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DEVELOPMENT OF LAWN MOWER CONTROL BY HAND GESTURE

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This report is submitted following the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Industrial Electronics)

by

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Tajuk: DEVELOPMENT OF LAWN MOWER CONTROL BY HAND GESTURE

Sesi Pengajian: 2021

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Tarikh: 19/2/2021

DECLARATION

I hereby, declared this report entitled "Development Of Lawn Mower Control By Hand Gesture" is the results of my research except as cited in references.

Signature :…………………………………………………….

Author's Name : **MUHAMMAD HAZIQ BIN MAZELAN**

Date :……………..19 February 2021. ………….

APPROVAL

This report is submitted to the Faculty of Electric and Electronic Engineering Technology of UTeM as partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Electronic Industry). The member of the supervisory is as follow:

Signature :……..………………………………………………….

Supervisor Name : **Muhammad Izzat Zakwan Bin Mohd Zabidi**

Date :……………19 February 2021. ………………...

DEDICATION

To ALLAH SWT, RASULULLAH SAW, Mama, Abah, my supervisor Sir Muhammad Izzat Zakwan Bin Mohd Zabidi, my friends Andy and Nabil, my classmate, and my families.

ABSTRACT

This project's purpose is to create a low-cost lawnmower with a compact 'accelerometer' controller. A portable wireless 'accelerometer' controls the electric lawnmower. This approach is used to support and also can regulate a person with disabilities because of many factors. On the rear of the lawnmower were its pipes which are connected to the motors to shift according to the feedback of the "accelerometer" controller. The device is related to the interaction of the radio frequency between the lawnmower motor and the "controller accelerometer" was designed using a variety of modules: Radiofrequency, Accelerometer, and Microcontroller Arduino. The lawnmower is also coupled with the Frequency radio modules to communicate with the control unit. The driver and Arduino are used to power the motor. This study has addressed both implementations and designs.

ABSTRAK

Tujuan projek ini adalah untuk membuat mesin pemotong rumput murah dengan pengawal 'accelerometer' yang ringkas. 'Accelerometer' wayarles mudah alih mengawal mesin pemotong rumput elektrik. Pendekatan ini digunakan untuk menyokong dan juga dapat mengatur orang kurang upaya kerana banyak faktor. Di bahagian belakang mesin pemotong rumput ada paipnya yang disambungkan ke motor untuk beralih sesuai dengan maklum balas pengawal "accelerometer". Peranti ini berkaitan dengan interaksi frekuensi radio antara motor pemotong rumput dan "accelerometer pengawal" dirancang menggunakan berbagai modul: Frekuensi Radio, Accelerometer, dan Mikrokontroler Arduino. Mesin pemotong rumput juga digabungkan dengan modul radio Frekuensi untuk berkomunikasi dengan unit kawalan. Pemandu dan Arduino digunakan untuk menghidupkan motor. Kajian ini telah menangani pelaksanaan dan reka bentuk.

ACKNOWLEDGEMENT

First of all, love and gratitude to everyone who has helped make this project possible are innumerable. My Supervisor, Sir Muhammad Izzat Zakwan Bin Mohd Zabidi, for all your encouragement, advice, ideas, and critics, the suggestion that has helped complete and effective this project. Thank you for sharing all the details up to the end of this project.

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CHAPTER 1

INTRODUCTION

The main idea for this project was to develop a lawnmower that allows remote control by hand gestures by the user. There are three main elements of the prototype: Arduino (Nano and Uno), Accelerometer 3-axis, and BLDC.

The Arduino is the microcontroller used to manage the Lawn Mower input and output. As for the accelerometer 3-Axis Module, it was used to control the movement of the Lawn Mower from the end-user glove and the Brushless Motor Driver (BLDC) module is used to monitor the Lawn Mower engine's direction of motion. As for the Arduino, it will handle all the inputs and outputs of the Lawn Mower where the RF transmitter and 3-axis accelerator which control by Arduino Nano act as the input for the overall system while Motor Driver, Brushless Motor Driver (BLDC), RF receiver and RC motor which control my Arduino Mega act as the Output. In the Arduino, the instruction code would be a program as it constructs the Arduino to perform the operations as specified by the user. For the RF transmitter and receiver, it creates the interconnection between the Arduino Nano on the glove and the Arduino Mega in the Lawn Moyer. The 3-axis accelerator Module will detect the hand gesture of the end-user then process by Arduino Nano and transfer the instruction via RF signal as an input system. The instruction sent to the lawnmower to be read by Arduino Mega via RF receiver and sent the data to BLDC for controlling the Moto Driver which controls the movement of the lawnmower.

1.0 BACKGROUND

Compared to the other projects listed in the papers, this project is an easier-to-build project with lower production costs. Most of them use GPS as compared to others, as it helps Lawn Mower operate within the given area. Nonetheless, technology is much harder to build as required by the Cell ID, Assisted GPS, and WI-FI, both of which allow students to decide the exact location of the Lawn Mower and the area to cover. Many projects use the Zigbee module in Web Design Computing, which helps users to track and manage the Lawnmower. The system is well advanced but the user was expected to control the Lawn Mower entirely via the screen. If something is wrong with the Lawn Mower, the user can’t check the issue immediately, since the user is not operating in the Lawn Mower area. In comparison, this method's cost of output is significantly higher than that of the Zigbee Module relative to Arduino. The system chosen to use in the project is a Radio Frequency (RF) system that is easily connectable to the Arduino. The key explanation for the use of the RF system as the linking medium was that it was cheaper, simpler, and smaller. So, eliminating the Lawn Mower as possibly as they wish is better for the end-user. Additionally, manufacturing costs are much lower due to the flexibility of the RF module. Last but not least, the Arduino Uno has been chosen as the glove microcontroller with 6 input pins and 6 output pins that are also appropriate for the 3-axis accelerator module with 3 output pins.

1.1 PROBLEM STATEMENT

Based on the current end that uses a traditional lawnmower in his semi-D house near Durian Tunggal and a paintball field operator in Cyberjaya, there continually needs to spend a fortune of money and time to make sure the lawnmower is in a good condition and can always be used when in need which prevents the client from purchasing and utilizing an electric motor powered lawn mower as they feel that it’s quite expensive and not worth the money.

Other than that, some individual faces handicap or trouble to control the lawnmower independently without anyone else assistance. For instance, a half paralyze or an old folks age 50 years old and above. These individuals were unable to operate the conventional lawnmower on their own, thus allowing them to travel easily to wherever they chose and thus requiring another person to allow them to operate the mower.

As it also helps all end-users cut the lawn at their lawn yard on their own with so much fun. Nonetheless, the previous traditional lawnmower is still important, by using Petrol as an energy source capable of generating air pollution. However, most people don't have as costly and spacious as the traditional Lawn Mower to stock. By doing this, air pollution can be solved and compact for the owner or the user to carry it anywhere because it has been built with a lightweight and a smaller scale.

Besides, the motor is less noisy compared to traditional engines which can solve noise pollution.

1.2 OBJECTIVE

The main objectives of this project are:

1. To develop a simpler motorized system on the Lawn Mower that can reduce the maintenance time and cost.
2. To build a lawnmower that has less cost in production, less noise and air pollution compare to petrol power lawnmower.
3. To use an accelerometer 3-axis module as the controller for the movement of the lawnmower so it is easier for a handicapped individual to control it.

1.3 SCOPE OF PROJECT

The purpose of this project is to use it only at home. That is because the lawn mower's compact size is ideal for the backyard house. Other than this, the distance covered by the hand motion recognition used for pushing the lawnmower is between 0 and 50 m, which enables the controller to push the mower to 50 m. The aim of this project is also to attract young people to clean their backyard houses using this interesting technology. The DC engine used is not bigger than the motor used by traditional paddling machines and is less efficient than the ac engine. Compared with the traditional blade, the blade is less flexible as the project often intends to handle it as a hand-removed control car to prevent any risks. As the purpose of this project, users would like to have fun while cleaning their backyard home.

CHAPTER 2

LITERATURE REVIEW

2.0 OVERVIEW

Edwin Budding was the first to discover garden tools in 1830 in Thrupp, just outside Stroud, Gloucestershire, England. Budding's mower was primarily designed to chop the grass as an option superior to scythe on sports grounds and extensive gardens and was granted a British patent on 31 August 1830 (Heilig, 1994). The first computer of Budding was 19 inches (480 mm) long, with a frame made from atomic number 26. They were pushing the mower from behind. Cast-iron gear wheels transmitted power from the rear roller to the cutting cylinder, allowing the rear roller to move the knives on the cutting cylinder; this ratio was 16:1. To change the cutting point, the roller placed between the cutting cylinder and thus the main or ground roller may be elevated or lowered. Grass clippings were placed into a tray-like jar. However, it was very soon discovered that an additional handle was needed in advance to help pull the machine along. These machines were generally surprisingly similar to modern mowers.

In unconstrained conditions, a hand gesture recognition system works to perceive continuous motion. The framework consists of three modules that use Pseudo two-measurement concealed Markov models (P2-DHMMs) to track, prepare signals, and identify gestures in real-time. After amassing movement descriptors and hand areas, they had used a Kalman channel and hand mass examination for hand (Binh et al., 2005). It is truly effective for the muse community and uses skin shading to imitate and recognize hand movement. In addition, plans are being made to improve the overall application of the methodology:

(1) Smart choice in picture preparation and

(2) Adaptive limit signal to expel a non-emotional design that helps to define the info design as a motion.

A motion acknowledgement framework that will reliably perceive single-hand signals continuously on the progress of standard equipment. In the course of the investigations, their framework was based on the jargon of 36 motions, including the American Gesture Communication (ASL) letter spelling letters as well as digits and the viability of the methodology (Binh et al., 2005).

2.1 CONTROL SYSTEM

At the top of the theory, there are two main groups, modern and classic, with direct consequences for the applications in control engineering. Implementation of the classical control theory is limited to creating a single input and a single output (SISO) system, with the exception of evaluating disruption rejection through a second input. System analysis is administered in the time domain using differential equations, in the complex domain with the transformation of the Laplace, or through the transformation from the complex domain within the frequency domain. Even in the time domain, many systems may require a second-order and a single variable system response. A controller developed using classical theory often requires on-site tuning due to mis-approximations in specifications. Nonetheless, for most industrial applications, these controllers are preferred, as opposed to systems developed using modern control theory, due to better physical implementation of classical control designs. Proportional-Integral-Derivative (PID) controllers are the most frequently designed controllers using the classical control theory. Whether a lead filter or a lag filter might be used less frequently (Ahmed et al., 2018).

The ultimate target is usually to meet the requirements typically set within the Step Response time domain, or sometimes within the Open-Loop Response frequency domain. The characteristics of the phase response implemented during the specification are usually over-shooting, time-setting, etc. The characteristics of the open-loop response 4 used in the specification are usually Gain and Phase Margin and Bandwidth. Simulation may also test these characteristics including the in-check system dynamic model including the compensation model. On the other hand, modern control theory is applied within state space, which can influence multiple-input and multiple-output (MIMO) systems. In addition to complex design problems, such as fighter control, this overcomes the limitations of the classical control theory with the drawback that no frequency domain analysis is feasible. The system is best expressed in modern design as a group of decoupled first-order differential equations identified by the state variables. This section contains hypotheses concerning nonlinear, multivariate, adaptive, and robust controls. For MIMO systems, matrix methods are significantly restricted where linear independence in the relationship between inputs and outputs can not be guaranteed (Nise, 2011).

The control system may be a device or set of devices managing, controlling, directing, or regulating other devices or system's behaviours. Industrial control systems are used to control machinery and/or machines in industrial production (Nise, 2011). There are 2 common control system types, open-loop control systems, and closed-loop control systems. Supported inputs are generated within the output of the open-loop control systems. For closed-loop system control systems, current performance is taken into account, and accepted input is corrected. Additionally, a system with a closed-loop is considered a feedback system.

2.1.1 Open-loop control systems

The controller calculates the exact voltage or current the actuator needs to perform and send the task in the open-loop system automatically. Nonetheless, the controller doesn't know if the actuator did what he wanted to do in this approach since there is no feedback. The system is entirely dependent on the controller who knows the functionality of the actuator (Paraskevopoulos, 2017). The actuator is extremely repetitive and reliable. In this process. Relaxes and step motors are robust instruments and usually operate on an open loop. Actor systems such as motors or flow valves are frequently used in open-loop operations but must be regulated and altered periodically so that the system is operating properly (Paraskevopoulos, 2017). In order to perform the task as shown in Figure 2.1, the controller calculates independently the exact voltage and current required by the actuator in the open-loop system.

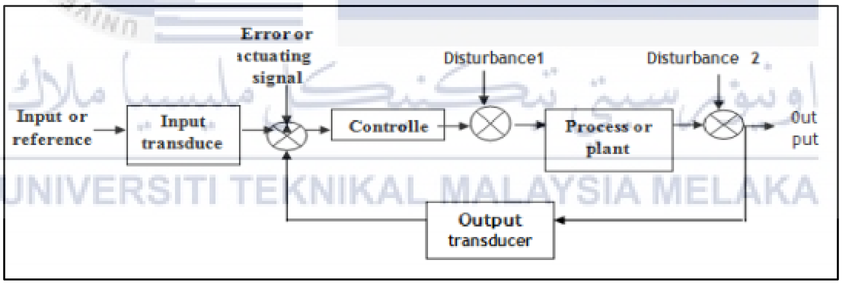

Figure 2. 1: Open-Loop Control System

2.1.2 Closed-loop control systems

In a closed-loop system, a sensor constantly monitors the output of the method (controlled variable); the sensor samples the output of the system, and this measurement is converted into an electrical signal that the controller is going back, as shown in Figure 2.2. Since the control system knows what the system does, any necessary changes can be made to keep the output where it is located. The forward-path is the signals from the controller to the actuator, and the feedback is the signal from the sensor to the controller. The feedback signal at the comparator is subtracted from the setpoint (Paraskevopoulos, 2017). Despite the additional hardware required, the closed-loop control self-correct feature makes it preferable in many applications to open-loop control. This is because the closed-loop system provides reliable, reproducible efficiency even though machine components are not completely reproducible or understood accurately (Paraskevopoulos, 2017). The system really does, it can make any necessary adjustments to keep output where it belongs. The forward-path is the signals from the controller to the actuator, and the feedback is the signal from the sensor to the controller. The feedback signal at the comparator is subtracted from the setpoint (Paraskevopoulos, 2017). Despite the additional hardware required, the closed-loop control self-correct feature makes it preferable in many applications to open-loop control. This is because the closed-loop system provides reliable, repeatable performance even when the components of the system themselves are not absolutely reproducible or accurately known (Paraskevopoulos, 2017).

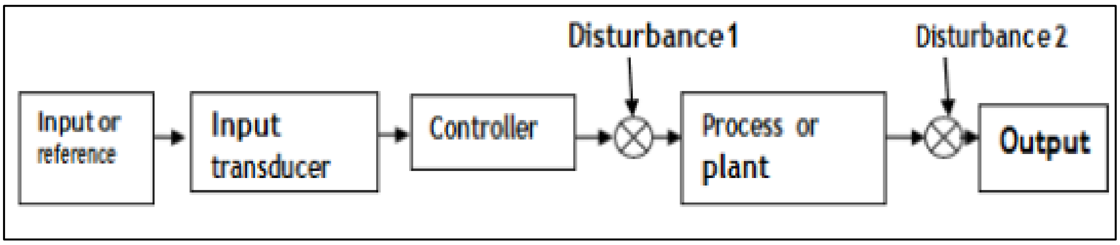

Figure 2. 2: Closed-loop Control System

2.1.3 Microcontroller

A single-chip computer may be a microcontroller. Micro indicates that the device is small and that the controller is used in control applications. The built-in