Imaging Moves Into the Mainstream

Why 2D Imagers are Surpassing Laser Scanners for Bar Code Applications

Intermec

Misperceptions about 2D imagers are changing fast, which is why 2D imagers are the fastest-growing category of bar code readers. Only a few years ago 2D imagers were (wrongly) considered a niche technology mostly used for reading 2D bar codes. Now they are becoming the technology of choice for most bar code applications, and lasers are on the way to becoming a niche technology. The reasons: 2D imagers are as fast or faster than laser scanners, can read all the same bar codes as lasers plus 2D symbols that lasers can't, and can do much more.

Not only can 2D imagers read more bar codes than lasers – including QR Codes, Data Matrix and other popular 2D symbols – they can also do more than read bar codes. Imagers can take digital pictures, shoot video, capture customer signatures, scan documents and even process the scanned data. These capabilities, which are outlined in the graphic below, enable new business processes that are not possible with older-generation technology. In an era where workers are tasked with doing more – collecting more information, providing more documentation, being more productive, etc. – 2D imagers provide more flexibility.

2D imaging technology gives businesses the two things they need most from their bar code readers: outstanding performance in today's applications, and investment protection to meet future needs. This white paper is a guide to 2D bar code imaging technology, including an overview of capabilities and how 2D imagers perform in traditional applications, the beneficial new business processes that imaging enables, and the advantages 2D imaging provides compared to laser scanners.

Analyst Insight
"In 2008, laser scanners were the preferred handheld solution. However, the proportion of users planning subsequent investment in laser scanners is disproportionately lower than in other faster growing product categories i.e., linear and 2D imaging solutions. Imaging is expected to emerge as the fastest growing technology segment."

VDC Research Group, 2009

Technology Basics
Technology fundamentals determine the major performance differences between laser scanners and 2D imagers. Laser scanners were developed specifically for reading linear bar codes. They work by oscillating a laser spot across the bars of the symbol. Bars and spaces are recognized based on where light is reflected back to the photodiode and where it was absorbed. Lasers cannot read matrix bar code formats, including Data Matrix codes that are commonly used for direct part marking and product authentication, MaxiCode used on UPS package labels, Aztec codes used on mobile phones, or QR Codes, which are used in marketing and other scan-to-web applications.

2D scanners were developed by adapting the technology used in digital cameras to overcome the limitations of laser scanners. Imagers take a picture of the entire bar code and use image processing software to decode it. Imagers therefore are not limited to reading linear bar code symbologies. Imagers also have more tolerance for linear symbols with small bar heights.

Fig. 1: 2D Imager and Laser Scanner Functionality Overview
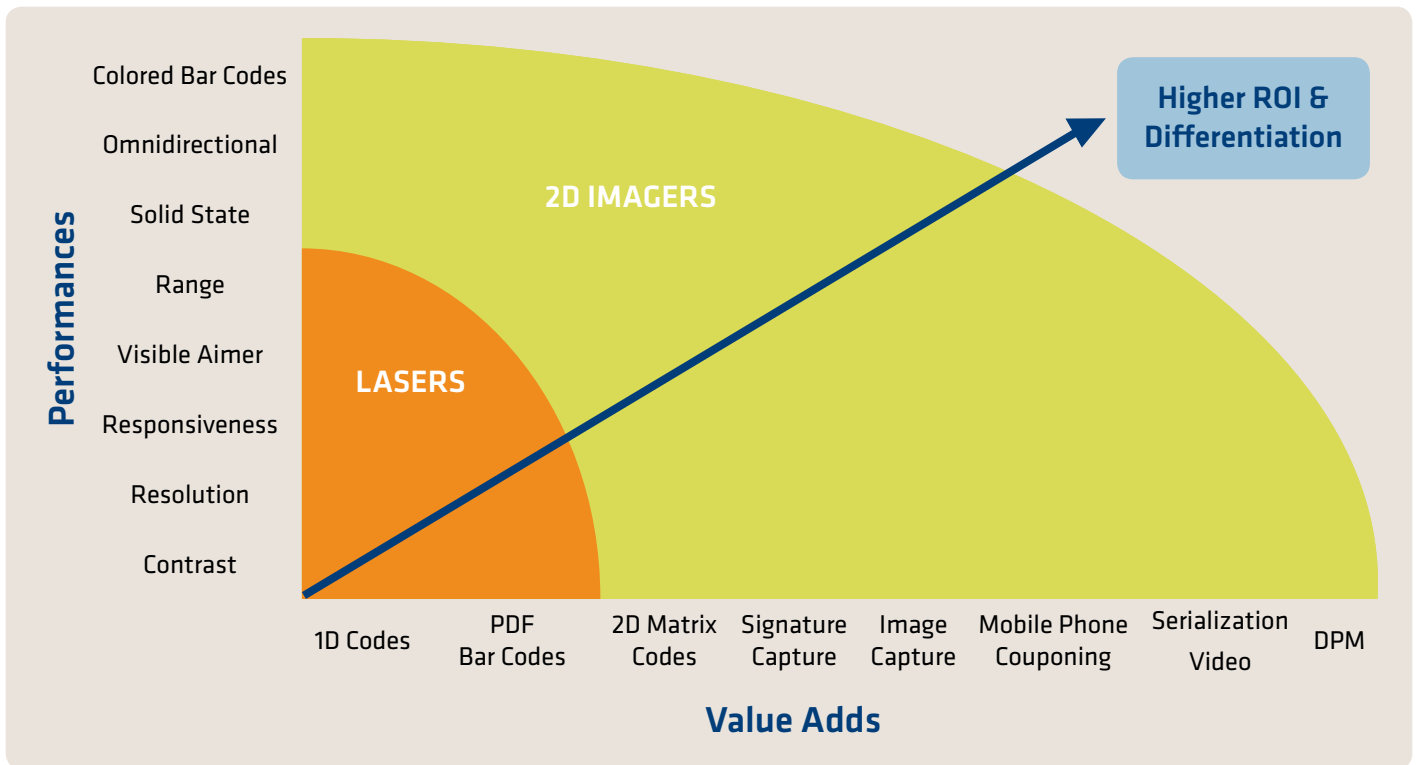
Despite being a newer technology, 2D imagers quickly gained a foothold in the bar code market because of their ability to read 2D codes and low-quality symbols. These abilities provide a true advantage, and the functionality gap between 2D imagers and laser scanners continues to widen as imaging technology continues to evolve. Imagers are based on the same technology used in digital cameras. The explosion in digital cameras and camera-enabled mobile phones has advanced imaging by reducing component sizes and power consumption, improving performance and driving down cost. Today 2D imagers are a practical option for most mobile bar code reading applications, and their ability to take pictures, capture signatures and scan documents is attracting considerable interest because these features enable efficient new business processes.

Performance for Today

2D imagers provide performance advantages today even if enterprises do not need to read 2D bar codes or use the additional functionality. These advantages include the ability to read more sizes and types of bar codes, very fast reading, and the convenience of not having to orient the reader to the bar code symbol.

Bar Code Reading

2D imagers are very easy to use because they can read symbols from any orientation, and do not require a scan line to be aimed across the horizontal bars of a bar code. This characteristic enables fast scanning and better productivity because there is no need to realign labels for the scanner. Another reason 2D imagers are fast is because their motion tolerance has improved significantly – new generation models can read bar codes moving up to 500 inches per second

Orientation-free reading is very beneficial for applications that involve sorting and processing variable-sized objects, which is why imagers are becoming popular for point-of-sale, check-in/check-out and other mainstream applications. 2D Imagers also can simultaneously process all the bar codes within their field of view, without requiring each to be scanned separately. This characteristic also supports higher productivity in applications that require multiple objects to be scanned.

Exceptional working range enables2D imagers to read bar codes from near contact to more than 50 feet away. This flexibility is valuable in environments where there is not always a fixed distance between the worker and the object being scanned. Examples included warehouses, where items may be within easy reach, or on a shelf more than 50 feet from the floor. Long range isn't exclusive to 2D imagers, since specialty laser scanners can read bar codes at long distances. However, laser scanners require the operator to align the laser beam with the bar code, while 2D imagers eliminate the need for alignment, thereby increasing comfort and productivity.

2D Imagers also have more flexibility for the symbol sizes they can process. They can read a location label on a warehouse shelf and can also read the compact 2D bar code used to identify an individual part. As bar codes become smaller they become more dense, which can also make them harder to read. 2D imagers excel at reading high-density bar codes, and are by far the leading scanning technology used to read the 2D bar codes used for direct part marking, electronic component tracking and other small-item identification.

Laser scanners can read these 2D symbols:

...but not these:

Analyst Insight

"For end users, having one scanner that reads codes in any orientation dramatically improves productivity."

Steve Banker, ARC Advisory Group

Because imagers take a picture of the symbol to be read, they can process bar codes displayed on cell phones, TVs, PCs and PDAs.It is difficult to impossible for laser scanners to read from TV screens, computers and other electronic device displays, making lasers ill suited to emerging ticketing, coupon, mobile marketing and customer loyalty applications.

As noted, the ability to read all types of bar codes is one of the biggest differentiators between 2D imagers and lasers. Many operations today call for reading a mix of bar code symbol types, and many more will in the future. The retail and logistics industries provide examples. In retail, the UPC/EAN bar code remains the primary product identifier but the newer GS1 DataBar symbols are increasingly being used on produce and other perishables. GS1 DataMatrix is now used in pharmacy applications. In logistics, shipping labels commonly include both 1D and 2D bar codes. The more functionality a reader has, the more investment protection against technological obsolescence it provides should business processes or bar code symbol requirements change.

Additional Capabilities

2D Imagers provide better investment protection because they can do much more than read bar codes. When using high-quality imagers, the same device that reads bar codes can also capture signatures, digitize them and apply them to transaction records, scan forms, process document data and digitally record either still images or video.

Digital Imaging & Video

Imagers enable workers to take digital images without having to carry a separate digital camera. By making digital image capture more convenient, enterprises can take advantage of many practical applications. These include documenting proof of delivery and proof of condition, enhancing inspection and service records, supporting merchandising and DSD operations by taking pictures of retail shelves to monitor planogram compliance and competitor's approaches, and much more. Video recording enables additional processes.

For example, technicians might record a machine as it runs to help diagnose a problem, and might record the service performed for future reference or training.

Signature Capture

The digital photography capability can be used to capture signatures. This functionality is useful in operations where workers do not carry mobile devices with signature capture touchscreens. When used with a mobile computer, the imager can capture the customer signature and automatically append it to the transaction record in the application software.

Document Imaging & Processing

Basic imagers can take a picture of a document that is suitable for electronic archiving. Advanced models work like document scanners by enabling data to be extracted from the document image for processing. These imagers have enhanced optics and specialized software that can extract addresses from shipping labels and facilitate other information processing from documents. Common applications include automatically entering order and billing information into enterprise software applications, and extracting addresses from delivery documents. To learn more about mobile imaging technology or document processing and its applications, watch this brief video and see Intermec's white papers Transportation Operations: Clear Cash Flow Roadblocks with Enhanced Mobile Document Imaging and Delivering Efficiency: Streamlining Pick-Up and Delivery in the Post & Parcel Industry.

These brief descriptions of imager capabilities and their applications clearly show that 2D imagers are valuable for much more than reading 1D and 2D bar codes. While laser is still the most commonly used handheld scanning technology, 2D imagers can match or surpass laser performance in today's leading applications, including shipping and receiving, checkout, asset management, inventory control, work-in-process tracking, picking and putaway, delivery, patient and customer identification and more. Enterprises can improve productivity in these environments through new processes that use the additional functionality that imagers provide.

Protection for Tomorrow

One of the reasons 2D imagers are the fastest-growing scanner category is that business processes are changing. In the past a delivery driver could leave a package at a doorstep. Today the driver likely would be required to document the time of delivery and perhaps get a customer signature. Tomorrow he or she may need to take a picture of the package to document it was delivered in good condition – or to take a picture of a problem at the destination (e.g. locked gate, guard dog) to document why the delivery wasn't completed.

There are numerous other examples of how changing business processes are requiring more powerful technology. Coupons and tickets are being redeemed from the screens of cell phones instead of by paper. Industrial goods that used to carry a serial number now often also have a 2D bar code that encodes the serial number plus important production information such as the lot code and product configuration. The common bond among these changing business processes is that businesses want more information and more information delivery options. This in turn requires more from the devices that capture and communicate information in the field.

Two dimensional bar codes are one of the most powerful and popular ways to share more information, and the use of digital images and video are growing. Meanwhile many businesses continue to use paper forms and have new forms and data fields to fill out. The following sections describe how 2D imagers can help collect information from all these sources and incorporate it into new business processes.

2D Bar Coding

Two dimensional bar code growth is experiencing rapid growth because current adoption is widespread, reaching the industrial, retail, service and consumer markets. 2D bar codes are being used to provide information about the labeled item itself, or to encode a URL that automatically takes the reader to a Web site, where much more information can be stored. Consumers use their cell phones to read QR Codes to get product information, read movie and entertainment listings, download coupons, receive real estate listing information and much more. Variations of these applications have long been part of industrial, logistics and asset management operations, and new ones are emerging.

Direct part marking, including the U.S. Department of Defense Unique Identification (UID) program, is one of the most established industrial 2D applications and it continues to grow. Tens of millions of military and private sector parts and components are marked with Data Matrix 2D symbols that encode a unique serial number to provide lifetime identification for the item. Two dimensional bar codes are advantageous because they can encode a serial number and other data in a very small space. 2D is thus becoming the technology of choice for secure identification and traceability in the pharmaceutical and food industries, where track-and-trace requirements are growing. Traditional logistics operations already make extensive use of 2D bar codes, which appear on millions of shipping labels. To learn more about DPM and reading options, visit http://intermec. custhelp.com/app/answers/detail/a_id/12938/kw/12938.

Imagers are advantageous for direct part marking applications even if 2D bar codes are not used. There is often little or no contrast between the dark and light on a direct part mark, so an imager's ability to reliably read low-contrast symbols is valuable.

Supply chain traceability programs are bringing more 2D bar codes into the retail industry, and retailers are also pursuing 2D for mobile marketing, customer loyalty and information-on-demand programs. The net result from these developments is that retailers need to read 2D symbols on shipping labels, product packaging, plus customers' loyalty cards, PDAs and cell phones. The standards body, GS1, has established a deadline of January 1, 2014 for retailers to have their point-of-sale systems capable of reading the DataBar symbols that are increasingly being used on produce, loose items and small products. While not all DataBar variations are 2D symbols, they are easier to be read with 2D imagers, especially the stacked version of the symbology that is already being used on fruits and vegetables.

Consumer marketing alone does not account for the recent explosion in 2D bar code use. The symbols have long been used in some production, asset management and logistics processes. Business needs for more information and more traceability mean that 2D bar codes will be used in even more factories, distribution centers, service trucks and retail outlets. Intermec's white paper The 2D Revolution: How evolving business needs and improved technology are driving explosive growth in two-dimensional bar coding provides overviews of 2D bar coding initiatives in different industries and describes several leading applications.

Text & Signature Processing

Many information capture and documentation needs are not satisfied by bar coding. Pen and paper remain the most common means for mobile workers to collect information. Order forms, customer signatures, service notes, inspection reports and other records that are prepared manually cost businesses twice – first by limiting productivity in the field, and again when someone in the office reviews the information and enters it into the computer system. Saving a few minutes on each form processed can lead to hundreds of hours of increased productivity each year, along with thousands of dollars in labor savings.

The most productive and profitable mobile workforce organizations have reduced latency in their information capture and processing. They are often able to close out customer engagements in the field by preparing documentation, capturing customer signatures and even processing payment. Imagers can be an integral part of these processes. Using the document processing capabilities of 2D imagers, it is now possible to capture, process and archive sales orders, service requests, shipping forms and other documents. In long-haul trucking operations, capturing documents by imager and transmitting them from a mobile computer can eliminate the need for drop boxes and courier services. Imagers can also read both bar codes and text from drivers' licenses, business cards, customer loyalty cards and other forms of customer identification to save data entry time and ensure accuracy. If businesses want do more than provide basic form data, records can be enhanced by appending digital pictures or video from the imager.

Images & Video
The business use of pictures and video has been growing ever since digital cameras became affordable for the mainstream market and cameras became standard features in cell phones. If workers use a 2D imager to read bar codes, they will not have to carry a separate device to take pictures and video. Making it more convenient to capture images will expand the realm of applications. Pictures and video are already widely used in many applications, including inspection and insurance adjustment, recording the condition of assets being serviced, providing proof of delivery and documenting conditions that impact service.

Conclusion

Many businesses that bought laser scanners a few years ago hadn't even thought of some of the digital camera, 2D bar code reading and forms processing applications that are providing value today. More new applications will emerge by the time today's equipment is refreshed. Best practices and the most-efficient business processes present a moving target that requires flexible technology to hit. Imagers give businesses the flexibility to be successful by providing high performance for today's bar code scanning needs and added functionality that provides protection against changing requirements.

Regardless of what future applications are pursued, today the "need" for laser scanners is based more on perception than performance.. 2D imagers can match laser speed and performance, but lasers cannot match the enhanced functionality that imagers offer. That fundamental truth, along with the rise in applications that include 2D bar coding, mobile forms processing and digital photography, are why 2D imagers are the fastest-growing bar code reading technology and why analysts agree imaging is the technology of the future.

Intermec has been a pioneering developer of all types of bar code readers and has sold hundreds of thousands of each type over the years. We believe imaging has surpassed laser as the superior handheld bar code reading technology for most applications, and that its performance and cost advantages will grow in the future. Visit the Data Capture Technologies education section of our Web site to learn more about laser and imaging technologies, 2D bar coding and Intermec's imaging product family. The site includes additional white papers, videos that demonstrate scanner performance, case studies and more resources. To learn more about specific imager capabilities, visit the product pages for Intermec's imager family, including the EA30 high performance 2D imager, and the breakthrough EX25 close-range/long-range 2D imager, available in Intermec mobile computers and handheld scanners.

Intermec Inc. (NYSE:IN) develops and integrates products, services and technologies that identify, track and manage supply chain assets and information. Core technologies include rugged mobile computing and data collection systems, bar code printers, label media, and RFID. The company's products and services are used by customers in many industries worldwide to improve the productivity, quality and responsiveness of business operations. For more information about Intermec, visit http://www.intermec.com or call 800-347-2636.

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