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USER SAVVY

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Efficient Inventory Operations Using Mobile Technology

Sponsored by WithoutWire Inventory Sciences

Travis Smith & Sharon Sens

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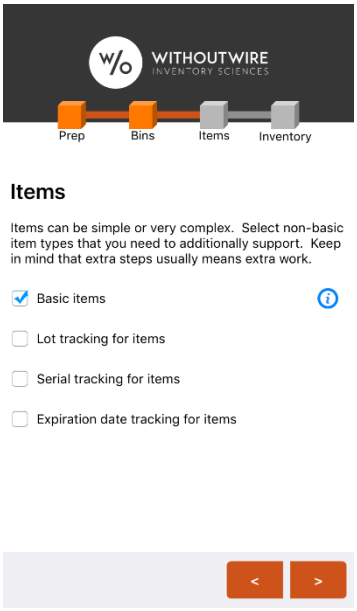
Contents

Introduction

While there is a long list of benefits to using smart devices in supply chain, this article focuses on what one can argue to be the most important: usability. Inventory operational efficiency is about how we as consumers and workers interact with devices and why usability is so imperative to driving efficiency when working with inventory. The arrival of modern mobile devices in supply chain applications is resulting in operational efficiencies not seen before.



Usability is about ease of use. Watching a two-year-old flip through pictures and navigation menus on a smartphone is a shocking example of the power of easy. Yet these simple interfaces that have made this rapid adoption so historical, have been slow to make their way to supply chain. The good news is that this trend is changing.

Until very recently, rugged handhelds have missed the boat. Mobile barcode scanning devices used in places like warehouses are often referred to as rugged handhelds because they were built to last, not built to evolve. Unfortunately, that means many devices have gotten old in technology years. The average life span for these devices is 10 years—just old enough to completely miss the usability benefits that have been garnered in by the incredible R&D investments of the mobile revolution.

The Challenge

Simply adopting mobile technology in your inventory operations isn't enough to guarantee improvements in efficiency. The mobile device and the software must enhance productivity, consider ergonomics, and be user-friendly.

For example, software that requires multiple scans will waste costly time and can lead to increased errors, negatively impacting productivity. Likewise, inefficiently designed processes within applications can also lead to repetitive stress injuries. And a poorly designed software interface will require extensive training and lead to errors, reducing both productivity and user satisfaction.

On the other hand, a user-friendly application engineered to minimize scans and leverage mobile technology will help ensure efficient inventory operations.

Overview of the Principles

We summarize efficiency into three topics; productivity of the operation, ergonomics of the devices, and usability of the software.

Productivity

Productivity in warehouse operations is measured by speed, accuracy, and endurance. Productivity is a product of good usability; however, it is not the most crucial component. Good process design that considers specific expectations for accuracy at each step is most important here.

The key to good process design is to balance the reduction of steps, screens, scans, and taps with the need to ensure that the end result is reliable enough. The challenge here, is that the phrase "reliable enough" varies greatly across industries, the task being completed, and what place within the supply chain the process is occurring. What is acceptable for accuracy and fast across for one organization will be completely unacceptable to another. Here is a list to demonstrate the point:

- Distributor receives full pallets of wood shavings versus a rush order to fulfill a hospital request for serial tracked pharmaceuticals.
- A field technician who is about to travel 30 miles to fix an air conditioning unit for a commercial building on a sweltering afternoon versus a manufacturer mass producing bread and must replenish their manufacturing line with more packaging.

The process design for inventory should include considerations for what a scan represents. Multi-scan and single scan modes help you tailor your process for efficiency. If it is determined that scanning is required to ensure accuracy of inventory, then the first question is whether to allow 1 scan to account for validation of multiple quantity movements or to require 1 scan for EVERY quantity.

Serial tracked items can be accounted for by multi-scan (1 scan = multiple quantities) by using license plates or lazy data collection. License plates and lazy data collection are ways to avoid single scan (1 scan = 1 quantity). License plates are uniquely identified collections of inventory that can be transacted by a single scan. Process designs using license plates should be carefully considered. They can be dramatically increase productivity when used appropriately, or if poorly design will bring an operation to its knees. Here is where experience working with supply chain consultants can really make the difference.

Lazy data collection allows the operator to delay collection of serial numbers to a later step in the supply chain. An example here would be to avoid breaking down full pallets of serial tracked products to capture the serial numbers only to rebuild the pallet for put away to storage. This step can be avoided by delaying the collection of a serial number until it is actually needed.

Single scan can also be useful for newly trained warehouse workers. Forcing them to scan every item in a single scan mode can be made at the user level until such time their accuracy can be confirmed as trustworthy.

When it comes to productivity the software must be flexible to work with a good process design and while software must be configurable to meet these demands, the ultimate measure of efficiency will rest on the thoroughness of the process design.

Ergonomics

Ergonomics also known as the “human factor” is about designing products for interaction by humans. Android and iOS devices bring powerful processing, incredible choices in apps, and global adoption. They also provide an amazing selection of devices with a high degree of concern for the human body. The ergonomics of the device is about minimizing strain on the user. Ergonomics measure repetitive actions, device weight, eye strain, and muscle strain in order to avoid persistent pain, disability, fatigue, and discomfort.

Whether you need long-range scanning, low-cost devices, or even forklift mounted tablets, there are more ergonomic choices today because there are so many users for so many environments. It is estimated [*Ericsson Mobility Report*] that there are 2.6 billion smartphone users alone globally.

Many devices of the past rely on physical keys to interface with the software. Training can become very specific to the device, which can be costly. The device should become a tool that is natural to use and users focus on being efficient in the app, rather than how to use the device or troubleshoot connectivity. All too often warehouse workers have been trained to deal with connectivity or device reboots. The maturity of Android and iOS platforms when it comes to application isolation (you don’t need a reboot) and connectivity are real benefits to the inventory worker.

Device Interface and Design

Whether it’s consumer smartphones or warehouse rugged Android devices, buyers are seeing significant benefits when it comes to ergonomics.

Android and iOS tablets are lightweight, and the choices for rugged enclosures that minimize wrist movements have grown significantly.

Large easy to read text reduces eye strain when used.

One device that is making waves in the market is the first Android device by a major manufacturer built specifically for the warehouse. The Zebra TC8000 includes an all-touch keyboard. According to research done by Zebra, it allows users to type up to 40% faster with 60% fewer errors compared to traditional push-button keyboards.

Another ergonomic advance found on the TC8000 is the scan angle. By tilting the device scanner 90^{o}, the user isn’t constantly scanning and twisting their wrist to view the results. This has been shown to have a 14% to 55% reduction in wrist motion and a 15% reduction in muscle effort.

Usability Factors

In addition to maximizing productivity and addressing ergonomics, operational efficiency in the mobile world must also address the user interface—the connection between people and app. Mobile device screens present unique user experience challenges due to their limited real estate. However, when designed well, a mobile user interface can help reduce training costs, minimize errors, and increase job satisfaction.

Reduce Training Costs—and Increase Productivity

An intuitive user interface requires minimal cognitive effort to accomplish a task. This reduces the amount of training required and improves productivity in general. Myriad books are devoted to user interface design; however, following the principles below will help optimize operational efficiency in the mobile world.

- Good interfaces present timely content with less noise. Intelligent presentation means presenting only the content and user actions that are relevant to the current task.
- When labeling tasks and steps or writing descriptive content, use terminology that is common to warehouse operations, rather than software-oriented language.
- Use terms and icons consistently throughout the interface. If an icon represents a specific task on one screen, the same icon should be used only for that task and used throughout the entire system to represent that task.
- Design icons and buttons with strong affordance. Affordance is a "perceived signal or clue that an object may be used to perform a particular action." [*Smashing Magazine*] Consider the shopping cart icon used on e-commerce sites. Someone purchasing an item online for the first time would know the items they had selected would be found by clicking the shopping cart icon without having to learn this pattern. They can intuit this from action from their real-world shopping experiences.
- Leverage screen technology such as hyperlinks and buttons, rather than expecting a user to memorize archaic key sequences. For example, provide a "refresh" button or icon, as opposed to requiring the user to depress the "Shift" and "F5" keys which are commonly found on warehouse rugged handheld scanning devices. The search function should be globally available within your application, preferably in the same menu or panel where primary navigation or functions are located.
- Even the best user interface requires help content, but it's only helpful if it's easily accessed and organized in a way that parallels the software's functions and layout.

Minimize Errors

Obviously, the fewer errors made translates to less time wasted. How can a user interface minimize errors and help users recover from errors that cannot be avoided?

- Point out errors as soon as they are made and provide context for fixing the error. For example, consider an employee who is setting up a new item on a screen with several fields. An error made at the top of the screen could propagate additional errors in subsequent fields if the error isn't caught and messaged as soon as it's detected. This not only saves time by not requiring the user to correct more fields, it reduces frustration.
- Offer an easy escape, such as a "Cancel" button, so users who recognize their own mistakes can easily return to their starting point.
- Error messages should clearly indicate where the error occurred and be written so the user knows exactly what they did wrong and how to resolve the problem.
- Provide a confirmation option so users can review their work before they commit to an action that would require significant steps—and potentially another person—to fix.

Increase Job Satisfaction

An intuitive user interface not only reduces training needs, it can provide an engaging experience that builds confidence in a system and helps employees with their tasks. Designing software for use with mobile devices is as important to job satisfaction as providing high-quality tools to a master mechanic. Both lead to higher job satisfaction. And it follows that a satisfied workforce reduces employee turnover as well.

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Usability of the Software

Beyond the device and the operating systems lies the app itself. Usability isn't just a nice-to-have checklist, it is the main ingredient for an app that must work well for warehouse workers, consumers volunteering at a food drive, 3PL customers, and even executives reviewing high level KPIs.

Anticipate the User

The key term we use here is **Contextual Intelligence**. Contextual Intelligence is the application logic's ability to adapt its user interface to meet the needs of the current user state. In basic terms, the app anticipates and adjusts its data input requirements based on the user, the current operation, and the data in the application. We use search technology to simplify tasks such as scanning picks and bin moves. For example, if a picker is asked to go to a bin to pick an item, in the background the app will search the inventory location at that bin to determine whether we want the user to scan both the bin and the item, or if the only item in that bin is the one item, then we can bypass an extra scan.

We analyze in real-time if a user can benefit from moving the entire contents of a bin or license plate based on the context of the operation. If the system determines a more efficient move can be accomplished using a full license plate pick, it provides the user with that option.

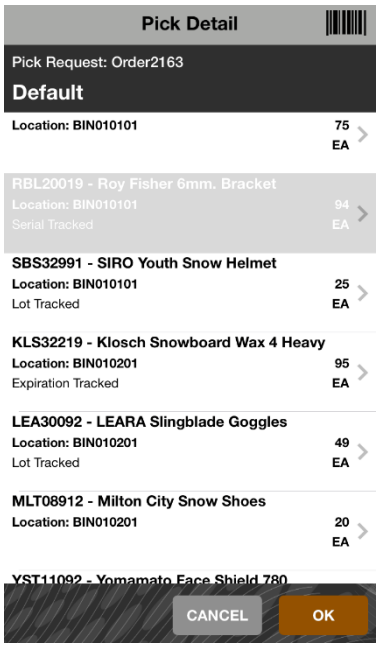

FIGURE 1. REDUCING SCANS USING REAL TIME DATA

User Search

Search has become a basic staple of the app user. We provide searching as part of the overall experience within both the apps we build as well as the self-service portal on the web. Users type portions of text and the system narrows down the list (referred to by many developers as "intellisense"). Users no longer have to memorize part numbers or descriptions. The mobile experience of today's inventory workers must include rapid lookup of items, bins, and inventory.

Another search ability that is equally important to efficiency is what we call a main screen scan. From the main menu of the app, a user can scan anything in the system. This includes:

- serial numbers
- item numbers
- item SKUs and manufacturer barcodes
- license plates
- bin locations (including pick, staging, manufacturing, damage, and overstock)

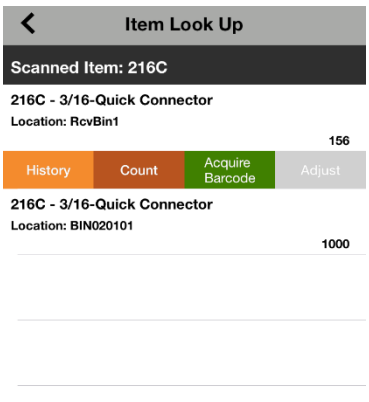

FIGURE 2. MAIN SCREEN SCAN FOR RAPID SEARCH

When a user scans these barcodes, we provide a multitude of information on inventory quantities, locations, and from there users can access most common features from a swipe move on the list such as inventory history, cycle count, acquire barcode, and inventory adjustments.

Navigation

If an app is hard to navigate, then users won't want to use it. Navigation adheres to these basic rules:

Role based – Users should only see functions, screens, and buttons that are available to their roles. We limit users based on their roles, which are managed via the self-service portal.
Context based – In addition, based on context and state of any given operation, we disable buttons that are not available to the user. Another important concept when it comes to context is what is referred to as breadcrumbs. It allows users to move in and out of areas of the application without having to explicitly navigate to previous screens.
Visual and Descriptive – We combine simple one color images, colors, and simple text to quickly allow users to understand the features of the system.
New User Guide – Some new users need additional help understanding the flow of the app. Using descriptive bubbles that appear upon first launching the app reduce training.

FIGURE 3. NAVIGATION USING COLOR, IMAGES, AND TEXT

Setup Wizard

User efficiency is also about the speed at which a user can experience the system. This is especially true in today's fast paced world of constant information. Bringing the user into the core features of the system quickly was the driving factor in creating a setup wizard. We have incorporated a setup wizard that allows users to quickly experience our system as a trial/demo, or to actually set up their own physical inventory and prepare for a live system. Usability here is about education and choices.

Part of the balancing act is to provide the user enough choices to make the experience meaningful, while not exposing the user to too many choices and require large amounts of training time. Training staff can be a very expensive proposition depending on the size of the workforce.

The setup wizard gets users trained and understanding how the system works within minutes.

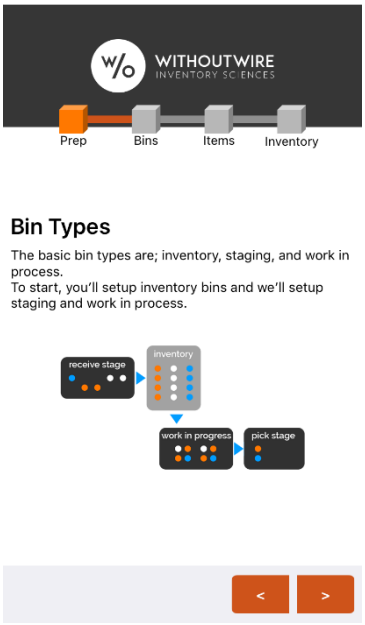

FIGURE 4. SETUP WIZARD BIN TYPES

"Cancel," "OK," "Save," "Close"

Naming buttons is not as easy as it sounds. The problem in presenting consistent action words is very important yet it is a common usability mistake. Leveraging years of customer feedback, we designed our buttons with a consistency that brings fast training and user adoption.

Saving or cancelling changes is another important usability consideration. Many inventory tasks deal with users in various environments where efficiency is about speed of data entry. For some companies, saving records that are incorrect can cause a lot of additional labor to resolve the error. For these areas of the system, we prompt the user to confirm the transaction before committing the change. For other areas where speed is more important, confirmation messages become a hindrance to users.

Executive Summary

WithoutWire Inventory Sciences is a place of constant R&D where our experts push the fields and disciplines related to inventory, warehousing, workflow, and supply logistics, as well as how humans interact with those warehousing ecosystems. And although we're called "sciences," we also understand that inventory science itself is, ironically, often an art.

The WithoutWire inventory system combines technologies like Microsoft Power BI, Microsoft Office 365 integration, and Azure AD B2C security to deliver usability on Android and iOS devices, which is unique in the industry. We are so confident that our customers will agree, we provide free access to our full featured system so you can experience it yourself.

Take a look—sign up now at www.withoutwire.com.

Authors

Travis Smith

Travis founded Appolis after a successful stint as CTO and co-founder of Inetium. He has built a highly successful Warehouse Management company that continues to thrive today. In 2016, Appolis was rebranded as WithoutWire Inventory Sciences. Travis has led Appolis' expansion into iOS and Android based platforms built using Azure and other Microsoft technologies. Prior to Appolis, Travis has spent more than nine years consulting and architecting business solutions for companies like General Mills, Honeywell, US Bank, Cargill, Lifetouch, and Young America. He is creator of the original Essential Element product in November 1998. Travis spent two years as a senior solutions architect at Rainier Technology, based in Minneapolis, Minnesota.

Sharon Sens

Sharon Sens provides both freelance and contract UX consulting services. She'd been enjoying a marketing career when, in 2003, she discovered she was a natural at something the business world called "usability" (it was common sense to her) and joined the UX movement in its early stages. Her primary role is user experience architect, or as some prefer, interaction designer. Sharon has considerable experience in responsive and adaptive platforms, mobile apps (iOS and Android), ecommerce and transactional sites, and content-focused internet and intranet sites.

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