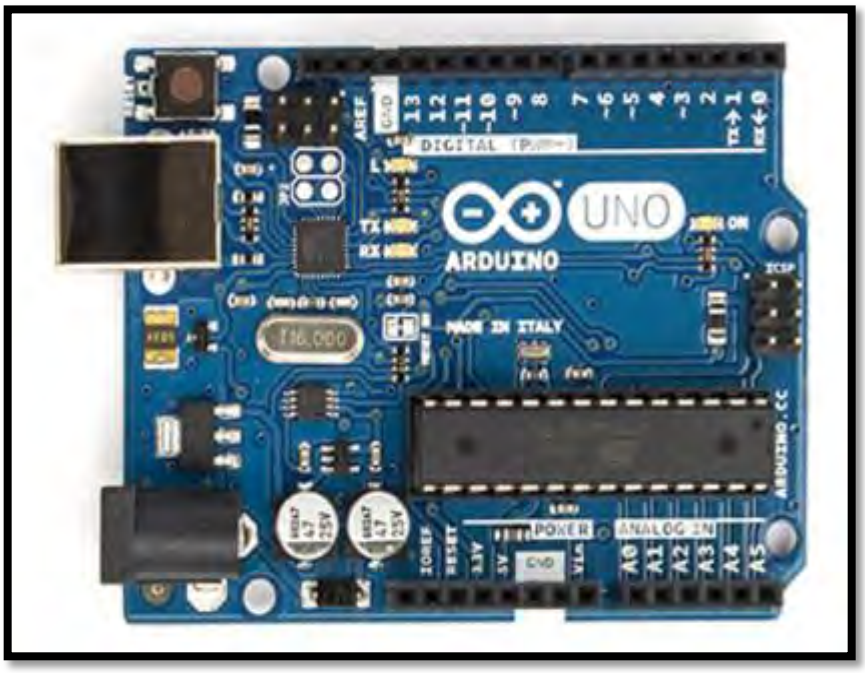

Figure 1: Arduino UNO Circuit

Nowadays, having many types of microcontroller with different platform of configuration, but same function which is as a controller device. The main function of all these tools is to simplify the complex language of microcontroller programming in a simple form. Arduino is one of the platforms that have simplified procedure to work with a microcontroller:

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- Inexpensive - Arduino is more economical than the other types microcontroller. The cheaper cost of Arduino can reduce the cost of development.
- Platform - Software (IDE) is able to generate with Ios, Mac and IOS operating system. Most microcontroller frameworks are constrained to Windows.
- Simple to build - Software (IDE) suitable and friendly use even for beginners, of course is more advantageous for advanced users.
- Variety and simple programing - The Arduino programming is open source, and easy to develop through C++ libraries.
- Open source and extensible hardware - The developer creates this hardware with an open source and license, so we can build our particular form of the module and enhancing it with spare our budget.

The Arduino block (A. U. ARDUINO UNO, 2012) made of various pins with own capacity, the pin is determined as follows:

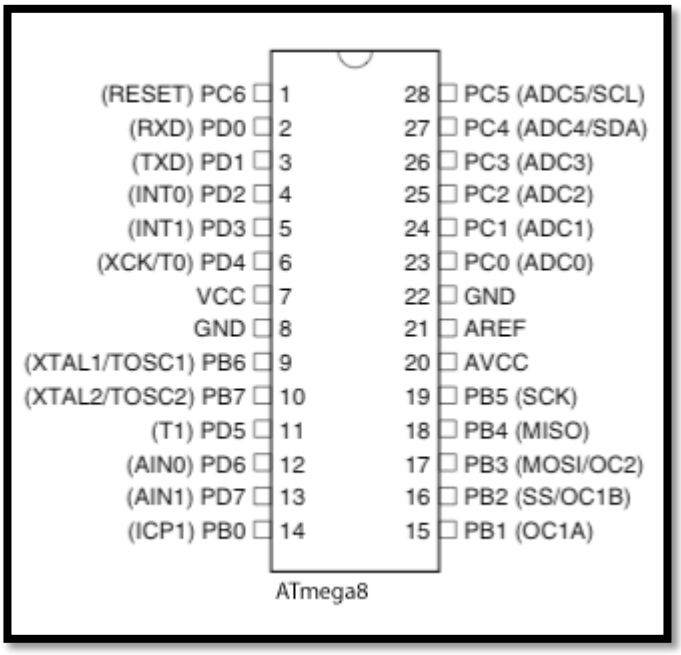

Figure 2: Arduino pin mapping

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- Port USB, the initial segment act as a transmitter of the microcontroller which is transferring the build programmed.
- Power Supply (external): The most part if the USB plug does not give adequate energy to whatever you have customized it to do the power supply will act as main power to control the board. Normally 9V to 12V is used.
- Reset button: reset the program to the initial condition.
- Microcontroller: This is the brain of system that received, and sends and process data or command to our circuit.
- Analog (pin 0-5): Read the analog input
- I/O pin: Read digital input and output.
- Ground pin: Act as negative terminal in the circuit.
- VCC pin: Normally VCC pin is determined by VDD, which is 5volt to turn on the microcontroller.

2.1.2 Android smart phone

According to (S.Sujendran, P.Vanitha 2014): "Nowadays, the number of appliance services and their complexity has increased. There is a need to get familiar with the different operations of many remote control manufacturers, which is very confusing. To overcome this problem they have built these remote controller, which is called Universal. Sometimes, such universal remote control has numerous buttons which is not user friendly". To solve this issue an Android application through Bluetooth is created by the system allow human easily control thing. It's designed to associated with the hand-off and the Bluetooth gadget. Once the user start/stop the command in smart phone the device will detect and do the task it received from smart phones.

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2.1.3 Stepper motor

According to (M.Kelemen, 2015): The stepper engine is working to make a situating of the rotor with exactness. To make the framework that necessities accuracy as an essential component the most appropriate engine is stepper engine. The control unit is fundamentally expected to control stepper engines. This engine ready to characterize and reach through certain position . By appropriate movement of control unit the progression of the engine is come to. The fundamental guideline of this engine is controlled by attractive fields is made by a present move through the coil. The rotor will turn after the magnetic field is made and pulls the rotor magnet (Siripala & Sekercioglu, 2013).

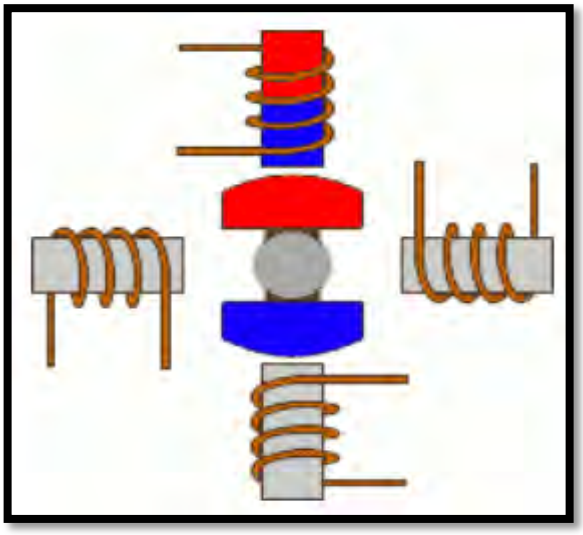

Figure 3: stepper motor architecture

There are different types of stepper motor such as unipolar and bipolar stepper motor. It is a four wired stepper motor. It rotates in a stepwise manner. Each two wires represent the north and south poles of a magnet. It consist of two elements, namely stator and rotor. Stator represents the magnets in stationary movement and the rotor which represents the magnets in rotatory movement. Stationary part of the magnet can be wounded with the coil. When the copper coil receives the current supply, the magnet gets energized and then it acts like a magnet. By applying the power supply in the circuit, the rotor may rotate either in forward or in a reverse direction. The speed of the

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stepper motor can be controlled by Arduino microcontroller. By varying the program parameters, the speed, torque and the direction of the stepper motor can be controlled. These stepper motors can be used for many industrial applications and also for the general purpose applications (Siripala, P.J. & Sekercioglu, Y.A., 2013). This below equation shows the relation of speed and voltage and time.

$$speed = \left[\frac{Voltage}{\left(\frac{Inductance}{1000}\right) \times 2 \times Imax \times Step}\right]$$

$$Time/Step = Inductance \times Imax \left[\frac{2}{Voltage}\right]$$

$$Power = Voltage \times Imax$$

Figure 4: Relation speed, voltage and time

To control the motor we need an understanding operation of that type of motor. Mostly the stepper motor used the H-bridge concept to manipulate the direction of a motor either forward or backward. This concept is depending on the changing of current flow through the circuit by crossing the transistors. The name H-Bridge is getting due to the formation looks like an H. The circuit as follows:

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