

# **AUTOMATIC JUICE MIXER**

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**This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours**

**Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : AUTOMATIC JUICE MIXER  
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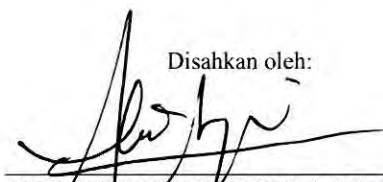
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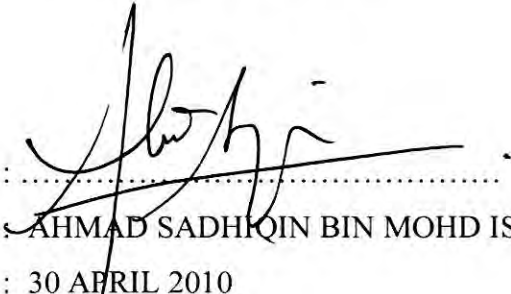
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Special dedication to my loving husband, sons, family, all my siblings, and my kind hearted supervisor Mr. Ahmad Sadhiqin Bin Mohd Isira and also dearest friends.

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## ABSTRACT

This project is a solution to the problem faced by entrepreneurs of Small and Medium Industry (SME) especially in the local fruits drink process. Automatic Juice Mixer is a machine designed to mix juice and water to control the bottle packaging process. It uses the Programmable Logic Controller (PLC) to control the electrical and mechanical process. The usage of PLC Omron CJ1G-H as a hardware has been introduced in Automatic Juice Mixer, to enable the selection of the supporting components such as the water valve, conveyer motor, mixer motor, limit switch, level switch etc which represent the input and output system. Ladder diagrams are used to illustrate the control system of the programming activities where CX-Programmer software can be downloading to PLC with RS232C cable as the communication system. One of the advantages is the reduction of man power thus leads to the reduction of the overall product cost.

## ABSTRAK

Projek ini merupakan satu penyelesaian masalah yang dihadapi oleh usahawan Industri Kecil dan Sederhana (IKS) dalam pemprosesan minuman buah-buahan tempatan. Pembancuh Jus Automatik adalah sebuah mesin yang direka untuk proses pencampuran jus buah-buahan tempatan dan air sehinggalah selesai proses pembotolan. Projek ini menggunakan Pengawal Logik Boleh Aturcara (PLC) untuk mengawal proses elektrik dan mekanikal. Penggunaan PLC Omron CJ1G-H telah diperkenalkan di dalam projek Pembancuh Jus Automatik bagi menentukan modul masukan, modul keluaran, unit pemprosesan berpusat (CPU) dan ingatan (memory). Pembancuh Jus Automatik membolehkan pemilihan komponen-komponen sokongan seperti injap air, motor conveyor, motor pembancuh, suis had, suis paras air dan sebagainya untuk masukan dan keluaran sistem. Gambarajah tangga digunakan untuk aktiviti pengaturcaraan menggunakan perisian CX-Programmer yang boleh di muat turun kepada PLC melalui kabel RS232C. Di antara kelebihannya adalah pengurangan penggunaan tenaga manusia sekaligus dapat mengurangkan harga produk keseluruhan.



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## LIST OF SYMBOLS AND ABBREVIATIONS

AC	-	Alternating Current
CPU	-	Central Processing Unit
Com	-	Common
DC	-	Direct Current
EEPROM	-	Erasable Electrical Random Access memory
IC	-	Integrated Circuit
I/O	-	Input/ Output
LED	-	Light Emitting Diode
MIDA	-	Malaysian Industrial Development Authority
NC	-	Normally Close
NO	-	Normally Open
PLC	-	Programmable Logic Control
PWM	-	Pulse Width Modulation
RAM	-	Random Access memory
ROM	-	Read Only Memory
SME	-	Small and Medium Industry



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## **CHAPTER 1**

### **INTRODUCTION**

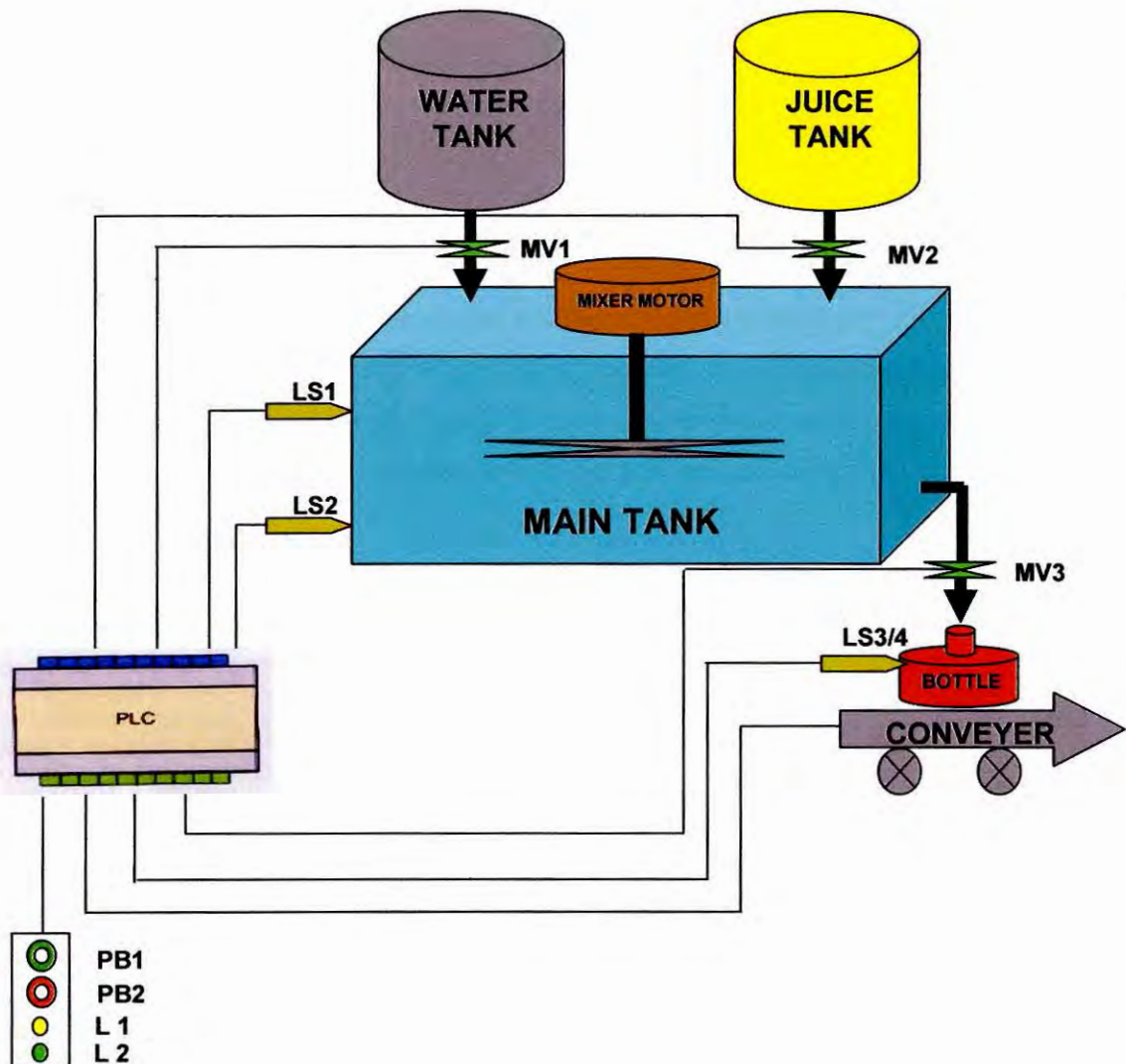
#### **1.1 Background of Project**

Programmable logic control (PLC) is the most commonly used industrial automation technique in the world. It is universally applied for factory automation, process control and manufacturing systems. Programmable logic control originated from the creation of computerized versions of relay control systems used to control manufacturing and chemical process systems. For example in beverage production factory, provision process by sequence needed are bottle cleaning, filling drinking water, label installation, bottle closing and bottle packaging.

Although this task can be done by human, Programmable logic control (PLC) and robot used to increase the productivity of company. It is because it can produce the products speedily, reduce manpower and material cost and improves the quality of product. Here, this project can help entrepreneurs of Small and Medium Industry (SME) to reduce usage of the man power thus leads to the reduction of the overall product cost.

The processes of Automatic Juice Mixer starts when the push button ON is pressed, where the treated water and juice fills the main tank. When the water and juice have achieved a maximum level served by the water level switch, the juice mixer motor would turn.

At this point, the juice bottling process is started where the bottling valve will open and water level will be determined by using the timer in PLC. At the same time, the bottle is moved by conveyor system. The filling processes will continue to second bottle and the process will continue until the juice in the main tank is in low level. This process will stop if push button 'OFF' is pressed whether the process finished or any emergency.



**Figure 1.1: Overview of This Project**

## 1.2 Project Objectives

The project is aimed to meet the following objectives:

- 1.2.1 To design the Automatic Juice Mixer machine for Small and Medium Industry (SME) with reasonable cost.
- 1.2.2 To utilize the Programmable Logic Controller (PLC) in the automation system for the juice processing and packaging.
- 1.2.3 To apply Ladder diagram using CX-Programmer software used by PLC Omron CJ1G-H.

## 1.3 Problem Statements

- 1.3.1 This project is using the PLC system that can control automatically the mixing process and bottling of a juice mixer.
- 1.3.2 Save the machine purchasing cost and reduces manpower utilization.
- 1.3.3 Give the opportunity to local entrepreneurs whom are willing and capable in designing new inventions and also assisted by countries.

## 1.4 Scope of the Project

All projects have their own scope or limitation as a guideline throughout the completion of the project. The project scope for implementation these projects are:

- 1.4.1 The Automation Juice Mixer uses the Programmable Logic Controller (PLC) to control the electrical and mechanical process.
- 1.4.2 The usage of PLC Omron CJ1G-H trainer as a hardware that is able to select supporting components like water valve, conveyor motor, mixer motor etc that is suitable for input and output system.
- 1.4.3 Ladder Diagrams used to illustrate the control system of the programming activities of the project where CX Programmer software

can be downloading to PLC with RS232C cable as the communication.

## **1.5 Methodology**

Methodology is a part will explain about the project path from the beginning until it is completed. Every selection and action that has been done while implementing the project must be explains in stages. This methodology must be done to make sure the project that consists of hardware and software development will be developed systematically, smoothly and successfully.

### **1.5.1 Methodology of the Project**

“The definitions state that Programmable Logic Controller (PLC) is industrial computers, where the term “industrial” implies that PLC’s are computers designed to operate in the harsh physical and electrical noise environments present in production plants. They are also specialized electronic devices, so they are not just personal computers that have been moved to the factory floor.” (James & Glenn, 2007, p.4). This project is using PLC to control the system juice processing and packaging.

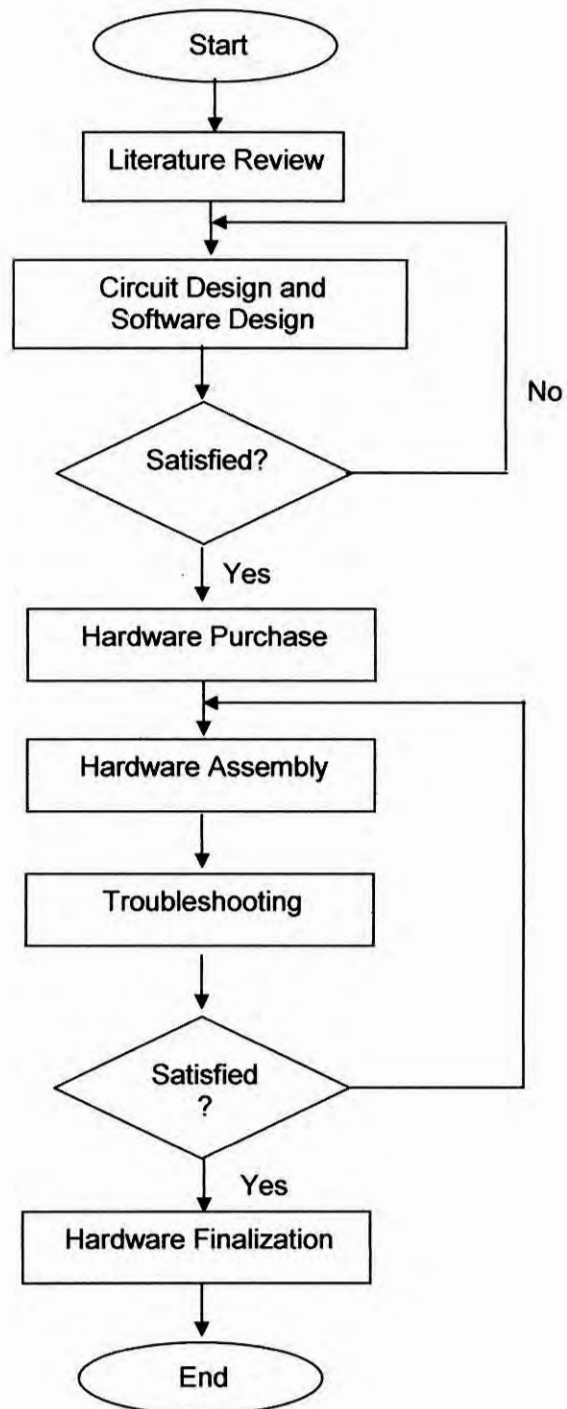
Firstly, the projects start by collecting or gathering information from books and internet websites. The information collected is included PLC, input material such as push button, component of water level sensor and limit switch. Besides that, the output material such as external relay, AC drain valve, DC motor and AC motor will be countered to make an output of mixer motor and conveyor motor. Apart from that, the asking of lecturer and friends with related topic can helped to solve the problems in this project.

Secondly, the circuit design and Ladder Diagram will be designed in order to control the system using Programmable Logic Controller (PLC). The software used is CX-Programmer version 7.2 where it will be synchronized with PLC Omron CJ1G-H trainer. The program needs to be designed, simulated and tested. The Ladder Diagram will be simulated without assembled to PLC so that the operation of the process can be observed. When there is a problem, the will be redesigned together with the Ladder Diagram.

When the simulation stage has completed, the project will commence with the purchase of the entire component needed. These will include the mechanical and electrical parts such as push button, limit switch, water level component, external relay, AC drain valve, AC motor and DC motor to make a mixer and conveyor. The parts will be purchased at the earliest time possible to enable the assembling process to run smoothly later on. If a problem persists, discussions with the supervisor are needed.

Finally, the troubleshooting stage will start by concentrating on the performance of the process, electrical wiring and mechanical parts. If the function is not suitable, the assembled of hardware will be checked again until the project succeeds. The overall cost of this project is not more than RM500.00 without PLC. The project is suitable used in Small and Medium Industry (SME) with reasonable cost using the suitable equipment. In Malaysia's Machinery and Equipment Industry, sources from Malaysian Industrial Development Authority (MIDA), the total of imports in M & E specific industries is about US\$3,444.00 million[4]. That is a big amount but Automatic Juice Mixer machine is designed to reduce the machine import with reasonable cost and suitable used in Small and Medium Industry (SME).

### 1.5.2 Flow Chart of the Project



**Figure 1.2: Flow Chart of the project**

## 1.6 Report Structure

This report contains of five chapters that explain detail about this project. The first chapter is introduction of the project. This chapter contain of project introduction, project objectives, project scope, problem statement and research methodology.

The second chapter is literature review about PLC, input control devices and output control devices. This chapter discuss about source or article that related to the project. This chapter is also contained the theory of the components, equipments and programming languages that is used in the project. So, it is very important to understand the concepts involve and how this system works.

The third chapter is Software Design. This chapter consist the Ladder Diagram in CX-Programmer software. This chapter will figure out the software interface, flowchart of the project, input / output table and ladder diagram of this project. This is more important to construct the ladder diagram first before doing the wiring diagram and hardware installation.

The fourth chapter is about hardware design which is consisting the maximum and minimum water level detector circuit. This chapter will figure out a few tests that have been conducted. This is to make sure the components and other devices involves are in good condition function. The testing procedures, devices and method used to generate the expected results will include in this chapter

The fifth chapter is about result was be explain about simulation result and hardware result. The sixth chapter is Discussion which is discussed about design process, problem statement and some new idea. Lastly, chapter seventh is conclusion and future recommendation. This chapter also contain of suggestion to improve this project for future works. The overall conclusion of this project showed.