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Automation Dashboard for Industrial IoT Applications

Providing users with cross-platform, cross-browser data access and user interface based on HTML5 technology

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Supervisory Control and Data Acquisition (SCADA) systems, software and hardware are used in automation and control in the electrical power, chemicals, oil and gas, food and beverage, manufacturing and other industries. That is because SCADA solutions offer such benefits as real-time detection of machine faults, output defect reduction, and cost savings. In the electrical and oil and gas sectors, SCADA systems reduce losses and optimize production.

Thanks to such benefits, SCADA deployments are expanding. Analysts forecast SCADA components to have a compound annual growth rate of 5.2 to 6.6 percent over the next five to seven years.

Another growing technology is the Internet of Things (IoT). Tens of billions of devices will be connected by 2020, according to Cisco. The networking company says there will be a four-fold increase in connected devices at the end of the decade as compared to the number in 2010. A significant fraction of these will be in industrial applications. This means there will be a proliferation of sensors and data, as well as an expanding pool of devices available for accessing this data and exercising control via SCADA.

This presents challenges but solutions built upon HTML5 technology can overcome them. The result will be cross-platform viewing of data and implementation of control functions.

SCADA Challenges

To see why IoT creates issues for traditional SCADA solutions, consider how these systems have been designed and deployed in the past. Years ago, control and automation systems were stand-alone and separate.

Often, the critical nature of the functions carried out meant that such systems had limited access to the outside world. They also had a designated human-machine interface, an HMI, which handled nearly all day-to-day interaction between the control system and operators. To ensure the highest possible system safety, security and reliability, the HMI might be the only way for anyone but a developer to access the SCADA system.

Over time, these systems were integrated into an industrial network that connected everything on a plant floor together. This made it possible for vital data to flow from a factory floor or similar location to a management network and vice versa. Typically, though, the points of connection were strictly limited and restricted, again for safety and performance reasons.

Thanks to this setup, SCADA software has traditionally been designed for specific screen sizes and orientations. A designer, for example, might lay out buttons and gauges on a touch screen that is known to be 20 centimeters or more diagonally, with a fixed aspect ratio between the width and length. The designer would then place a

certain number of items on the screen. The goal would be to maximize usefulness to and productivity of an operator, with tradeoffs made between element size, readability, usefulness, and resulting HMI complexity. Human factor considerations, such as the size of fingers and the consequent need for a certain button dimension, also played a role.

However, the growing proliferation of connected devices is fundamentally changing this picture. For one thing, the increasing connection between SCADA systems and the outside world means that the display screen is no longer as fixed as it once was. Before the HMI might run on a screen measuring 18 centimeters, or seven inches, on a side, with no other option now, displays used for data viewing and control functions might range from that of a smartphone to a tablet or a desktop computer. While smartphone displays have gotten steadily larger over the years, there is still a significant difference in the size of a smartphone's screen and what can be found on a desktop.

Since this involves displaying information and buttons, more than physical screen real estate is involved. What is important is resolution, and this varies significantly between devices. A high-end phone, for example, may have a screen of 1080 x 1920 pixels while high performance desktop systems may have a 5120 x 2880 pixel display. Tablets have yet another configuration, as do other phones and devices.

Thus, SCADA access now may come using a variety of displays, all with differing resolution and orientation. Indeed, the aspect ratio of the screen may change, as happens when a phone or tablet is switched from a horizontal to vertical orientation or vice versa.

An additional challenge arises from the IoT. The Internet of Things means that there will be a great many more sensors, with these providing what may be critical information on machine health, process conditions, or both. Such data may be what was traditionally captured by a SCADA system. However, it is likely that what is generated by these sensors will be much more extensive than anything coming out of a traditional SCADA setup.

This, then, gives rise to the second great SCADA challenge. There will be much more data produced by all the new sensors. This will lead to cross-platform applications that make use of this flood of data and the greater connectivity. Consequently, a SCADA system will find itself in an environment that is much more complex than what has been the case in the past.

So, SCADA information will be displayed on a wider range of devices than was the case previously. Some of these will be remote and some will come from non-traditional suppliers. Yet for all that, the basic needs that the system must meet will not change. Information will still have to be displayed in a way that makes sense

to users, while control and other functions must be carried out. This will have to take place in a setting that is more complex and variable than before.

Solve SCADA's Problems and Benefit

Fortunately, the new technology landscape contains solutions to such challenges that also can create new benefits. This comes from using the power of HTML5, the fifth version of the hypertext markup language standard. It is the core language of the IoT.

Adopted in October 2014, HTML5 is an improvement over its predecessors because it supports the latest multimedia as well as allowing application programming interfaces for complex web applications. Additionally, it has features designed to make it work better on low end devices. This includes loading and running faster while allowing for higher quality video and audio content. In turn, this means that graphics can be more detailed.

Also, the greater performance means that applications can be more intelligent. The power this offers gets a further boost because HTML5 applications are quicker to design and modify. What’s more, the debugging process of any application is faster because of the features built into the language.

Importantly for SCADA applications, HTML5 allows for the correct scaling of graphics, images and text on any size or orientation screen. This scaling is uniform. Consequently, what is on a SCADA display need no longer be tied to one fixed

screen layout.

What is needed, of course, is an HTML5 capable web browser. For SCADA applications, there also must be enough screen real estate for information to be readable and buttons big enough to be pushed. With the ability to zoom in or out and pan around as needed, though, even small screens can offer large functionality.

With HTML5 and web access, it is possible for users to browse and monitor a SCADA-controlled process using virtually any device at any time and at any place. Thus, this solves the problems presented to SCADA displays by the new era of connectivity.

However, HTML5 offers a vital additional benefit: it is the connective link for the Internet of Things. Many IoT devices generate data, with examples being sensors that report on the characteristic vibration of a machine, its temperature, the temperature of a room, and other environmental conditions. This information must be sent to servers, which then can distribute the data. From there, action can be taken, such as scheduling preventive maintenance for a machine that is showing signs of wearing out. There must, however, be communication between the data generator and the server.

What's more, this communication must be full duplex. With such a two-way link, either end of the connection can initiate a data exchange. A final key characteristic that must

be present is that the communication must have low latency and little overhead. These requirements are important in an IoT setting. After all, a sensor generating data may not transmit much or often, but when it does need to send information there should not be a big computational penalty. The billions of IoT devices that will be connected will not happen without a flexible and powerful connector.

The Websockets protocol built into HTML5 does just that. Although designed to be implemented in web browsers and web servers, Websockets can be used by any client or server application. Using this technology leads to a low overhead persistent connection between the client and the server, one in which both can start sending data at any time. This capability is a leading reason why HTML5 has become the language of choice for IoT applications.

What this means is that an HTML5-capable browser and associated software are well suited for the IoT environment. The power of HTML5 makes it possible to easily develop an IoT application. This could be used to allow fast and stable integration of third party data, such as the information generated by sensors. That makes it feasible to then take advantage of the flood of IoT devices and the data they capture.

As this shows, HTML5 solves the problems created for SCADA systems by screens of varying resolution and orientation. Additionally, the latest version of the hypertext markup language also makes it possible to incorporate information from IoT devices into a SCADA scheme, thereby extending the reach of a solution while enhancing its

usefulness and value.

Typical applications

Seeing examples of how such a setup would work illustrates the advantages of this approach. Typical applications are found in managing a factory floor, as well as monitoring photovoltaic operations or a facility.

In the case of the first of these applications, the ability to gather data from an array of sensors allows an HTML5-based solution to improve the effectiveness of factory automation and control setup. For example, integrating machine vision, motion and robotics leads to enhanced production, with less waste, fewer defects or rework, and tighter product specifications. What's more, additional data and greater connectivity allows the energy supply to be optimized and consumption reduced, thereby cutting operating costs. Production can be monitored and adjusted remotely, improving traceability and flexibility.

A final point about using this technology on the factory floor is that equipment can be monitored, enabling more intelligent maintenance. It may be possible, for instance, to lengthen the interval between scheduled downtime of a machine. That increases uptime and system throughput, leading to lower costs.

Utility sized photovoltaic operations, a second possible application, involve large facilities, with these often located at significant distances from one another. Since

electricity storage can be expensive, a utility must adjust what it gets from its solar cell arrays to meet demand. This can be done by altering the tilt of the panels with respect to the Sun or by taking parts of an array offline. This tuning of electricity production must account for cloud cover, rain, and other weather factors at individual locations.

Combining the data from sensors with what is produced by the array itself and that coming from customer or network demand provides the information needed for this balancing act. An HTML5-capable solution can access this data and a SCADA setup, forming the basis for a centralized control and monitoring system.

The third and last typical application is in facility monitoring, such as when data is used in a building EMS. An EMS, or energy management system, can enable significant savings, with reported consumption reductions of as much as 75 percent. This is possible even in older buildings that have not yet implemented the latest technology. Newer buildings equipped with an EMS can also benefit from the additional information generated by a swarm of IoT sensors. Taking advantage of this data, though, requires a capable monitoring and control solution, which can be built using HTML5.

Advantech provides such a solution in its WebAccess HTML5 Business Intelligence Dashboard. It features a widget library, more than 40 different kinds of built-in widgets, consisting of such items as real-time energy and building weather information. The library also contains data and chart displays, google map integration, alarm log, event log, along with many other items. It also is possible to build a widget, if something suitable is not in the library and create your own automatic graphics by using Widget Builder that is a drawing tool in WebAccess Dashboard. Widgets can be assembled using the Dashboard Editor into the desired solution. You can adjust your dashboard layout automatically or manually and set the order shown on the phone. This can then be viewed and controlled via any HTML5-capable browser on any device at any place and time.

With the new data connector, WebAccess Dashboard cannot only get internal data from WebAccess but also can get data from standard database such as, Microsoft SQL Server, Oracle, or MySQL and through Restful API to integration with 3rd party software that makes it easy to integrate IoT applications as well as cloud services.

Dashboard is a standard function of Advantech's WebAcess/SCADA. That means that data from machines, motors, sensors, robots, controllers, and CNC systems can all be accessed and displayed, along with information from IoT sensors. Dashboard is configured as a server/client model, with versions of the latter available in Windows, iOS and Android. This means that it can be used on desktop, laptop, tablet and smartphone. In the future, WebAccess Dashboard will be an independent product and will continue to develop its capabilities with a cloud-based visualization platform.

Conclusion

To review, SCADA systems are used in a variety of industries, such as electricity generation and oil and gas production. Projections for continued growth in SCADA components are proof that the technology is still valued. But, traditionally SCADA was designed for a given screen size. The advent of greater connectivity and the proliferation of display devices make this a problem.

This can be solved by putting HTML5 technology to use because the fifth version of the hypertext markup language can properly scale what is on a display. An added benefit is that HTML5 is also the language of choice for the IoT. Hence, it is possible to both overcome SCADA's display challenges and make use of the data generated by IoT sensors. This can improve factory floor, utility, and facility management operations.