HUMAN MACHINE INTERFACE (HMI). USAGE OF CLOUD HMI AND ITS COMPARISON WITH OTHER HMI SYSTEMS.

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Introduction

An HMI is the acronym for Human Machine Interface and in common it can be interpreted as an interface between the user and the machine. But such a term can include cell phones, personal and industrial computers, all household appliances, office equipment, etc. However, an HMI is much more specific to manufacturing and process control systems, where it's become widespread because of possibility to provide a visual representation of a control system and information about industrial process in a "real time" mode. These features lead to the productivity increasing of the controlled processes.[1]

General aspects of HMI.

According to all information, which was described before, HMI is a set of technical tools for providing direct interaction of user and technical equipment, which allows user have a constant monitoring equipment operation and condition.

An HMI is the centralized control unit for manufacturing lines, equipped with Data Recipes, event logging, video feed, and event triggering, so that one may access the system at any moment for any purpose. For a manufacturing line to be integrated with an HMI (it is shown in figure 1), it must first be working with a Programmable Logic Controller (PLC). It is the PLC that takes the information from the sensors, and transforms it to Boolean algebra, so the HMI can decipher and make decisions.

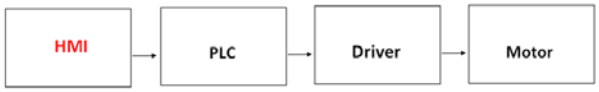

Figure 1. Manufacturing line integrated with an HMI

There are two basic levels of HMI: supervisory level and machine one. Supervisory level HMI is designed for control room environments and used for system control and data acquisition (SCADA), a process control application which collects data from sensors on the shop floor and sends the information to a central computer for processing. Machine level HMI uses embedded, machine-level devices within the production facility itself.[2]

In general HMI has two parts, which are control device and driving system. Control device is a part of the system, which receives human's impact and starting actions. As for driving system, it is a set of interconnected devices used for an exact purpose by performing their own functions.

The main rules and principles of HMI constructing

1. Control devices must be directly identified in all exact conditions and their replacement must permit safe and fast execution of all operations.
2. Control device must perform only tasks according to the goals of usage of this device.
3. The system must be constructed and adjusted so that user's actions will not lead to indefinite and dangerous condition of the parts of system.
4. Dialog of HMI and a user must be based on aspects of ergonomics, appropriate specific problem.
5. It is recommended for excluding the dangerous consequences because of operator's errors to do the next:

- Exact priority of commands (for example, the command "STOP" has a higher priority than the command "START»);
- Possibility to lock the control by the system;
- Operation in jog mode.

6. Groups of control devices must be situated according to the priority, their functions and interconnections, the sequence and frequency of devices usage, the cases of work, such as normal, critical, etc.[3]

Cloud Human Machine Interface

Cloud HMI is an innovative HMI architecture. It has many prospects in the future and its full potential is yet to be revealed.[4]

Normally a cloud based HMI consists of a server and a visualization device.

The server device connects with controller and proceeds protocol conversion, data logging, event logging, recipe, database maintenance, macro commands execution, etc. Usually plants install the HMI software itself on secure servers, or even virtual servers, and using web browsers or special applications access the control screens.

Many electronic devices with screens can be used as the visualization device. That is why the visualization function can be perfectly integrated into, for example, iPad with the powerful Cloud HMI software.

Advantages and disadvantages of a cloud based system

A cloud based system has the following advantages:[6]

1. The cloud model itself.

The very reason that cloud based applications are gaining traction is that there is no need to deal with all of the problems associated with owning software. The cloud gives you functionality of the software without the aggravation of installing and maintaining the program itself.

2. Cost

The way companies make money offering a cloud version of their application is to charge consumers for its use. This is the SAS model, and the per-month cost can be very attractive, especially if you have a lot of workstations that you need to deploy. You also don't need to have the 'hosting' hardware (a server, or two) and don't have to pay for operators to backup the software or, more importantly, keep it current.

3. No obsolesce

The hosting company is going to make sure that you are always running the latest version of the product. This also ensures that all of the instances of your system will be running the exact same version of the application.

4. See your screens from anywhere

It is very easy to set up access to your control screens from any Internet connection.

However, there are also some problems with a cloud based system:[6]

1. Security problem

It is very easy to set up access to control screens from any Internet connection. This means that there is a possibility to have someone exploits your information. If one of any number of hackers discovers your interface there can be a potential problem.

2. The network connection

When a cloud based HMI is used you have the internal network to. Putting all data in the cloud adds one more point of failure.

3. Loss of data

All the company hosting your application cares about is their monthly fee. That is why if your company can't afford to pay the fee in the end there will be absolutely no HMI/SCADA software left.

Comparison of cloud HMI architecture with traditional HMI architecture

When a traditional HMI architecture is used (Figure 2), each workstation is equipped with one HMI. If any of the HMIs stops working, the machine is out of service.[5]

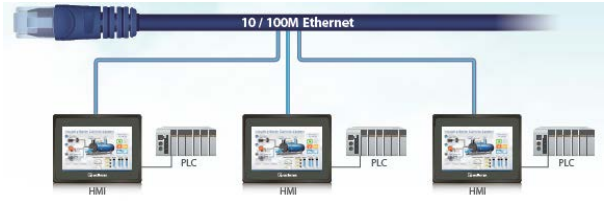

Figure 2. A traditional HMI architecture

When a cloud based HMI architecture is used (Figure 3), servers are situated in the cloud and they are connected to PLCs. The visualization device can be a wireless iPad or wired screen. Each visualization device can access any server with hot-standby mechanism. If any visualization device is out of service, another visualization device can take over operation without interruption.

Figure 3. cloud based HMI architecture

Let's take two widely spread companies on the markets of cloud based HMIs and traditional HMIs and compare their products (Table 1).

	cMT-SVR-100 (WEINTEK) – cloud based HMI	EA7-T6C (C-more) – traditional HMI
Display	1024x748	5.7"
CPU Type	ARM Cortex A8 600MHz	32-Bit RISC CPU 333 MHz
Memory	256Mbytes	32 Mbytes
I/O Ports	COM1 RS-232, COM2 RS-485, COM3 RS-485 USB 2.0 x 1 SD/SDHC card slot Ethernet10/100/1G x 2	Serial PLC Port: RS-232/422/485 USB Ports Ethernet 10/100 Base-T
Supply Power	24 VDC	24 VDC

Table 1. Comparison of cMT-SVR-100 and EA7-T6C

It can be seen that most features of the cloud based HMI are more advanced, that is why using of this architecture is more beneficial.

The idea of cloud based HMI is gaining in popularity. It can be predicted that over time more and more of technical processes will be moving into the cloud, and this will bring many benefits and possibilities.

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