UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATED FACTORY SAFETY CONTROL SYSTEM USING PLC

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

MOHD SYUKRI BIN MOHAMED

FACULTY OF MANUFACTURING ENGINEERING

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DECLARATION

I hereby, declared this report entitled "Automated Factory Safety Control System Using PLC" is the results of own my research except as cited in references.

Signature:

Author's Name: Mohd Syukri Bin Mohamed

Date: 17th April 2009

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) with Honours. The member of supervisor committee is as follow:

(Signature of Supervisor)

....

(Official Stamp of Supervisor)

ABSTRAK

Kajian in dilakukan untuk mencari dan mengenalpasti permasalahan yang di hadapi di dalam industri. Pendekatan ini dilakukan bagi menambahbaik sistem yang ada sekarang dengan mengunakan sistem yang ringkas dan berkesan. ’ Automated Factory Safety Control’ di lengkapi dengan PLC (Pengawal logik aturcara) yang memainkan peranan sebagai perantara antara penderia dengan paparan LED. Sistem ini beroperasi mengawal operasi mesin, mengawal suhu di dalam kilang, mengenalpasti kerosakkan dalam sistem kawalan elektrik dan lain lain lagi. Paparan LED digunakan bagi mengenal pasti kerosakkan yang di alami. Sistem ini dapat membantu mengurangkn masa lengah mesin, mengurangkan kos baik pulih mesin dan membantu memudahkan kerja kerja baik pulih sesuatu masalah yang di hadapi.

ABSTRACT

This paperwork describe about a problem faces in industrial by improving an existed system with effective and simple . PLC (programmable logic controller) has been used acts as a interface between sensor and LED display for this automated factory control. Operation of this system are control machine, control temperature, and detect fault in electrical control system. This system can be help to reduce a downtime and cost machine maintenance,and a gives a good product.

DEDICATION

For my supervisor, lecturers, family and friends

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Safety systems provide the safety for humans, machines and environment. They are used to prevent accidents and damage resulting from a fault or malfunction. The safety controllers (Safety Integrated) detect faults autonomously and immediately change into or remain in a safe mode when a fault occurs. They are optimized for use in production engineering and provide air-tight safety for all its many facets.

All industry must include safety protection device to protect the machine, electrical equipment, operator and to produce the quality of product. All system are required to have a minimum amount of protection to protect personnel and property. Most system required more than the required minimum amount of protection in order to minimize equipment damage and reduce maintenance downtime.

In this project, PLCs have been used to reduce costs and increase productivity. They are now being incorporated for safety aspects. Safety PLCs are easier to repair and use while also reducing false alarms

By acting as a automated factory safety control system, when a problem and error occurs in the system of factory, number, light indicator or words are displayed on a digital readout attached to the equipment or LED display panel.

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1.2 Objective

The main objective of this project is to develop a automated factory safety control system using PLC. This system can be detect fault of the all system and show in LED fault indicator. All of the system controlled by PLC (Programmable Logic Controller) and PIC (Programmable Integrated circuit). Additional objective of this projects are :

(a) To develop a fully functional controller that can be used to detect the problem in the system.
(b) To design and develop a program PLC and PIC controller.
(c) To reduce course of maintenance in industry
(d) To design a LED display panel

1.3 Scope Of Work

The scope should be identified and planned to achieve the objective of the project successfully on the time, first the scope for this project is to design and develop an electrical circuit to control input and output from PLC (Programmable Logic Controller). Second scope is to design a program in PLC system for control all or the system, the design program must be function, easy to understand and comfortable to maintenance. Another scope are :

(a) To used and understand the PIC (Programmable integrated circuit)

1.4 Problem Statement

In most industrial, they still used manual system to control their system. The malfunction at DB (Distributor Board) occurred when there are no supply current, it is one of the example of manual system that used in industry. In order to detect the malfunction manually a multimeter or multitester is used to ensure the component are damage. Some of the manual procedure that one still being practice in industry are such as trigger the blower fan, fault machine detection and others. When manual system fail to operate it will give side effect such as interfering with machine movement. It will also effect the maintenance occurred thus effecting the production course. In order to overcome this problem, a automated factory safety control system with LED display panel is used. It function as a monitoring device to the factory with only one workstation.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a description of the literature relevant to a particular field or topic. This is often written as part of a postgraduate thesis proposal, or at the commencement of a thesis. In this project overview about the Smart Factory in industrial automation.

Industrial automation or numerical control is the use of control systems such as computers to control industrial machinery and processes, replacing human operators. In the scope of industrialization, it is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the physical requirements of work, automation greatly reduces the need for human sensory and mental requirements as well. Currently, for manufacturing companies, the purpose of automation has shifted from increasing productivity and reducing costs, to broader issues, such as increasing quality and flexibility in the manufacturing process.

The old focus on using automation simply to increase productivity and reduce costs was seen to be short-sighted, because it is also necessary to provide a skilled workforce who can make repairs and manage the machinery.

An automated system is collection of device working together to accomplish tasks or produce a product or family of product.(John Stenerson (2003)). An automobile, for example, is an automated system. The automobile has a brain box to receive inputs from various sensor and to control various output that regulated the engine's operation and other function such as antilock braking.

A home burglar alarm system is another automated system. its control box receives input from sensor and switches located on doors and windows of the house. If the control box receives a signal that a door or window has been opened, it sound the alarm and calls the police department. (John Stenerson (2003)

Industrial automated system can be one machine or a group of machines called a cell, show in figure 2.1 below :

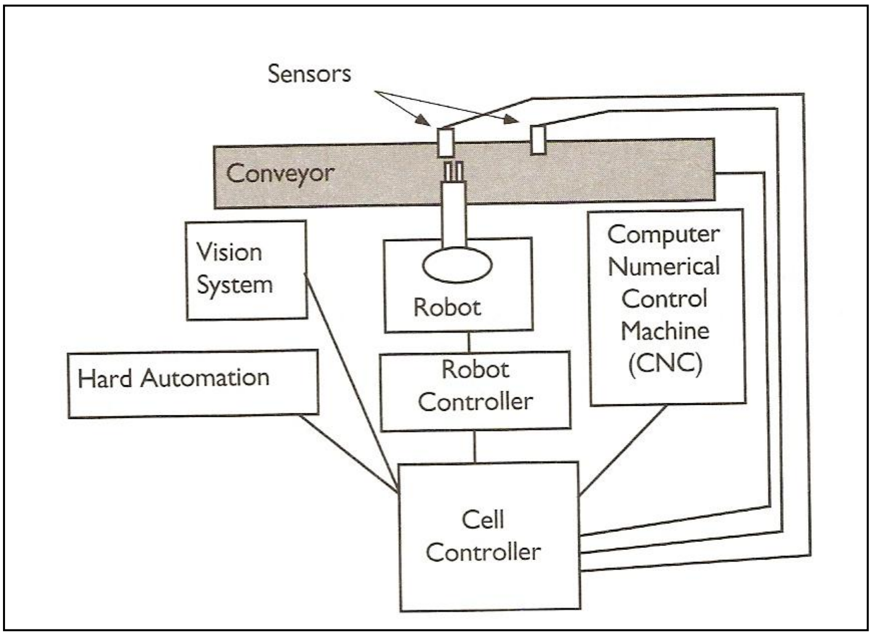

Figure 2.1 : This figure show a simple automated cell with several devices. (John Stenerson (2003)

The cell has a conveyor for bringing material into and out of the cell, a robot to move the material between devices in the cell, a CNC machine for the machining the parts, a hard automation device for a special task, a vision system for inspecting the parts, some sensor for sensing parts, and a cell controller for integrating and controlling all of the other device. Device includes those that actually produce the product and that provide support, control, and feedback to the system. The four basic type of device in a cell are production, support, control, and feedback. (John Stenerson (2003).

2.2 Smart Factory

Smart factory its means in industrial the factory used the high safety to protect all system. Where PLC will control the alarm system and analyse data from sensor. In smart factory PLC is used to detect temperature gradient, smoke alarm detection, machine operation and malfunction of electrical system. The PLC will control the alarm system and analyse data from sensor and show on the indicator controller monitor.

2.2.1 Argus Titan System

In industrial like ‘’Argus Titan System’’, are used automation safety system, The Argus Titan system is a user-programmable, real-time control system with dedicated distributable hardware. It has been specifically designed to accomplish three objectives within a single platform:

(a) Automated equipment control
(b) Monitoring and alarms
(c) Data acquisition

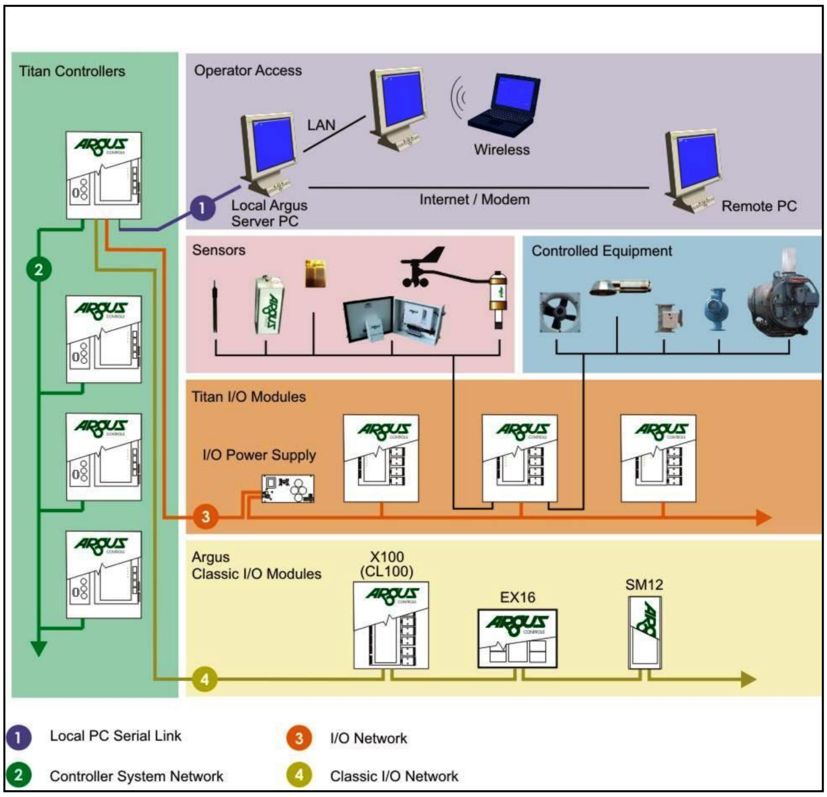

Figure 2.2: relationship block diagram for Argus system

For horticulture applications, the Argus system can also meet the needs of the crop by controlling CO2 levels, irrigation, chemical treatments, and nutrient supplies. It continuously monitors all growing environments and equipment operations and reports on the consumption and supply of resources such as water, electricity, heat, and chemicals and equipment operation hours.

The Argus system not only addresses direct safety problems with proper equipment installation and wiring, but also includes additional settings to further protect and improve operation. These include

(a) Minimum "on" and "off" times prevent short-cycling and premature wear of equipment.
(b) Power-up delay times will delay and stage load operations upon return from power failures or drop outs. This feature is much appreciated by either your generator or the electrical company, as the case may be.

(c) Event records and data recording provide summaries of equipment operating frequency and duration as well as a continuous operating audit. This information is very important when evaluating performance or maintenance and service requirements.

(d) Multiple operating limits, and safety overrides can be configured to ensure the safest operation, and extend the operating life of equipment.

(e) Modulating control - the Argus system contains programs to manage modulating equipment such as hot water heating systems and ventilation systems. These systems are capable of delivering a wide range of output levels. The computer can calculate and then directly deliver the correct output, after evaluating a range of operator set limits

(f) Pulse-width modulation - most on/off equipment is either too effective when on or not effective enough when off. Unfortunately, most equipment responses required are somewhere between these two extremes. Staging of multi-unit systems like cooling fans can provide some intermediate steps, but these are not sufficient for full smooth control.

(g) The Argus system can cycle a piece of equipment on and off in proportion to the required response and achieve a very full range of control. The inertia of the greenhouse environment can absorb these operating pulses quite effectively and smooth out the “bumps”. For example, the computer will turn a unit heater “off” after the calculated heat requirement has been delivered, regardless of the current air temperature. The longer term air temperature average will include the pulse of heat and future heat pulses will be adjusted to give greater or lesser response as required. This control strategy greatly reduces temperature overshoot, resulting in lower energy costs and a better growing environment without increasing the total number of equipment operations (cycling). It is particularly effective when managing fog and mist systems.

The distributed network of controllers is treated as a single system. The activities of individual controllers can be coordinated to accomplish cross-module control objectives such as irrigation and the efficient distribution of heat from a central supply.

Typical Hardware components include in this smart system is, :

(a) Argus Titan controllers
(b) Titan I/O modules (and any 'Classic' equipment on older installations and retrofits)
(c) Sensors
(d) Output relays
(e) Power supplies
(f) Local PC for operator access

2.2.2 Smart (Intelligent) system

In the hard wiring circuit, inputs such as limit switch, emergency push button, sensor such as temperature switches are wired into the system using several different wires for each device. For example is show a car wash system in figure 2.3 below :

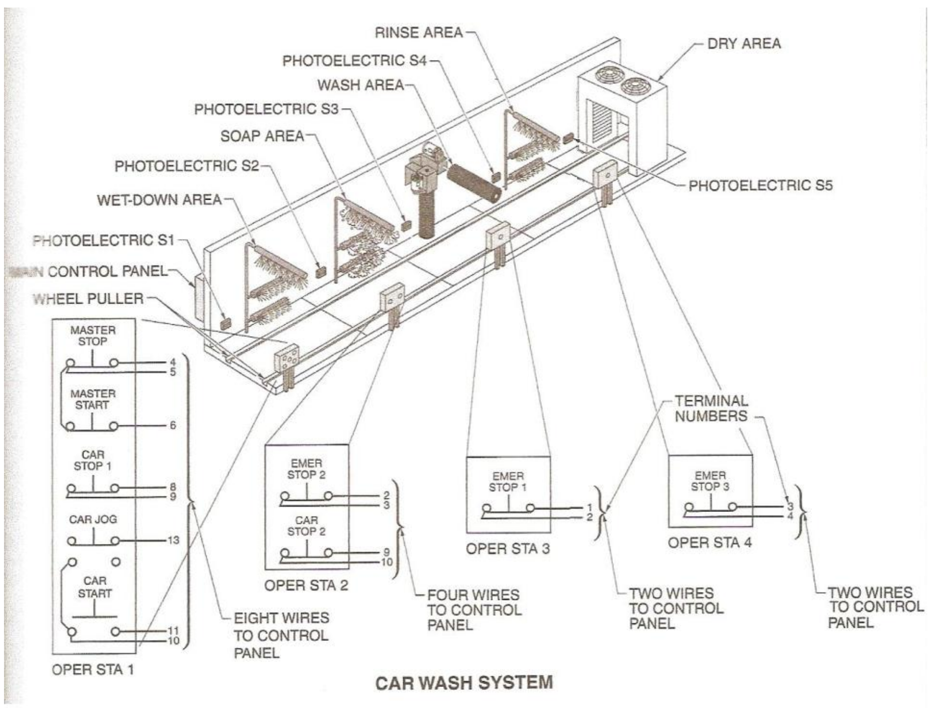

Figure 2.3 : Hard wiring require a large number of control wires to interconnect a system. (Gary J. Rockis and Glen A. Mazur 2003)