UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATIC PART FEEDER

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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TAJUK: **AUTOMATIC PART FEEDER**

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

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Process) with Honours. The member of the supervisory committee is as follow:

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ABSTRACT

A part feeder is a device that arranges works (machine and electronic parts, and tablets, etc.), which are supplied in random posture from former process, automatically in constant posture, and supplies them to the next process. In this report we propose an automatic parts feeder of a new mechanism and show how it can feed parts into a pressing machine. Based on the improving technology, the need of automation is a must. This part feeder will also add safety for the machine, it will uses microcontroller and it is cheaper than the ordinary part feeder. In addition, this project is and industrial based project which is in collaboration with Selia-Tek Industries.

ABSTRAK

"Part feeder" merupakan alat/peranti yang berperanan dalam mengatur/menyusun kerja (mesin dan bahagian elektronik, pil-pil dan sebagainya), yang dibekalkan oleh proses terdahulu secara rawak atau berkedudukan tetap secara automatik. Ia juga merupakan penghubung kepada proses yang seterusnya. Di dalam laporan ini, kami mengusulkan "part feeder" automatik yang menggunakan mekanisma baru dan menjelaskan bagaimana ia menyuap bahagian ke dalam mesin tekan. Berdasarkan perkembangan teknologi yang kian membangun pada masa kini, automasi dilihat sebagai satu keperluan. "Part feeder" ini juga dapat meningkatkan tahap keselamatan terhadap mesin tekan tersebut dengan menggunakan pengawal mikro yang kosnya jauh lebih murah berbanding dengan "part feeder" biasa yang ada di pasaran. Tambahan pula, projek ini adalah berteraskan industri di mana ia adalah kolaborasi dengan Selia-Tek Industries.

DEDICATION

Specially dedicated to
my beloved parents and family who have encouraged,
guided and inspired me throughout my
journey of education

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LIST OF ABBREVIATIONS

PC	-	Personal Computer
MC	-	Microcontroller
DC	-	Direct Current
AC	-	Alternating Current
PIC	-	Programmable Interface Controller
PLC	-	Programmable Logic Controller
LED	-	Light Emitting Diode

CHAPTER 1
INTRODUCTION

1.1 Background

Parts feeders are machines that feed parts so that robots or other automated processes can capture and use or package the parts or components. Applications range from packaging pills in the pharmaceutical industry to sparkplug production in the automotive industry. The main difference between parts feeders is their method of directing the feed. The purpose of this project is to create an automatic part feeder for pressing machine. This feeder will direct the part into the machine with the right orientation. Operator will put the parts into the part feeder with large volume and the feeder will let the part move one by one into the pressing machine. Automation nowadays is a must for a manufacturing factory as it provides many benefits. The advantages of part feeder to manufacturing nowadays as it reduce cost where factory will not have to pay for operator. By using part feeder also it will increase the manufacturing productivity because it reduces time and cost.

1.2 Problem Statement

Nowadays, automated manufacturing needs are changing from large-volume, single-product runs to small-size, customer-specific lots. There is also a continuing pressure for higher quality, lower cost, and shorter design cycles.

The parts for the pressing machine need to be inserted manually by operator, so there is no safety element. The hands of the operator might be pressed by the pressing machine while inserting the part. To avoid any accident, this automatic part feeder will replace the inserting part job with the feeder feeding the part automatically to the pressing machine.

With the use of operator to insert the part and at the same time to control the pressing machine is quite hard. So with this automatic part feeder, it is easier to use. The operator will just put the part into the part feeder in large volume, and the feeder will let go the part one by one, so operator just have to control the pressing machine and not to repeat inserting the part into the machine.

The disadvantage of the normal part feeder as it is expensive. This automatic part feeder wills cost cheaper than the normal part feeder because it uses cheaper material for building it. This automatic part feeder also will use microcontroller to control all the sensors and actuators on the automatic part feeder.

1.3 Objectives

The objectives of the project are:

a) To develop an automatic part feeder for pressing machine.
b) To added safety element to the pressing machine to avoid any accident.
c) To create a cheaper and easier to use part feeder than the normally part feeder that is available in the market.

1.4 Scope of project

In order to complete this project, the following tasks are required:

a) Design the part feeder mechanical structure.
b) Develop the prototype of the feeder.
c) Program the feeder using microcontroller.
d) Test and analysis.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter reviews some of the previous works that have been done in the field of feeder technology. This section highlighted the needs of part feeding in automated assembly systems, the common applications of automatic feeder, types of conveying in part feeder, analysis on the part feeding system as well as design of effective traps for a typical type of part feeder.

2.2 Previous Work and Research

2.2.1 Part Feeder in Automated Assembly

Nowadays industrial sector have been using automated assembly line which come in bulk, so the use of part feeder is essential as it will orientiate and transport the part. Some of the previous work will be discussed to support the need of the part feeder.

Boothroyd (1992) states that an automated assembly system has the purpose of combining multiple components into a single entity through a sequence of automated assembly operations. The single quantity can be a final product or a subassembly for a larger product.

The components are usually joined one at a time and are completed progressively. An automated assembly system consists of the following subsystem:

a) One or more workstations at which the assembly steps are performed.
b) Parts feeding devices that deliver the individual components to the workstations.
c) A work handling system for the assembled product.

Prior to starting any automation project, it is important to set goals and determine why the automating process is necessary Philip (1998). The following are the few possible reasons:

a) Increase productivity

   Many times the use of automation will allow an operator to perform more than one task. In other situations, the automation device can actually assist in an operation, resulting in increased productivity.

b) Labor savings

   Automation usually performs tasks that are very repetitive,which can lead to fatigue and boredom if performed manually. Automation can free a worker to perform additional, more highly-skilled assembly functions. One type of automated parts handling system consists of a storage supply hopper, vibratory parts feeder, an in-line track, and a part placing device. This system reduces the requirement for a full time employee to hand load the machine. Assuming one shift operation, payback for this system would be less than one year. In multiple shift operations, payback can be little as four months.

c) Quality

   Automation can lead to increased consistency and quality. In general, automatic systems require a higher quality supply of parts than that required for hand assembly.

d) Safety

   Some types of automation devices are ideal for use in hazardous environments. In addition, automation often results in a reduction of work-related injuries, especially chronic problems, such as carpel tunnel syndrome an back injuries.

Before any automated solution to be considered, focused attention must be given to the part. The shape, size, weight, composition and condition of the part must be evaluated to determine if an automated solution is achieveable. To effectively feed and orient a part, the shape of the part must be consistent so that an orientation method can be properly design. Quality of the part handled is very important success to part feeding. Part size and weight also play a big role in the evalution process of part feeding. The equipment size will determined by the part size, feed rate, complexity of part shape, as well as part compostion .

2.2.2 Importance of Part Feeder

The importance of part feeder is to maximize productivity in industry in order to satisfy increasing labour cost and increasing demand for finished goods. In his proceedings, Natarajan (2007), points out that assembly accounts for up to 50% of the total manufacturing cost so it is quite mandatory that we opt for a mechanized assembly. It shows that we should use other method because assembly will cost alot and then we have to pay for the workers. By this, part feeder became and important solutions, where cost of workers can be cut.

Another work that points out the important of part feeder is shown in an article by Sprovieri (2005), as he tried to disassemble his hard drive from his computer when he encountered problems while using the computer. In his article, he state that, Seagate Technology (Scotts Valley, CA), one of the largest manufacturers of hard drives, assembled more than 80 million of the devices lastyear alone. If each of those drives contains only half the number of fasteners in his old drive that amounts are more than 6 million screws per day. Furthermore, he explained that human operators cannot orient the small screws in such an amount. The operators cannot pick, orient and control them to be assembled on the part. Tooling or machines have to be developed to solve ths problem. His article is actually encouraging the development of part feeder to handle the buIk screws which is complex to separate by human operators. This part feeder reduce error in orienting the screw in the right condition before they are assembled to the product, and reduce production time in assembling a product in his case the hard drive.

2.2.3 Flexible Part Feeding

Automated manufacturing needs are changing from large-volume, single-product runs to small-size, and customer-specific lots according to Branicky et.al. (1999). This shows that factory doesn't need a big and flexible part feeder that can orient all part and feed it to one machine, but the growing needs of small and cheaper part feeder is higher. Moreover, a continuing pressure for higher quality, lower cost, and shorter design cycles for part feeder makes one lot-specific part feeder more better than the flexible part feeder that can feed many part. However as it can feed many part, it will also decrease the feed rate and thus make the feeding process slower than the one lot-specific part feeder.

Sprovieri (2004) discussed about flexibility in automated assembly operations. Usually, manufacturing engineers would like to feed part A today, part B tomorrow and part C next month. But, when they realize that such flexibility will decrease the feed rate and increase the cost and complexity of the system, suddenly flexibility doesn't seem like such a good idea. Flexibility involves three of the manufacturing biggest needs which are automating more processes, reducing changeover time, and spreading the cost of equipment investment over multiple products. This shows that flexibility is depends on what the company needs, if the company produces variety of product and want the equipment cost to be low, the use of flexible part feeder is important, but then, if the company only produces two or three product, the needs of flexible part feeder is lower as the one lot-specific feeder gives you lower cost, shorter design cycle and a better quality.

Most of the new flexible feeders do not try to orient parts. Instead, they merely separate the parts and allow them to seek a natural, stable state. Stable means that, they should come to rest very quickly, if the handfuls of parts are dropped on a flat surface.

2.2.4 Important Factor for Part Feeder

To build an automatic part feeder, speed, flexibility and ease of integration must all be considered according to Weber (2001). However the method to use to build the part feeder depends on part configuration and its complexity. Variables such as size, shape, density and material will determine how effectively a part can be positioned. The speed of the part depends mostly from the inclined surfaces of the part feeder. The coefficient friction of the incline surface on the part feeder will also affect the speed of the part going through the part feeder. So the use of the right material is important for the part feeder. The friction between part and the surface of the feeder must be low to prevent part from damage or scratch because of the friction.

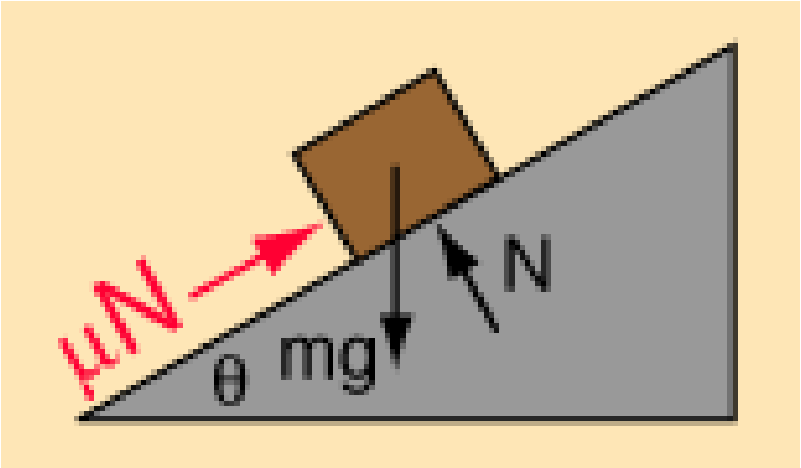

Figure 2.1: Friction on incline track

Where, **θ** - angle of inclination of track

m - mass of part

g - acceleration of gravity

μ - coefficient of friction