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

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

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Electronics Engineering Technology (Industrial Electronic) with Honours.

by

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I hereby, declared this report entitled MODULAR PRODUCTION SYSTEM (MPS) SENSOR'S AND ACTUATOR'S PREDICTION FOR MAINTENANCE USING PROGRAMMABLE LOGIC CONTROLLER is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Pada masa ini, dengan revolusi industri 4.0 (IR4.0), kebanyakan industri telah menggunakan mesin automatik. Tujuan projek ini adalah untuk mengkaji ramalan penyelenggaraan untuk penderia dan penggerak dengan meggunakan pengawal logik boleh aturcara (PLC). Penderia dan penggerak sangat penting dalam industri yang menggunakan sistem automasi. Di samping itu, untuk mengetahui kerosakkan pada penderia dan penggerak adalah luar daripada kemampuan manusia. Oleh itu, kegagalan mesin automatik semasa operasi dapat dielakkan dengan menganggar jangka hayat penderia dan penggerak dalam sistem ini. PLC digunakan sebagai media penghantaran untuk memberi arahan kepada MPS, dimana setiap pergerakan dalam MPS dikawal oleh atur cara PLC. Sistem Pengeluaran Modular (MPS) adalah mesin automatik yang mempunyai penderia dan penggerak untuk sistem automasi di dalam industri. Data kitaran penderia dan penggerak dikira dan disimpan oleh PLC dan dihantar ke skrin HMI. Antara muka mesin manusia (HMI) adalah antara muka grafik yang membolehkan manusia dan mesin berhubung. Paparan keadaan lampu pada skrin HMI akan menunujukkan keadaan penderia dan penggerak. Keadaan lampu yang dipaparkan adalah berdasarkan skala jangka hayat yang telah ditetapkan. Sebagai contoh, pengguna perlu menetapkan skala untuk minima, sederhana dan maksima dari nilai purata jangka hayat. Jadi, jika nilai kitaran penderia dan penggerak pada skala minima, skrin HMI akan memaparkan lampu hijau. Seterusnya, jika nilai kitaran penderia dan penggerak pada skala sederhana, skrin HMI akan memaparkan lampu kuning dan jika nilai kitaran penderia dan penggerak pada skala maksima, skrin HMI akan memaparkan lampu merah. Sebagai kesimpulan, projek ini dapat membantu industri dalam membuat persediaan untuk penyelenggaraan mesin. Tambahan, ia juga dapat mengurangkan kehilangan pengeluaran dan kos alat ganti.

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 be estimating the lifespan of sensor and actuator to avoid the automatic machine failure during the operation. 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. The state of lamp depends on the range of lifespan of sensor and actuator that has been set. For example, the user needs to set the range of minimum, moderate and maximum of the average lifespan, so if the value of cycle sensor and actuator at the minimum range, the HMI screen display the green lamp. If the value of cycle sensor and actuator at the moderate range, the HMI screen display the yellow lamp and if the value of cycle sensor and actuator at the maximum range, the HMI screen display the red lamp. As conclusion, this project may help the industry in preparation of machine maintenance. Moreover, it helps in reducing production loss and cost of spare parts.

DEDICATION

To my beloved parents, my friends and my supervisor, Ts. Shahrizal Bin Saat was inspired during this project besides their full support, encouragement and guidance.

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CHAPTER 1

INTRODUCTION

1.1 Background

Recently, the modern industry has used fully automatic machines. Automatic systems are highly regarded in the industrial world as they guarantee the quality of the manufactured products, shorten the production time and reduce the human workers costs. One of the most popular controllers is the Programmable Logic Controller (PLC), particularly for the sequential system. PLC is characterized as an advanced electronic device with programmable memory to store guidelines that to perform specific capacities. For example, logic, sequence, time and arithmetic to control the industrial machine or modern procedure as wanted. The PLC can perform persistent procedures as indicated by input variables and decides decision as indicated by the programming requirements so that output values remain in charges. Then, we need an interface to monitor and control the works of PLC that connects humans to computer technology. The interface is called the Human Machine Interface (HMI). HMI can be manually or by using real time computer visualization in the form of controlling and visualizing the status.

Modular Production System (MPS) is a one of automatic machines that used the PLC controllers for control the sequence of each station. MPS are used as a plant in industry which it has a sensor's and actuator's for automation system. Other than that, the sensor's and actuators have their own lifespan how many cycles can detection or operating hours. The life span for each sensor for detection limit about 300 000 cycles while for the actuators is 120 000 cycles. But it also based on the types of sensor's and actuator's. For automation system, sometimes the failure of sensor and actuator are unseen by eye, so the worker did

not notice the fault happens. This is one of the causes of production loss during operation. Therefore, the development prediction system for maintenance for overcome this problem. Then, for the prediction system in this project is to design a PLC instruction that will detect the failure sensor and actuator during the operation. The instruction in PLC consists the differentiate up and increment, for counting the cycle of sensor's and actuators and timer for detect the failure.

1.2 Problem Statements

Nowadays, with the increasing demand for technology in machining and manufacturing, the complexity and integration of industrial machinery and equipment has increased dramatically. The prediction for maintenance is needed to reduces the affected of quality, cost and production because the limitation of human ability to find out the damage of sensor and actuator. Then, when faults occur, the maintenance did not notice. So, the production will be disrupted and production losses would be huge. But, with early detection and prediction it will be avoid from failures increasing and eventually turning into critical problem.

Besides, monitoring the condition of machines manually is tedious due to the large number of machinery present on industries. The strategy to prediction lifespan of an equipment is ensure that the equipment in good condition without failure during running a production. On the other hand, advanced information and communication technologies such as smart devices now help skilled workers to execute scheduled maintenance services such as replacing parts or equipment at the optimum time. Other than that, frequent of detection cycle sensor and actuators can be shorten the average expectancy lifespan. So, with these systems can estimate the lifespan of sensor and actuator before its failure.

1.3 Objective

The objectives of this project are as follow:

i. To utilizes existing conventional sensor and actuator for maintenance prediction system by manipulating a data process by Programmable Logic Controller.

ii. To reduce risk of emergency operation shut down due to sensor and actuator failure by monitor predict the remaining life time of a sensor and actuator by using Human Machine Interface (HMI).

iii. To analyse the count of cycle detection for lifespan expectancy of sensor and actuator.

1.4 Scope of Project

The scope of the project is the is the development prediction system for maintenance of machines in industries by using the Programmable Logic Controller (PLC). The system only uses at industry. In the industry, have automatic machine such as modular production system which is consists of smart sensor and actuator will control by PLC and sent the data to HMI. Next, the PLC will control the prediction for maintenance of machines by design the programming at PLC software. The scope of this project would involve in implementing and testing of the prediction maintenance in a laboratory. This project will be divided into two parts which is software and hardware development. Thus, the scope of this project is firstly, design the programming by using PLC software. Then, connect the PLC to the MPS to predict the failures of the sensor and actuator. Lastly, connect the HMI to the PLC as the output to display condition of machines.

1.5 Contribution of Research

Contributions of this proposal are made in the following terms:

i. By identifying and solving the maintenance problem in this project, it is estimated that unscheduled stops and maintenance cost can be reduced effectively.

ii. By monitoring the cycle of detection sensor and actuator in this project, it can improve the product warranty and extend the life on the asset.

iii. By development predictive system for maintenance, it can cut the inventory cost by only replace the sensor's and actuators if it reaches the limit of cycle.

1.6 Thesis Outline

This thesis is separated into five chapter:

- Chapter 1. Illustrate the background of this project, objective, problem statement and the scope of this project.
- Chapter 2. In this part, providing the complete research writing of the method or technique of the prediction maintenance for sensor and actuator. In this theory likewise incorporate the information and hypothesis are required for this project.
- Chapter 3. Describe the technique or method are utilize to accomplish the objectives of this project. This chapter also discusses the software program and hardware wiring.

¶ Chapter 4. This part discusses the result of the overall progress made in the development of prediction maintenance for sensor's and actuator's using the Programmable Logic Circuit and Modular Production System.

¶ Chapter 5. Explain the conclusion of the overall report after the development of the project is complete. Other than that, limitation and recommendation of the project also will be describe in this chapter.