# DESIGN OF ELECTRICAL HARDWARE AND CONTROLLER FOR NATA DE COCO SCRAPPING MACHINE

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### 7 MAY 2007

"I admit that I have read from the scope of and quality of this work, for my opinion this work suffices from the scope and quality for getting degree in Bachelor of Electrical Engineering (Control, Instrumentation and Automation) "

Signature           : _____

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# DESIGN OF ELECTRICAL HARDWARE AND CONTROLLER FOR NATA DE COCO SCRAPPING MACHINE

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**This Report Is Submitted In Partial Fulfillment Of Requirement For The Degree Of Bachelor in Electrical Engineering (Control, Instrumentation and automation)**

**Faculty Of Electrical Engineering (FKE)**
**Univesiti Teknikal Malaysia Melaka**

**MAY 2007**

"I admit this report is from my own work except summary and quotation which each of them I'm telling the source"

TANDATANGAN : ...........................................

NAMA : MOHD HAFIZ BIN MOHD ZAILAN

DATE : 7 MAY 2007

To father and mother,
sisters, brothers and lecturers beloved

# ACKNOWLEDGEMENT

I would like to say thank you very much to my family which is always gave me moral support and encouragement to do this project and also to Mr. Saifulza bin Alwi @ Suhaimi who was a great lecturer and helped me in many things to develop this project until completed. He always spent his time to teach me and guide me how to develop and designed this project completely. He also always gave his comments to me so that I could improve what mistake that I had done in this project. Beside that, I'm also to say thanks a lot to Mr. Zaini who is owner of ANZAG Industries (M) Sdn. Bhd because he gave me a lot of information about Nata De Coco and co-operation with me while I was developing this project until finished. However, I would to say thank you once again to them because they had taught me a lot until this project absolutely complete.

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Thanks.

# ABSTRACT

Scrapping machine is a machine to scrap white layer of fresh nata de coco in nata de coco manufacturing process. Nata de coco is an organic high fibred food product, cultivated by fermentation activity happened on coconut, sugar, water and a specially developed nutrient. The main objective of this scrapping machine is to remove a white layer like a thin membrane, where this process currently carried out manually by workers of ANZAG Industries (M) Sdn. Bhd. Through observations, this white layer is quite difficult to be removed and the operators will take some time to fully scrap it, even for one piece of fresh nata de coco. This project is focusing on development of an automated scrapping machine which is easy to be handled by the workers. The development of this machine will be focused on its electrical controller and physical design. Programmable Logic Controller (PLC) is used as the main controller to run this machine automatically. It monitors inputs, make decisions and control outputs in order to automate machines and processes. It also uses CX-Programmer software to design the circuit (ladder diagram) and transfer to this PLC to operate the machine. This PLC is a product of Omron and in this project the CQM1H type will be used which have sixteen inputs and outputs. The prototype of this scrapping machine have to be tested to ensure that it can be used in nata de coco manufacturing process.

# ABSTRAK

Mesin kikisan adalah sebuah mesin untuk mengikis lapisan putih nata de coco di dalam proses pembuatan nata de coco. Nata de coco adalah satu produk makanan berorganik tinggi, ditanam oleh aktiviti penapaian kelapa, gula, air dan satu terutamanya memberikan zat makanan. Matlamat utama mesin kikisan ini adalah untuk membuang satu lapisan yang putih seperti satu selaput nipis, di mana proses ini pada masa ini dijalankan secara manual oleh pekerja-pekerja Anzag Industri (M) Sdn. Bhd. Melalui pemerhatian-pemerhatian, lapisan warna putih ini adalah agak menyukarkan untuk tersingkir dan pekerja-pekerja akan mengambil masa untuk mengikis nata segar walaupun untuk satu keping. Projek ini adalah menumpukan pada pembangunan satu mesin kikisan berautomatik yang senang dikendalikan oleh pekerja-pekerja. Pembangunan mesin ini akan menumpukan pada pembangunan pengawal elektriknya dan juga reka bentuk fizikal. Pengawal logik boleh aturcara (PLC) adalah digunakan sebagai pengawal utama untuk mengoperasikan mesin ini secara automatik. Ia boleh memantau masukan, membuat keputusan-keputusan dan kawalan keluaran dalam perintah untuk mengautomasikan mesin-mesin dan proses-proses. Ia juga menggunakan perisian CX-Programmer untuk mereka bentuk litar (gambarrajah tangga) dan memindahkan kepada PLC ini untuk mesin beroperasi. PLC ini adalah satu produk Omron dan dalam projek ini jenis CQM1H akan digunakan di mana ia mempunyai enam belas masukan dan pengeluaran. Prototaip mesin kikisan ini hendaklah diuji untuk memastikan yang ia boleh digunakan dalam proses pembuatan nata de coco.

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# CHAPTER 1

# INTRODUCTION

Scrapping machine is a machine to scrap white layer of fresh nata de coco in nata de coco manufacturing process. Nata de coco is an organic high fibred food product, cultivated by fermentation activity happened on coconut, sugar, water and a specially developed nutrient. The main objective of this scrapping machine is to remove a white layer like a thin membrane, where this process currently carried out manually by workers of Anzag Industry. Through observations, this white layer is quite difficult to be removed and the operators will take some time to fully scrap it, even for one piece of fresh nata de coco. This project is focusing on development of an automated scrapping machine which is easy to be handled by the workers. The development of this machine will be focused on its electrical controller and physical design. Programmable Logic Controller (PLC) is used as the main controller to run this machine automatically. It monitors inputs, make decisions and control outputs in order to automate machines and processes. It also uses CX-Programmer software to design the circuit (ladder diagram) and transfer to this PLC to operate the machine. This PLC is a product of Omron and in this project the CQM1H type will be used which have sixteen inputs and outputs. The prototype of this scrapping machine have to be tested to ensure that it can be used in nata de coco manufacturing process.

## 1.1   Objectives Of Project

- To apply the knowledge obtained in lecture and during practical (lab) in this project.

- To design suitable automated scrapping machine for using in nata de coco manufacturing process.

- To design suitable main controller using PLC which is easy to be handled by operators.

- To develop automation system using PLC.

## 1.2   Scope Of project

- Design of automated prototype scrapping machine for nata de coco manufacturing process.

- The machine will use PLC as the controller to control the operation

- Develop the suitable circuit using PLC which is ladder diagram using CXP software based on machine operation and transfer to PLC.

LADDER DIAGRAM → PLC → SCRAPPING MACHINE
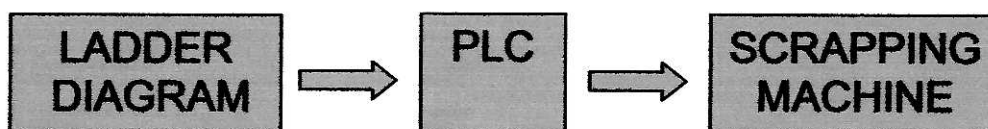
Figure 1.1: Block diagram of project scope

## 1.3   Problem Statement

Basically, this project will be done based on these problem statements:

In nata de coco manufacturing process there is a scrapping process which to remove the white membrane formed at the bottom of surface fresh nata de coco. Currently, the process is carried out manually by operator and take long time to finish for one fresh nata. Therefore, more than one operator needs to do this process especially when to produce big quantities of nata. Besides, this membrane gives unpleasant smell and it is condensed layer.

The figures below show currently how the scrapping process is carried out:
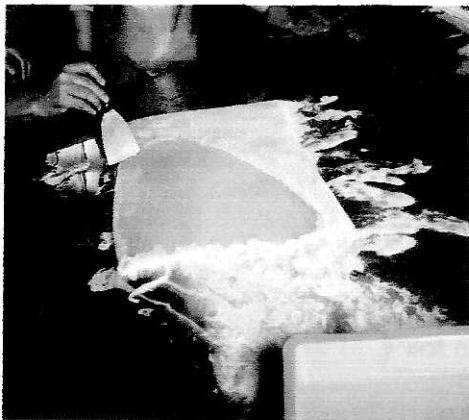
Figure 1.2(a): First scrapping

Figure 1.2(b): Scrapping the white layer

Figure 1.2(c): Scrapping the thin
membrane

Figure 1.2(d): Finish scrapping

## 1.4 Methodology

This project is divided into 2 parts of development which is controller part and hardware part.

1) Controller part

a) Design and develop the program (ladder diagram) based on scrapping machine operation.

b) Simulation of the program before applying to mechanical structure.

2) Hardware part

a) Design drawing of wiring between PLC and mechanical part.

b) Install the program (PLC) to the mechanical structure
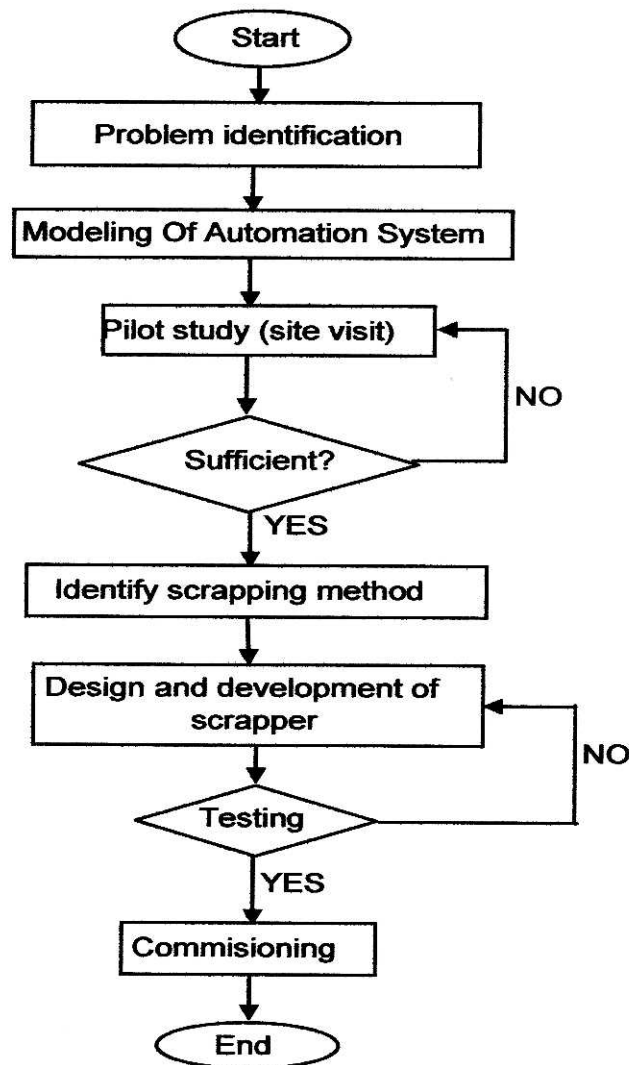
Flow chart 1.3: Project Methodology

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 What Is Nata De Coco

Nata de coco, is an organic high fibre food product, cultivated by activity of fermentation action on coconut, sugar, water and a specially developed nutrient. Nata de coco is high in soluble dietary fibre, carbohydrate, vitamins and minerals and is low in fat and contains no cholesterol.

Nata de coco is widely enjoyed in Japan, China, Hong Kong, Taiwan, Philippines, and Thailand as snack or dessert. It is excellent on its own or as topping for ice creams, jellies, fruit cocktail, cold cakes, yogurt, soups, fruit juices and alike.

## 2.1.1 Fresh Nata De Coco Characteristics

➤ Solid
➤ Soft
➤ Smooth surface
➤ Chewy
➤ Fragile
➤ Length: 37-40 cm
➤ Width: 22-25 cm
➤ Thickness: 15-20 mm

### 2.1.2 Production Process of Nata de Coco

Nata de Coco is a white, gelatinous food product. Quality nata is smooth, clear and chewy. It can be sweetened as desserts or candies. It is an excellent ingredient for sweet fruit salads, pickles, fruit cocktails, drinks, ice cream, sherbets and other recipes.

```
┌─────────────────────────┐
│ Preparing of            │
│ ingredients             │
│ o Water                 │
│ o Dissolving sugar      │
│ o Extracting coconut    │
│ milk                    │
│ o Glacial acetic acid   │
│ o Mother liquor         │
└─────────────────────────┘
            ↓
      ┌───────────┐
      │  Mixing   │
      └───────────┘
            ↓
┌─────────────────────────┐
│ Filling the mixture into nata │
│          mold           │
└─────────────────────────┘
            ↓
┌─────────────────────────┐
│ Fermenting in temperature 23-32° C │
│     about 8-10 days     │
└─────────────────────────┘
            ↓
┌─────────────────────────┐
│ Cleaning nata by scraping the cream and │
│   the thin, white layer part │
└─────────────────────────┘
            ↓
┌─────────────────────────┐
│ Soaking clean nata by keeping immersed │
│        in water*        │
└─────────────────────────┘
            ↓
     ┌────────────────┐
     │ Cutting into cubes │
     └────────────────┘
            ↓
┌─────────────────────────┐
│ Draining and boiling in water for 5-10 │
│        minutes          │
└─────────────────────────┘
            ↓
┌─────────────────────────┐
│ Checking if acid is totally │
│        removed          │
└─────────────────────────┘
            ↓
┌─────────────────────────┐
│ Making Nata de Coco In  │
│        syrup            │
└─────────────────────────┘
            ↓
```
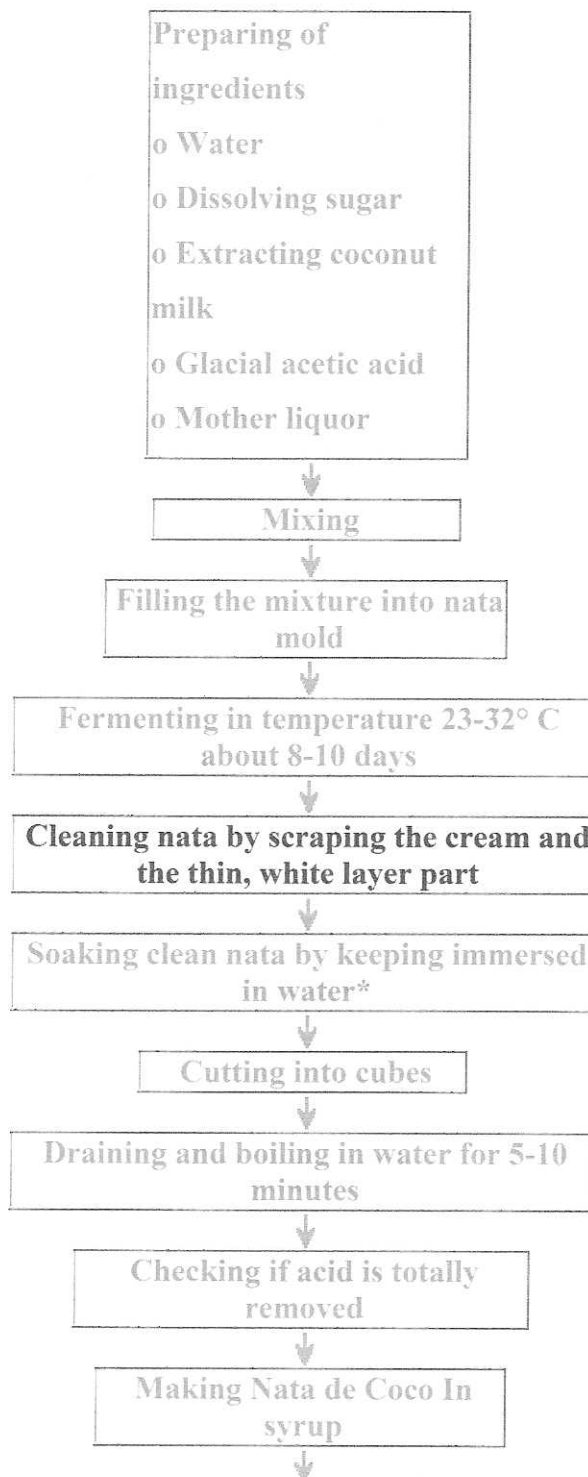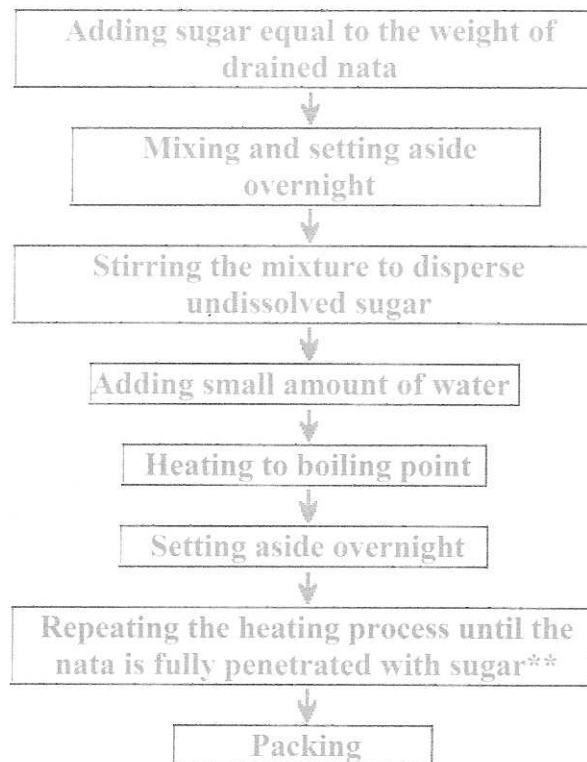
Flow Chart 2.1: Flow Chart of Nata de Coco manufacturing process

## 2.2 Structure Of An Automated System

### 2.2.1 Control System And Application

All automated system consist two parts:

1)         The application (formally call the operative unit)

2)         The control system which coordinates actions of the 'Application'
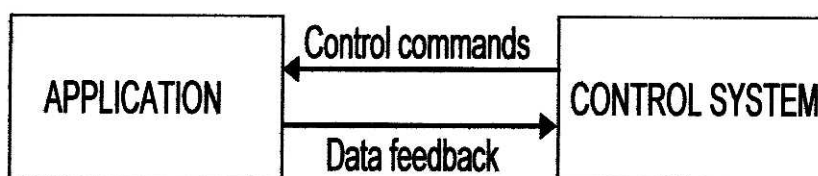


Figure 2.2: Block diagram of control system and application

## Application

The application operates on the worked material and the product. It generally consists of:

~ Tooling and various facilities performing the production process for example:

moulds, punches, cutting tools, welding head and marking heads.

Actuators intended to drive or operate these facilities such as:

-electric motors to activate pump

- hydraulic cylinders to close moulds

- pneumatic cylinders to drive marking heads

## Control system

The control system sends orders to the application which then feeds signals back to the control system. In this way, actions are coordinated. Control systems are based on programmable controllers or hard wire technology depending on the system complexity.

The control system coordinates three types of dialogue:

1) <u>Dialogue with the machine</u>

Control of the actuators such as motors and cylinders via pre-actuators such as contactors, control valves and variable speed drives: acquisition of feedback signals from sensors reporting the progress of the machine.=

2) <u>Man-machine dialogue</u>

In order to operate, adjust and repair the machine, operations personnel enter instructions and receive data in return.

3) <u>Communication machine with other machines</u>

Several machines can operate within the same production systems. These machines coordinate through dialogue between their respective control systems.