DESIGN AND DEVELOPMENT OF EGGS GRADING AND STORING SYSTEMS

ABDUL RIZAL BIN JOKARIAH

A report submitted in partial fulfillment of the requirements for the degree Of Bachelor of Mechatronics Engineering

Faculty of Electrical Engineering

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"I hereby declare that I have read through this report entitle "Design and Development Of Eggs Grading and Storing Systems" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronics Engineering"

Signature : ....

Supervisor's Name : **MASLAN BIN ZAINON**
Lecturer
Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka

Date : 13/5/2009

To my beloved mother and father

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I wish to dedicate this project to my parents, family and friends whose gave me the strength, wishes and moral support from the beginning until the end of the project.

In the end, I would like to thank those individuals who involved bring something idea, shared the knowledge also gave their suggestion in order to finished and completed my research for this project.

ABSTRACT

Mostly, the small and medium livestock farming system in Malaysia is still used the conventional method including the process to collect eggs, grading until to compile in the tray for packaging. These conventional methods use a more man power. This will increase cost operation to farmer. Development project and to design egg grading system and storage expected can overcome this problem. The whole of the project system is used automation method. It involving two processes is grading and storing eggs in the tray. The PLC is function as a main controller to control the entire of the machine process. System begun with eggs from the hen-house delivered using conveyor system entering through this machine. Eggs are transfers by conveyor will pass a grading process where can separate egg into 2 sizes. Then, eggs would pass grading system that would allow egg through his lane according to size. Eggs will be redirected inlet to conveyor which will bring eggs to eggs storage system into tray. When photoelectric sensor detect and count as much as egg 5 units, a storing arm will pushed eggs to egg storage conveyor. At the end of process, conveyor will move the eggs tray in accordance with the storing eggs.

ABSTRAK

Kebanyakannya, penternakan ayam di Malaysia secara sederhana dan kecil-kecilan masih lagi menggunakan kaedah penternakan lama, termasuk cara untuk memungut telur ayam, penggredan hinggalah ke proses penyusunan telur di dalam tray untuk pembungkusan. Penternakan cara lama menggunakan tenaga pekerja manusia yang lebih. Ini akan meningkatkan kos pengoperasian kepada penternak. Projek pembangunan dan mereka bentuk sistem penggredan dan penyimpanan telur ini dijangka dapat mengatasi masalah ini. Projek yang dibangunkan ini menggunakan pengoperasian keseluruhan sistem secara automasi. Ianya melibatkan dua proses iaitu proses penggredan dan penyusunan telur ayam di dalam tray dengan menggunakan kaedah secara automatik. Aplikasi peranti PLC digunakan sebagai penggerak utama untuk mengoperasikan keseluruhan proses dengan lancar. Sistem dimulai dengan penghantaran telur melalui satu sistem konveyor dari reban ayam. Telur yang digerakkan oleh konveyor tersebut akan melalui proses penggredan di mana mengasingkan telur kepada 2 saiz. Kemudian telur yang diasingkan akan melalui sistem pengasingan gred yang akan membenarkan telur melalui lorongnya mengikut saiz. Telur akan dialihkan kepada konveyor yang akan membawa telur ke sistem penyimpanan telur ke dalam tray. Apabila penderia optik mengesan dan mengira telur sebanyak 5 biji, satu penggerak akan menolak telur ke mekanisma penyimpanan telur. Mekanisma ini akan memasukkan telur ke dalam tray. Akhir proses, tray akan bergerak selari dengan kemasukan telur ke tray dibantu oleh sistem konveyor.

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CHAPTER 1

INTRODUCTION

This chapter will explain about the objective, problem statement, scope of the project and the some of the literature reviews related with this project.

1.1 Project Overview

This project is about to design and develop eggs grading and storing systems. The main function of this project is to grade the eggs based on size and weight and then storing them to the eggs tray. This project has two systems consist of grading and storing systems. It is a combination of the hardware and software implementation. The hardware of the entire of this system consists a PLC as the main controller of the system, a motor, an actuator, various types of sensors, air supply unit and other mechanical parts.

1.2 Project Objectives

The project is aimed to meet the following objectives:

(a) To design and develop a prototype of egg grading and storing systems using a PLC system

(b) To design and develop eggs grading and storing systems for the small and medium enterprises livestock farmer

(c) To acquire experience and knowledge about designing and building a project

1.3 Problem Statement

In the small and medium livestock farming, most of the farmers are still using the conventional system when grading and storing eggs. When using the conventional system, the farmers face many problems especially on cost, and a lot of manpower in the short term. Usually, the workers are facing some difficulties when sorting the eggs because of their different size and make the process in a long duration to finish.

1.4 Scope of Project

The scope of project is a limitation or main purpose to do project. The scope of development and designing the eggs grading and storing systems is in the lists below. In the end, this scope of the project was determined the target and the results.

(a) To build a prototype of the automated system in development the eggs sorting and storing systems
(b) Design and develop the system mechanical parts as a conveyor mechanism
(c) Design and develop the PLC programs using CX-Programmer
(d) Implement the wiring system
(e) Target for users in small and medium livestock farming industries
(f) Input and output is below 16 unit and appropriate for PLC Omron CQM1H

CHAPTER 2

LITERATURE REVIEW

2.0 First Review: Inter Compacta

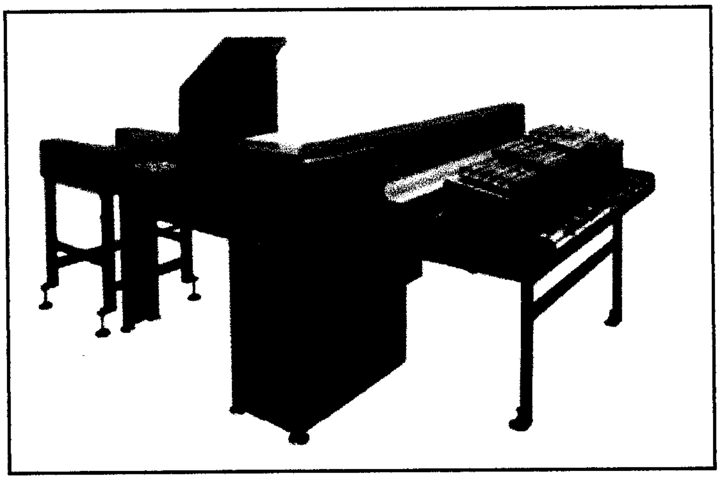


Figure 2.0: Inter Compacta

This machine has a 3 grader row for sort the eggs. There is a proven mechanical weighing part as a function as grader system. The function of the semi-automatic hand vacuum lifter with pump can places up to 30 eggs at a time on the in feed Rotary loader. This machine has a counter device to count the egg which had grade by this machine. There are four processes for complete successfully of grade egg, which is infeed, candling section, grader and hand packing and packing shelves process. Inter Compacta is an ease of operation, have a low consumption and compact in construction. [13]

2.1 Second Review: FRG 20 Free range grader

Figure 2.1: FRG 20

FRG 20 Free range grader is a 3 row grading and packing of egg machine. The accurate mechanical weighing is a mechanism to grade the egg to its size and weight. This machine is equipped with two automatic packing lanes and 1 manually packing lane. The FRG 20 offers flexibility in the egg sizes to be packed automatically. It is very compact; ease of access can be operated with only one person. The whole of the body is design and constructed in stainless steel to ease cleaning and high standard of hygiene. [13]

2.2 Third Review: Egg Sorter Machine

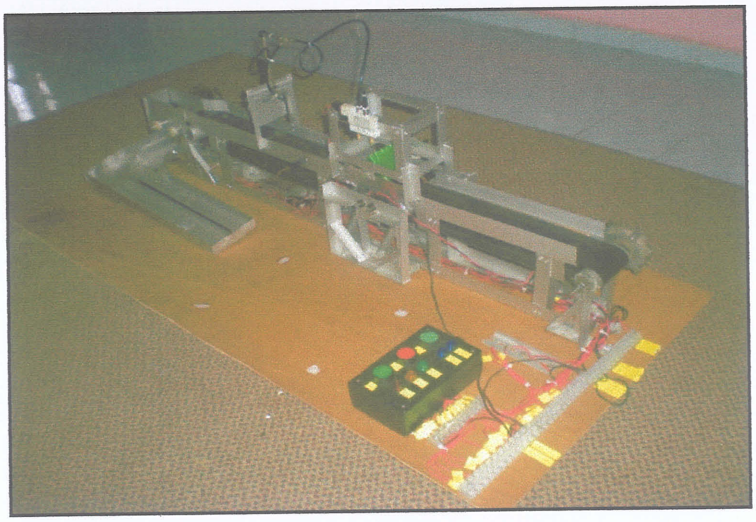


Figure 2.2: Egg sorter machine

This eggs sorter machine is a project that is developed by the previous UTeM (Universiti Teknikal Malaysia Melaka) student. The function of the machine is to sort the eggs depends on the size and grade. This project has a two grader to grade into the two of the size eggs; the large and medium. This sorter machine is used a power window motor as a motor conveyor to transfer the eggs (input) to the end product (output) that has been separate depends on its grad and size. The egg sorter machine used a PLC application to implement to this project. This machine have a pneumatic system is used to blow and clean the eggs before proceed to the next process. The egg is traveled from the cleaning process to the grader process by the conveyor. For the grader process, there is a motor and mechanical part to grade the eggs. Then, the egg is dividing and sort into small and large grade. In the end of the process, there are two different size of the egg was separated on the separated container. [8]

2.3 Fourth Review: Visit at LTK (Melaka)

The main purpose of the studies visited at LTK (Melaka) Berhad on the 29 July 2008 is to experience the environmental and researching related with this project. The conductor of the visited is Mr. Nazridatul Faizal Mohd Kasim, as a post of engineer in LTK (Melaka) Berhad. This is the larger company and main producer based on the egg product in Malaysia. Their special product is a LTK Omega Plus. In this company, all of the process is used the automatic system include the sorting egg, storing egg in the tray, feeding and drinking. In the sorting process, this company uses the machine from Germany that can grade to the eight grader depend on the egg weight. This machine use PLC device as a controller on the main system. The sorting process is integrated with the other process include the packaging, painting the logo on the egg, and cleaning process.

Figure 2.3: Automatic packing system in LTKM

Figure 2.4: Automatic grading system in LTKM

CHAPTER 3

THEORETICAL BACKGROUND

3.0 Implementation of Hardware and Software

Overall of the design and development egg grading and storing systems is dividing into two parts that is software and hardware. In the software part, it is include the PLC ladder diagram to program the entire of the system. For the hardware, there is a mechanical part and electrical part. The mechanical part involves the motor, actuator (pneumatic cylinder), conveyor, the power distribution and the chassis of the machine. The electrical parts is includes several of the sensors, switches, PLC device, and the wiring cable for electric circuit.

3.1 Part 1: Hardware

Hardware is included the mechanical and electrical parts. These parts are linked with each other to make sure this project is running and successfully functioning. Several of the mechanical parts act as actuator on this project system. In this project, the mechanical parts are as state in the table 3.0.

Table 3.0: List of Parts

NO.	PART	FEATURE	UNIT
1	PLC (Programmable Logic Controller)	- Manufacture: Omron - Model: CQM1H - 16 Input/16Output	1
2	Actuator	- Pneumatic cylinder - Manufacture: Chelic (Taiwan) and CKD (Japan) - Double acting and single acting - Bore Size:20mm, Stroke: 75mm	4
3	Solenoid Valve	- 5/2 way valve - Manufacturer: CKD Corporation	4

4	Sensor	- Photoelectric
		  - Manufacture: Omron
		  - Diffuse Reflection Type
		  - 24 V
		- Limit Switch
		  - 3A, 240Vac
			6

5	Motor Power Window	- Manufacture: Denso - 2A, 12Vdc	4
6	Switch	- Push Button type - 240Vac	3
7	Indicator Lamp	- 12Vdc	5
8	Power Supply	- Input: 240Vac, 15A - Output: 12Vdc, 15A	1
9	Housing and Chassis	- Material: Aluminium - 90^{o} angle 'L'	

3.2 PLC (Programmable Logic Controller)

A programmable logic controller is a special device used to control machines and automation industrial. It is also known as programmable controller. It is a special form of micro processor based controller that uses a programmable memory to store instructions and to implement functions such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes. They are not designed so that only computer programmers can set up or change the programs. Thus, the designers of the PLC have pre-programmed it so that the control program can be entered using a simple, rather intuitive, form of language. The term logic is used because programming is primarily concerned with implementing logic and switching operations. Input devices, like sensors, switches, and output devices in the system being controlled and output devices like motors, valves are connected to the PLC. The operator then enters a sequence of instructions, such a program, into the memory of the PLC. The controller then monitors the inputs and outputs according to this program and carries out the control rules for which it has been programmed. The PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. In automated system, the PLC is commonly regarded as the heart of the control system. Figure 2.0 shows the basic internal architecture of a PLC.

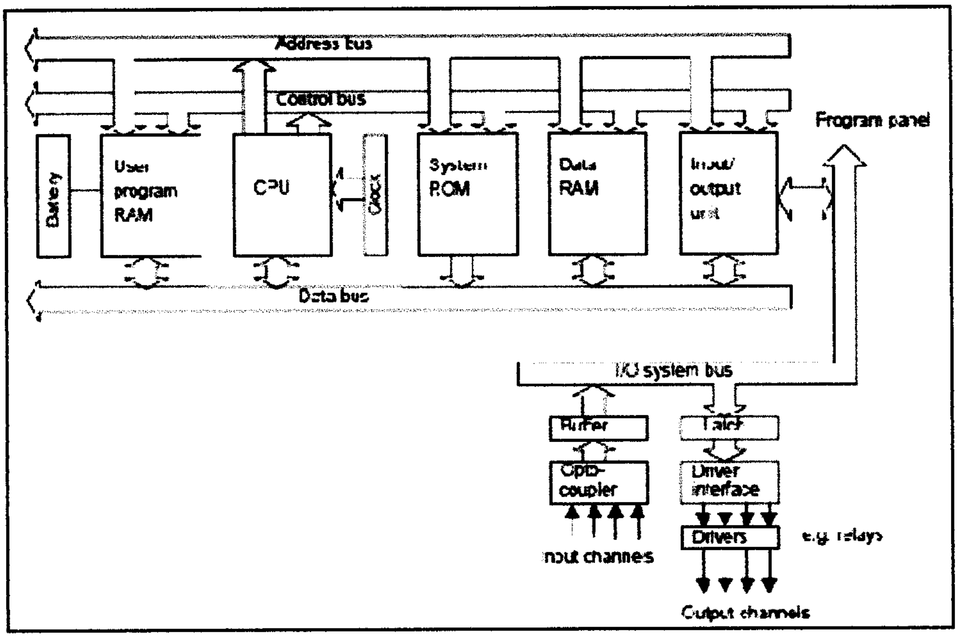


Figure 3.0: Architecture of PLC

A PLC consists of a central Processing Unit (CPU) containing an application program and Input Output Interfaces modules which are directly connected to the field I/O devices. The input devices is consists of push button, keypad, toggle switches, which form Human Machine Interface (HMI).The commonly used for the output devices such as motors, actuators, solenoids, relays and pilot lamp. A PLC is act as a main device in executing a write program to send the signal to motion the parts on the machine. It has an input and output port function as an interface between PLC device and machine parts. The signal from PLC is decide the process of the machine. Figure 2.1 shows the real PLC from the Omron manufacturer. PLCs have the great advantage that the same basic controller can be used with a wide range of control systems. To modify a control system and the rules that are to be used, all that is necessary is for an operator to key in a different set of instructions. There is no need to rewire. The result is a flexible, cost effective, system which can be used with control systems which vary quite widely in their nature and complexity. PLCs are similar to computers but whereas computers are optimized for calculation and display tasks, PLCs are optimized for control tasks and the industrial environment. Thus PLCs are:

(a) Rugged and designed to withstand vibrations, temperature, humidity and noise.
(b) Have interfacing for inputs and outputs already inside the controller. Programmable logic controllers
(c) Are easily programmed and have an easily understood programming language which is primarily concerned with logic and switching operations. The first PLC was developed in 1969. They are now widely used and extend from small self-contained units for use with perhaps 20 digital inputs/outputs to modular systems which can be used for large numbers of inputs/outputs, handle digital or analogue inputs/outputs, and also carry out proportional-integral-derivative control modes.[1][2][4][7]

Figure 3.2 shows the control panel using the conventional system and PLC system.

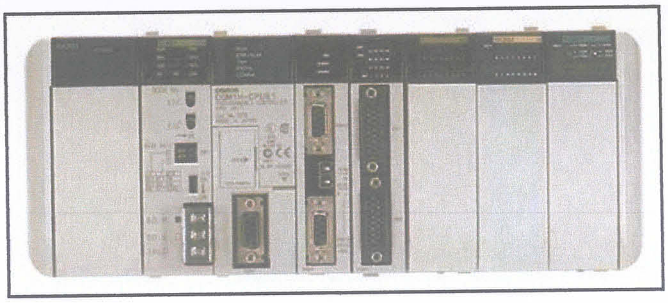


Figure 3.1: CQM1 Omron PLC

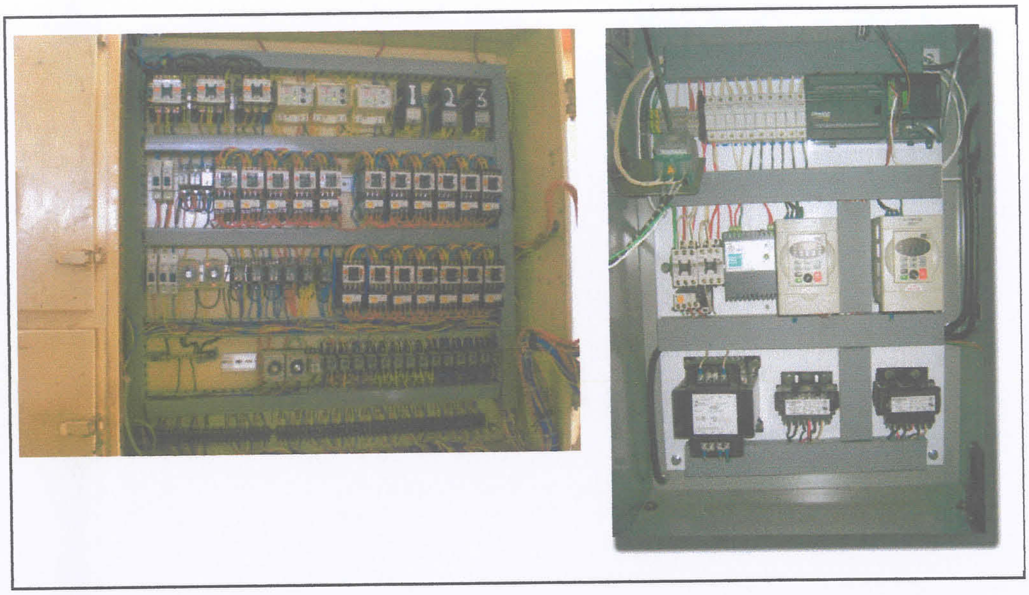
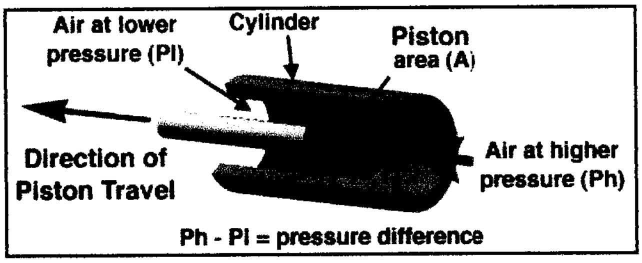


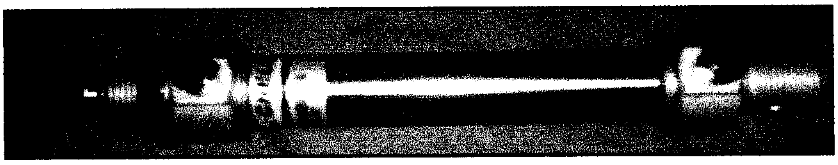
Figure 3.2: Left: Control panel using conventional system,
Right: Control panel using PLC system

3.3 Actuator

Actuator is a mechanical device that transforms or converts energy into motion. The function device is for moving or controlling a mechanism on the system. Also applied as a force, an actuator usually is a mechanical apparatus that takes energy, normally constructed by liquid, air, or electricity, and converts that into a specific kind of motion. The motion can be rotary, or linear depend on the type. Pneumatic cylinder is the one of the actuator type. It is mechanical devices which produce force, and powered by compressed air. For the working principle, pneumatic cylinder imparts a force by converting the potential energy of compressed air into kinetic energy. The pneumatic cylinder are designed and specialized to fulfill the needs from the industrial purpose. A single acting and double acting cylinder is an outcome from the needs. Single-acting cylinder is a fluid power actuator that directs energy in one direction and otherwise the double acting cylinder use the compressed air to move both extends and retract strokes. In this project, single acting cylinder is use to guided the egg delivered into the appropriate container after sorting process. The double acting cylinder acting as to push the egg after finished from the grading process. Then it is used as to push the egg to entering the storing arm.



(a)



(b)

Figure 3.3: (a) Section view of the actuator, (b) Pencil type actuator

3.4 Sensor

A sensor is a device that receives a stimulus and responds with an electrical signal. The stimulus is the quantity, property, or condition that is sensed and converted into electrical signal. Sensors are a type of transducer and can change one form of energy into another. The purpose of a sensor is to respond to some kind of an input physical property (stimulus) and to convert it into an electrical signal which is compatible with electronic circuits. The sensor output signal may be in the form of voltage, current, or charge. Figure 2.4 is show the internal structure of sensor.

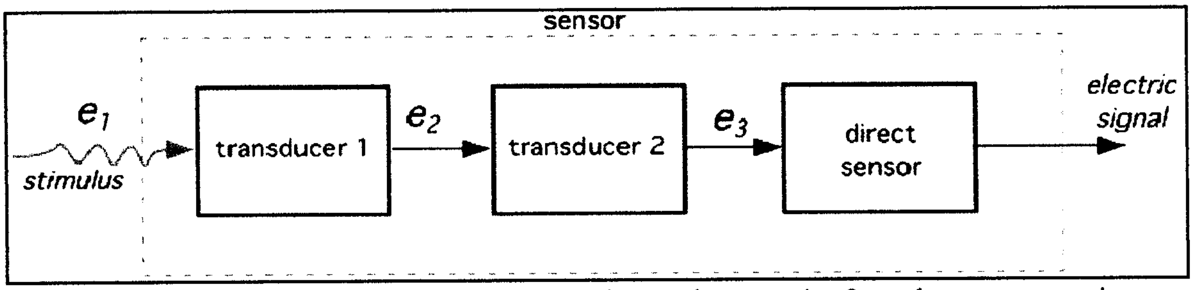
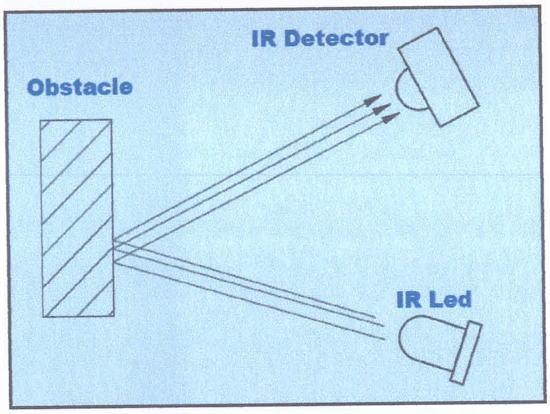
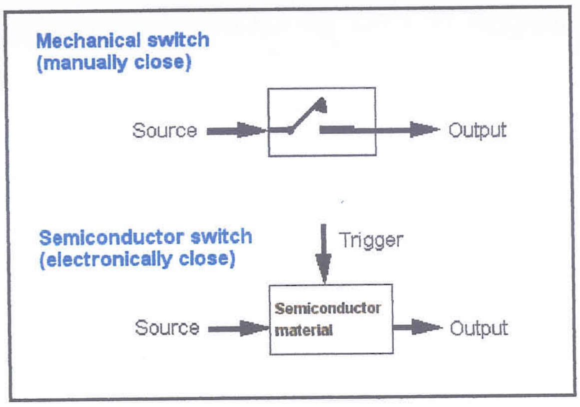


Figure 3.4: A sensor may incorporate several transducers. e1, e2, and so on are various types of energy. Note that the last part is a direct sensor.

Sensors can be direct and complex. A direct sensor converts a stimulus into a classified according to the type of energy transfer that they detect. Sensors are divided to two kinds, passive and active. A passive sensor does not need any additional energy source and directly generates an electric signal in response to an external stimulus. The input stimulus energy is converted by the sensor into the output signal. The examples are a thermocouple, a photodiode, and a piezoelectric sensor. The active sensors require external power for their operation, which is called an excitation signal. That signal is modified by the sensor to produce the output signal. The active sensors sometimes are called parametric because their own properties change in response to an external effect and these properties can be subsequently converted into electric signals. Example of an active sensor is a resistive strain gauge in which electrical resistance relates to a strain. In this project, there is a several types of sensor is definite to use such as infrared proximity sensor and mechanical sensor. Infrared proximity sensors work by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal. The sensor has transmitter as function to transmit the signal and receiver as function to receive the transmit signal. Limit switch is a type of mechanical sensor that requires physical contact to detect the presence or absence of an object. This sensor has a mechanism as function to contact to make the circuit is closed.[5]

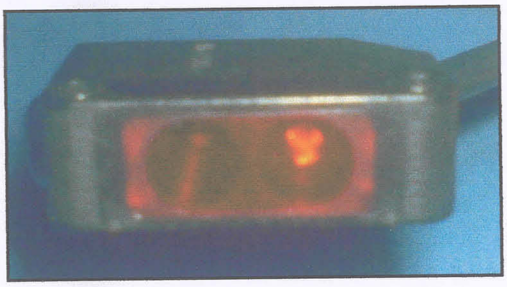


(a)

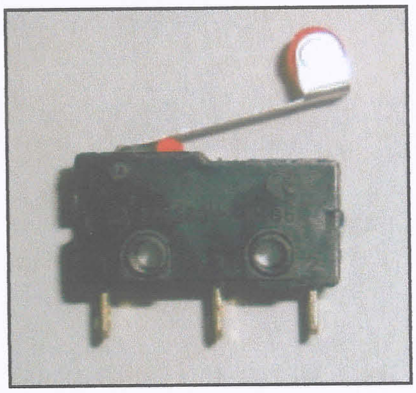


(b)

Figure 3.5: Working principle of devices. (a) Transmit and receive signal of IR sensor. (b) Diagram of limit switch



(a)



(b)

Figure 3.6: (a) Photoelectric sensor, (b) Limit switch

3.5 Motor

Electrical motor is devices that convert an electrical energy to mechanical energy. Motor is a motion device and operate when receive the power source. A direct current (DC) motor is a fairly simple electric motor that uses electricity and a magnetic field to produce torque, which turns the motor. Two magnets of opposite polarity and an electric coil act as an electromagnet. The major physical principles behind the operation of an electric motor are known as Ampere law and Faraday law. The first states that an electrical conductor sitting in a magnetic field will experience a force if any current flowing through the conductor has a component at right angles to that field. Reversal of either the current or the magnetic field will produce force acting in the opposite direction. The second principle states that if a conductor is moved through a magnetic field, then any component of motion perpendicular to that field will generate a potential difference between the ends of the conductor.

An electric motor consists of two essential elements. The first, a static component which consists of magnetic materials and electrical conductors to generate magnetic fields of a desired shape, is known as the stator. The second, which also is made from magnetic and electrical conductors to generate shaped magnetic fields which interact with the fields generated by the stator, is known as the rotor. The rotor comprises the moving component of the motor, having a rotating shaft to connect to the machine being driven and some means of maintaining an electrical contact between the rotor and the motor housing (typically, carbon brushes pushed against slip rings). In operation, the electrical current supplied to the motor is used to generate magnetic fields in both the rotor and the stator. These fields push against each other with the result that the rotor experiences a torque and consequently rotates. Figure 2.7 show the internal construction of DC motor.

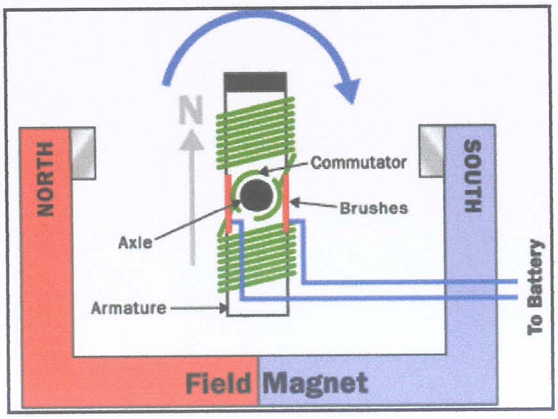


Figure 3.7: Internal construction of DC motor

3.5.1 Working of a DC Motor

When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn towards the right, causing rotation. When the coil turns through 90^0, the brushes lose contact with the commutator and the current stops flowing through the coil. However the coil keeps turning because of its own momentum. Now when the coil turns through 180^0, the sides get interchanged. As a result the commutator ring C_1 is now in contact with brush B_2 and commutator ring C_2 is in contact with brush B_1 as shown in figure 2.9. Therefore, the current continues to flow in the same direction.

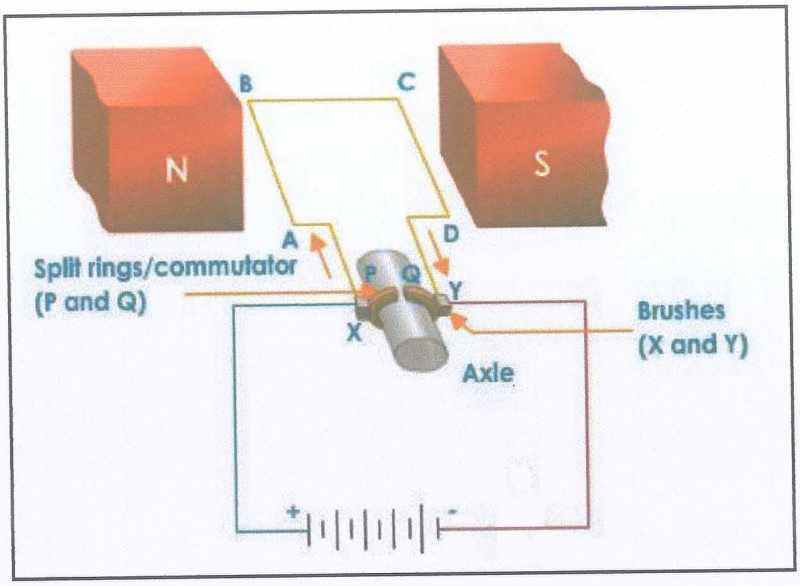


Figure 3.8: Basic circuit configuration motor electric

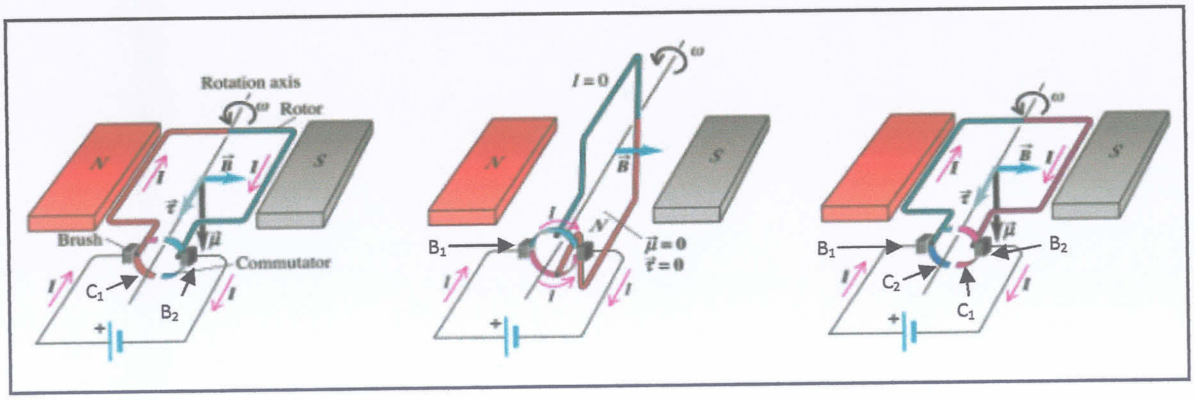


Figure 3.9: Basic operation of DC motor

The Efficiency of the DC Motor Increases by:

(a) Increasing the number of turns in the coil

(b) Increasing the strength of the current

(c) Increasing the area of cross-section of the coil

(d) Increasing the strength of the radial magnetic field

Motor power window is selected in this project. The reason of the selection because of the power window motor gives the high torque at the beginning of the starting and can maintain the high torque until the end of the functioning. This motor is use a 12Vdc as a source voltage and 2 Amp as a current needed. This project used four unit motor power windows as an actuator to moving the conveyer mechanism. One unit motor power window is for one conveyer system. [6][15]

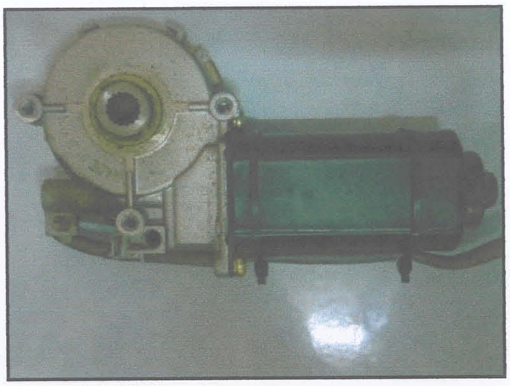


Figure 3.10: Motor power window

3.6 Relay

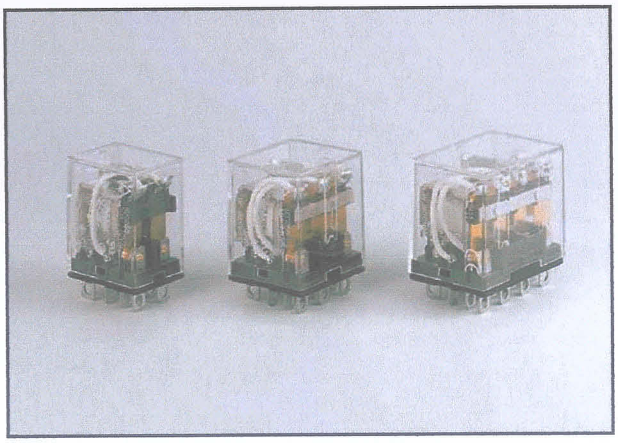


Figure 3.11: Relay

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. It was invented by Joseph Henry in 1835. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier. The two main types of relay are electromechanical and solid-state. Electromechanical relays have a moving plate with contacts on it, while solid-state relays work similar to transistors and have no moving parts.

3.61 Relay operation

Relay has two circuits, control circuit and a load circuit. The control circuit has a small control coil while the load circuit has a switch. The coil controls the operation of the switch when the coil is energized. The coil is energized when the power supplies through to control circuit.

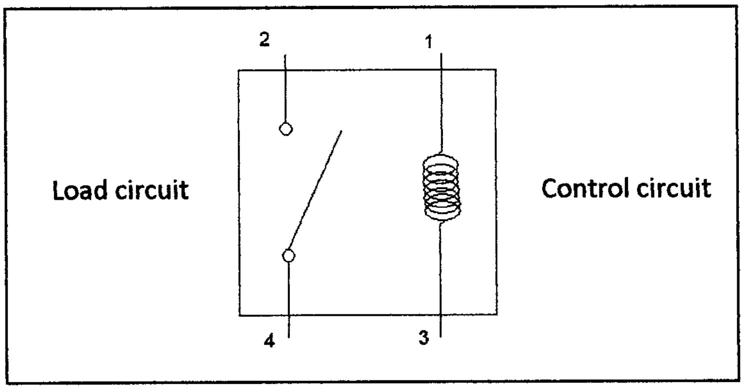


Figure 3.12: Relay block diagram

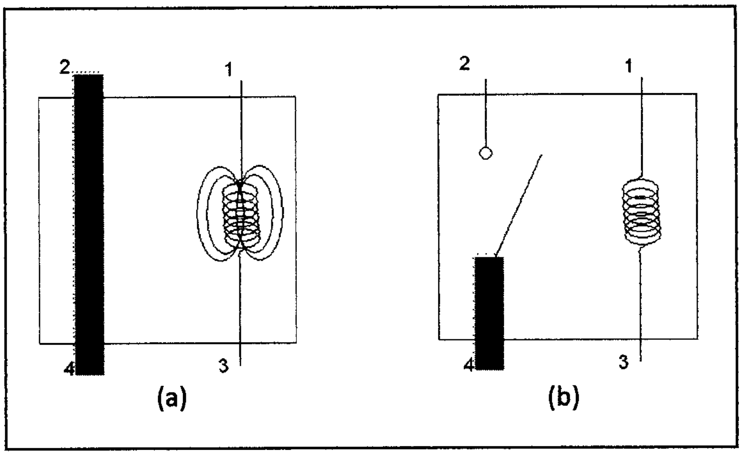


Figure 3.13: (a) Relay 'on', (b) relay 'off'

Current flowing through the control circuit coil (pins 1 and 3) creates a small magnetic field which causes the switch to close pins 2 and 4 shows on the figure 3.13 (a). The switch is a part of the load circuit used to control an electrical circuit that may connect to it.

Current now flows through pins 2 and 4 in stripe when the relay is energized. When current stops flowing through the control circuit, pins 1 and 3, the relay becomes de-energized. Without the magnetic field, the switch opens and current is prevented from flowing through pins 2 and 4 on figure 3.13 (b). The relay now is off.[5]

3.7 Power Supply

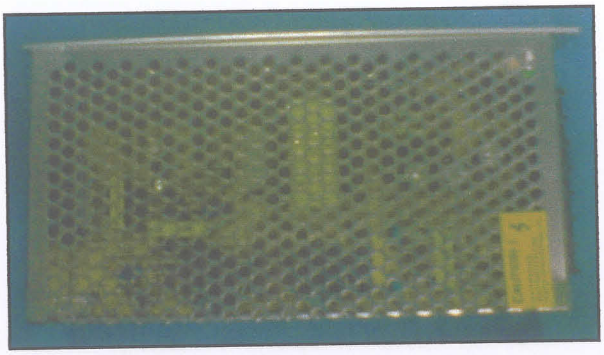


Figure 3.14: Power Supply

Power supply is a device that transfers electrical energy from one form to another form using electronic circuits. It is also called a power supply unit or PSU. The power supply then pulls the required amount of electricity and converts the AC current to DC current. It also regulates the voltage to eliminate spikes and surges common in most electrical systems. Power supplies are rated in terms of the number of watts they generate. The more needs of electrical component power, the more watts it can provide to components. A switched-mode power supply also known a switching-mode power supply (SMPS) is an electronic power supply unit (PSU) that incorporates a switching regulator. It is switches a power transistor between saturation (full on) and cutoff (completely off) with a variable duty cycle whose average is the desired output voltage. It switches at a much-higher frequency (tens to hundreds of kHz) than that of the AC line (mains), which means that the transformer that it feeds can be much smaller than one connected directly to the line/mains. A SMPS can be a fairly complicated circuit, as can be seen from the block diagram shown in Fig. 3.15. (This configuration assumes a 50/60Hz mains input supply is used.)

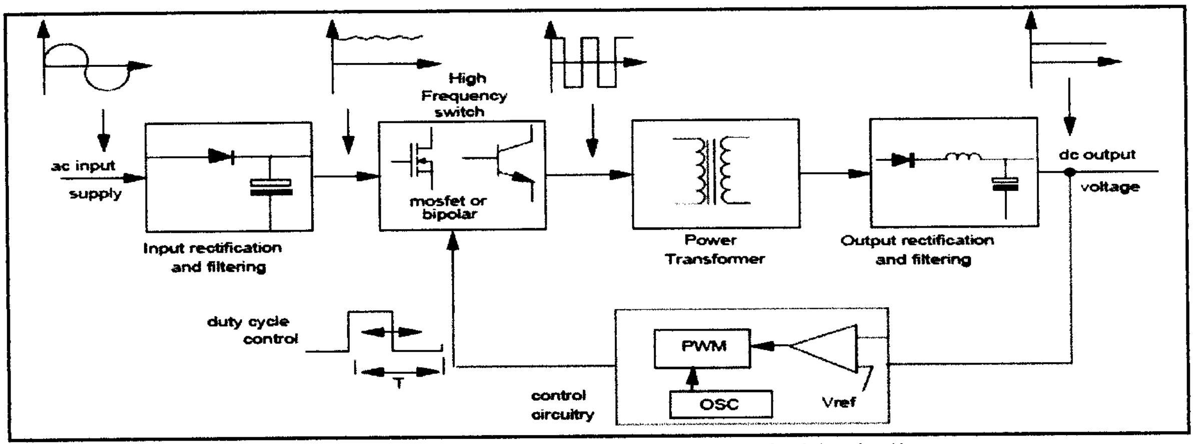


Figure 3.15: Basic switch mode power supply block diagram

The ac supply is first rectified, and then filtered by the input reservoir capacitor to produce a rough dc input supply. This level can fluctuate widely due to variations in the mains. In addition the capacitance on the input has to be fairly large to hold up the supply in case of a severe droop in the mains. The SMPS can also be configured to operate from any suitable dc input; the supply is called a dc to dc converter. The unregulated dc is fed directly to the central block of the supply, the high frequency power switching section. Fast switching power semiconductor devices such as MOSFETs and Bipolar are driven on and off, and switch the input voltage across the primary of the power transformer. The drive pulses are normally fixed frequency (20 to 200kHz) and variable duty cycle. Hence, a voltage pulse train of suitable magnitude and duty ratio appears on the transformer secondary. This voltage pulse train is appropriately rectified, and then smoothed by the output filter, which is either a capacitor or capacitor / inductor arrangement, depending upon the topology used. This transfer of power has to be carried out with the lowest losses possible, to maintain efficiency. Thus, optimum design of the passive and magnetic components, and selection of the correct power semiconductors is critical. Regulation of the output to provide a stabilized dc supply is carried out by the control / feedback block. Generally, most S.M.P.S. systems operate on a fixed frequency pulse width modulation basis, where the duration of the on time of the drive to the power switch is varied on a cycle by cycle basis. This compensates for changes in the input supply and output load. The output voltage is compared to an accurate reference supply, and the error voltage produced by the comparator is used by dedicated control logic to terminate the drive pulse to the main power switch/switches at the correct instance. Correctly designed, this will provide a very stable dc output supply. In most applications, the S.M.P.S. topology contains a power transformer. This provides isolation, voltage scaling through the turns ratio, and the ability to provide multiple outputs. However, there are non-isolated topologies (without transformers) such as the buck and the boost converters, where the power processing is achieved by inductive energy transfer alone. In this project, two power supplies is required, internal power supply for PLC device and external power supply for electrical parts. The PLC used the internal power supply to support the 24Vdc voltage to the device and support energy to the other parts like relay, and solenoid valve. The external power supply is provided the 12 Vdc voltage and 15 Amp of current to support the electrical components like motor power windows and lamps. [10][16]

3.8 Chassis and Housing

The chassis of the machine has to be a strong structure to support the devices and part of the machine. For that reason, the entire structure is made from the sheet steel material and the 90° angle aluminium. This material is strong and has an ability to hold the parts that are used in this project. This material was selected and is used to build a chassis of the storing and conveyer systems.

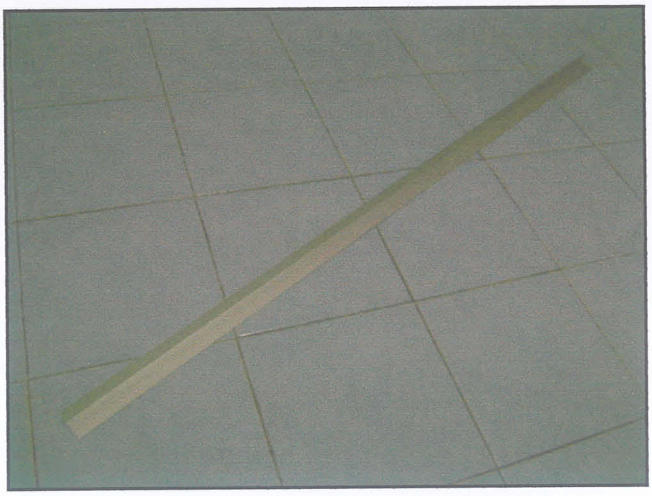


Figure 3.16: Aluminium sheet

3.9 Part 2: Software

Figure 2.8: CX-Programmer 6.1 for Omron PLC

Software is a general term for the various kinds of programs used to operate computers and related devices. The CX-Programmer is software as a PLC programming tool for the creation, testing, and maintenance of programs associated with all OMRON PLC. It provides facilities for the support of PLC devices and address information and for communications with OMRON PLCs and support network types. The version of CX-Programmer was used is a version 6.1. This software version has a special function to simulate the ladder program without online or connect the PLC device via PC. The Simulator on this software version help the user to monitor the work flow of the ladder diagram for checking and detect if any error occur in the designing program.

CHAPTER 4

METHODOLOGY

4.0 Methodology of the Project

The methodology in this project is divided into 3 main phases; first phase, second phase and third phase. The first phases are determining the title of the project. There are some of the title is recognize. Then, the titles of the project are discussed with the supervisor to choose the suitable title for this project. After that, the project flow is continued with the literature review as a gain of supporting information and review of the related project. The second phases are including the design of the project overall. This phase is consisting of design mechanical, electrical and the programming systems. Next stage is an assembly and analysis of the overall system. These stages are finalizing process needed all of the sketching design for implement to the project. The analysis and troubleshooting is followed to test and measuring functioning of the entire machine systems. Figure 4.0 and 4.1 is shows the flow chart of the methodology of the project.

4.1 Flow Chart

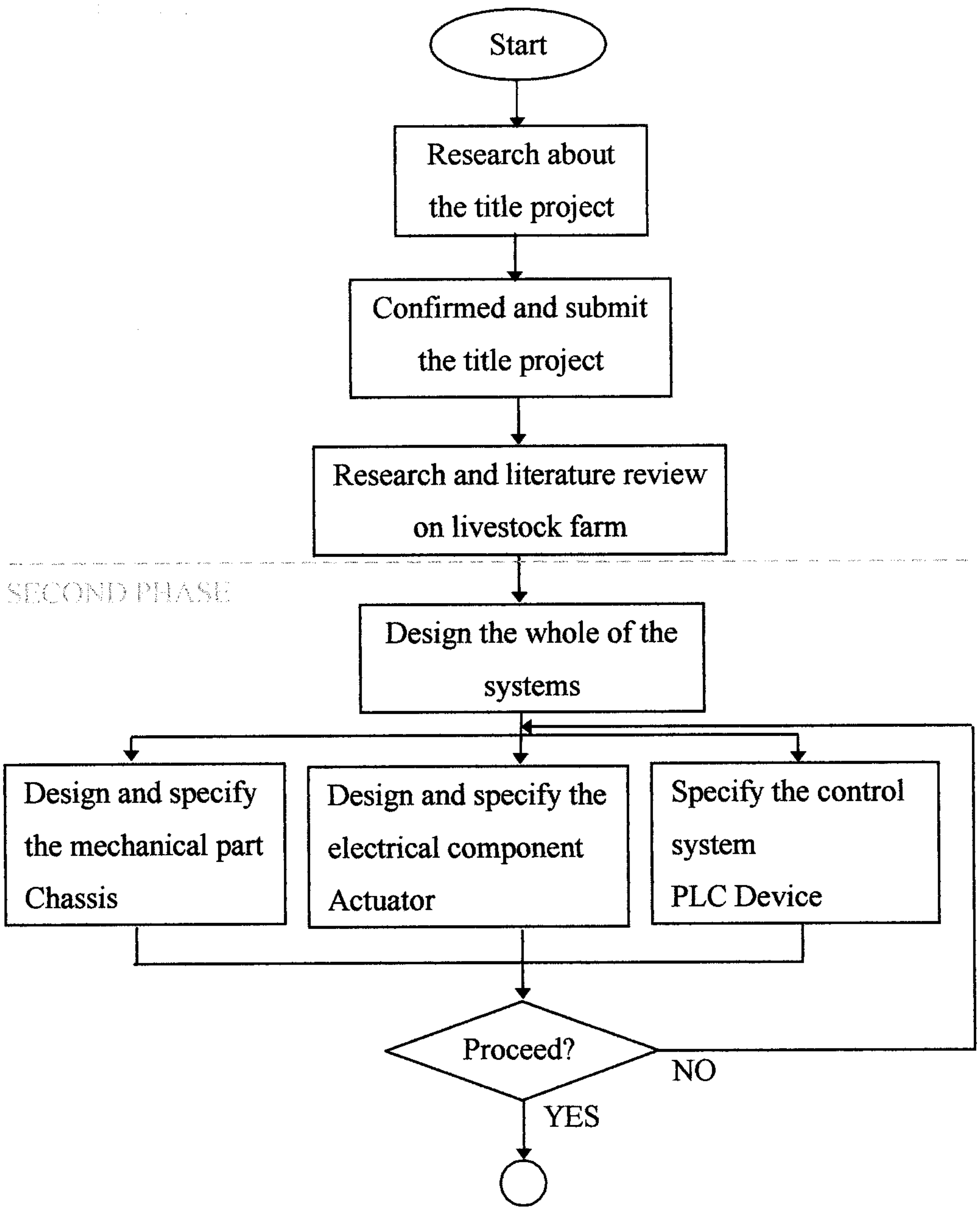


Figure 4.0: Flow chart of project executed