

Multi-touch Technology: Intuitive Functionality Advances Automation

Multi-touch HMI takes HMI visualization to the next level to improve performance, enhance safety and cut costs.

A White Paper from InduSoft

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Most industrial automation and other manufacturing personnel are very familiar with multi-touch technology from their smartphones and tablets. Many work for companies that allow employees to use their personal mobile devices for work purposes, from checking emails to accessing corporate data. Now, multi-touch technology is making its way to the automation world through multi-touch Human Machine Interface (HMI) applications.

When used in industrial settings, many of the benefits of this technology are similar to those encountered in the commercial sector: relatively low cost hardware, the ability to access and work with data quickly and easily, and near universal familiarity with the technology. However, when multi-touch technology is used with HMI systems, it offers unique advantages in addition to those mentioned above.

Using multi-touch devices such as smartphones and tablets to access and interact with data when in remote areas or simply away from the control room is fast becoming the de facto standard for manufacturers. A significant leap was ushered in with the introduction of browsers, apps and virtual private networks to access HMI systems through hand-held devices. Multi-touch offers the next step: the ability to quickly and intuitively view and analyze data from virtually any location.

Beyond Touchscreen

At first glance, it's easy to confuse multi-touch applications with traditional touchscreen designs. A traditional touchscreen application simply uses single touches to access different screens, basically replacing a keyboard and a pointing device such as a mouse. But multi-touch offers a number of advantages over touchscreens, keyboards and pointing devices (Table 1).

Multi-touch systems recognize the position of several touches and finger movements, which are referred to as "gestures." As with touchscreens, multi-touch technology enables users to operate an entire system without the need for a keyboard or pointing device. However, it goes further in that it enables intuitive gestures that facilitate the execution of commands up to three times faster than those performed on traditional touchscreens.

TABLE 1: Benefits of Multi-touch for HMI
Three times faster than traditional touchscreens
Reduces training time and cost
Improves remote access and functionality via smartphones and tablets
Similar operation to smartphones and tablets
Better suited for harsh and hazardous environments
Provides enhanced protection for worker and machines
Delivers superior visualization, the next step in HMI evolution

Gestures used with multi-touch screens provide the ability to move through many screens by swiping. Zooming by pinching enables users to quickly zero in on areas of interest, and rotation and other manipulation of screen objects is greatly simplified and expedited. A good example of how these gestures improve operations is enabling users to swipe through pages quickly to find the data they need. This is a great improvement over touchscreen buttons, mouse movements and keyboard commands that require the user to slowly drill down page by page.

Low Implementation Costs

There are many new technologies being introduced that started in consumer electronics. Some of these are more easily adaptable for the industrial market than others. In the worst case, some require a paradigm shift or investment that outweighs the benefits of the new technology. Multi-touch for HMI is clearly different in that it offers many real advantages without significant required investment or changes in work practices.

The arrival of the Windows 7 operating system and its built-in multi-touch programming capabilities has made it much easier and cheaper to implement multi-touch on tablets and smartphones. Windows 7 has also created a platform that greatly eases development of HMI software for multi-touch applications. In response, certain providers of HMI software are including multi-touch development tools with their traditional PC-based HMI packages; and these tools typically encompass PCs, tablets and smartphones.

Therefore, a company can invest in the same HMI software package to develop multi-touch screens for the PCs in the control room, and then use the same development tools to provide multi-touch enabled access for smartphones and tablets used in the field (Figure 1).



Figure 1: Multi-touch for HMI will greatly enhance the ease and mobility by which remote workers can access systems and perform command through a variety of handheld devices.

In addition, multi-touch for HMI doesn't require an expensive investment in new hardware. Workers can use their company-provided smartphones and tablets, as these devices have multi-touch functionality built-in. Many companies are going a step further by allowing for workers to use their own handheld devices on the job, a trend known as BYOD, or bring your own device.

Job satisfaction is increased when workers use their own devices, and companies often provide a monthly allowance to workers using their own devices, as the cost is typically lower than making a large capital expenditure to provide each worker throughout the company with handheld device.

Inherently Suited for Industrial Conditions

The design of multi-touch screens, with their lack of moving parts, is inherently better suited than keyboards and pointing devices for industrial areas subjected to contamination from dust and water. No moving parts are exposed, which extends the equipment's lifespan. This design enables some off-the-shelf devices to be used in the field without any additional protective measures, while others require only minimal modifications as compared to keyboards and pointing devices.

However, just as industrial PCs are made for the rigors of the automation world, panel developers have also introduced multi-touch screens that are reinforced for use in hazardous and other extreme environments. It's possible to protect keyboards and pointing devices in hazardous areas such as Zone 1 or 2, but very expensive. Multi-touch HMI screens provided with a protective overlay of glass or polycarbonate to safeguard them from splashes, dirt and extreme temperatures are often a better, less expensive alternative for these and other demanding areas.

Lowering Training Time and Costs

As mature operators and technicians retire at greater rates, younger workers will have to be trained to replace them, and companies naturally want to minimize training time and cost. Since the majority of these younger workers will have years of experience using smartphones and tablets, using multi-touch gestures for HMI systems will be intuitive and quickly learned.

In addition, interface to the process or operation will be similar whether the device is a PC, a tablet or a smartphone—as all will utilize multi-touch technology. This obviously is much simpler than learning a different method of interface for each device. With less time required to learn how to use HMI system interface devices, more training time can be spent on learning about the manufacturing processes and operations.

On the flip side, in the not-so-distant future a generation of workers will be very unskilled at performing keyboard commands and using pointing devices, so companies that continue to rely on these older technologies will have to spend more time and money training new workers.

Protecting Workers and Machines

The ability to improve safety with multi-touch HMI probably isn't as immediately apparent as the economic benefits and convenience of this technology. However, multi-touch technology used to access HMI systems does enable the implementation of significantly enhanced safety features.

In order to ensure worker safety and reduce the possibility of an accidental command, the HMI system screens can be programmed to require users make certain gestures unique to a specific operation. For example, the ability to start or stop a machine can be designed so a checkmark across the screen must be performed as a final step before the machine executes the command.

Operations for machines can also require users to have both hands on the screen at the same time in order to execute the command, thus protecting hands from accidentally becoming injured, and ensuring that critical operations are not performed with casual or accidental touches.

Some multi-touch applications even enable actions to be performed with gloved hands, an operation that is extremely difficult with keyboards. This frees workers from removing and putting gloves back on, saving time and making it easier to maintain personal protection.

Easier Diagnosis of Possible Problems

Perhaps the most unique functionality multi-touch technology offers is the ability to visualize machines and processes, and then access the right screen to diagnose a problem. One of the difficulties in viewing complicated machines and processes is that numerous layers of screens must be created to capture an entire view (Figure 2).



Figure 2: Multi-touch for HMI enables users to quickly access data and execute commands by using familiar gestures, such as pinch and swipe.

Traditional HMI applications use multiple screen frames, and more frames mean greater memory requirements for the PC or other display device. A multi-touch application, on the other hand, requires far fewer screen layers to show a complete system overview. Smartphones and tablets have less memory than PCs and were once prohibitively slow when trying to move through multiple screens, but now users can access data very quickly and easily via multi-touch gestures.

Users can tap options on the screen to shrink and enlarge as needed, getting rid of the constraints of screen frame to enter a new era of visualized control. Perhaps, this ability to drill through screens in an instant or enlarge areas with a simple gesture is the new functionality, the killer app, which will hasten the adoption of multi-touch technology in the industrial workplace.

The Next Step in Visualization

HMI applications at the core have always been about providing visualization for machines and processes, rendering these operations and systems in a way that humans can easily understand. HMI systems are also designed with the purpose of viewing and controlling remote locations, and multi-touch HMI is the latest step in the evolution of visualization and remote access.

In addition to improved visualization capabilities, multi-touch technologies simplify how users physically interact with systems each time they touch a screen to expand or contract a view, or drag an item. Making it easier and more intuitive for humans to interact with machines and processes improves performance and reduces errors. This lets operators spend more time on analyzing and improving systems and processes instead of on access and visualization.

In the near future, operators in a control room will most likely continue to use PCs as their workstations. However, it isn't difficult to envision those same operators taking their smartphones and tablets to locations outside the control room to access HMI systems and troubleshoot problems. Furthermore, combining reduced headcounts and smaller budgets with improved remote technology means the workplace of the coming years must and can be far more mobile than in the past.

The advantages that multi-touch for HMI bring in terms of improved performance, faster and more accurate command execution, and enhanced safety mean it will become more prevalent in the industrial world. Seeing technicians in areas outside the control room, both in plant and remotely, using multi-touch smartphones and tablets to access HMI systems will probably become the norm rather than the exception over the next few years.

About the Author:

Mr. Clark started with InduSoft in 2012 and prior to that he spent almost 15 years at Wonderware. He has extensive technical expertise encompassing IT and control systems engineering, administration, and security. Mr. Clark combines 20 years' experience in all industrial sectors of automation with technical training in electronics from California State Polytechnic University.

About InduSoft:

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