Advances in PC Based Applications For the Jewelry Manufacturer

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Abstract

Personal Computer (PC) use in the jewelry industry has exploded. New technologies and software have expanded the scope of the PC's uses to include facility control, machine control, security, production tracking, sales support and many others. Recent advances in PC technology and software and their implications on the industry are discussed and analyzed.

Keywords

Personal computer, PC, barcodes, shop floor control, RFID, AIDC, networks, Windows, year 2000, Y2K, digital cameras, smart cards, biometric identification, accounting software, 2D barcodes, fingerprint scanners, retinal scanners, face recognition systems, virtual private networks, image enabled, document imaging, forms processing, EDI, production tracking, bill of materials, routing, customer specific costing.

Introduction

The PC is the ultimate flexible automation tool. Its use has proliferated in the past few years to the point that it can be found in every corner of the modern factory and office. It has, to a large extent, replaced manual systems in the small to medium sized company and it has superseded the dumb terminal as the primary access device to the mainframe in many larger companies.

This paper explores the changing ways that PCs are used today and presents an overview of its many new uses as it relates to the jewelry manufacturer. I will also present some specific adaptations of new technology and discuss the implications for the industry.

Why have PCs proliferated?

PCs have gotten very inexpensive, very quickly.

Today's entry level P166, costing about $1,200, is by most measures at least 200 times more powerful than the comparably priced PC of only 10 years ago. This hardware has made many of the new applications technically and financially possible.

Networks have become more manageable and reliable.

With the advent of peer-to-peer and small workgroup networking in the early 90's, small networks could be installed and maintained for the first time by companies with no technical support in-house.

User friendly interfaces.

Windows and other graphics based operating systems have made user interfaces less hostile with animated graphics, images and sounds. It is generally believed that the development of Windows™ with its multimedia extensions has played the major part in the acceptance of PCs.

The proliferation of inexpensive and fast storage devices.

Recordable and rewritable CDs, Magneto-optical drives, and Zip™[1] drives have made storage very inexpensive. For under $500, PC users can now create their own CDs at a cost of under $2 each. With a storage capacity of 640mb, CDs can hold an entire library of about

[1] Zip drives manufactured by Iomega Corp.

10,000 medium quality images complete with a database of product information.

Workable telecommunications for remote access and support.

Dial-up access, Internet access, and products like PCAnywhere[2] make it possible to provide support and retrieve data anywhere in the world. It is not unusual today for a sales person to prepare a quotation, write orders, allocate finished goods inventory and update the home office on a laptop, in real time, with a cell phone modem, or via replication back in the hotel room.

Year 2000 problems.

Almost everybody has heard of the Year 2000 problem, where some hardware and applications will fail on January 1st, 2000. This occurs because some systems store years as 2 digits i.e. 1998 = 98. As a result of this, literally hundreds of thousand of systems will fail to calculate dates properly on or before January 1st, 2000. Most Windows PC based applications are free of this problem. For this reason, many companies are using the "Y2K" problem as the justification to replace older systems with newer PC based systems.

Superior interconnectivity.

Many devices can now be more easily interconnected with PCs. The advent of the PC card slot on laptops and desktops, infrared interconnects and "Plug and Play" technology make it almost as easy to install accessories as inserting bread into a toaster. Some examples are:

1. *Digital still and video cameras.* Most of these devices connect directly to a PC via an SCSI ("Scuzzy") interconnect. These devices are often controlled from the PC itself, such as for image capture. Other cameras can store images on flash cards (solid state

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[2] PCAynwhere is a trademark of Symantec Inc.

memory cards). This can be removed from the camera and inserted into the PC card slot, where it becomes a temporary hard disk. These devices are 1,000 times faster than a standard hard disk.

2. *Measuring devices* such as electronic balances, and vernier calipers, and XRF machines. Most electronic balances today contain RS232 connects. This can be attached to any PC via an inexpensive cable and software[3] costing about $200.
3. *Production machines* with on-board computers such as casters and wax injectors. Many manufacturers now provide a software and hardware interface to permit these machines to report production statistics and operating parameters.
4. *Automatic identification devices*, such as barcode scanners, smart card readers, and magnetic swipe card readers. Many of these devices attach via a "Y" cable to the keyboard port. Installing many barcode readers, for example, doesn't even require opening the PC.
5. *Biometric identification devices* such as fingerprint and face recognition devices. Many of these install as easily as the barcode scanner mentioned above.

What challenges does this technology present?

With all the new technology available, one is faced with many issues. While PC networks can offer tremendous productivity benefits at the individual level, often, when considered on a corporate level, the gains are nil. Some reasons are as follows.

[3] WinWedge from TAL Technologies

Inappropriate application of technology.

As with any rapidly evolving technology, the difference between 'leading edge' and 'bleeding edge' is often a very fine line. Careful and honest assessment of the company's sophistication and commitment is a priority in deciding which technology is appropriate for a company.

Security.

Computers on a network, especially those with dialup and/or Internet connections, expose the company, to a certain degree, to internal or external tampering or vandalism. This *can* be managed with planning and controls, but security does not happen by itself.

Untrained users.

Most office workers typically receive little or no formal training in computer operation. Training in applications, database design, or systems analysis is even more rare. The result is often a significant initial drain in productivity.

Untrained internal or external developers.

Any custom or off the shelf software solution must address the needs of the business as it is or as you intend to adapt it. A crucial factor to success is communicating business requirements to the developer. This implies both knowledge of the jewelry business and the actual programming skills required to make it all happen.

No overall company strategy.

The unmanaged development of PC applications leads to "islands of automation" that are poorly designed, extremely inflexible, totally undocumented, and unable to intercommunicate.

For example, consider the home-grown Human Resources application that is used to store employee information but cannot interface with a

payroll system which is isolated from the accounting system that has no connection with the security control system.

How can these challenges be overcome?

Consider only appropriate applications.

Most PC based systems in the industry share the following characteristics:

1. *They are repetitive.* Is this an operation that is performed regularly? A security system that validates ID badges is a good example of a relatively simple yet repetitive process.
2. *They are procedural and rule-based.* Can I clearly define what steps I want the system to perform? When the task or operation can be reduced to a set of instructions, rules, or a flowchart, then automating it is feasible. Sales order entry with on-line credit checking is one of many examples.
3. *They are word, number, or image intensive.* Does the application manipulate words, numbers, or images? A desktop publishing system for your catalogs and selling sheets is a good example.
4. *They involve substantial effort or are impossible to do manually.* Is the task too large or complicated to do manually? When the volume of data or the speed with which it must be performed is large, the computer may be the only option. Consider systems that keep track of all material and job bag movements and maintain an up-to-the-minute perpetual inventory. Real time Shop Floor Control applications have no parallel in a non-computerized environment.

Plan and manage your implementation.

Treat your computer implementation plan as if you were designing a new facility.

1. *Develop a specification.* You may need to utilize outside consultants knowledgeable in the industry to help you with the details. Do not overlook your own managers when developing and reviewing the specifications. This is the best time to build consensus and enthusiasm.
2. *Submit formal request for quotations.* Be sure to check references with clients, local agencies and national organizations such as the Better Business bureau and MJSA.
3. *Prepare a written contract and specification.* Once a vendor has been selected, prepare a written contract with specific deliverables and a reasonable timeframe.
4. *Manage the project.* Require timely completion with benchmarks and testing.
5. *Plan for a structured implementation* and/or cutover.
6. *Train* and involve your employees. Build enthusiasm rather than dread.

Trends and developments - New Technology to watch

Windows based financial and accounting software will completely replace DOS systems.

Literally dozens of Windows™ based packages have come on the market. Many have embraced an open systems concept where the accounting database is both secure and available for inquiry. This, plus more sophisticated end user tools such as Microsoft® Access™ and various report writers, offloads the inquiry and reporting process into the hands of the end user.

Most of the new generation of systems has improved customization tools. This reduces the total cost of adapting the product to the

idiosyncrasies of the jewelry business. For example, Solomon IV for Windows[4] has the ability to retain customizations across version upgrades. Great Plains Dynamics[5] now utilizes the popular Visual Basic for Applications language from Microsoft® to make customizations more accessible to more programmers. UA Corporate Millenium[6] is completely based on Microsoft® Access™ and Microsoft® SQLServer, making customizations and integration of third party add-ons practical and affordable.

In terms of advantages, popular accounting systems use generally accepted accounting practices. They are understood and supportable by those outside of the industry. They have a large customer base that helps ensure longevity of the software provider.

However, most still suffer from certain drawbacks. They usually are incapable or have difficulty with commodity pricing such as spot gold pricing. They do not support customer specific pricing and special pricing needs. They cannot handle memos well (if at all). They often require customization to handle charge-backs, special credits and breakout. Inventory tracking is inadequate. They cannot track by quantity and weight. They often have no capacity to track process losses with any sort of detail. Many in the industry recognize this and have turned to more specialized applications to deal with these specific issues.

Barcode, RFID, and Biometrics will change the face of Security and Access Control.

New advances will dramatically change the marketplace in the next 5 years.

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[4] Solomon IV is a trademark of TLB, Inc.
[5] Great Plains Dynamics is a trademark of Great Plains Software, Inc.
[6] UA Corporate Millenium is a product of by Advanced Software Development Corporation.

1. *Advances in barcode technology* have made this mature product even more useful. 2D Barcodes can store much greater amounts of information. Barcodes can be printed black-on-black to make them non-copiable. Barcodes can be printed in invisible ink that is readable even if printed over readable text.

2. *Radio frequency identification* (RFID) has been used for years for theft control in stores and for non-contact identification in warehouses and security. RFID is also used in decoder rings, key chain gas station credit devices, and automated toll devices RFID devices such as labels, tags, and even tiny animal injectable serial tags the size or rice may find use in non-contact tracking in the factory, warehouse, and other locations.

3. *Fingerprint scanners* are becoming cheap, fast and reliable. These accessories can read a fingerprint with an accuracy of about 99.99%. When used in time and attendance monitoring systems, they prevent buddy punching and lost cards. When used in security and access control, the benefits are obvious.

4. *Retinal scan* reads the patterns of the retina in the eye to validate against a unique pattern, much the same as the fingerprint. Since it requires a person to present their eye to a viewer, I do not expect that there will be much market penetration where fingerprint recognition systems are adequate.

5. *Face recognition systems* are currently used for access control in a few high security companies. Employees enter a PIN number or swipe a magnetic card, then stand in front of a pair of cameras. The system identifies the face of the employee with high accuracy and is unaffected by haircuts, sunburns, and eyeglass changes. Another company provides a product that mounts on a PC. It has a camera facing the user so that when someone sits down in front of the computer it logs the user on or locks him or her out based on the facial pattern. This effectively prevents anybody other than the approved users from working with the machine.

6. *Smart cards* contain data internally in non-volatile memory. They are used extensively in Europe and to a lesser degree here in the US. One manufacturer has over 125 million in use worldwide and both swipe cards and proximity cards are available.

   Typical applications include prepaid telephone or mass transit access cards, or debit cards In high security applications, a card might contain a digitized image for identification, a secure electronic key and built in time stamping for transactions tracking. Using such a system, expensive shipments could not be released to unauthorized individuals.

   Jewelry manufacturers have used smart cards for metal free in-house vending and cafeteria debit card systems as well as access control for years.

Virtual Private Networks will begin to replace EDI.

This technology, which utilizes secure internet-based interchange of quotes, orders, acknowledgements, ship notices, and links customer and vendor networks will probably replace EDI as the primary form of data interchange in the next 10 years.

The automotive industry is currently implementing such a system, called the Automotive Network Exchange, due to go live in the second quarter of 1998. This will interconnect thousands of suppliers and vendors and allow transfer of CAD and CAM files, images, and many other data files in a global, secure environment. Automotive industry experts believe the system will save $70 per vehicle in telecommunications and other costs.

Image-enabled sales & marketing tools will raise the expectations of customers.

1. *Presentations, quotations, and sell sheets* with full color images can be easily transmitted and printed at the destination making faxes and pasted-up sheets look amateurish.

2. *Laptop based field sales support systems will proliferate.* Sales people now carry laptops instead of (or as a supplement to) a sample line. Off-the-shelf products can now display full color slide shows of pre-selected products. Sales people can click a button to include the items in quotations with customer specific pricing. Many systems can even accept an order on the spot, which can be communicated to the main office via the Internet or via direct dial in.

3. *Product costing.* Customized systems can price a product according to a predefined pricing method for a particular customer or item. Many systems now permit "what-if" pricing. This allows a sales person to respond to a customer request for a price on an existing product with a lower quality diamond or different karat gold.

Document imaging technology will change archiving and order entry.

1. *Document imaging* systems are in use now in many office environments such as legal, accounting, and medical offices. Consider using such a system anyplace where large amounts of paper documents must be readily accessible on line. This application is replacing microfiche systems and has broad application in the industry, primarily for any company that has two or more full time clerical workers doing filing and retrieving.

   Some imaging systems can also support annotation. This is a process where separate electronic layers are added to an image. These layers can include text, highlighting, balloons and freeform scribbling while leaving the original untouched. For example, a designer could email a sketch to a group of company personnel for comment. Those people could respond by writing on the sketch, each on their own annotation layer.

Justification of the cost of scanners and computer output to laser disk systems is easy when the true cost of filing, retrieving, and searching for lost documents is honestly assessed.

2. *Forms Processing*. Optical character recognition (OCR), mark sense and barcode recognition with predefined forms is used in the industry to "read" orders and other documents.

   For example, if a manufacturer sells to end users or customers who do not have EDI capability, the company can provide preprinted forms that are filled in by hand or printed. These are then scanned into an order entry system. This speeds processing while reducing cost and errors. Another example is a manufacturer that deals with many small subcontractors. Preprinted invoice forms will make things easier for all parties involved.

Increased intercommunication between the manufacturing floor and your office system will reduce the clerical burden.

Computer controlled manufacturing equipment, such as CAD/CAM, rapid prototyping, and continuous casters are rapidly becoming the norm. Besides the obvious benefit of factory automation, they offer a secondary opportunity to 'report' their performance to a central system in the form of direct output of production and performance parameters.

For example, a gold rolling machine I installed in 1989 at a precious metal manufacturer in Mt. Vernon, NY, is capable of self-controlling its rolling output thickness to an accuracy of ±50 millionths of an inch. During rolling, the output is constantly measured and corrections are being made to compensate for roll eccentricity, variations in input materials, temperatures and other variables. The on-board computer also generates SPC information and prints its own inspection report and process capability charts, eliminating final inspection and incoming inspection at the customer.

Inventory and Production Tracking will replace manual systems to speed throughput and enhance control.

It is widely acknowledged that generic manufacturing control systems will not work in the jewelry industry without extensive and expensive modifications. Specialized jewelry industry shop floor control and production tracking systems are available off the shelf today to address these shortcomings with varying degrees of success. These real-time systems offer loss control and tracking capabilities that are otherwise unattainable. Minimum expectations for such systems are as follows:

1. *Provide secure logon and user level security.* Only authorized users are able to perform specific actions.
2. *Use transaction based processing* to record the specifics of every inventory action. This creates the traceability required for security.
3. *Print job bag or work orders.* Bar-coded and imaged job bags speed movement through the factory while minimizing errors.
4. *Track by quantity and/or weight.* Chain, wire and strip might be tracked by only weight while rings could be tracked by quantity or quantity and weight.
5. *Record and track process and 'other' losses.* Manufacturing processes often involve weight losses not recorded by conventional inventory control systems. This is needed to 'close the loop' on process losses, such as polishing and mass finishing or process gains such soldering.
6. *Interface directly to barcode scanners, scales and other devices.* Avoid keypunch errors by direct data capture with a bar code scanner or scale.
7. *Support for imaging.* Display or print product images on demand for immediate on-line reference.

8. *Include multi-level bill of material and routing.* Jewelry manufacture typically involves multiple variations on a style and multiple methods of manufacture.
9. *Cloning item feature.* Make a new item from an old one by cloning and changing only what you need to.
10. *They can track production in real time including support for splits, merges, and out-of-routing moves.* You must be able to track your product as it actually moves in your workspace.
11. *Intercommunicates.* Integrated with, or interfaces to, the accounting system.
12. *Special jewelry related functions.* As appropriate to your factory, such as calculations for casting and shotting operations.

Conclusion

An explosion of PC use has been driven by cheaper and ever more powerful hardware and software. This presents both an opportunity and a challenge in today's extremely competitive marketplace.

Most manufacturers are under pressure from customers and vendors to provide better information, shorter lead-times, lower prices and EDI. This has forced reluctant companies to begin using PCs with mixed results.

Successful implementations are properly planned and embrace only the technology appropriate for the company. Mismanaged or poorly planned implementations can be a tremendous drain on any company's resources.