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Controller development of an automated press machine for
disposable pet bottle / Muhamad Shaiful Salleh.



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MACHINE FOR DISPOSABLE PET BOTTLE”

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**CONTROLLER DEVELOPMENT OF AN AUTOMATED PRESS
MACHINE FOR DISPOSABLE PET BOTTLE**

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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2008

DECLARATION

I hereby declare that this report entitled “**Controller development of an automated for disposable PET bottle**” is the result of my own research except as cited in the references.

Signature : 
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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 (*Robotic and Automation*). The members of the supervisory committee are as follow:



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ABSTRACT

This report is about research and developing a controller that can be used for press machine. This machine will be used for pressing the PET bottle in the house or public place area. PET (polyethylene terephthalate) is extremely popular on the packing materials market. This project is mention to demo the pressing PET bottle for 500 ml mineral water by using selective controller method. Controller can be function as a brain of a system and the machine. It is a main of a system or a machine that will manage, command, or regulate the behavior of other devices or systems. Nowadays, controller development is spread so rapidly which various type of controller has been produce. Currently, the latest of the popular controller is PC based control. This controller method is used programming language, which programmer needs to write the coding then transfer to the devices. Actually, the basic coding is from c++ and it is extending to the other programming such as c language and c#. Two type of controller Programmable Logic Controller (PLC) and Programmable Intelligent Controller (PIC) are selected as controller for this machine.

ABSTRAK

Laporan ini merupakan kajian dan penghasilan sebuah pengawal yang boleh digunakan pada mesin pemampat botol plastik. Mesin ini digunakan untuk memampatkan botol plastik kosong sebelum membuangnya ke dalam tong sampah. Mesin ini adalah digunakan khusus untuk botol air mineral berkomposisi 500ml. Pengawal boleh digambarkan sebagai otak kepada sesebuah mesin atau sistem. Ia merupakan pusat kepada mesin yang berfungsi untuk mengatur dan mengawal komponen-komponen yang terlibat di dalam mesin. Ketika ini, pengawal berkomputer merupakan salah satu pengawal yang popular. Pengawal jenis ini adalah pengawal yang menggunakan komputer yang di masukkan dengan bahasa komputer seperti bahasa C dan C#. Dua jenis pengawal telah dipilih untuk dinilai kesesuaiannya apabila digunakan sebagai pengawal mesin pemampat ini.

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LIST OF ABBREVIATIONS, SYMBOLS, NOMENCLATURES

PLC	-	Programmable Logic Controller
PIC	-	Programmable Intelligent Controller
ICs	-	Integrated Circuits
LD	-	Ladder Logic Diagram
FBD	-	Functional Block Diagram
SFC	-	Sequential Function Chart
ST	-	Structure Text
IL	-	Instruction List
AC	-	Alternating Current
DC	-	Direct Current

CHAPTER 1

INTRODUCTION

1.0 Background

Nowadays, the technology spread rapidly throughout the world. It happens because the human needs the perfect systems or technology to make this life easy and as supportive to do the work. The technologies are required anywhere, anytime, and the every people need the technologies.

Currently, parts or bottle must be managed before throwing to the dustbin. For example, empty bottle can be compress to small size and this is important to minimize the space of the dustbin and to make recycling process easier. So, the idea to develop an automated press machine is very suitable by looking at the current environment.

This machine should not be a heavy machine but it must be suitable to be placed at public area and home. At home, the machine must not be expensive and should be able to use at each of these homes. So, this machine must be develop with low cost components but still have the safety elements to ensure it can be operated easily by everybody.

The selection of the components is an essential subject to consider in developing of this machine. Starting from the selection of the controller whether it is a microcontroller or the others type of controllers. The controller must be cheap and can be operated with actuator and other component.

To ensure this machine is safe for users, the suitable sensors need to be attached with the machine so that the machine can operate properly. Several types of sensor will be use in this project such as area sensor and proximity sensor.

This machine will be beneficial to all because it can reduce the space of dustbin, safe, easy to operate and it is low in cost as well.

1.1 Problems statement

In recent days, people will just throw the empty water bottle into the dustbin without compressing it. The reason is clear there is not much time to do that and it is difficult to compress it. However, several people do compress the bottle by pressing it using the foot. It will take time to do that especially if they are at the public places. In the end, people will take the simple way out which is by throwing the empty bottle to the dustbin and at the same times, the dustbin will be full easily. So, a system to solve this problem must be developed.

In developing the system, several element needs to be paid more attention. The first thing is the selection of controllers. There are many types of controller in the market. The most popular is Programmable Logic Controller (PLC), Programmable Integrated Controller (PIC), and others types of microcontroller. The selection of controllers must be based on the cost of the controllers, the numbers of input and outputs, and the suitability of the controller with the machine to be developed (Dunn, 2006).

Secondly, the selection of the actuator is also an important aspect to consider. Basically, the actuator consists of three fundamental types. There are; (1) Pneumatic Actuator, (2) Hydraulic Actuator, and (3) Electric Actuator (Groover, 2008). All the actuators have advantages and limitations over each other. The appropriate type of actuator chosen must be based on its cost and the power requirement.

Finally, power supply use must from matching the power required by the actuator. It is important to prevent the circuit not function or the power need to drive the actuator not adequate.

Rigorous study and research all aspects mentioned is needed so that the system can function safely and easy to use.

1.2 Objectives

- 1.2.1 To design control panel and controlling method for an automated press machine for disposable PET bottle.
- 1.2.2 To develop a low cost controller that can press the PET bottle and suitable to placed at home and public places.

1.3 Scope

This project will focus on developing the controller that will be used to operate the press machine. The controller must be suitability to drive and control the machine. The selection of controller is important to get low cost controller but can control the machine with full effectiveness. The controllers will compare from its performance, the cost, wiring, and the programming method.

The second scope is to develop a machine that is safe to use. To ensure the safety aspect of the machine, several parts of the machine must be close with a cover. The parts which have the tendency for people to get an accident are the controller wiring area and the actuator area.

The final scope is fabricated a prototype model with the controller to display the function of the machine. It is not a real machine but the function of prototype model is the same as the function of the real machine.

CHAPTER 2

LITERATURE RIVIEW

2.0 Introduction

This chapter is about the studies of components used in the project. The main purpose is just to more understand each part of the components. Starting from the controller that wants to be used, these studies are going to a deeper level where the components used to obtain the appropriate and suitable components to ensure all the objectives will be achieved. Furthermore, all the related information to make a guideline and reference are taken to make research about the project.

The main things to be paid attention in these studies are the controller and the actuator that we want to use. It is really important to make sure that the machine works properly and satisfies all the objectives that have been constructed before. The components are studied such as the sensors, motion transmission mechanism, the ICs regulator, and the electronic components.

Almost all of the references come from some books and the figures as illustrated are taken from Internet.

2.1 Controllers

In all the application in the industry or whatever the process that needed to be done, a device that monitors and controls the process variable and the operation is called a controller. The controller will receive the input to be processed and produce the output

to operate a process. It will compare between a signal representing the value of process and the set point and Figure 2.1 shown the block diagram of the controller configuration. The function of controller can be listed as below;

- a) Receiving a signal corresponding to the measurement to be controlled,
- b) Comparing that value to a reference set point value,
- c) Determining the difference or error in the measurement value,
- d) Providing a controlled output.

Basically, controller can be classified into three main categories such as hydraulic, pneumatic, and electronic controller (Kalsi, 2007).

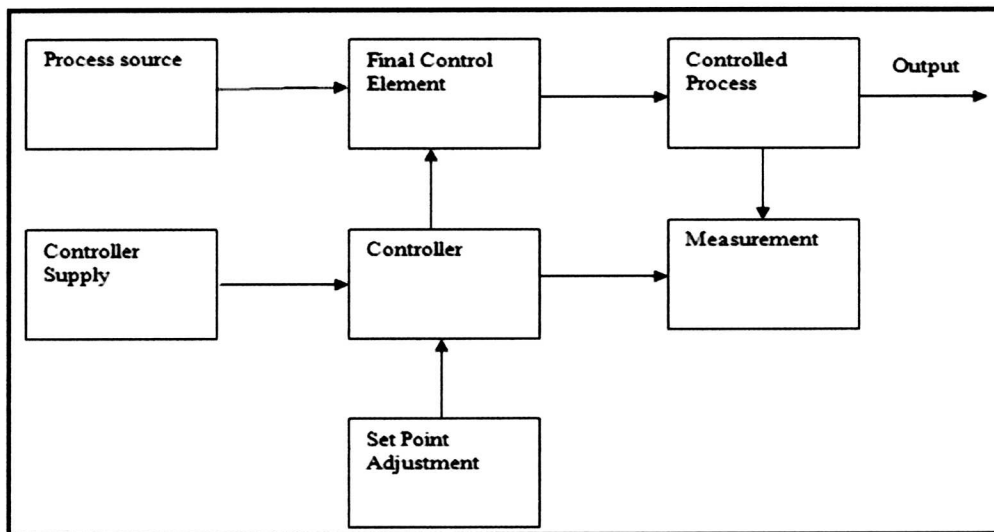


Figure 2.1: Block diagram of controller configuration (Kalsi, 2007)

2.1.1 Electronic/Electrical Controller

In recent days, electronic or electric controller are preferred than pneumatic and hydraulic controller. This controller is widely used in industry application because it can

perform the process very fast. The main component of electronic controller is the very high gain Op-Amp. The advantages of this controller are;

- a) Compactness.
- b) Have a decided advantage if fast response is needed and the response faster.
- c) The installation cost is low for large plant.
- d) Provide convenient, economic interfacing with supervisory digital computers, data processing or data acquisition systems.
- e) High reliability.
- f) High accuracy than other controller.

However, this controller also have one disadvantage, the electronic controllers have risk to burn than other controller. Programmable Logic Controller (PLC) and Programmable Integrated Controller (PIC) is a most popular in electronic controller (Kalsi, 2007).

2.1.1.1 Programmable Logic Controller (PLC)

Programmable Logic Controller (PLC) is defined a special-purpose industrial computers designed for use in the control of a wide variety of manufacturing machines and systems. The other definition of PLC is a specialized electronic device based on one or more microprocessor that is used to control industrial machinery (Rehg and Santori, 2007).

Groover (2008) defined the PLC as a microcomputer-based controller that uses stored instruction in programmable memory to implement logic, sequencing, timing, counting, and arithmetic function through digital or analog input/output (I/O) modules, for controlling machines and process.

PLCs are used widely in industrial application and to control the system or the process. It can function like a computer to the system. The PLC will receive the inputs from switches and sensors, then evaluates these based on a program, and changes the state of outputs to control a machine or process (Groover, 2008).

The advantages of PLCs are included;

- a) PLC programming is easier than relay control panel.
- b) Can be reprogrammed.
- c) Less space.
- d) Greater reliability.
- e) Easy maintenance.
- f) Can be connected to computer system.
- g) Can perform greater variety of control function.

Basically, this controller replaced the conventional system which uses the hard-wire to integrate controller. This controller was introduced since 1960s by Richard Morley who called it Programmable Controller (PC). After that the name PC is changed to PLC to avoid confusion with personal computer. The personal computer and PLC have much similarity such as both of them have motherboard, processor, memory, and expansion slot. Figure 2.2 illustrates the architecture of PLC central processing unit (CPU). Today, the structure and the component in PLC are improved to current technology (Rehg and Santori, 2007).

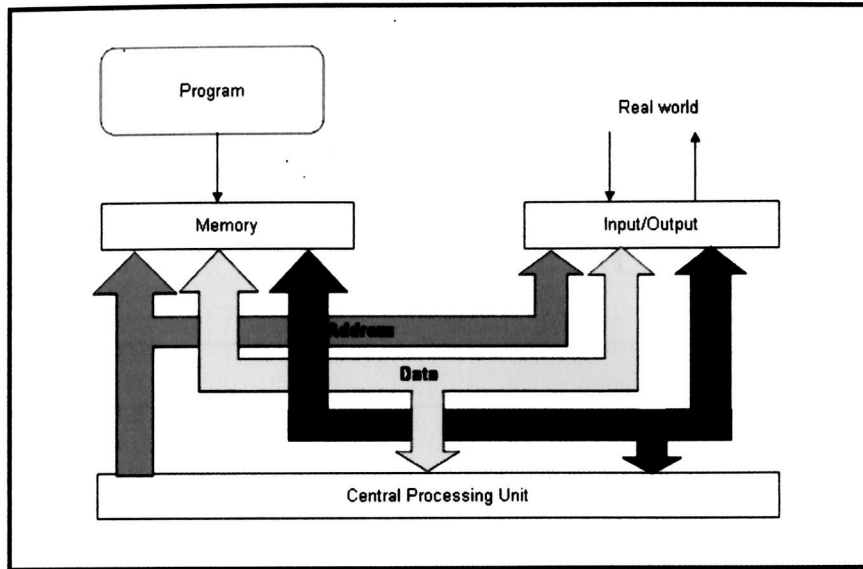


Figure 2.2: Architecture of PLC central processing unit (CPU)

Based on PLC standard, called IEC 1131, PLC has five types of languages to program it such as ladder logic diagram (LD), functional block diagram (FBD), sequential function chart (SFC), instruction list (IL), and structure text (ST).

LD, FBD, and SFC are represented in graphical structure language where programmer enters the control instruction to PLC by using the icon and symbol in the software.

Currently, LD is widely used by user as PLC programming language. This programming is easy than other programming language. Programmer need to enter the component in symbol into the rung by using software in personal computer. The component can be classified into two type; contacts, and coil. Contacts are input that includes switch, relay contact, and similar element. Meanwhile, coil represents the loads such as motor, solenoid, relay, timer and counter. Normally input unit is located at the left side of rung while the output at right side. The output can be as input to activate the other output or to hold the coil. Figure 2.3 illustrates the structure of LD.