CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter, the design and the method are explained to meet the objectives of this project which are to develop Poka-yoke system to detect nut using the Arduino Integrated Development Environment (IDE) programming, Arduino Uno board, driver board, proximity sensor, transformer, trigger box and direct current (DC) motor with conveyor.

In this project, the activities are divided into three phases. Phase I, is a software development using Arduino IDE software. For software programming, an assembly language was used to construct the command in order to get the best results with the least expensive micros. Assembly language can be used to specify the exact instructions where the central processing unit (CPU) will follow and one can control exactly the time and memory used for each step of the program.

The phase II is uploaded the programming code into ATmega328 and all variables that want to use is write down on it. The programming interprets and sends to the PIC in phase II. The input and output is declared. After the process has complete, the program will analyze and run in the Arduino IDE to identify and detect if there have any failure in programming before loading to ATmega328. The next step is to upload via universal serial bus (USB). The USB-to-serial adapter chip or cable is implemented through USB interface.

After send command via USB to Atmega328, the programming will analyze again to the electronic component to works. Phase III is the hardware which is fabricate the system.

In the phase III is fabrication of the system. The components that used to build hardware are driver board, proximity sensor (metal), conveyor, motor, transformer, Arduino board and trigger system. The driver board is the main of the part of the system. The function of driver board as a transmitter which is acting as control the other components when the signal from the programming will verify.

Arduino Uno board is a microcontroller board based on the ATmega328. It has 14 digital input/output pins. 6 analog inputs, a USB connection, power jack, an in-circuit serial programming (ICSP) header and reset button. It is simply connect to a computer with a USB cable or power it with alternating current (AC)-to- direct current (DC) adapter or battery to get started.

Proximity sensor is device that used to detect the prevention of the specimen or nut. The type of sensor is metal. The two sensors named as sensor 1 (SEN1) and 2 (SEN2). SEN1 is act as signal to SEN2. In most cases these devices send an electronic signal when they are move under the sensor. The sensor will detect the nut is missing or not when nut moving with conveyor.

Conveyor is one element that used to move the specimen. It is just simple of conveyor. The motor will connect with conveyor. The conveyor moving depends on how fast the motor is setting on the programming.

The type of motor that used is DC motor. This device is converts direct current (electrical energy) into mechanical energy. It is a permanent magnet 24VDC. It is used to rotate the roller and roller will move the belt of conveyor.

AC output is response from input signal. The signal from programming sent to AC output. When the defect detection, the AC output trigger the signal. The Light-Emitting Diode (LED) as act as trigger system. AC output is important because they give to signal if the defect occurring in the production line. The signal can shut down the operation or give

an operator a warning signal to fix the problem. The figure 3.1 showed the flow chart for whole system and how the system operates to detect the missing nut.
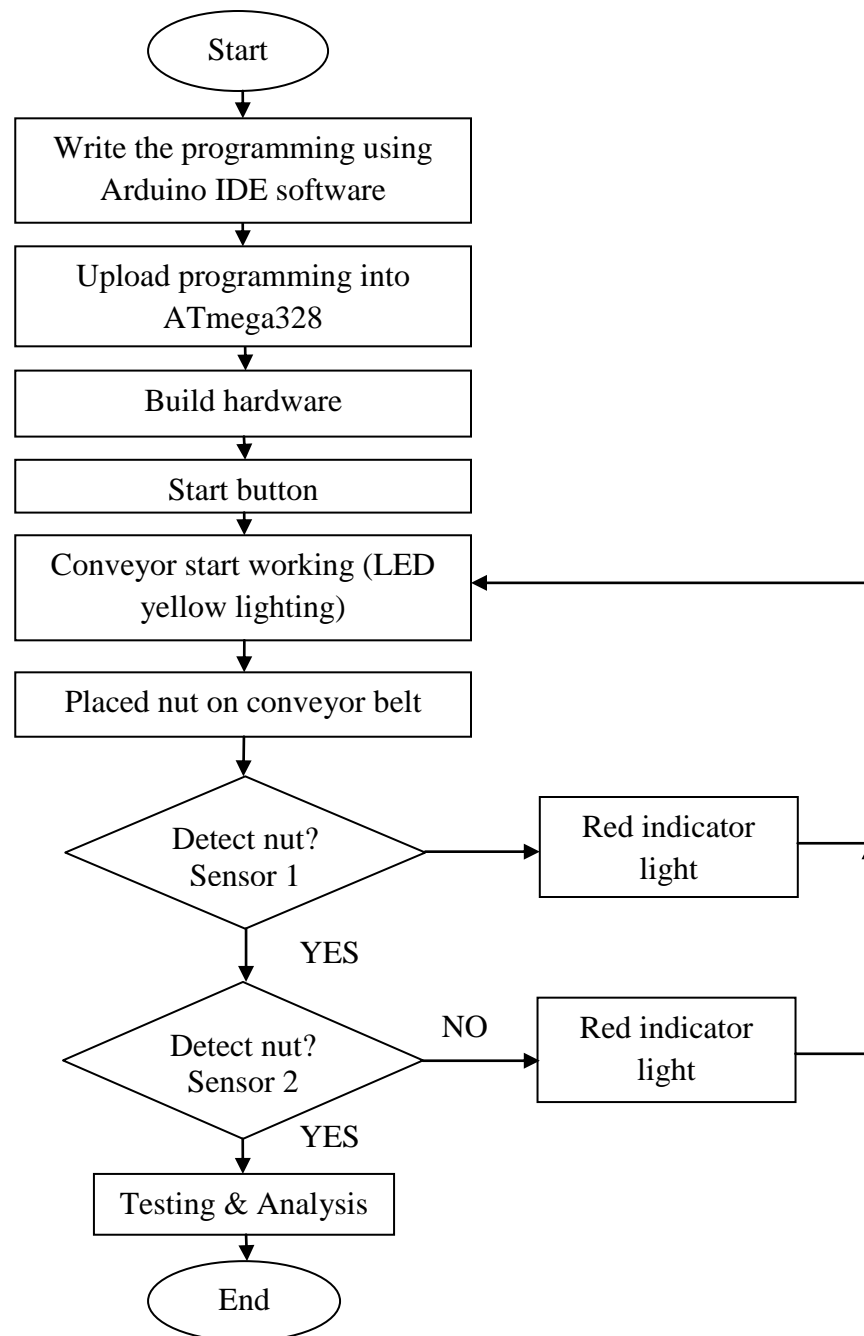
3.2   FLOW CHART POKA-YOKE SYSTEM

```
                    ┌─────────┐
                    │  Start  │
                    └─────────┘
                         │
        ┌────────────────────────────────┐
        │ Write the programming using    │
        │      Arduino IDE software      │
        └────────────────────────────────┘
                         │
        ┌────────────────────────────────┐
        │   Upload programming into      │
        │          ATmega328             │
        └────────────────────────────────┘
                         │
        ┌────────────────────────────────┐
        │        Build hardware          │
        └────────────────────────────────┘
                         │
        ┌────────────────────────────────┐
        │        Start button            │
        └────────────────────────────────┘
                         │
        ┌────────────────────────────────┐
        │  Conveyor start working (LED   │
        │       yellow lighting)         │
        └────────────────────────────────┘
                         │
        ┌────────────────────────────────┐
        │  Placed nut on conveyor belt   │
        └────────────────────────────────┘
                         │
              ╱ Detect nut? ╲         ┌──────────────────┐
             ╱   Sensor 1    ╲───────▶│  Red indicator   │
              ╲             ╱          │      light       │
                   │                   └──────────────────┘
                  YES
              ╱ Detect nut? ╲    NO   ┌──────────────────┐
             ╱   Sensor 2    ╲───────▶│  Red indicator   │
              ╲             ╱          │      light       │
                   │                   └──────────────────┘
                  YES
        ┌────────────────────────────────┐
        │      Testing & Analysis        │
        └────────────────────────────────┘
                         │
                    ┌─────────┐
                    │   End   │
                    └─────────┘
```

Figure 3.1: Flow Chart for Poka-Yoke system