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REMOTE CONTROL OF A ROBOTIC ARM USING THE OPERATOR PANEL

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Abstract: This paper presents the adopted solution for remote control via Ethernet of a robotic arm controlled by a Siemens PLC. PLC control interface is designed with a touch screen Weintek. This HMI control the local PLC, entering the coordinate on the axes X, Y and Z. The HMI command so the stepper motors which actions on the axis of the robotic arm. This presents the Ethernet interface to be controlled remotely. With authentication (user and password) you can interference on the displacement path of robotic arm. Subject allows the development in a virtual environment for e-learning and monitoring of actions (webcam).

Keywords: PLC, robotic control, HMI, remote control

INTRODUCTION

Introducing the programmable automations on a larger and larger scale due to their quality and working precision, as well as due to a good price/quality report, imposes them for the substitution of the old command schemes of equipment. More and more equipment are modified on their command part, a numeric command or the display of the realized quantities or of those to be realized being required. The use of programmable automatons together with the frequency converters makes the equipment safer, with a higher precision and a shorter time for realizing the product.

Through its conception, a programmable controller is adaptable for functioning in the industrial environment, it can operate in a large variety of temperature and humidity. It is easily adaptable to interfacing with any process and does not raise any special problems regarding the training of service personnel, due to the programming facilities it offers. The industrial robots appeared as a response to the human's need to automate the manufacturing processes, especially the repetitive ones. The main activities that industrial robots can carry out are linked to the transporting and manipulating of objects and also to realizing some processes (painting, inspection, assembling, etc.). [4]

The utilization of PLCs presents a series of advantages, among which the reducing of

manufacturing time and the decrease of costs are the most important. Mainly, any application that requires electric control needs a PLC. [3, 6]

The interface is necessary in the commanding and monitoring of the process realized by the PLCs, because they do not have a screen. EMT3070a is a touchscreen produced by Weintek Company, which facilitates the creation of a graphic interface for a high number of PLCs found on the market. [5]

THE SYSTEM STRUCTURE

Siemens PLC

The Programmable Logic Controllers are command and adjustment programmable automates that are used for industrial machines and processes. Their programming is done using dedicated software, developed by each PLC manufacturer, but having as common point the use of the Ladder Diagram (command electric schemes).

The Weintek interface

HMI – operator panel

HMI eMT3070A (Figure 1) is a touch screen produced by Weintek which facilitates the creation of a graphic interface for a large number of PLCs found on the market. EMT3070A series is the new generation of HMI from Weintek. This is more than a simple touch screen; it is capable of programming the PLC and of transferring data and programs among several similar devices from this producer. [8, 9]



Figure 1. The panel eMT3070A

One of the great advantages of this equipment is able to be put into an Ethernet network because of the network card provided. Placing into a network one HMI can be done in different ways and can use existing network or it can be create a network in which to operate. (Figure 2)



Figure 2. Different types of network protocol

The way the system is built allows implementation in any type of network and access the machine remotely via LAN or even WAN (Internet). This allows by default to the multiple users to be connected for monitoring or edit the process values in real time. Another advantage is email notification if a fault occurs, is set regular reporting or in case of predefined reports. (Figure 3)

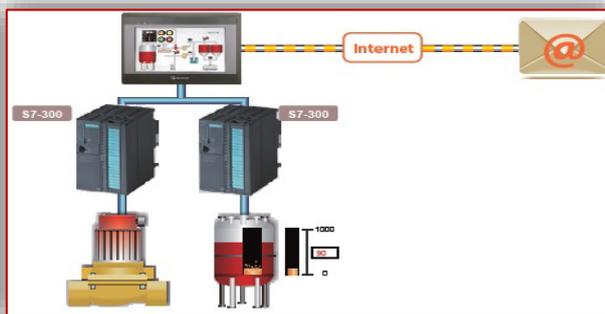


Figure 3. Email notification

EASY ACCESS – control software is the software which work with touch screens produced by Weintek and it becomes very easy to monitor and troubleshoot HMI and PLC that are at a remote location as long as Internet connection is available. As EasyAccess 2.0 already takes care of network settings and addresses security issues, the user can connect easily to the HMIs as if they were on the local network. (Figure 4)

EasyAccess 2.0 not only makes possible direct connection to a Weintek HMI, but also provides pass-through function that enables the user to connect to the PLC on the remote HMI's network. Consider an EasyAccess network as shown below where a PLC is within the same LAN network as the HMI. [7]

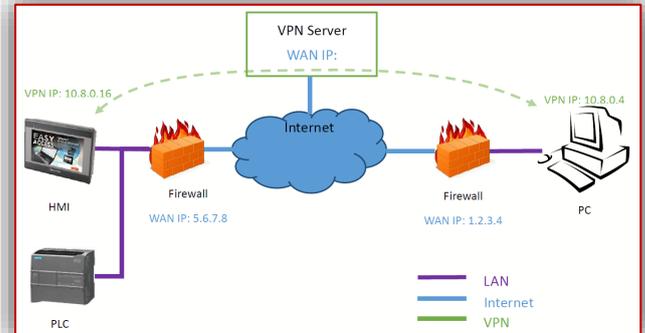


Figure 4. The EasyAccess network configuration

The HMI list (Figure 5) shows all HMIs registered in the current domain, and the HMI Group list shows all groups currently existing in this domain. The first column can sort the HMI by name, while the other columns can be set to show the following information: Private IP, Public IP, Activation Date, or Custom Field.

HMI Name & Type	Private IP
Demo-2 Type: eMT3070A	192.168.1.88
Default HMI Type: eMT3070A	192.168.1.33
Default HMI Type: MTB100E	192.168.1.68
nicolas Type: eMT3070A	192.168.1.44
Default HMI Type: MTB050E	192.168.5.23
Default HMI Type: eMT3070D	192.168.1.44

Figure 5. HMI Management



Figure 6. Different platform connections

In conventional HMI architecture, the operators must operate in front of the machine, and only one operator can access one HMI at one time. This way is very inefficient. Through remote control distributed architecture greatly improves the monitoring efficiency on the plant floor. The HMI can be flexibly

designed for multiple levels of operators (system engineer, plant manager remote technician, and etc.) to access the needed information anywhere in the plant floor at the same time and from different platforms. (Figure 6)

Remote control

Configure remote control

The HMI must have been activated in order to be connected using EasyAccess 2.0.

The activation status can be check it on HMI in the [EasyAccess2] tab of the System settings page (Figure 7). HMI's Hardware key will be required for insert in the web page of EasyAccess HMI Manager.

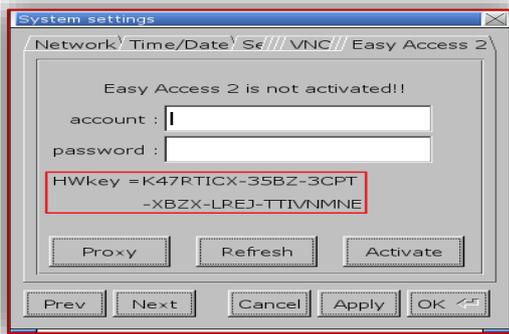


Figure 7. Activation status and Hardware key EasyAccess 2.0 service requires that each HMI belong to only one domain. If an activated HMI does not currently belong to any domain, once it goes online, it will obtain a set of Session ID/Password, which can be used to add the HMI to a domain. Therefore, once an HMI is added to one domain, it cannot be added to another one.

Application interface

HMI – operator panel

User interface that we have created for the simulation operation of robotic arm is made of five windows (main menu, X axis, Y axis, Z axis and animation (monitoring)). At the time of simulate, navigation between windows is performed using specific buttons (Function Keys).

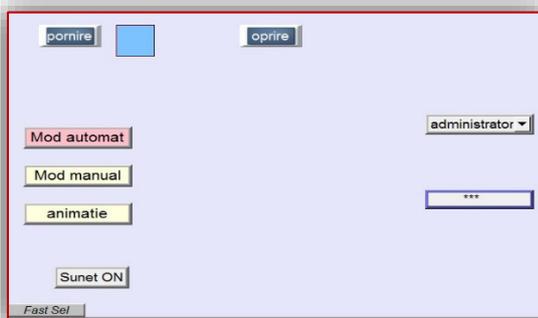


Figure 8. Main menu panel

Main Menu panel (Figure 8) present major information to any user, while having windows (screens) for additional axes robotic arm that works.

This panel consists of buttons with which we communicate with the other interface windows, buttons and switches automatic and manual start and stop the operation of the program. [1, 2]

Interfaces allows creating different security levels that can be divided into categories of users. Each user access can be set to different interfaces of the program, you can set up to 12 users whom have individual levels of security:

- » Administrator - has access to all buttons, windows and all functions available;
- » User - has access to all the windows but no to all buttons and available functions;
- » Guest - has access only to monitoring

To use the interface have to be logged with username and password preset.

Within the security level was used Option List Object button where have been defined usernames and passwords. (Figure 9)

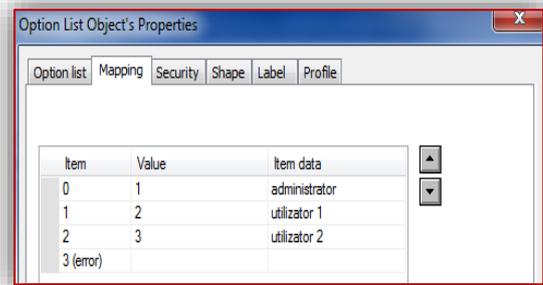


Figure 9. Usernames and passwords



Figure 10. The animation windows



Figure 11. The user window

In animation windows (Figure 10) robotic arm moves in X and Y directions and it can be set the values for manual mode, but just if we are login in

like Administrator. Another else we can only monitoring the moves on axis. [1]. In figure 11 we observe disappears of the Manual Mod for User account.

Through EasyAccess 2.0, if the customers is reporting a problem, which may or may not require inspection by an engineer, he can remotely connect to the HMI to investigate the problem. The customer needs no extra network configuration, just Internet connection. In addition, he can also update the HMI project, monitor the PLC by Ethernet Pass-through, or even update the PLC program.

CONCLUSIONS

The paper highlights the utility and importance of programmable automates in the control of the industrial processes, command the function over 3 axis of a robotic arm, in order not using CNC commands.

The interface has been designed so that the displacement moves on X, Y and Z of the robot arm to be controlled by using the eMT3070a interface. It allows to start and stop the application on the panel Weintek, as well as monitor the movement on the axes. With authentication (username and password) you can interference on the displacement path of robotic arm.

Implementation of multiple security levels provide a better organization in use by the program operators. Subject allows the development in a virtual environment for e-learning and monitoring of actions (webcam).

Note

This paper is based on the paper presented at The International Conference on Social and Technological Development – STED 2015, organized by the University for Business Engineering and Management, in Banja Luka, BOSNIA & HERZEGOVINA (1st and 2nd of October, 2015), referred here as[10].

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