Research Proposal for Bachelor Thesis

Usage of Raspberry Pi Running OpenPLC Controlling FactoryIO Advanced Sort By Height Scenario

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Introduction

Many manufacturers nowadays always look for a way to maintain high-efficiency production to produce more products in less time or even better yet can reduce the workforce required. Industrial automation is one of the solutions for this once-dreamed solution to be true.

A Programmable Logic Controller of just better known as PLC is a system that a specialized computer used for the Industrial Automation process. These kinds of systems can automatically handle a specific process, a machine function, or even an entire production line. PLC works as a main central hub from all input sensors or devices, triggering various outputs based on the pre-programmed parameters.

Some of the popular PLC manufacturers:

- Siemens
- Omron
- Allen Bradley
- Honeywell
- Schneider Electric (Modicon)
- Mitsubishi

However, a programmable logic controller is usually very expensive and can be very costly to maintain. Especially for a low to the medium-scale manufacturer. An alternative can be used to replace the PLC. One of the popular alternatives used is the Raspberry Pi.

The Raspberry Pi is a credit-card-sized pocket computer that can be programmed according to the user's requirements. This research paper will be focusing on using the Raspberry Pi with the OpenPLC API that can transform the Raspberry Pi into a low-cost programmable logic controller substitute.

OpenPLC is an open-source Programmable Logic Controller that acts as a fully functional and standardized PLC by IEC 61131-3 standard. The OpenPLC will be installed to transform a Raspberry Pi into a low-cost PLC substitute.

Using the Modbus TCP/IP communication protocol as the bridge between the Host Computer would act as the HMI and the Raspberry Pi as the PLC and the FMS Simulator acting as a factory simulation.

Literature Review

The 21st centuries industrial system relies on the automation system to be efficient and cost-effective. In order to achieve such high requirements, an automation system was created as the answer to the problem. In the early 20th century. They were initially only able to do simple, and repetitive tasks. And they helped to keep the quality consistencies

Nowadays, most automation systems can handle the most complex tasks, even doing full production lines. However, one of their weaknesses is they still need to be pre-programmed by humans. Although one day AI could potentially replace this.

The Objective of the Thesis

Using a Raspberry Pi as the Substitute for a PLC system running OpenPLC controlling sort by height (advanced) in the Factory IO software

Empirical Method and Structure of the Thesis

The first part of the Thesis should have introduced the automation industries and the history of programmable logic controllers (PLC) usage in the industries and the benefit to the manufacturer.

The Main Part of the thesis should have covered how Raspberry Pi can be used as a substitute controller, from the beginning installing the required software, firmware, and hardware required to connecting the Computer to Raspberry Pi to the target automated cycles using the Modbus Protocol system. A Computer will act as a Human Machine Interface acting as one that programs the automation scripts for the PLC and also does the central control monitor for the whole system to work correctly.

The final part of the thesis should cover how it can be implemented in a real-life world scenario where the factory can be installed the raspberry pi to be able to program the machine remotely.

Research Methodology

The research will be conducted through multiple software in order to make sure it could work before it can be applied to the raspberry pi.

- Using Control Development System (Codesys) first to code and simulate the Ladder Logic Diagram (LLD) program and using the Codesys Local Simulated PLC to test the code is error-free
- When all the code simulated in the Codesys is ensured error free then it is imported to the OpenPLC editor.
- After it successfully imported to the OpenPLC, the data continued to be downloaded to the Raspberry Pi that is already running the OpenPLC and be connected with the Factory IO Software

- The whole control is in the FactoryIO

References

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What is a Raspberry Pi? (2015, August 20). Raspberry Pi.

https://www.raspberrypi.org/help/what-+is-a-raspberry-pi/

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