Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF MODULAR PRODUCTION SYSTEM (MPS) WITH SENSOR'S AND ACTUATOR'S PREDICTION FOR MAINTENANCE USING PROGRAMMABLE LOGIC CONTROLLER (PLC)

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Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

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Sesi Pengajian : 1 2021/2022

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DECLARATION

I declare that this project report entitled “Development of Modular Production System (MPS) with Sensor’s and Actuator’s Prediction for Maintenance using Programmable Logic Controller (PLC)” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature	:	
Student Name	:	Ahmad Tirmizi bin Azman
Date	:	10/1/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

Signature : 

Supervisor Name : Ts. Shahrizal bin Saat

Date : 10/1/2022

DEDICATION

To my beloved mother and father, thank you for the courage word and support given to me in order to fulfil this report.

ABSTRACT

Nowadays, with the revolution IR 4.0, most industry have used the automatic machines. The purpose of this project is to study about prediction maintenance for sensor and actuator by using Programmable Logic Controller (PLC). Sensor and actuator most important for industry that use the automation system. Besides, one of the limitations is human ability to find out the damage of the sensor and actuator. These systems can notify the state of sensor and actuator so that the factory can detect of how much the machine works and it can prevent unpredictable system damage. The PLC is used as a medium in giving instruction to MPS where the PLC programmed to control each step of MPS. MPS is an automatic machine which it has a sensor and actuator for automation system in the industry. The PLC count and store the data of cycle sensor and actuator, then sent to HMI screen. Human Machine Interface (HMI) is a graphical interface that allows humans and machines interact. HMI screen display the state of lamp for condition of sensor and actuator. By The state of lamp depends on how the machine functioning. There are 3 state that can be implant in this project to make the sensor and actuator in the MPS have the features like smart sensor and actuator. If the sensor and actuator are in good condition, the lamp will show green colour. If the sensor and actuator is almost reaching the ecpectacy of the lifespan then it is in state of alert, the lamp will turn to yellow.Last but not least, when the sensor and actuator already reach the expectac lifespan then its the condition of the sensor and actuator needs to be checked.

ABSTRAK

Pada masa ini, dengan revolusi IR 4.0, kebanyakan industri telah menggunakan mesin automatik. Tujuan projek ini adalah untuk mengkaji mengenai penyelenggaraan ramalan untuk sensor dan penggerak dengan menggunakan Programmable Logic Controller (PLC). Sensor dan penggerak paling penting untuk industri yang menggunakan sistem automasi. Selain itu, salah satu batasannya adalah kemampuan manusia untuk mengetahui kerosakan sensor dan penggerak. Sistem ini dapat memberitahu keadaan sensor dan penggerak sehingga kilang dapat mengesan berapa banyak mesin berfungsi dan dapat mencegah kerosakan sistem yang tidak dapat diramalkan. PLC digunakan sebagai media dalam memberi arahan kepada MPS di mana PLC diprogramkan untuk mengawal setiap langkah MPS. MPS adalah mesin automatik yang mempunyai sensor dan penggerak untuk sistem automasi dalam industri. PLC mengira dan menyimpan data sensor kitaran dan penggerak, kemudian dikirim ke layar HMI. Human Machine Interface (HMI) adalah antara muka grafik yang membolehkan manusia dan mesin berinteraksi. Skrin HMI memaparkan keadaan lampu untuk keadaan sensor dan penggerak. Keadaan lampu bergantung pada jarak fungsi mesin. Terdapat 3 keadaan yang dapat diserapkan dalam kaian ini untuk menjadikan sensor and penggerak biasa dalam MPS mempunyai ciri-ciri seperti sensor dan penggerak pintar. Sekiranya sensor dan penggerak berada dalam keadaan baik, lampu akan menunjukkan warna hijau. Jika sensor dan penggerak hampir mencapai jangka hayat penyelenggaraan ramalan maka ia akan berada dalam keadaan berjaga-jaga, lampu akan bertukar kepada warna kuning. Akhir sekali, apabila sensor dan penggerak sudah mencapai jangka hayat penyelenggaraan ramalan maka sensor dan penggerak perli diperiksa, lampu akan bertukar kepada warna merah.

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I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support through lending me the equipment in the labotary which enables me to accomplish the project. Not forgetting my fellow colleague, housemates for the willingness of sharing his thoughts and ideas regarding the project.

My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study.

Finally, I would like to thank all the staffs at the Industrial Control Laboratory, fellow colleagues and classmates, as well as other individuals who are not listed here for being co-operative and helpful.

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PLC – Prorammable Logic Controller
IoT – Internet of Thing
MPS – Modular Production System
HMI – Human Machine Interface

CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, fully automatic machine have been used in industrial manufacturing. Automatic systems are highly regarded in the industrial world because they ensure quality of manufactured goods, minimise processing time and lower human labour costs. The Programmable Logic Controller (PLC) is one of the most common controllers, especially for sequential systems. PLC is characterised as an advanced electronic device with programmable memory to store specific capability guidelines. Then, we need an interface to monitor and control PLC works connecting humans to computer technology called Human Machine Interface (HMI). HMI can be manually or using real-time computer visualisation as control and status visualisation. Modular Production System (MPS) is an automatic machine that used PLC controllers to control each station's sequence. PLC controllers are used to control each station's MPS sequence.

1.2 Problem Statement

The complexity and integration of industrial machinery and equipment has increased significantly as a result of the growing demand for technology in machining and manufacturing. Because of the human ability to detect sensor and actuator harm, maintenance prediction is needed to reduce the impact on quality, cost, and output. Then, as problems arise, maintenance fails to realise. Furthermore, due to the large number of machines present in industries, manually monitoring the condition of machines is time consuming. The technique for predicting an equipment's lifetime is to ensure the equipment is in good condition and does not malfunction during manufacturing.

From the previous program’s production rate for MAP-205, we can see that it is too slow since the assembly process is done one by one and it takes time to wait for the assembly process to be completed. The manufacturing speed will be increased when the parallel sequence technique is used in MAP-205.

Sensor and actuator errors and failures are difficult to predict, if the sensor’s and actuator’s failure or errors while production is running, then it will cause problems. With HMI, it is easy for the technician to monitor and prepare by displaying how frequent of cycle sensor and actuators is running.

1.3 Project Objective

The main objective of this project is:

i) To improved existing conventional sensor and actuator to become a smart sensor and actuator by manipulating a data process by Programmable Logic Controller (PLC).

ii) To improve the production rate of MAP-205 by implement parallel sequence programming technique.

iii) To reduce risk of emergency operation shutting down due to sensor and actuator failure by notification system of the life span of sensor and actuator displaying on Human Machine Interface (HMI).

1.4 Scope of Project

The scope of this project are as follows:

i) Develop prediction system for maintenance of machines in industries by using the Programmable Logic Controller (PLC).

ii) Having automated machine such as modular production system which is composed of smart sensor and actuator will operated by PLC and delivered the data to Human Machine Interface (HMI).

iii) Apply the prediction maintenance in the industry.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the research work for the related project, which will include information about the previous project's studies and ideas, as well as the hypothesis that will be tested in this project. The methods used to execute this project will be discussed in details below.

2.2 Research by Journal

2.2.1 Design of Automatic Sleeve for Transfer Nut Clutch using Programmable Logic Controller.

Switching devices produced on press machine operators, replacing the risky and ineffective work of the die machine after the press, where it is done manually by a person, and these instruments can help increase the production capacity expected by the company. The automatic nut transfer coupling system uses a Programmable Logic Controller and is able to save energy by increasing production from 180,000 pieces to 470,000 pieces per month.[1]

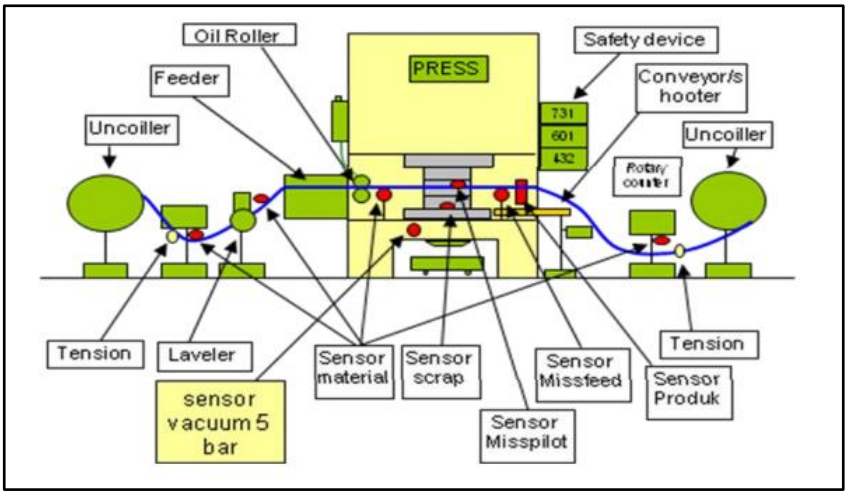

Figure 2.1: The Schematic of Press Machine

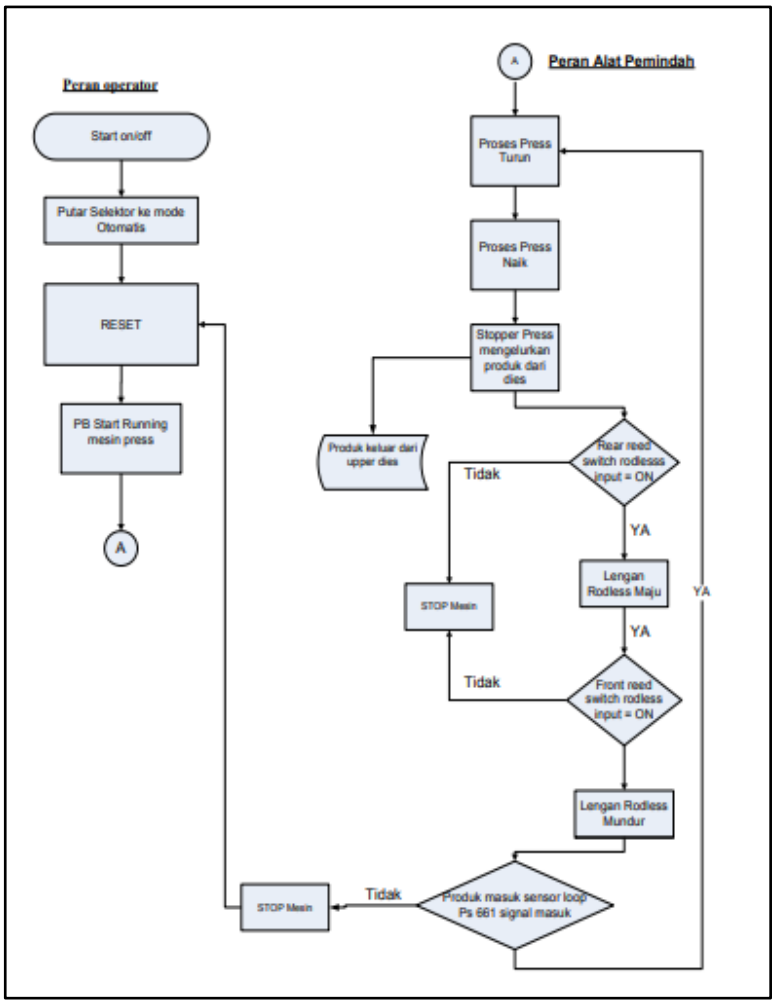

Figure 2.2: Flow coupling nut production process 261-04E06-00S

2.2.2 Fault Identification and Protection of Induction Motor using PLC and SCADA

This article uses a Programmable Logic Controller (PLC) and sensors to prevent induction motor failure by detecting induction motor characteristics such as current, voltage, temperature, speed, and vibration. During motor operation, all these features are continuously monitored with the help of SCADA. If an error occurs, one or more parameters will change, allowing us to take the necessary steps and avoid damaging the induction motor.[2]

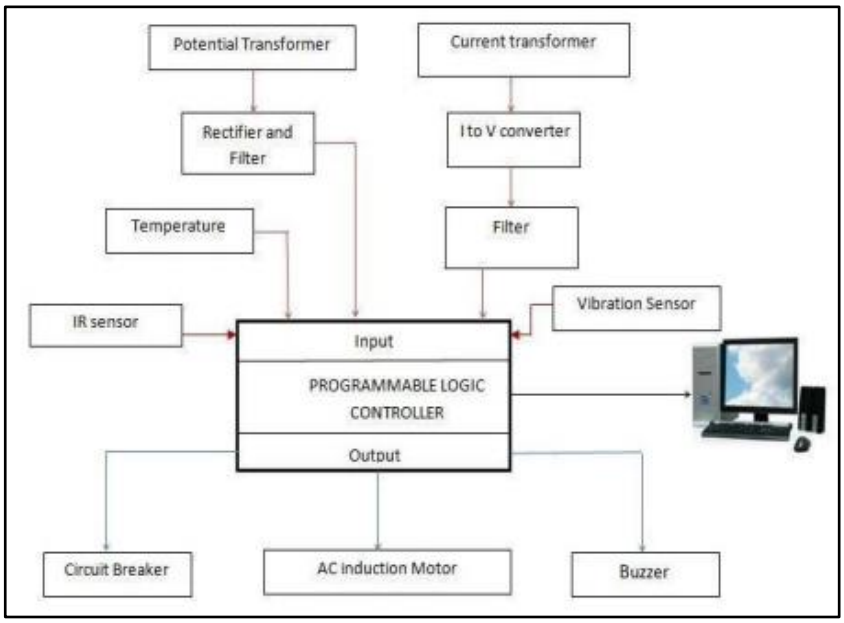

Figure 2.3**:** Block diagram of the protection system

2.2.3 Automation of Packaging and Material Handling Using Programmable Logic Controller.

This This article presents automated packaging and material handling using a programmable logic controller. The goal is to automate the process of loading items into the box, identify good and bad items based on weight, and close the box using packing tape. Besides that, this research aims to replace industrial manual systems and compare the time and manpower requirements for current and proposed automated systems. The system is mechanised using a Mitsubishi FX series programmable logic controller. The system receives input from proximity and load sensor. The output is provided by the motors, pneumatics, and solenoids.[3]

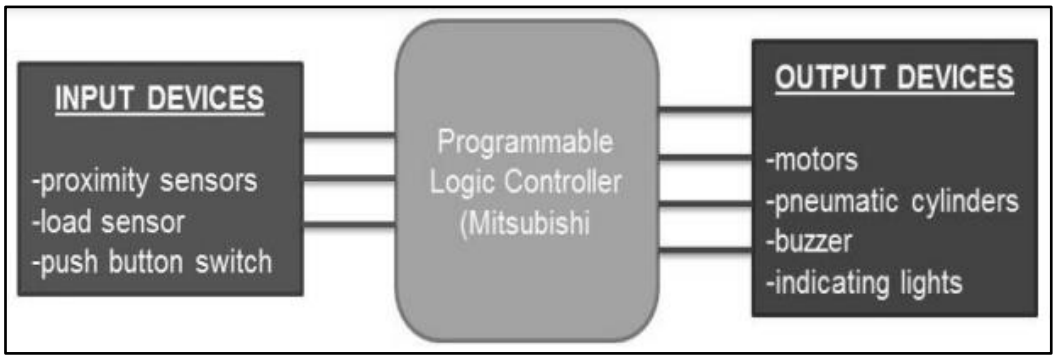

Figure 2.4: Conceptual framework for automation using PLC

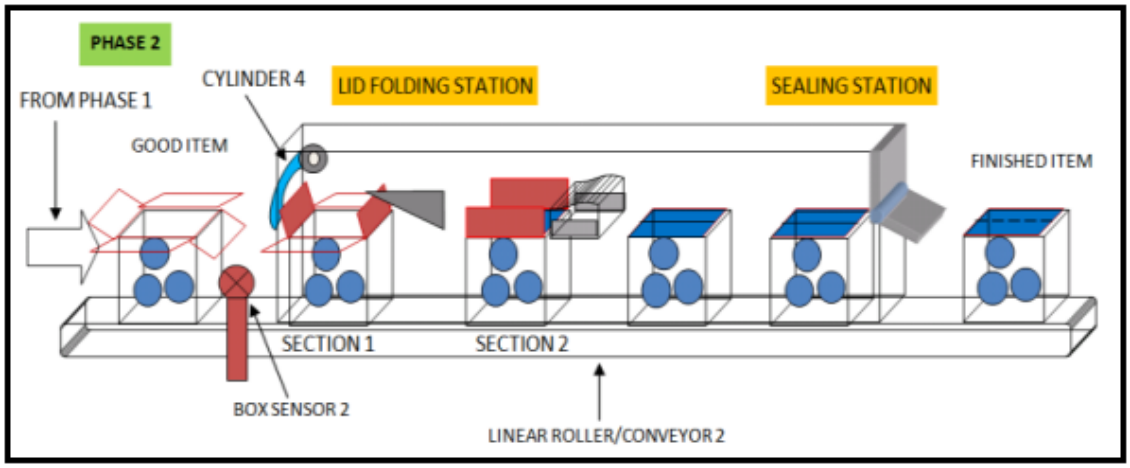

Figure 2.5: Design project flow for lid folding and sealing stations.