

**SMART AUTOMATIC DUAL FUNCTION LAWN MOWER WITH INFRARED  
AND METAL SENSOR.**

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I dedicate to my family especially my mother who always supporting me. Also always beside me are brothers, my nephews, lectures and all my friends.

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## ABSTRACT

This project presents a review of researches done on the subject of automated lawnmower. An autonomous lawnmower is a robot that can operate without or with minimal human control, self-propelled and guided automatically along a desired path. The benefits from such a system are useful for agriculture industry by reducing labor cost and time, as well as improving output efficiency by eliminating human errors. Many researches and inventions have been made, with the results ranging from successful, encouraging to some that are impractical for commercial implementation for certain reasons. These implements include sensor, machine vision, ultrasonic transmitter and as well as actuator and servo motor.

In committed situations, robots can do and should do the job for us. Robots are not only used in outer space, but, there are many places on earth where it is too dangerous for man to work at like in the deep sea, nuclear plants or waste dumps. Hence, there is also a growing need for robots in supporting human beings in their daily life at home or at work [18]. These are also reasons for the limited workforce available in this sector. The operation of a lawn is a skill and labor intensive task and furthermore the shortage and aging workforce in agriculture results in a decrease of skilled machine operators. Therefore, the development of driverless lawn tractor is of commercial significance and societal importance.



## ABSTRAK

Projek ini membentangkan kajian kajian yang dilakukan ke atas subjek mesin pemotong rumput automatik. Mesin pemotong rumput automatik adalah robot yang boleh beroperasi tanpa atau dengan kawalan minimum manusia, yg maju bergerak sendiri dan dibimbing secara automatik di sepanjang jalan yang dikehendaki. Manfaat dari sistem seperti itu adalah berguna untuk industri pertanian dengan mengurangkan kos buruh dan masa, serta meningkatkan kecekapan pengeluaran dengan menghapuskan kesilapan manusia. Banyak penyelidikan dan ciptaan telah dibuat, dengan keputusan yang terdiri dari berjaya, menggalakkan kepada beberapa yang tidak praktikal untuk implementasi komersial atas sebab-sebab tertentu. Alat-alat ini termasuk sensor, penglihatan mesin, pemancar ultrasonik dan serta penggerak dan motor servo. Dalam situasi yang komited, robot boleh buat dan patut buat kerja untuk kita. Robot bukan sahaja digunakan di angkasa lepas, tetapi, terdapat banyak tempat di bumi di mana ia adalah terlalu berbahaya bagi manusia untuk bekerja di seperti di laut dalam, loji nuklear atau tempat pembuangan sampah sisa. Oleh itu, terdapat juga keperluan yang meningkat bagi robot dalam menyokong manusia dalam kehidupan seharian mereka di rumah atau di [18] kerja. Ini adalah juga sebab-sebab bagi tenaga kerja yang terhad dalam sektor ini. Operasi padang kemahiran dan tugas buruh intensif dan tambahan pula kekurangan dan tenaga kerja penuaan dalam hasil pertanian di penurunan mesin mahir. Oleh itu, pembangunan traktor rumput pemandu kepentingan komersil dan kepentingan masyarakat.



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## CHAPTER 1

### INTRODUCTION

#### 1.0 Overview

This chapter will explain the introduction of study and problem statement. The problem is reducing man power in daily work. Besides, Objective of study and scope is explained in this chapter. The previous study is listed to get a reflective on this study.

#### 1.1 Introduction

Nowadays, people need new invention that can save their time, easy to use and flexible. As an addition, it will help people to make the work become easier. So came out with this project on making a machine that requires all the above matter.

This project is basically about grass cutter machine which name it as ‘Smart Grass Cutter’. Thus creation can help on human to make their work become easier because the cutting process can be done in two ways which is automatic and manually by the machine, furthermore the consumption of using



fuel will be decrease because battery will be used to produce energy which will generate the machine.

There are some basic equipment that will be used in this project which is the battery, servo motor, sensor (metal detector, voltage indicator and IR sensor) PIC and blade. Furthermore, a border wire is set up around the lawn that defines him area to be moved. This machine will use the wire to locate the boundary of to be trimmed.

## **1.2 Problem statement**

Nowadays, Lawnmower is used to make human's life much easier to do lawn mowing. As we can see today, most people still use man power on cutting grass. This project is an invention and a way to make human life become easier which is they can save their time. These following are the problems are occurred and the reasons why people rarely use this smart grass cutter.

There are many design has been made in the market, each design have a particular purpose. The small lawnmower types are suitable for small residential lawns and garden, while larger, self-container or ride-on mowers are suitable for large lawns.

Usually, time to use to cut the lawn is longer, depending on how large the size of the lawn. Moreover, the machine needs lots of man power to conduct so that the machine will be in its position. With this invention that is automatic lawnmower, it just spend about 5 minute to set up and left the machine to finish the job.

Besides that, the cost cut grass is expensive which includes the cost of hiring people, fuel and maintenance. This invention will help in reducing this cost where it will reduce to the maximum level. Besides that, by using the smart grass cutter there is no need to use the fuel. No fuel means, no emission and no pollution. There is 0% of exhaust emission on this machine. [17]

### 1.3 Objectives of Project

The objectives of this project are:

1. To make this machine in automatic and manual condition.
2. To create a machine without strict monitor.
3. To create grass cutter machine without using the fuel.

### 1.4 Project Scope

For this project it focuses more on domestic use. The machine is use for cutting grass on the house lawn. It also needs a border wire as a guide for the machine to work inside the border wire. This machine use IR detector to detect any obstacle like small rock, object within certain distance. As an addition, metal detector also is use to detect metal in certain distance. Last but not least, voltage indicator is use to indicate the amount of battery left whether it need to be recharge for the machine to work.

#### I. Sensor

- This project metal detector as a sensor. Metal detector use electromagnetic induction to detect border wire.
- IR sensor also will be used which is use to detect any obstacles that can be found on the ground for example vase, toy car and tricycle.

#### II. Blades

- In this cutting grass machine, cable ties as the blade because it is easy to be replace and can get it anywhere. Furthermore it is light and has more safely because it is not sharp when handle it during the changing the cable.

### III. Battery

- Multiple batteries between 3V-12V in the smart grass cutter. This battery will be used to save and generate the machine.
- This battery can be recharge.

### IV. Chassis

- Light material which is aluminums.
- It is covered by plastic cardboard.

### V. Remote control

- The remote control which is transmitter and receiver.
- The remote control to avoid the area that the area that not spotted.

## 1.5 Significant of study

Lawn mowing is an important part of the process to keep terrain with grass well manicured and tidy. Places such as soccer field, garden, home lawn, golf course and many others require constant lawn mowing and grass cutting. One of the complicated tasks is mowing, with large amount of time and effort needed to complete it. Depending on geographical location and weather trends such as rainfall and temperature, it is generally necessary to move a lawn on a weekly basis. The duration to complete the task takes from minutes to hours, depending on the size of the particular lawn and the moving equipment available. The required long hours and the complicated job would make the operator to succumb to fatigue. It is a fact that humans have some physical limitations regarding environmental factors such as weather conditions, including temperature, pressure, humidity and so on which causes low blood pressure and poor fluid intake. [17]

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

One of the objectives of this project is making the smart grass cutter operate easily. Therefore, it is important on reviewing the literature on this project. Explaining the theory on all related component through findings, collecting and gathering all needed information to attain the objectives. Besides that, we can determine the important component used in this project. The process of gathering information will help us to understand our project much more through expert researchers who had done similar studies in the past.

#### **2.1 Controlling circuit**

Control circuit is the most important part in this project; this is to make sure that the project can be function well as the planned. In this project, I have chosen some control circuit such as, Microcontroller, speed controller and infrared sensor and metal detector. All of this control circuit are use to make sure that the circuit can operate and perform well in future.

## 2.2 Component and equipment

Electronic components are the most important appliance in an electronic circuit. Components or circuit findings are create and defined by performance characteristics of a component. Components are produced with its functions and operated in accordance with the resolution made. The components that will use in this project are the microprocessor, resistor, capacitor, relay etc. There are also a variety of tools used such as soldering iron, suckers, and others.

### 2.2.1 Microprocessor 16F877A

PIC16F877A is a small piece of semiconductor integrated circuits. The package type of these integrated circuits is DIP package. DIP stand for Dual Inline Package for semiconductor IC. This package is very easy to be soldered onto the strip board. However using a DIP socket is much easier so that this chip can be plugged and removed from the development board. [2]

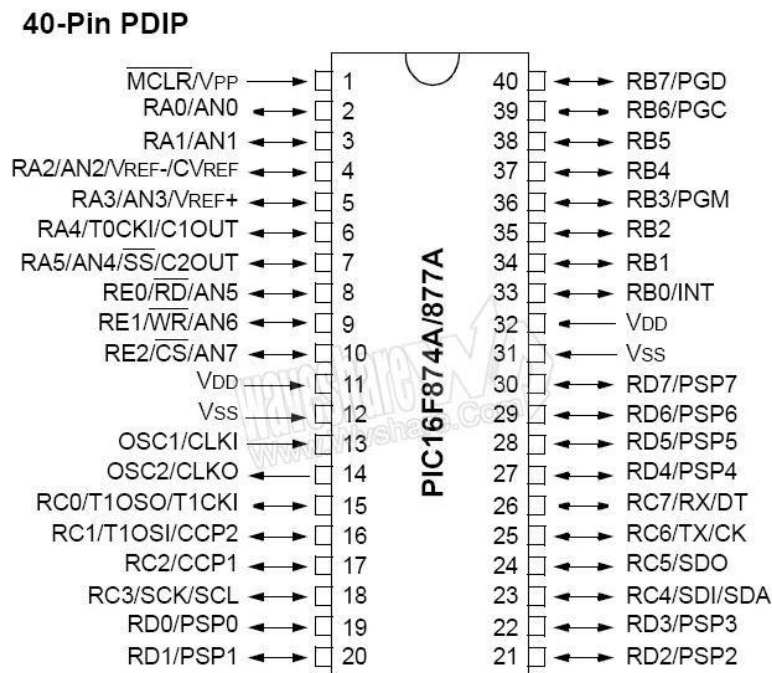


Figure 2.1: Microprocessor 16F877A Output/Input.

**Peripheral Features:**

- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - Capture is 16-bit, max. Resolution is 12.5 ns
  - Compare is 16-bit, max. Resolution is 200 ns
  - PWM max. Resolution is 10-bit
- 10-bit multi-channel Analog-to-Digital converter
- Synchronous Serial Port (SSP) with SPI(Master mode) and I2C(Master/Slave)

Table 2.1: Comparison Microcontroller.

<b>Key Features PICmicro™ Mid-Range Reference Manual (DS33023)</b>	<b>PIC16F873</b>	<b>PIC16F874</b>	<b>PIC16F876</b>	<b>PIC16F877</b>
Operating Frequency	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz
RESETS (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
FLASH Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory	128	128	256	256
Interrupts	13	14	13	14
I/O Ports	Ports A,B,C	Ports A,B,C,D,E	Ports A,B,C	Ports A,B,C,D,E
Timers	3	3	3	3
Capture/Compare/PWM Modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Instruction Set	35 instructions	35 instructions	35 instructions	35 instructions

Table 2.2: PIC16f877 pin out description.

Pin Name	DIP Pin#	PLCC Pin#	QFP Pin#	I/O/P Type	Buffer Type	Description
OSC1/CLKIN	13	14	30	I	ST/CMOS(4)	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	14	15	31	O	—	Oscillator crystal output. Connects to crystal or resonator in crystal oscillator mode. In RC mode, OSC2 pin outputs CLKOUT which has 1/4 the frequency of OSC1, and denotes the instruction cycle rate.
MCLR/VPP	1	2	18	I/P	ST	Master Clear (Reset) input or programming voltage input. This pin is an active low RESET to the device.
						PORTA is a bi-directional I/O port.
RA0/AN0	2	3	19	I/O	TTL	RA0 can also be analog input0.
RA1/AN1	3	4	20	I/O	TTL	RA1 can also be analog input1.
RA2/AN2/VREF-	4	5	21	I/O	TTL	RA2 can also be analog input2 or negative analog reference voltage.
RA3/AN3/VREF+	5	6	22	I/O	TTL	RA3 can also be analog input3 or positive analog reference voltage.
RA4/T0CKI	6	7	23	I/O	ST	RA4 can also be the clock input to the Timer0 timer/ counter. Output is open drain type.
RA5/SS/AN4	7	8	24	I/O	TTL	RA5 can also be analog input4 or the slave select for the synchronous serial port.
						PORTB is a bi-directional I/O port. PORTB can be soft-ware programmed for internal weak pull-up on all inputs.
RB0/INT	33	36	8	I/O	TTL/ST(1)	RB0 can also be the external interrupt pin.
RB1	34	37	9	I/O	TTL	
RB2	35	38	10	I/O	TTL	
RB3/PGM	36	39	11	I/O	TTL	RB3 can also be the low voltage programming input.
RB4	37	41	14	I/O	TTL	Interrupt-on-change pin.
RB5	38	42	15	I/O	TTL	Interrupt-on-change pin.
RB6/PGC	39	43	16	I/O	TTL/ST(2)	Interrupt-on-change pin or In-Circuit Debugger pin. Serial programming clock.
RB7/PGD	40	44	17	I/O	TTL/ST(2)	Interrupt-on-change pin or In-Circuit Debugger pin. Serial programming data.



### 2.2.2 Example program for PIC 16f77

```

list    p=pic16f877a
includep16f877a.inc
__config    0x1E72
errorlevel  -302 ;Suppress bank warning

CBlock 0x20
N                               ; Delay registers.
N1
N2
T_OB
T_NoGrass
Turningx
countl
counta
countb
countc
MOTOR
FIXDELAY
visdelay
priority
dataL
COUNTER1
COUNTER2
temp_num
temp_dig
D0
DIGIT
C1
C2
D1
D2
X1
X2
Y1
Y2

```

```

ENDC

org 0x00

start    call initports          ; Initialize Ports as output/inputs.

        call INITLCD
        call clrscreen
        call DisLCD2          ;LCD display Are you ready to start
        call visualdelay
        call SECOND_1        ;Delay before proceed to main

program

        call SECOND_1
        movlw A'1'
        movwf Turningx
        movlw A'0'
        movwf C1
        movwf C2
        movwf D1
        movwf D2

-----START OF MAIN PROGRAM-----
        call SECOND_1        ;3seconds delay before start
        call SECOND_1
        call SECOND_1

main     btfs PORTD,0
        goto MANUAL_CONTROL
        btfs PORTD,1
        goto MANUAL_CONTROL
        btfs PORTC,2
        goto MANUAL_CONTROL
        btfs PORTC,3
        goto MANUAL_CONTROL
        call FWD              ;move forward
        btfs PORTA,0          ;check Metal Sensor
        goto TURN1
        btfs PORTA,1          ;check IR sensor
        goto main
        call Blocking
        goto main

main2    btfs PORTD,0
        goto MANUAL_CONTROL
        btfs PORTD,1
        goto MANUAL_CONTROL
        btfs PORTC,2

```