Real Time Automated Process Controlled by Using PLC and LabVIEW

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Abstract: The main idea is to interface Labview and PLC for easy and efficient process control by using MLPI (Motion Logic Programming Interface) toolbox developed by rextroth for easier and efficient process control. This project of interfacing two most powerful technologies ruling the industries end in many new features like acquiring data at a faster rate, controlling the strategy accurately, providing Multi-Tasking operations, Remote controlling and a number of other features. The LabVIEW and PLC integration for monitoring and controlling parameter provides high-speed monitoring and connectivity to enterprise-level systems or plant. Used correctly, multithreading offers numerous benefits including more efficient CPU use, better system reliability, and improved performance on multiprocessor computers. Thus, the PLC has been interfaced with LabVIEW and a number of other real-time processes are controlled.

Keywords: LabVIEW, MLPI (Motion Logic Programming Interface), PLC, Real-time communication.

1. Introduction

A Programmable Logic Controller (PLC) or Programmable Controller is additionally an informatics system used for automation of electrochemical processes, like control of machinery on factory assembly lines, amusement rides, or lights. The PLC is supposed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to manage operation are typically stored in battery-backed or non-volatile memory. A PLC is an example of a difficult real-time system since output results must be produced in response to input conditions within a bounded time. Otherwise, the unintended operation will result. Programmers develop software applications daily to extend efficiency and productivity in various situations.

LabVIEW (Laboratory Virtual Instrument Engineering Workbench), sort of a synthetic language, maybe a robust tool that may be reception with help to realize these goals. LabVIEW is additionally a graphically-based communication developed by National Instruments. Its graphical nature makes it ideal for test and measurement (T&M), automation, instrument control, data acquisition, and data analysis applications. This lands up in significant productivity improvements over conventional programming languages. National Instruments focuses on products for T&M, giving them an honest insight into developing LabVIEW.

The LabVIEW graphical programming paradigm simplifies the event of your distributed monitoring and control systems. Creating your application is as simple as dragging and dropping graphical functions and wiring the objects together to make a dataflow program. Built-in libraries include resources from general programming functions to powerful, application-specific routines. Construct interactive user interfaces from many included objects, like charts and graphs, numerical representations, and Boolean operators. LabVIEW also features robust debugging tools, including probes, breakpoints, execution highlighting, and thus the pliability to single-step through code.

The information development is sophisticated by the combo of hardware and code that exists in plants and therefore the limitation of ancient systems. we are able to incorporate LabVIEW into existing system to feature measurements and analysis to processes to collect advanced information and convert it into helpful info. in addition, through the openness of LabVIEW we are able to connect and supply the data wherever it's required, whether or not that's in a very information, accessible on an online based mostly dashboard, or provided into the present plant management hardware. we are able to even use LabVIEW to shut feedback loops and perform advanced management operations mistreatment the provided info.

A. PLC to LABVIEW integration

To regulate the operation of various control schemes, a PLC and LabVIEW-based control system is being created. LabVIEW compared to the logic of the ladder. Saving historical information in a database is also comparatively simple.

Interfacing both LabVIEW and PLC will combine the Reliability of PLC’s for control and flexibility of LabVIEW for HMI. A LabVIEW program is used for displaying PLC values to the user and allowing the user to regulate PLC elements. The PLCs are programmed to work flawlessly to detect if they lose communication with each other or the PC.

Both process and equipments manufacturers are under the pressure, to maximize efficiency, reduce downtime, and
improve yield. Manufacturers recognize that the key to making these improvements is timely and accurate flow, logging, recording and analyzing the information. However, information development is complicated task because of mix of hardware and software that exists in plants and the limitation of traditional systems. It can incorporate LabVIEW into the existing system to add measurements and analysis to the processes to gather complex data and convert it into useful information. Additionally, through the openness of LabVIEW can connect and provide the information where it is needed, whether that is in a database, available on a web-based dashboard, or provided into the existing plant control hardware. can even use LabVIEW to close feedback loops and perform complex control operations using the provided information.

A personal computer (PC), with National Instrument LabVIEW Version 2015 is used to develop the HMI layer. LabVIEW VI can implement HMI functionalities such as sense the level, ON/OFF of Motor and Solenoid Valve etc. LabVIEW works like a Master and PLC as Slave. PLC will work on the control system, real-time access and store various sensor signals after receiving the control command from the PC. It was easy to develop an automated system using PLC and LabVIEW via Ethernet. MLPI SDK for LabVIEW that is design to facilitate communication to a device.

2. Methodology

The MLPI (an acronym for Motion Logic Programming Interface) is additionally a programming interface and a component of the Open Core Interface (OCI). It's reception with writing applications to configure and run motion controllers supplied by Bosch Rexroth AG which supports the MLPI technology, like IndraMotion XLC/MLC 13VRS and newer.

Using PLC Function Blocks to program a tool employing a PLC task, the MLPI allows programming the device employing a higher-level communication and a third-party development environment, like National Instruments LabVIEW. The "mlpi4LabVIEW" libraries are designed to be reception with writing user applications with "National Instruments LabVIEW". The MLPI has the possibility of user-specific account management supported the function layer, meaning a user account the owner of a group set of permissions to execute only a group scope of MLPI functions on the control. The relations between the user accounts and their permissions are described during a manifest accounts.xml on the control. Something that require to be considered when accessing I/O devices of assorted buses. At first be familiar with that the bus configuration is compiled into the PLC application file, this means we would like a compiled and downloaded PLC project to any of the bus devices (onboard, inline, Profibus, sercos IO, etc...). Whether or not do want to jot any PLC code, should download (login) a legitimate PLC project and begin the PLC to activate the bus drivers.

In order to access PLC variables through functions of the Logicalis by symbol, then these functions should be a part of the symbol configuration. add variables to the symbol configuration by using the dialog 'symbol configuration' which might be found within the logic configuration of the Indra Works project.

MLPI provides the mlpi4LabVIEW toolbox with an extensive and comfortable set of VIs and CTLs within the LabVIEW add-on palette mlpi4LabVIEW. MLPI Applications require an established connection to the target device. In order to establish a connection, it is required to use the Connection control method with the correct connection parameters. These connection parameters must contain the user credentials as defined in Usage and additional connection parameters. The success of the connection establishment relies on the correctness of the provided. Once the connection has been recognized, it is possible to obtain information and perform other actions on the target control as long as the permissions for the exact library methods are correctly configure as. It is suggested that one connection is established at the creation of each application and closed until all the required MLPI functions of each application have finished.

3. Configuration and Implementation of LabVIEW

The information development is complicated by the combination of hardware and software that exists in plants and therefore the limitation of traditional systems. We can incorporate Lab VIEW into existing system to feature measurements and analysis to processes to collect complex data and convert it into useful information. Additionally, through the openness of Lab VIEW we can connect and provide the information where it is needed, whether that is in a database, available on a web-based dashboard, or provided into the prevailing plant control hardware. We can even use Lab VIEW to close feedback loops and perform complex control operations using the provided information. MLPI enable the communication between PLC controller and Lab VIEW. Ethernet channel of PLC is selected for communication channel. MLPI provides read/write flexibility to Lab VIEW and PLC. LabVIEW a software machine interface is given by below steps:

1. PLC connects to LabVIEW through Ethernet
2. MLPI contains a group of tags defined by address and data type of respected variable in controller. In Lab VIEW we have bound variables of front panel
with respected tags of mlpi server. Data binding property of variable provide connectivity with respected MLPI toolbox in Lab VIEW. We give the addressing of the input/output variables as per the syntax of the PLC and the data type of the variable can be selected from the drop-down menu. This arrangement develops real time system.

3. On online mode of PLC and Lab VIEW with the healthy configuration we can make monitoring and control system with Lab VIEW as an SMI (software machine interface). Lab VIEW is employed as an SMI (software machine interface) in project. Lab VIEW provides graphical programming.

Lab VIEW software has two parts front panel and block diagram. Front panel is the GUI wherein the operator sets the input parameters as per the requirements along with various graphical and pictorial representations of the process. And the Block diagram executes the sequential logic and predefined algorithm in the form of G-programming (G graphical)

4. Working with the PLC and the I/O Configuration

Working with the PLC and the I/O configuration there are a few things which need to be considered when accessing I/O devices of different buses.

5. Result

• The final program is like shown below

To work with the real time process control first have to configure the suitable plc in Indra Works software which enables open core engineering and chooses Ethernet for communication. After the healthy configuration build the logic diagram and assign the input and output variables if no error in logic then to create the symbol configuration. Once done the above procedure and attend online from IndraWorks engineering.

Below is a sample program.

Fig. 2. Procedure identification

Fig. 3. Sample program

a. Create ladder diagram and define the variable, build the program
b. There after click on symbol configuration
c. Here select them to access them from the LabVIEW program, build and generate code
d. Now an instance path is created for each variable which is used in LabVIEW program to access those variables for both read and write.

Fig. 4. Block diagram

• Create a vi as in steps below to access the variables from the PLC directly
• Open LabVIEW icon from desktop and select blank vi
• Now select Connect icon from mlpi4Labview as follows(Function->Addons->mlpi4Labview->apilib->connection control->connect)
• Now create controls for address, user and password terminal on manage block.
• Now you have to add the VIs "Connect (mlpiApiConnect.vi)" and "Disconnect (mlpiApiDisconnect.vi)" to your block diagram, because they are necessary for all mlpi4LabVIEW projects.
• To do this please go to "Function->Addons->mlpi4LabVIEW->ApiLib->Connection control->Connect (mlpiApiConnect.vi)". The "Disconnect (mlpiApiDisconnect.vi)" VI for disconnecting is located beside.
• In the next step, you have to add one or more VIs from
the mlp4LabVIEW toolbox about a function you are interested in.

- for reading variable select read variable by symbol and for writing data select write variable by symbol (search on function palette) blocks as below figure and
- open the add-ons in function palette drag and drop the blocks which is required and paste the instant path for read and write variable and in order to assign the suitable data types.
- Now an instance path is already created for each variable in Indra works which is used in LabVIEW program to access those variables for both read and write. In the drop-down box shown below choose appropriate data type so as there would not be any error in reading and writing data.
- Now paste the instance path on the symbol in terminal of the Read Variable by Symbol block. The data terminal from the above block will give the current data of that variable in PLC. The VI has to end with the disconnect icon and an error panel to show error messages to user.
- Now you have to wire the "connection" terminals by using "connect wire" from the tools palette which you can find under "View->Tools Palette". Furthermore, you have to add a control element or constant to the "address" input terminal of the Connect (mlpiApiConnect.vi) VI because it's also a required input.
- Now, add all other recommended or optional elements like output and error terminals no matter if it's an input or output. Finally, you should be able to execute the project by clicking the "Run" button.
- After successfully executing the output form should be filled with values.
- At the end, your "FRONT PANEL" should look like that as shown in bellow.

With this procedure, you should be able to create your own easy LabVIEW project using the mlp4LabVIEW.

Fig. 5. Front panel

6. Conclusion

Users can advantage from PLC programming and flexibility with device platform selection and high-level programming language integration in machine projects. LabVIEW be able to act like monitoring software for acquiring all the field data of plc and act like SCADA. A LabVIEW program is used to show values of the PLC to the user, as well as allow the user to control aspect of the PLC. The PLCs are programmed to operate guaranteed such that they can detect if they lose communication with each other or the PC. Have presented a process of combining the benefits of PLC hardware and LabVIEW software suitability. LabVIEW code enhances the performance of systems while not outlay development time and allows handling the complexity of application. Therefore, the PLC will be integrated with LabVIEW for dominant many real time applications in trade for effective management of parameters.

References