

Key Enablers for an Efficient & Optimized Voice-Based Warehouse

**Critical Insights to Selecting a Comprehensive Voice-Based
Warehousing Solution**

Introduction

Today's business applications are more complex and time-critical than ever before. Adaptability and multi-tasking have become more than just industry buzzwords in recent years, and nowhere are they more necessary than in warehouse operations. The ability to efficiently identify, receive, store, retrieve and ship goods and materials is critical to the overall health of a company. Complicating this task is a shrinking labor pool of skilled workers and an influx of workers for whom English is not their first language.

Increasingly, companies are recognizing that voice-based solutions offer significant benefits for a number of warehouse applications and help warehouse workforces to rapidly become more efficient and productive in their day-to-day operations, regardless of their skill level or language spoken.

Voice solutions recognize spoken words as data entry and provide audio (verbal) directions and confirmations to workers. For the non-technical operator, voice is the easiest and most transparent of all data entry and order picking technologies available. In fact, voice has been called the most natural and intuitive of all data entry methods since it's one of the first skills we learn.

Voice Overview

Voice solutions leave a worker's hands free and eyes free to focus on the task at hand. Operators don't have to hold a bar code scanner or other type of reader and don't have to take their eyes off their work to read prompts on a screen. This single fact is an indication of the immediate time and productivity gains that can be realized with a well-designed voice solution.

Voice Applications

In the warehouse, voice solutions are most appropriate in operations such as:

- Picking
- Put-Away
- Shorts Processing
- Replenishment
- Returns Processing
- Inspection and Quality Control

For shorts and returns processing, voice is a natural data entry method. Particularly useful in returns processing where a variety of actions might be taken -- such as un-kitting, returning to vendor, repair, or restocking -- phrases rather than codes are the natural entry method. Finding a bar code symbol on a menu or locating the screen entry that indicates "damaged during shipping" takes far more time than simply saying it does -- therefore operators can focus on handling the return rather than on data entry.

In applications where there is a context to the data, such as location or condition, voice excels. Voice solutions are frequently used in manufacturing quality programs to record defects but, for the same reasons of allowing eyes- and hands-free operation as well as natural input (a word instead of a code). Additionally, voice solutions benefit any application where the item must be handled and evaluated to record its condition, disposition or destination.

For put-away, replenishment and picking operations, a shorthand code can easily be used on the product as well as the storage location. The voice-enabled terminal would direct the operator to a specific location -- for example, Row L5, Bin 15. An operator involved in picking would verbally confirm the location, possibly by reading a second code printed on the location label, and then be informed of the quantity and product code to pick. The operator would then speak the quantity and product code to confirm the pick. The solution would verify the entry then move

to the next task. For put away, the same basic scenario would play out with the voice prompt directing the put away and the worker verifying location and quantity.

Voice solutions typically employ a "shorthand" code for a location or product code -- or even the actual product description -- when doing voice entry. Voice is not well suited for reading long strings of part numbers. It's as easy to make a "speako" as a spoken "typo" such as verbally transposing numbers. Voice solutions do offer verbal confirmation to help reduce errors, but it's more advantageous to use shorthand codes.

For applications where this kind of "shorthand" is not feasible, for example, where data entry requires a long purchase order number, shipping container code (SSCC-18), EPC code, or other long string of numbers or characters, the use of a mobile computer with a bar code reader or RFID reader may make more sense. Speaking long strings of letters or numbers may take more time than scanning them. The right set of tools, in this case voice and AIDC readers, leverages the appropriate technology to increase productivity and accuracy in different applications.

For applications that do require bar code scanning, today's voice computers can take advantage of small, light, wearable laser scanners or imagers that still leave operator's hands free.



Scanners and imagers can now be used in conjunction with voice-dedicated devices

Because voice is speaker dependent, the language spoken by the worker is irrelevant. Voice solution companies offer core vocabularies in a variety of common languages including English, French, Spanish, German and others. In one warehouse application, Vietnamese, Somolian, Bosnian, Spanish and English are all used by the voice solution.

Although voice terminals are speaker dependent -- that is, they are designed to recognize a specific worker's voice input -- they do not have to be "reserved" for that individual. Personalized voice files are downloaded to each terminal as it's checked out at the beginning of each shift which means that any worker can use any terminal.

Operator Interaction

Industrial voice solutions are typically speaker-dependent. That is, they may recognize some words spoken by everyone but must be "trained" to recognize speech patterns and accents of an individual. Solutions are therefore "trained" to recognize a specific operator's pronunciation of each word in the accepted vocabulary. Training consists simply of repeating a list of letters, numbers and words several times. This speaker-dependant model enables the near-perfect voice recognition necessary for optimized material handling in all environments, including flash freezers, where the noise levels are up 90 decibels.

Voice solutions require only a short learning curve and training regimen -- typically half the time required for training with other AIDC technologies. Voice solutions are designed to recognize specific words or phrases in addition to alphanumeric characters. While it might seem to be a chore to memorize a list of specific words, voice prompts actually simplify a worker's routine by telling him or her exactly what to do and what input is required. Most of the time required for training is for training the voice solution, not the worker; days of trainings now become hours.

Voice Recognition Operation

Voice solutions have been around for more than 20 years and have evolved from limited desktop devices to small engines housed in a handheld or wearable computer connected via WiFi to the host. Today's dedicated voice computers are small, light and unobtrusive -- hardly more noticeable than a typical MP3 player. Voice recognition has achieved a sophistication that allows solutions to accurately operate in noisy industrial environments and to ignore non-data entry speech. They are also able to distinguish problematic words like "five" and "nine" as well as distinguish all the sound-alike letters of the alphabet such as "b," "d" and "e."

Today's voice solutions recognize continuous -- or natural -- speech. Continuous speech voice solutions recognize the idiosyncrasies of natural speech patterns where two or more words may be pronounced almost as one. For example, few people would say "returned product" distinctly. More likely it would sound like "returnproduct". Continuous speech voice solutions would know what that meant.

Voice solutions typically do not have limits on their capacity to receive continuous speech data without a pause. In fact, most people would run out of breath before exceeding the ability of today's voice solutions to recognize a continuous speech entry.

Because of the complex nature of warehouse operations today, different applications may require significantly different meanings for similar voice entries. That is, the same word can mean different things depending on the job. "Left" might mean a direction or that something remains. Voice solutions can offer distinct "grammars" for different applications. The vocabulary of acceptable words can be designed to eliminate some of the confusion but the use of "grammars" to assign different significance to the same word -- or even homonyms -- based on the specific application helps ensure accuracy and simplifies creation of vocabularies.

Architectures

There is a general technological trend toward standards-based, open solutions, and voice solutions have kept pace. The use of Voice XML (VXML) has become the standard to create application packages and enable real-time communications between the client hardware and the order management system.

The open solution approach to voice reduces the total cost of ownership. This can be seen on many fronts. Open solutions offer companies greater flexibility when it is time to add features or change the behavior of the solution. Modifications can usually be done at a lower cost since VoiceXML is open to everyone, and there is a growing pool of programmers with VXML experience. Open solutions also provide a level of assurance that support will not suddenly disappear which may happen with proprietary solutions.

The same is true of wireless communications protocols. The use of IEEE 802.11x (WiFi) radios provides a stable migration path for future enhancements regardless of the radio's manufacturer. 802.11x guarantees multi-vendor interoperability. Today, an access point costs 80% less than it did 5 years ago and additional features are available that were not possible in the past. Furthermore, the new solutions are still backward compatible with the first 802.11 devices. This is the power of an open architecture; VoiceXML architecture is delivering the same benefits.

Another growing standards-based IT trend is



Programmable keys can make it easier to access commonly used functions

Service Oriented Architecture (SOA) solutions. The idea behind SOA-based solutions is to create software services that are independent of each other yet which can be combined to accomplish a business objective. The main focus of SOA is to create a responsive and agile IT infrastructure in which new solutions can be quickly fielded and existing systems can rapidly adapt to changes in the business – whether they are process changes or updates to other IT systems.

Implementing Voice Technology

Voice recognition solutions, unlike bar code and RFID readers, do not take digital data as input. Input must be translated into a digital code recognized by the processing solution, and then associated with a validation or action code in the host. Similarly, direction from the host has to be translated from digital to verbal form.

There are two aspects to voice solution software: applications and host communication. In both cases, there are typically proprietary and open solution solutions.

Voice Tools

Voice solution software should offer a "toolkit" with pre-written applications for a variety of common tasks as well as the necessary tools for users to write their own applications. Pre-written applications are typically used as the basis for customization by the user and are a significant head start to completing the final product. In some cases, these "toolkits" are based on proprietary architectures.

In addition to lowering the customization and maintenance costs, open solutions can offer a more consistent look and feel in mobile and stationary terminals. Applications can also be written using open solution tools for both socket-based and web-based connectivity.

The range of features available from different vendors may vary and, insofar as developing the application software will be the most time-consuming aspect of the implementation, care must be taken to evaluate the various offerings.

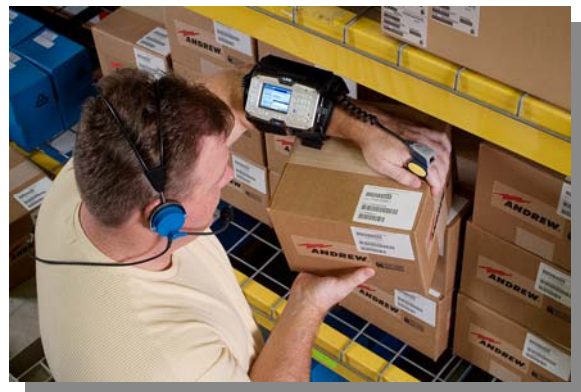
Software should also help enable development of Service Oriented Architecture (SOA) applications to help future-proof solutions. SOA applications are developed as discrete modules, which simplify application modifications. An individual module can be revised without requiring changes to the application software as a whole.

Choosing a Voice-Enabled Device

Choosing the right voice-enabled mobile computing device requires an understanding of your 24-hour operations.

In some companies, picking and other operations that could benefit from voice are performed 24 hours a day (or for each full schedule of shifts, whatever that happens to be). For these applications, dedicated voice-enabled client devices are usually the most cost-effective solution. Dedicated voice client devices can be equipped with optional scanners or imagers to expand their capability to perform additional types of data entry that do not require a screen or full keypad.

In order to future-proof applications and mitigate the cost of changes in the warehouse environment, you should be



Advances in technology can deliver the benefits of a multimodal voice-directed data collection device while still keeping the hands free.

able to answer "Yes" to all these questions.

Does the voice computer run truly open software?

What software does the voice computer run? Does it take advantage of standards-based, open solutions that can be readily used by the greatest pool of available programmers -- either straight out of school or with considerable experience? Does it employ browser-based, Java, voice XML, and other open solutions software to provide the optimal path to tie together legacy solutions and provide ongoing solution maintenance and expansion?

Does the voice device support Service Oriented Architecture?

Can the voice computers offer solutions that embrace today's Service Oriented Architecture (SOA) while providing tools and pre-defined routines to simplify initial setup? Does it offer SOA features to enable change without requiring substantial revision to other, existing solutions?

Is it transportable?

Can the voice software run on multiple platforms -- whether dedicated voice computers or, if the need arises, more full featured mobile computers? Similarly, can voice computers run a variety of voice solutions to provide future migration paths?

Does it utilize the most current wireless standards?

Does the voice computer offer flexibility and connectivity, from IEEE 802.11 b/g, to Bluetooth, to ports for optional bar code scanners and imagers? Is wireless security standard?

Is it ergonomically designed?

Does the keypad design allow users to continue operations without having to look at the keypad or breaking stride. What are the scanning options? Are they compatible with eyes-free and hands-free operation? Is it small, lightweight, and unobtrusive?

Is it easily configurable?

Are there keys that can be programmed to provide one-touch access to the most common functions if desired? Are there provisions to tune the audio to filter various background noise levels? Does software and hardware work together to provide quick set-up and implementation? Does it have the processing power and memory capacity to handle tomorrow's applications?

Is it rugged and reliable?

Is the voice computer truly designed for the warehouse environment? Does it provide good noise-cancelling capabilities for loud, busy environments? Can it operate over a wide range of temperatures? Does the standard battery allow for more than a full shift of intensive use? Does the manufacturer have a reputation for quality, ruggedness and service?

The suitability of a particular device for your application depends not only on your current operations, but also on your vision for the future. Dual-use and multimodal wireless computers offer you the flexibility to change as your operations evolve.

Conclusion

This paper provides only a brief overview of voice-enabled operations and wearable voice computers. It is intended to provide a basic understanding of the benefits of dedicated voice computers and considerations for selecting them in order to help you to evaluate how they might benefit your operations.

Your LXE representative would be more than happy to help you review your applications and help you evaluate whether wearable voice computers could improve productivity and efficiency in your operation or whether a more full-featured mobile computer would be the best choice.