Rockwell Automation

Designing for Mobility

Top 10 design tips for a mobile HMI with FactoryTalk ViewPoint

Contents

Foreword

Interaction with a traditional HMI system allows an operator to run a process by providing an interface for status indication, machine control, data trends and alarm information. When we introduce mobile technology into a traditional HMI system, not only are we expanding access to that system but we're able to take advantage of mobile features to enable not only operators but everyone responsible for keeping the plant running.

What is FactoryTalk ViewPoint?

FactoryTalk® ViewPoint is a web-based extension to FactoryTalk View, which publishes an existing FactoryTalk View application to a web server.

FactoryTalk ViewPoint (v8.10 and later) uses HTML5 technology to render the HMI graphics that support connectivity across common types of mobile devices and modern browsers. While a client plug-in is not necessary, a web browser is needed to gain access to a web-enabled application that was created using FactoryTalk View Site Edition (SE) displays.

Who is this document for?

This document targets HMI display designers who are designing their next project with mobile in mind or publishing their existing application for mobile clients. If you are looking for a quick way to get started with FactoryTalk ViewPoint, you can refer to this **Quick Start Guide (FTVP-QS002E-EN-E)**.

The tips presented in this document are recommendations. No additional development is required to create a web-enabled application, but these design tips are meant to help you optimize the mobile experience for your users.

Tip 1: Think small!

We've heard that in order to be successful we must think big, right? Well, this is not true when designing for mobile devices. FactoryTalk ViewPoint will do its best to scale content to the destination device, and in some cases, it will even attempt to maintain the screen's original aspect ratio. But if your users will commonly be on smaller devices, there are considerations you can take into account to make them more efficient.

Designing for smaller screens forces clarity — you are left with no choice but to prioritize information and eliminate all content that does not provide key value.

Designing for larger screens suddenly becomes much easier as the increased real estate can allow more flexibility for secondary and tertiary content. Larger screens also do not require complex interactions like showing or hiding content on demand, as is often necessary on a small form factor.

To learn how device-agnostic design can be used in the manufacturing industry to meet the growing expectations of mobile users, the following easy-to-read white paper is a great reference:
The Fluid Screen (RA-WP001A-EN-E).

But be aware that not all small screens are created equal. For such small screens, mobile devices can have higher resolutions and pixel densities compared to a standard desktop display. That means your mobile device may have many more pixels jammed within the same space. Your design personal computer may be configured at a generous 1920 x 1080 resolution, but an iPad Air with a retina display has a resolution of 2048 x 1536 — and with a high DPI (dots per inch), images may scale smaller or look blurry.

Therefore it's helpful to be aware of the differences in resolution and aspect ratio between devices. Knowing your target resolution prevents having to guess an appropriate size for the objects on your display, and it guarantees your text will always be legible without forcing the user to zoom in.

Standard display   **Retina display**
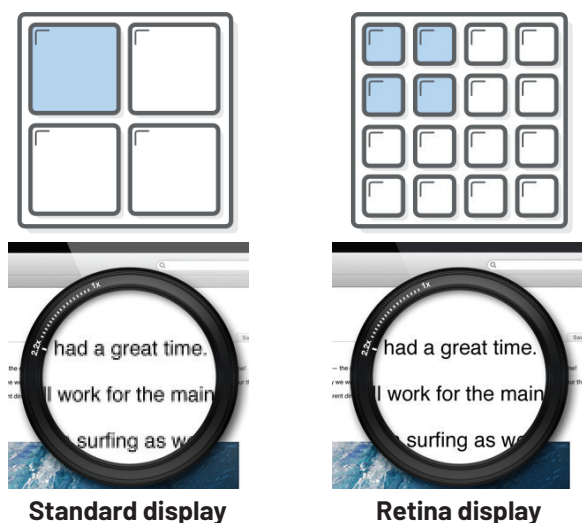
FIG 1. Standard display vs. retina display.

Tip 2: Always design for touch

Take a minute and try to imagine a mobile device without a touch screen. It's difficult, isn't it? How would you even use it?

Understanding the DPI and aspect ratio of the destination device is important to make sure screen content is not only legible, but also touchable. A quick search on the internet reveals countless guides to help you design a display for touch, but there are a couple basic guidelines to remember.

Make sure that users can understand primary content at its default size. A key feature of mobile devices is the ability to zoom in to read specific information, then zoom out to see the entire page. It's an invaluable tool that mobile users are used to, but they shouldn't have to do it every time they access a screen they need. Users shouldn't have to scroll horizontally to read important text or always pinch zoom to see primary content. The primary content should be focused on the default landing position of your display for immediate attention and legibility.

Make it easy for people to interact with content and controls by giving each interactive element ample spacing. Industry standard guidelines say to give touch controls a hit target of about 44 x 44 pixels — and returning to the first tip, be aware of the relative screen resolution at runtime on the target device. You may design it big enough in FactoryTalk View Studio for a desktop, but it just doesn't scale to your phone. At this point in the world of technology, most of us have interacted with a mobile device in our personal life. Use your experiences as a reference for an optimal user experience. As you are developing new screens or optimizing screens for mobile use, start paying attention to your own likes and dislikes in regard to mobile experiences and incorporate that into your own design.


FIG 2. Make sure buttons are big enough for fingers.

Tip 3: Make content easy to find

An operator in the control room can spend hours at the desk, studying many screens to monitor the process. An operator on a mobile device spends a fraction of that time briefly reviewing only a portion of the same content. Make it easy for the mobile operator to find the content needed.

Provide easy ways to navigate screen content, which might mean that navigation bars are not the sole means of navigation. For example, abandon the complex navigation header and take advantage of a dashboard summary display, and configure touch animation to allow the operator to navigate to other content.

Additionally, for ViewPoint, there is the ability to enable displays for the web and/or mobile. For example, you may continue to use a header for your web application, which may contain navigation buttons, a company logo, and an alarm banner. However, these features might be programmed in your mobile application already. As you can see in figure 3, Displays, Alarming, and Recipes are quickly available for the user, so you do not need to condense the large navigation header used in your web and desktop-based client.
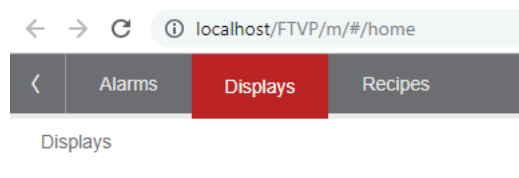
FIG 3. Mobile-enabled application.

A picture is worth a thousand words, and who wants to read a thousand words to figure out what content to select? Simplify the navigation strategy by using icons instead of words to make high-frequency content like the main screen, alarms and trends easy to get to.

Also, the use of icons should leave no doubt in the user's mind as to what the meaning of the icon is. Keep in mind that for touchscreens, we do not have the ability to hover over an icon to see what it represents, so intuitive iconography is key. Some common icons are below:
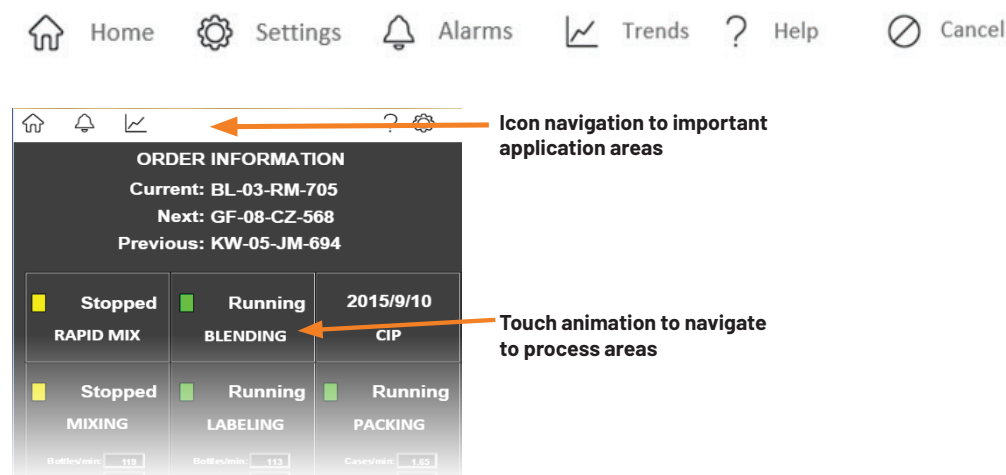
FIG 4. Simplified navigation bar with touch navigation to process content.

Tip 4: Make important information obvious

Choosing and prioritizing displayed data is a key concept when designing mobile screens. A mobile user wants to determine what data is important with just a glance.

The use of animation can draw a user's attention to an object instantaneously, but as a designer, you'll want to reserve its use for creating impact or highlighting important information. The other consideration when using animation is that overuse can impact display update performance.

FIG 5. Optimized use of color and icons to indicate status from the PlantPAx® Library of Process Objects.

Reduce non-critical color and animation by taking a cue from the **ISA 101 Human-Machine-Interface Design Standards**. Eliminate the use of color except to represent anomalies or abnormal states, and avoid animation or motion except where necessary to highlight an abnormal state. Sorry, that means no decorative flames. For more information on HMI standards for process automation systems, **click here**.

Simple color animation is the most commonly used type of animation, and it allows an object to change color as a tag value or result of an expression evaluation change. In the general sense, color should be eliminated or used sparingly to alert the user to a priority or alarm condition.

An overuse of color and animation distracts the user from what data is considered important.
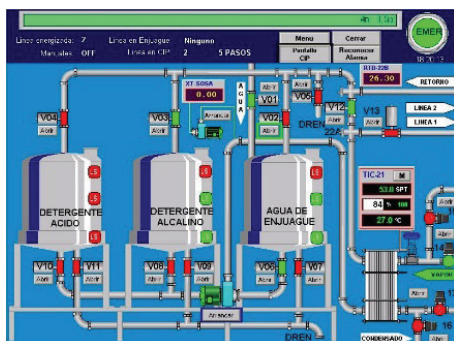

FIG 6. Colorful display.

FIG 7. Grayscale display with minimal color, highlighting only what's important.

Tip 5: Keep graphics simple

If a "busy" display is rendered on a smaller device where real estate is limited, it can be difficult for a user to focus. Sometimes it might be worth the improved user experience to create special screens for smaller devices to summarize what they need to know. Moreover, you could leave the "busy" screens as a secondary option when more detail is needed.

Think about what devices your users will have and adjust content accordingly. This is a best practice to follow considering variables such as the task at hand and the time spent looking at the screen may vary.

<div align="center">Mobile = seconds; Tablet = minutes; Desktop = minutes to hours</div>

With a phone, a user may quickly glance at a status or want to find a specific data value to make a quick decision, so an abbreviated screen is appreciated. If a tablet is used, a user may spend a few minutes interacting with an application or even collaborate with others to gather additional information to analyze a situation, so a fuller-sized screen is more appropriate.

Secondary level navigation is also a good way to display important information at first glance, while still giving the user a chance to "drill down" to get further information if needed. Think about providing primary information/overall status on the main screen and providing secondary information in a pop-up display. For example, an operator might be monitoring hundreds of similar assets, like pumping stations, with a very similar process running across all of them. Providing a quick view of all the pumps, along with the capability to drill down for more detail, gives the operator an easy way to increase his productivity.

In the example below, the Sequencer display element from the the Rockwell Automation Library of Process Objects is used to provide a quick visual reference for the state of the sequence. For a mobile user, this is probably enough information to make a decision, however, if additional information is desired, the user is free to click the element to launch a pop-up display providing detailed information about the sequence.
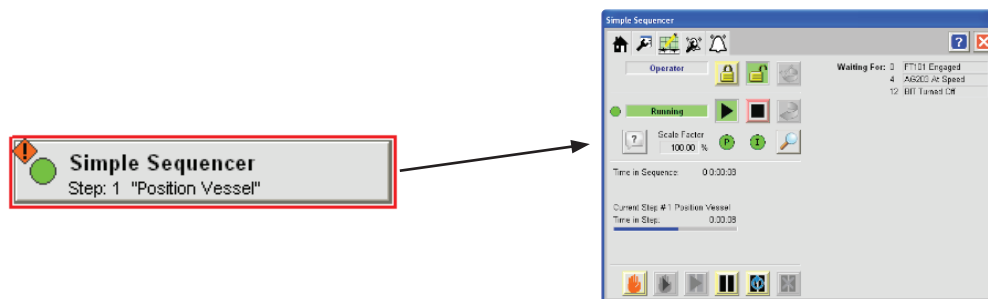

**FIG 8. Process object display element with pop-up details.**

Also note from Figure 8, this is a good reference for grayscale and prioritized color design. This object combines the readily necessary information in color, and the ability to drill down for further details, in one example.

Optimize screen real estate for small devices and consider putting alarm summaries and trends on their own displays to help the user focus. Both the alarm and trend displays in FactoryTalk ViewPoint are configured to be responsive to maximize the alarm/trend content when the control is resized. The alarm control will hide columns when the table is small, and the trend control will hide everything but the trend itself. Users have the option to see alarm details or enable the trend controls if they choose.
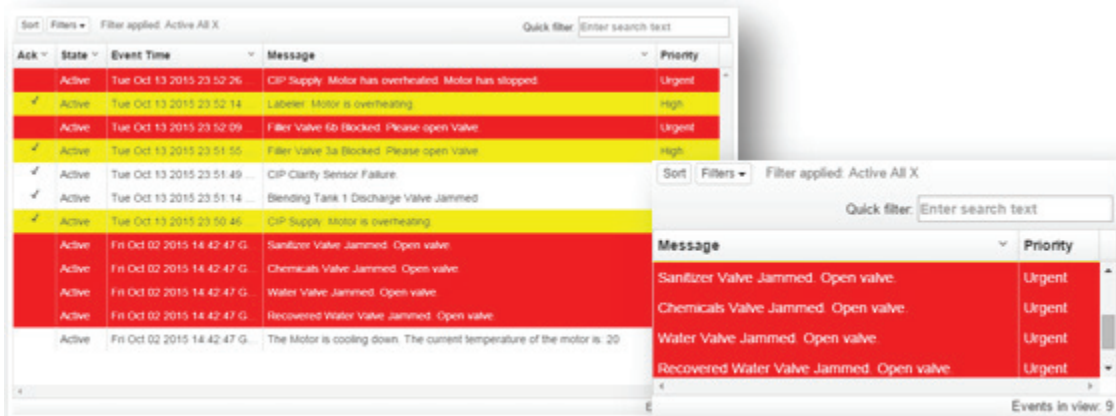
FIG 9. Responsive Alarm Summary object.
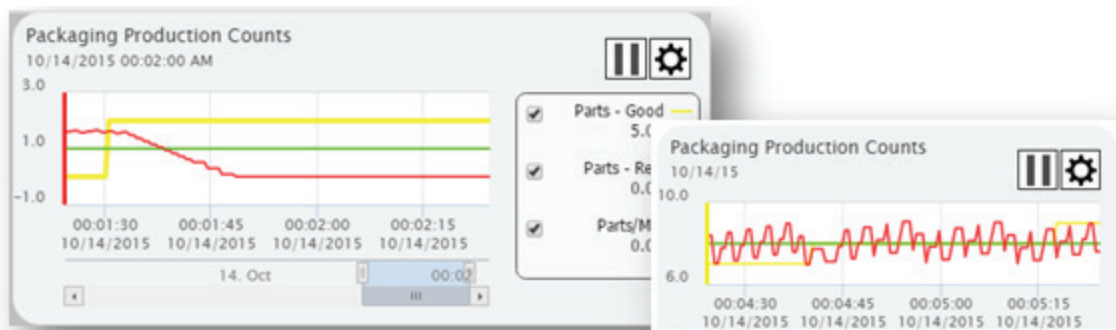
FIG 10. Responsive Trend object.

Tip 6: Different users have different experiences

What if your users are using both desktop and mobile device web browsers? You may decide that having different navigation, levels of data, or different displays for the mobile user is the way to go. There are two ways HMI designers of FactoryTalk View SE applications can create unique mobile experiences for users with different types of devices:

- Using the FactoryTalk ViewPoint Mobile URL

- Using different startup macros.

Point mobile users to the mobile site with built-in navigation. The FactoryTalk ViewPoint mobile site is a special URL that presents the user with a menu of all the published displays organized by areas of the application. This menu allows the mobile user to select the display they want. When the display is selected, it's shown inside the navigation framework and scaled to keep the original aspect ratio of the display. Moreover, the user can then return to see the list of screens to select another one.

FactoryTalk ViewPoint Mobile is a great way to let mobile users find information with minimal effort. The URL for the mobile website is: *http://<server_hostname>/ftvp/m/.*
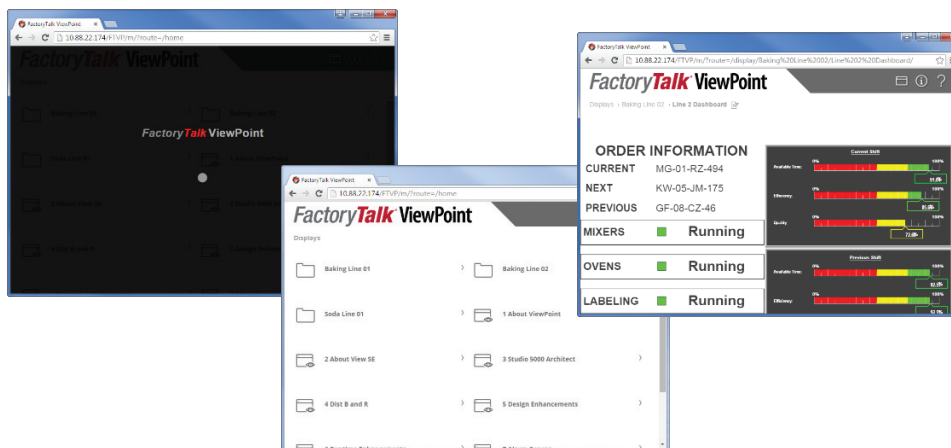
FIG 11. FactoryTalk ViewPoint Mobile.

Another way to differentiate the mobile experience is to use different startup macros to create custom URLs for different users. A macro can be defined in FactoryTalk View SE to call one or more HMI screens at once. With a simple change of the default FactoryTalk ViewPoint URL, a different client startup macro can be called to show different displays at startup:

http://<server_hostname>/ftvp/ViewPoint.aspx?macro=<macro_name>&area=<area_name>

An option would be to specify a different starting screen for a phone or tablet within a unique macro. To make it easy, a bookmark or favorite can save the URL for future reference.

More details about this solution can be found in the following technical support article:
**AID 731523 – Launching unique startup macros with FactoryTalk ViewPoint clients**.

Tip 7: Optimize for performance

There are many benefits to using native HTML5 technology to render graphics — no browser plug-ins to install or maintain, and it supports virtually any device using any browser. Performance, however, can sometimes be a moving target because it's a mixture that depends on the following properties of your application:

- Your browser's level of HTML5 support

- The mobile device you're using

- The speed and reliability of your network

- How the HMI screens are designed

- The numbers of tags the HMI screen is displaying

- Use of large graphic files

As you design your application, there are guidelines you can follow to make sure your applications are optimized to perform with HTML5.

Be conscious of the amount of data you're displaying on one screen. A full screen with a lot of information makes perfect sense for a desktop display, but it would be better to divide a large screen into smaller sections if it will be displayed on a mobile device. It will not only help performance, but also make it easier for the user.
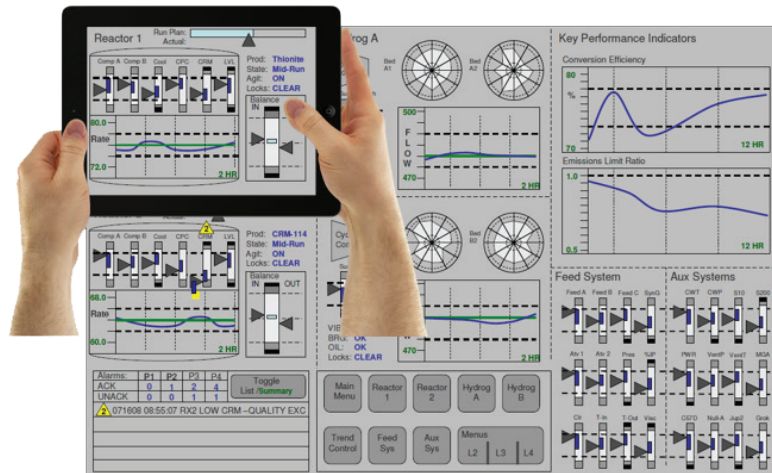
FIG 12. Target the information shown to mobile users.

Minimize complex objects. Evaluating animation expressions and the updating of tags are processed together, so a display that requires a large amount of processing power to evaluate animation expressions could potentially decrease the rate at which tags are updated. If numeric updates are a high priority, minimize the use of animation.

Avoid full scale graphics. They look nice, but as with any web page showing graphics, it will take longer to load and it does not provide much value to the mobile user.

Tip 8: Know what's published (and what's not)

FactoryTalk ViewPoint applications are easily created by publishing existing FactoryTalk View projects. No additional development is required to create a web-enabled application, but it's important to understand that some FactoryTalk View features are not suited for web browser technology.

During the publishing process, any feature encountered on the original display that can't be supported by a web browser is removed, and the rest of the screen is published.

To prevent empty spaces or missing features on your mobile displays, review the object and feature support spreadsheet found in article **AID 57596 – FactoryTalk View Object and Feature Support within FactoryTalk ViewPoint** prior to development to determine what objects to use for your mobile displays.

The most common features that cannot work on a web browser are the following:

- A ➜ P FactoryTalk security codes

- Visual Basic for Applications Scripting (VBA)

- ActiveX controls

If these features are of critical importance to your mobile solution, please see **Tip 9: Expand your System** for information on other mobile solutions that Rockwell Automation offers.

During the publishing process, if any objects or features are encountered that cannot be published, a notification will appear in the publishing report that an object or attribute was unable to convert, along with any other helpful information.

FIG 13. FactoryTalk ViewPoint publishing report.
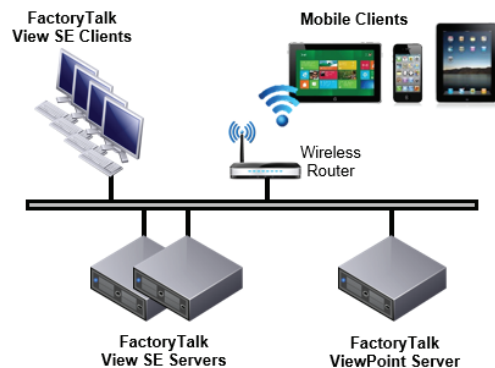
Tip 9: Expand your system

Mobile clients mean more users can access the system, right? That's true, as long as the additional users are using FactoryTalk ViewPoint clients. In general, there are three client categories for FactoryTalk View applications:

- Full clients
- Thin clients (using remote desktop)
- Mobile clients (FactoryTalk ViewPoint)

If mobile clients fit within your application, a FactoryTalk ViewPoint server can give you an opportunity to expand the number of clients in a system (see Figure 14). Be sure to review your architecture with your local Rockwell Automation® representative to help ensure your success.

Other mobile options from Rockwell Automation include **ThinManager®** thin client management software and the **FactoryTalk TeamONE™** application. **Virtual Network Computing (VNC)** technology is also available with many Rockwell Automation products.

Securing mobile users is done using the FactoryTalk ViewPoint Administration console. FactoryTalk ViewPoint security is based on FactoryTalk Security groups and uses FactoryTalk Security services on the server to authenticate and authorize users. Security can be configured by user groups for the whole application or by each individual display for No Access, View Only, or View/Write Access (see Figure 15).

FIG 14. Sample application architecture.

FIG 15. FactoryTalk ViewPoint security settings.

Tip 10: Work from the beach…maybe

We all know the stereotype of the mobile worker — sitting on the beach, drinking a piña colada, monitoring the plant. OK, maybe not so likely, but it does apply to remote facilities where the control room is in Toronto, and the remote stations are scattered across the country. There is a proper IT infrastructure that needs to be in place before this type of network can become a reality.

How should this network be designed? Rockwell Automation and Cisco® have defined recommended architectures for control systems and have published the following whitepaper: **Securely Traversing IACS Data Across the Industrial Demilitarized Zone**.

This paper recommends how to segment business system networks from plant-wide networks by using an Industrial Demilitarized Zone (IDMZ) to separate the network level between the Industrial and Enterprise Zones.

While the network architecture shown in Figure 16 is presented in relation to client access with FactoryTalk ViewPoint, it applies to any remote client access, web-based or otherwise.
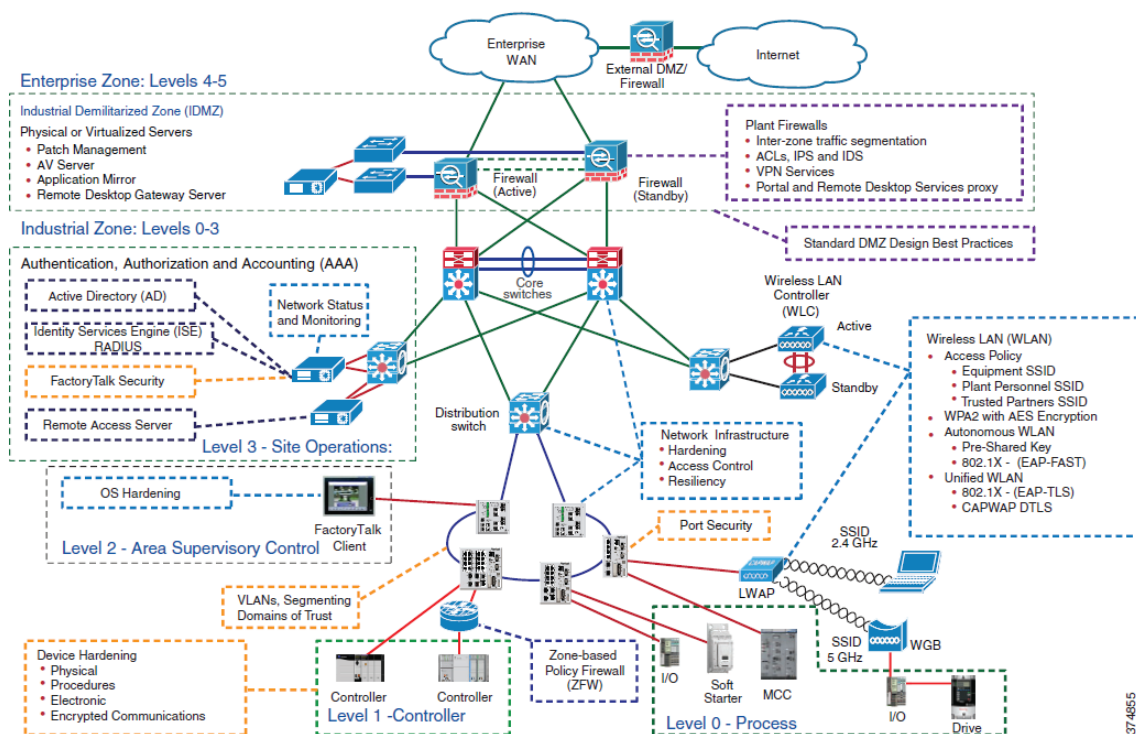
FIG 16. CPwE Industrial Network Security.

Happy networking!

Final thoughts

Where mobile devices were once an exception, they are now an expected part of a modern control system. Mobile devices empower manufacturing operators, managers and supervisors to make timely decisions no matter where they are.

Creating successful graphics for smaller devices does not have to be an overwhelming challenge. HMI designers do not need extra tools or design environments to create applications for mobile devices — they are able to use FactoryTalk View Studio as they would for their FactoryTalk View applications. With some planning and thought, HMI designers can create displays for a computer monitor, tablet or smartphone within the same HMI project.

By keeping some basic design tips in mind, the HMI designer will not only create a positive user experience for mobile users, but also increase the mobile users' efficiency and productivity. It's worth it!

References from the document

1. **FactoryTalk ViewPoint Quick Start Guide (FTVP-QS002E-EN-E)**
    https://literature.rockwellautomation.com/idc/groups/literature/documents/qs/ftvp-qs002_-en-e.pdf

2. **Rockwell Automation Literature Library**
    The Fluid Screen

3. **ISA 101 Human-Machine-Interface Standards**
    https://www.isa.org/isa101/

4. **ANSI/ISA-101.01-2015 Standard (Available for purchase from ANSI/ISA)**
    https://www.isa.org/store/ansi/isa-10101-2015,-human-machine-interfaces-for-process-automation-systems/41921133

5. **AID 731523 – Launching unique startup macros with FactoryTalk ViewPoint clients**
    https://rockwellautomation.custhelp.com/app/answers/detail/a_id/731523

6. **AID 57596 – FactoryTalk View Object and Feature Support within FactoryTalk ViewPoint**
    https://rockwellautomation.custhelp.com/app/answers/detail/a_id/57596

7. **Securely Traversing IACS Data across the Industrial Demilitarized Zone**
    Design and Implementation Guide

8. **AID 21564 - Virtual Network Computer (VNC)**
    https://rockwellautomation.custhelp.com/app/answers/detail/a_id/21564

Additional resources

1. **Human Machine Interfaces for Distributed Control Systems**
   https://literature.rockwellautomation.com/idc/groups/literature/documents/wp/proces-wp016_-en-p.pdf

2. **Rockwell Automation Process HMI Style Guide**
   https://literature.rockwellautomation.com/idc/groups/literature/documents/wp/proces-wp023_-en-p.pdf

3. **Wroblewski, L. "Data Monday: The Six Inch Gap." (January 2013).**
   Retrieved from the Luke W Ideation + Design website:
   http://www.lukew.com/ff/entry.asp?1679

4. **Apple iOS Developer Library, 2015**
   https://developer.apple.com/library/ios/navigation/

5. **The high performance HMI process graphics to maximize operator effectiveness, by Bill Hollifield**
   https://www.isa.org/standards-publications/isa-publications/intech-magazine/2012/december/system-integration-the-high-performance-hmi/

6. **PlantPAx library objects and tools can be downloaded from the Product Compatibility and Download Center (PCDC) by searching for "PlantPAx" at:**
   http://www.rockwellautomation.com/rockwellautomation/support/pcdc.page

A TechConnect™ contract or registered account is required for access to articles referenced in the Rockwell Automation Knowledgebase and to access the PCDC downloads.

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