UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SEMI-AUTOMATED LEMON GRASS CUTTER

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic and Automation) with Honours

by

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DECLARATION

I hereby declare that this report entitled "SEMI-AUTOMATED LEMON GRASS CUTTER" is the result of my own research except as cited in the references.

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ABSTRACT

The use of automation in agriculture is ordinary in industry, multiple automatic devices were used to ease and increase the manufacturing process and productivity of a product with help of the latest technology invention. Nowadays, there are numbers of cutter machine available in the market and designed in such a way to cut the vegetable or fruit to desired size. The semi-automated lemon grass cutter is designed to be used in Small Manufacturing Industries. Through this machine, it will be another alternative and help beside the workers to increase the output level of cut lemon grass and transformed a traditional system to be more efficient and systematic. The conveyor is used as medium to transport the lemon grass from feeder to the cutter by control of relay and limit switches. This machine is operated by one worker. By using this semi-automated machine, the fatigue cause by cutting process can be reduced and will help to optimize the productivity and indirectly reducing the dependence to worker.

ABSTRAK

Penggunaan automasi dalam pertanian adalah biasa di dalam industri, pelbagai alatan automatik telah digunakan bagi memudahkan dan meningkatkan proses pembuatan dan produktiviti satu produk dengan bantuan ciptaan teknologi terbaru. Kini, terdapat banyak mesin pemotong didapati di pasaran dan direka seumpamanya sebagai salah satu cara untuk memotong sayur atau buah kepada saiz yang diinginkan. Pemotong serai separa automatik direka untuk digunakan dalam industri pembuatan kecil. Mesin ini akan menjadi satu alternatif and bantuan selain dari pekerja untuk meningkatkan paras keluaran serai yang dipotong dan merubah satu sistem tradisional kepada yang lebih effisien and sistematik. Konveyer digunakan sebagai medium untuk mengangkut serai daripada penyuap kepada pemotong dengan kawalan geganti dan suis pengehad. Mesin ini dioperasikan oleh seorang pekerja. Dengan menggunakan mesin separa automatik ini, punca keletihan disebabkan oleh proses pemotongan boleh dikurangkan dan akan membantu untuk mengoptimumkan produktiviti dan secara tidak langsung mengurangkan kebergantungan kepada pekerja.

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LIST OF ABBREVIATIONS, SYMBOLS, NOMENCLATURES

SMI	-	Small Medium Industry
SALGC	-	Semi-Automated Lemon Grass Cutter
AC	-	Alternate Current
DC	-	Direct Current
Hz	-	Hertz
CD	-	Compact Disc
EMRs	-	Electromechanical Relays
RF	-	Radio Frequency
LED	-	Light Emiting Diode
FET	-	Field Effect Transistor
PWM	-	Pulse Width Modulation
NC	-	Normally Close
NO	-	Normally Open
SPST	-	Single-Pole Single Throw
SPDT	-	Single-Pole Double-Throw
DPDT	-	Double-Pole, Double Throw
mm	-	Milimeter
V	-	Volts
Amp	-	Ampere
N.m	-	Newton . Meter
O/P	-	Output
I/P	-	Input

CHAPTER I
INTRODUCTION

Nowadays, the improvement in technology can be seen clearly in differents kind of sector such from manufacturing to agriculture. In agriculture, there are many machines being made for the agriculture purposes. The cutter machine is common agriculture machine and being use to cut or sliced vegetables or fruits. Lemon grass is one of the plants that can be considered for cut. According to Wikipedia (2008), lemon grass or Cymbopogon which is a genus of about 55 species of grasses, native to warm temperate and tropical regions of the Old World and Oceania. It is a tall perennial grass. Common names include lemon grass, lemongrass, barbed wire grass, silky heads, citronella grass, fever grass or Hierba Luisa amongst many others. Lemongrass can also be grown at home by leaving the stalks bought from the market in a small pot of water for two weeks. As soon as little white roots grow, it can be moved to soil. The plants are perennial in nature and can give good crop up to 5 years. The first harvesting is done in about 90 days after planting and subsequently at 50-60 days interval. As shown in Figure 1.1, usually the lemon grass will be harvested manually by worker by cutting the grass 10 cm above ground level, this will left the leaves uncut. The lemon grass then will be clean by cutting the leaves using machete before proceed to another process. One of after harvest process is cutting process where the lemon grass will be cut to small size dimension or being shredded. The processing process that being using nowadays especially in Small Medium Industry (SMI) only used the automated or semi-automated machines to turn the lemon grass to the small size, but this neglecting the trimming process that still being done by man power. To make this process get into the automated process line, one effective machine is needed so the productivity of the line can be increased.

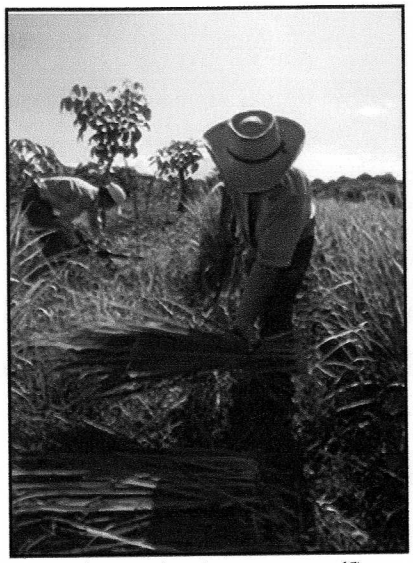

Figure 1.1: Worker harvesting lemon grass (Sprague, 2008)

1.1 Problem Statement

Small and medium enterprises or SMI nowadays using the chopper or cutter machine, specifically to turn the semi process lemon grass to small sized. But, the trimming process for the leaves is usually done manually. Figure 1.2 shows a trimming lemon grass. An operator is needed to trim the leaves by using knife and this will increase the risk to injury. It also gives an effect to the productivity. To overcome this problem, one effective semi-automated machine will be fabricated so when the lemon grass being fed manually, the cutter mechanism will trim the lemon grass, at the upper part (leaves) automatically. This project may overcome some of the problems encountered by human labors in terms of safety, fatigue and ergonomics, which will boost the results for better and faster work. This also can indirectly reduce the cost of production and eliminate repetitive task by human labor, which often leads to an unpleasant working environment.

Figure 1.2: Trimmed lemon grass ready for sell (William, 2008)

Figure 1.1: Worker harvesting lemon grass (Sprague, 2008)

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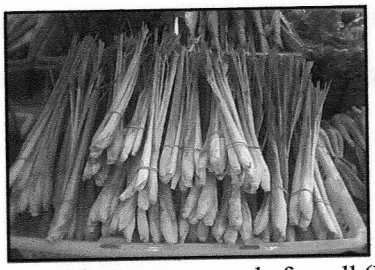

Figure 1.2: Trimmed lemon grass ready for sell (William, 2008)

1.2 Objective and Scope

1.2.1 Objective

The objective of the project based on application of knowledge in the field of robotic and automation to be apply to the machine. The following objectives are specified:

i. To design the appropriate Semi-Automated Lemon Grass Cutter (SALGC)
ii. To fabricate the selected prototype of the design
iii. To cut lemon grass to specific size that which is in range of 15cm to 20cm

1.2.2 Scope

The scopes of project are important as a fold review of project that being conducted. Without it, panels or some other researcher would have some problem to understand and assess the thesis.

In the first scope, it have been set that the machine should have the appropriate design with one drive motor for conveyer to drive the lemon grass to the cutter. The research is centered on the use of the motor because there are many drive motor available in the market and the selection of motor must be appropriate with the load.

Second scope that have been set that the lemon grass shall be manually feed to the machine hence the term semi-automated. The appropriate feeder or orientation design is needed so the the lemon grass in mass quantity can be arranged in the same orientation through out the conveyer to the cutting mechanism. This design must be appropriate with the SMI because the product may come in bulk and the manual orientations is tedious.

Third scope that have been set where the cutting mechanism shall be controlled by motor using electrical control system and the lemon grass will be cut to specific size.

This need research on the available cutting mechanism that already applied in certain agriculture cutting machine. Also the use of relay must be taken considerably in term of design, wiring and the appropriate relay used.

CHAPTER 2
LITERATURE REVIEW

2.1 Background

This chapter is important in determining the way of the project will lead because the mechanism of this project deal with fundamental of industrial automation and mechanical structure. Literature reviews have been conducted for all elements involved in the development of this project.

The elements that will be presented in this chapter involve the understanding of the title, objective, problem statement and the scope of project. All this information will be taking as guide to get the information from all sources either from book, journal, patent, conference paper, research paper or website.

2.2 Actuator

In industrial control system, an actuator is a hardware device that convert a controller command signal into a change in a physical parameter. Simply put, an actuator is something that converts energy into motion. It can also be used to apply a force. According to Groover (2008), the change of the physical parameter is usually mechanical, such as a position or velocity change. An actuator typically is a mechanical device that takes energy, usually created by air, electricity, or liquid, and converts that into some kind of motion. That motion can be anything from blocking to clamping to ejecting. Actuators are typically used in manufacturing or industrial applications and may be used in things like motors, pumps, switches, and valves. An

actuator is also a transducer, because it can changes one type of physical quantity, such as electric current, into another type of physical quantity, such as rotational speed of an electric motor. The controller command signal is usually low level, so an actuator may also require an amplifier to strengthen the signal sufficiently to drive the actuator.

Tatum (2008) classified actuator into three categories, according to the type of amplifier whether electrical, hydraulic or pneumatic. Electrical actuators are most common, they include electrical motors of various kinds, stepper motors, and solenoids. Electrical actuators can be either linear (output is linear displacement) or rotational (output is angular displacement). Hydraulic actuators use hydraulic fluid to amplify the controller command signal. The available devices provide either linear or rotational motion. Hydraulic actuators are often specified when large forces are required. Pneumatic actuators use compressed air (typically "shop air" in the factory) as the driving power. Again, both linear and rotational pneumatic actuators are available. Because of the relatively low air pressure involved, these actuators are usually limited to relatively low force application compared with hydraulic actuators.

Perhaps the most common type of actuator is powered by air or the pneumatic cylinder, also known as the air cylinder. Air cylinders are air-tight cylinders, typically made from metal, that use the energy of compressed air to move a piston. Air cylinders are most commonly used in manufacturing and assembly processes. Grippers, which are used in robotics, used actuators driven by compressed air to work much like human fingers.

Actuators can also be powered by electricity or hydraulics. Much like there are air cylinders, there are also electric cylinders and hydraulic cylinders where the cylinder converts electricity or hydraulics into motion. Hydraulic cylinders are often used in certain types of vehicles.

Many actuators have more than one type of power source. Solenoid valves, for example, can be powered by air and electricity. Electricity powered the solenoid, and the solenoid, powered by air, actuates the valve. Alternatively, the solenoid can be powered by hydraulics and electricity.