
**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

# Automatic Bottle Labeling System

Thesis submitted in accordance with the partial requirements of the
Universiti Teknikal Malaysia Melaka for the
Bachelor of Manufacturing Engineering (Robotics and Automation)

By

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May 2008

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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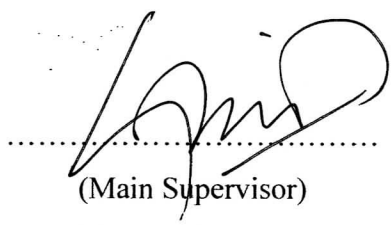
This PSM submitted to the senate of UTeM and has been as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotics and Automation). The members of the supervisory committee are as follow:



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# ABSTRACT

This thesis is about automatic bottle labeling system. The main focus of this thesis is to study the application of the bottle labeling system and to implement the improvement of the technique used in bottle labeling system. This thesis is also to optimize the labeling system by using good production and precision accuracy and at the same time analyze the advantages and disadvantages of using these processes. This experiment will be performed using manufacturing and fabrication processes. The model is known as wrap belt assembly and has adjustable clamp and transportation conveyor as the main functioning part. Then automatic bottle labeling process is performed using the result from the whole process of fabrication and build time. The manufacturing processes used in this experiment are cutting, bending, drilling, milling and threading.

# ABSTRAK

Tesis ini adalah berkenaan sistem melabelkan botol secara automatik. Tumpuan utama tesis ini adalah untuk mengkaji aplikasi sistem melabelkan botol dan untuk melaksanakan pembaikan teknik-teknik yang digunakan dalam sistem melabelkan botol. Tesis ini juga adalah untuk mengoptimumkan sistem melabelkan botol dengan menghasilkan produktiviti dan ketepatan label yang baik dan pada masa yang sama menganalisis kelebihan dan kelemahan dalam menggunakan proses-proses ini. Eksperimen yang terlibat dalam proses ini ditunjukkan menggunakan proses-proses pembuatan dan fabrikasi. Bahagian fungsi utama di dalam sistem melabelkan botol ini adalah model yang dikenali sebagai alat pelabel botol dan mempunyai pengapit boleh laras serta alat pengangkutan yang membawa botol dari satu stesen ke stesen yang lain. Proses melabel botol secara automatik ini kemudiannya dipersembahkan menggunakan hasil daripada keseluruhan proses pembuatan dan penggunaan masa untuk proses melabel botol. Antara proses-proses fabrikasi yang digunakan dalam eksperimen ini adalah memotong, membengkok, menggerudi dan memasang.

# DEDICATION

For my beloved mother and father.

# ACKNOWLEDGEMENT

I would like to convey my appreciation and indebtedness to those who has been great surprised and helpful for the completion at the project to bring it to success in respect with favorable advice and feasible solution.

Thus, I feel comfortably to take this golden opportunity to express my millions of gratitude to my supervisor, Mr. Shariman Bin Abdullah because of his kindly advice and guidance during the project providing tremendous considerately and useful comments and materials to overcome each obstacle I had faced.

Last but not least I would like to thanks my mother and my father, who has been the loveliest advisor to give continually supports and inspiration throughout my campus life.

With this my sincere and genial thanks to everyone I have not mentioned above from bottom of my heart.

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# CHAPTER 1
# INTRODUCTION

## 1.1 General Introduction

Automatic bottle labeling system is a new labeling technology system that consist three important components that are labeling applicator, fully integrated control system and conveyor. When all of these components are fully integrated, it means all work together without the need for human intervention, except for replenishing label stock, sticker bight setting and physical changeover to a different product. So, the system works through the entire speed range without need for readjustment of controls and this method will yield high production with high accuracy and precision.

Nowadays, there are too many techniques being used in whether automatic or semi automatic bottle labeling system and these conditions cause the variety of machines. Actually, an automatic labeling system consists of three key components: a labeling head (or label applicator), a conveyor (or other product transport device) and an integrated control system each of which, in turn, have their own sub-components. Optionally, other operations can be added to the system, such as Hot Stamp coders, bar code printers (print and apply), power unwinds (for extra large web capacity or feeding a barcode printer), verifiers (to make sure label is on and/or the code is readable) and etc.

When all of these components are fully integrated meaning they all work together without the need for human intervention, except for replenishing label stock, printer ribbons and physical changeover to a different product, and the system works through the entire speed range without need for readjustment of controls, it have an "automatic labeling system". It is not assumed that a labeling manufacturer who claims to have an "automatic labeling system" really have the whole system of automatic labeling. Some degree has the basic components, but many, if not most, are independent components that are not fully integrated.

## 1.2 Problem statements

The problem statements of the project are:

a) To apply the techniques of automatic labeling system in industrial workplace where generate the easiest method to the human operator to control the current process in labeling system.

b) To establish an optimum bottle labeling system that produce good productivity and high accuracy.

c) To optimize the labeling systems that used nowadays where human operator being replaced by the machine to operate the process.

## 1.3 Objectives of Project

The objectives of the project are:

a) To generate the bottle labeling system which is low cost maintenance but it can access high production rate and efficiency.

b) To identify the supporting and locating methods of the material selection to manufacture the system with high performance.

c) To implement the improvement to the performance of labeling systems that used in industrial nowadays.

d) To analyze the suitable material selection in order for manufacturing assembly of the system that has the effectiveness with low cost maintenance.

e) To determine the current labeling process and implement the improvement with consideration of efficiency, production time and maintenance cost for a bottle.

## 1.4 Scope of Project

Even though every aspect is looked into, this project is developed with limitation and therefore stated below:

Object:

- Wrap belt assembly as known as roller board
- It made by roller covered by conveyor belt and droved by the DC motor
- Static and automatically moving
- Placed randomly within the adjustable clamp and transportation conveyor

Working space:

- Transportation conveyor
- 10 cm in diameter
- Transport the bottles from another workstation to another
- Only one line or path to transport the bottles
- The driven motor is using DC motor

Sticker bight and roller mechanism

- Sticker bight is connected to a roller by using timing belt
- When the sticker start moving to adhered to the bottle, the timing belt will pull the roller so the mechanism will continuously operated
- So, the mechanism is not using any motor to rotate the sticker bight to move the sticker forward to attach at the roller board or wrap belt assembly

Adjustable clamp

- It made by acrylic material
- Consists two square parts which are fabricated by milling, drilling, cutting and threading process
- Used to completing adhesion of the sticker by providing limitation space within the wrap belt assembly and bottles
- It has the adjustable screw which is using to adjust the width of transportation conveyor based on the diameter of the bottles

# CHAPTER 2
# LITERATURE REVIEW

## 2.1 Introduction

The labeling system is using three main parts that are labeling head, conveyor and integrated control system. The labeling head or also known as label applicator has five components that are web unwind reel, dancer arm, label sensor, peel plate and drive roller. Web unwind reel is used to rolls the labeling sticker to attach to the bottles while dancer arm is used to allows smooth label starts, keeps web tension and acts as a brake to stop the web unwind roll from overfeeding. Label sensor detects the gap between labels to alert the control system to initiate a label sequence. Peel plate separates the label from backing paper and drive roller works as workhouse which is pulling web backing, starting and stopping with each labeling sequence.

Conveyor in labeling system uses two types of gear motor that are AC and DC gear motors. AC gear motors are utilized on very few labeling machines and rugged which have a long life and are relatively inexpensive and plentiful. When used on labeling systems they are either of two variable speed types; vary-cone (belt drive via a mechanically adjust variable pitch pulley) or through a special control driver that changes speeds electrically. DC gear motors are by far the most commonly used conveyor drive by labeler manufacturers, including CVC. CVC uses only Bodine, the world leader for quality and durability in fractional horsepower DC motors.

The heart of a labeling machine is the integrated control system. CVC supplies the latest in digital controls with its exclusive "Self Set" system, which greatly simplifies initial setups automatically and allows storage of at least 50 setups into memory. "Multiple Event Processing" permits higher labeling speeds than competing brands in this price range. The exclusive "Self Set" feature automatically optimizes the controls bottle and label. Complete changeovers can be accomplished in less than 2 minutes

without need for highly paid production line mechanics. All machine frame components are constructed of laser cut stainless steel and powder coated aluminum.
The figure of the labeling system and its specifications are shown below:

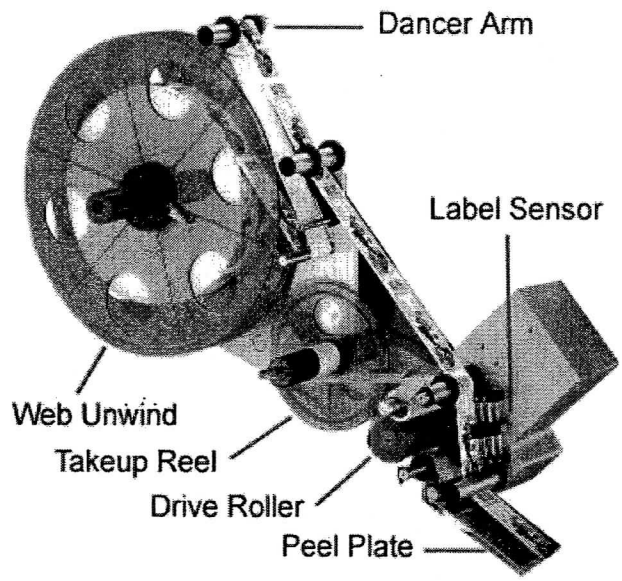



**Figure 2.1 Labeling head**

Dancer arm – allows smooth label starts, keeps web tension and acts as a brake to stop the web unwind roll from overfeeding

Label sensor – detects the gap between labels to alert the control system to initiate a label sequence

Web unwind – rolls the labeling sticker to attach to the bottles

Drive roller – works as workhouse which is pulling web backing, starting and stopping with each labeling sequence

Peel plate – separates the label from backing paper

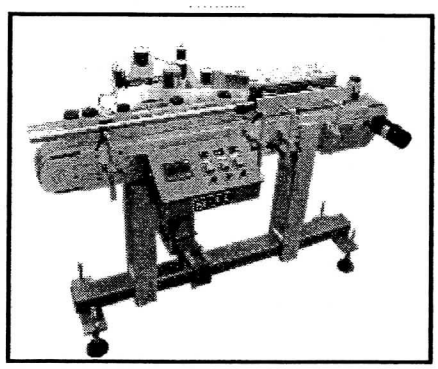
## 2.2 Previous Case Study

### 2.2.1 Case Study A

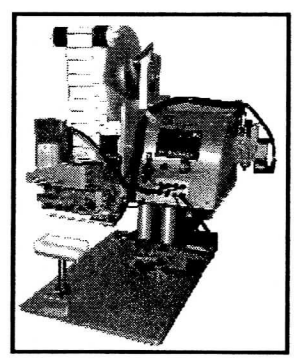
The previous labeling system has 7 standard labeling heads, when integrated with vast assortment of applicators, product sensors, encoders, head mounting options, product handling equipment and additional accessories. Labeling head is divided to several parts that are side panel, front or back panel, wrap around, corner wrap, top panel, bottom and leading or trailing. This labeling system offers 27 different label application methods such a corner wrap, roll-on, blow-on, or air cylinder tamp.

Common methods in this labeling system for product sensing are diffuse beam sensor, retro-reflective sensor, convergent beam sensor, infrared thru beam sensor, fiber-optic, clear product sensors, and mechanical switch interface. Portable head mounts such as a T-Base stand is a standard option along with custom head mounts to match a good labeling process so it can hold the high productivity process.

All product handling in this systems feature heavy duty aluminum and painted steel frame to fully support the conveyor and mounting stations. Optional castors can be provided for enhanced portability. The modular design can incorporate a variety of infeed systems such as a Spacer Wheels, Dual Infeed Belt, or Infeed Screws. Product control systems such as a Top Hold Down, Chain Aligner or Dual Transport Belts also can be used to install as well.



**Front back labeling system**



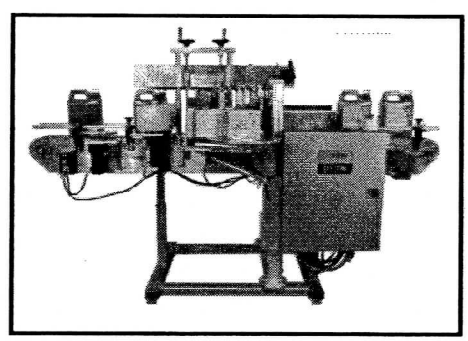
**Semi automatic labeling system**

**Figure 2.2.1**

### 2.2.2 Case Study B

There are too many types of automatic bottle labeler such as round bottle labeler, flat bottle labeler and glass bottle labeler. The Pressure Sensitive Labeler is an exciting new concept in the field of automatic labeling machines. It is a fully automatic, round bottle labeler but with simple features that make it truly user friendly. It has available options such as Hot Stamp or Ink Stamp application for labeling process, spacing wheel to stop the movement of bottles on conveyor, an extra tall labeling kit for adjustable labeling system. So, the height of the label can be adjustable from the base of the container. This process make this labeling system can be used for various products of bottles.

Running at speeds up to 60 containers per minute, it accepts random or continuous bottle feed. By adding a wrap station, this automatic labeler becomes an excellent round bottles labeler. It can precisely controls web feed and label placement through the use of a powerful PLC, quality photo eye and gap sensors, and a stepper motor and drive. It also has a touch screen interface that easily controls all machine functions. It has fixed labeling and conveyor speeds, a simplified web path, and a self-teaching label gap sensor. Normal set up and changeovers take less than ten minutes and require no tools. So it is said that this system is intelligent system for bottle labeling system.



**Pressure Sensitive Labeler**

**Figure 2.2.2**