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EXHIBIT 1007

But the emergence of the Web as a platform for Internet and intranet applications may make a Web browser the most important user interface in the future. Microsoft Internet Explorer and Netscape Navigator are the dominant browser interfaces in today's market. This chapter will address input design techniques for both the *Windows* client/server interface and the browser interface.

Remote Batch Batch and on-line represent extremes on the processing spectrum. A combination solution also exists—the remote batch.

In **remote batch processing,** data is entered using on-line editing techniques; however, the data is collected into a batch instead of being immediately processed. Later, the batch is processed.

Modern remote batch can take several forms. A simple example uses a PC-based front-end application to capture and store the data. The data can later be transmitted across a network for batch processing. A more contemporary example of remote batch processing uses disconnected laptop or handheld computers (or devices) to collect data for later processing. If you've recently received a package from UPS or Federal Express, you've seen such devices used by the drivers to record pickups and deliveries.

Now that we've covered the basic data capture, data entry, and data processing techniques, we can more closely examine the input methods shown as rows in Figure 14.1.

Input Methods and Implementation

Different input devices, such as keyboards and mice, are covered in most introductory information systems courses. In this section, we are more interested in the method and its implementation than in the technology. In particular, we are interested in how the choice of a method affects data capture, entry, and processing as described in the previous section. You should continue to study Figure 14.1 as we introduce these methods.

Keyboard Keyboard data entry remains the most common form of input. Unfortunately, it requires the most data editing because people make mistakes keying data from source documents. Fortunately, graphical user interfaces such as Microsoft *Windows* and Web browsers now make it possible to design on-line screens that reduce errors by forcing correct choices on the user. We will explore several useful GUI controls for such interfaces in the next section.

Mouse A mouse is a pointing device used in conjunction with graphical user interfaces. The mouse has made it easy to navigate on-line forms and click on commands and input options. For example, the legitimate values for an attribute can be recorded on a screen as "clickable" boxes or buttons that eliminate the need to key in that data. This results in fewer data-entry errors. We will explore mouse-based controls in our input designs for this chapter.

A Handheld Computer

Touch Screen An emerging technology that will greatly impact input design in the near future is the touch screen display. Such displays are common in handheld and palm-top computers that are finding their way into countless information system applications. A Symbol Technologies handheld computer based on the *Palm Operating System* is shown in the margin. Such devices simplify many data collection activities in a warehouse and on a manufacturing shop floor. Touch screen buttons can be programmed to collect the data. Most such devices support handwriting recognition as well. The Symbol Technologies unit depicted also can scan and read bar codes (discussed shortly).

Point-of-Sale Point-of-sale (POS) terminals have been with us for some time. They have all but replaced old-fashioned cash registers. These terminals capture data at the point of sale and provide time-saving ways to enter data, perform transactional calculations, and produce some output. Like the handhelds just described, most can scan and read bar codes to eliminate keying errors. Automatic teller machines (ATMs), another form of POS terminal, are operated directly by the consumer.

Sound and Speech Sound represents another form of input. You might have used a Touch-Tone telephone-based system to register for this course. Such tone-based systems require special input/output technology that drives the design. Those systems are beyond the scope of this book.

A more sophisticated form of this input method uses voice recognition technology to make it possible to input data. Currently this technology is relatively immature and unreliable. It is best utilized to input commands, not data. But the time may come when voice recognition technology replaces the keyboard as the principle means by which we enter data.

The remaining input methods are broadly classified as **automatic data capture (ADC).** With advancements in today's input technology, we can eliminate much (and sometimes all) human intervention associated with the input methods discussed in the previous section. By eliminating human intervention we can decrease the time delay and errors associated with human interaction.

Optical Mark **Optical mark recognition** (OMR) technology for input has existed for several decades. It is primarily batch processing-oriented. The classic example is the optical mark forms used for objective-based questions (e.g., multiple choice) on examinations. The technology is also useful in surveys and questionnaires or any other application where the number of possible data values is relatively limited and highly structured. Most applications that could benefit from this input method have probably already exploited it.

Optical character recognition (OCR) is less prevalent despite its maturity. It requires the user or customer to carefully handwrite input data on a business form. If the letters and numbers are properly scribed, an OCR reader can process the forms without human intervention. Obviously, this depends on the handwriting of the user or customer. But it does work. Columbia House Record Club used to use an OCR form for customer responses to orders. Like most OCR applications, the number of fields to be input was very small (reducing the possibility of errors). Processing methods must be implemented for any inputs rejected due to illegibility.

Today the most prevalent form of optical technology involves bar coding. **Bar codes** are on almost every product we buy, but bar-coding technology is not limited to retail sales. You can create bar codes for almost any business application. You can even integrate bar codes into *Windows*-based applications as shown in Figure 14.2.

Magnetic Ink Magnetic ink ADC technology is one you will likely recognize. It usually involves using magnetic stripe cards, but it also may include the use of magnetic ink character recognition (MICR). Over 1 billion magnetic stripe cards are in use today! They have found their way into a number of business applications, such as credit card transactions, building security access control, and employee attendance tracking. MICR is most widely used in the banking industry.

Electromagnetic Transmission Electromagnetic ADC technology is based on the use of radio frequency to identify physical objects. This technology involves attaching a tag and antenna to the physical object that is to be tracked. The tag contains memory that is used to identify the object being tracked. The tag can be read by a reader whenever the object resides within the electromagnetic field generated by the reader. This identification technology is becoming very popular in applications that involve tracking physical objects that are out of sight and on the move.

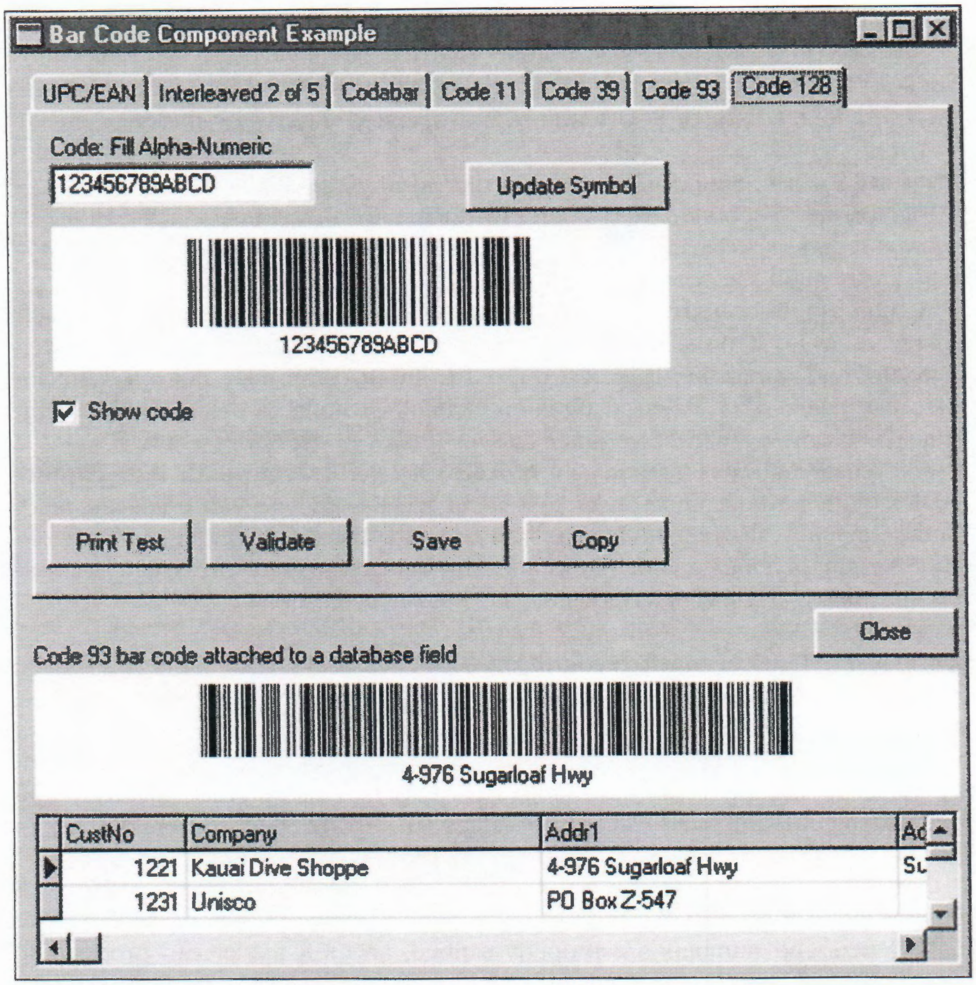

Figure 14.2
Bar Codes in a Windows *Application*

For example, electromagnetic ADC is being used for public transportation tracking and control, tracking manufactured products, and tracking animals, to name a few.

A Smart Card

Smart Cards Smart card technology has the ability to store a massive amount of information. Smart cards are similar to, but slightly thicker than, credit cards. They also differ in that they contain a microprocessor, memory circuits, and a battery. Think of it as a credit card with a computer on board. They represent a portable storage medium from which input data can be obtained. While this technology is only beginning to make inroads in the United States, smart cards are used on a daily basis by over 60 percent of the French population. Smart card applications are particularly promising in the area of health records where a person's blood type, vaccinations, and other past medical history can be made readily available. Other uses may include such applications as passports, financial information for point-of-sale transactions, and pay television, to name a few. Another future application could be a combination debit card that automatically maintains and displays your account balance. A smart card used in a security application is shown in the margin.

Biometric Biometric ADC technology is based on unique human characteristics or traits. For example, individuals can be identified by their own unique fingerprint, voice pattern, or pattern of certain veins (retina or wrist). Biometric ADC systems consist of sensors that capture an individual's characteristic or trait, digitize the image pattern, and then compare the image to stored patterns for identification. Biometric

ADC is popular because it offers the most accurate and reliable means for identification. This technology is particularly popular for systems that require security access.

System User Issues for Input Design

Because inputs originate with system users, human factors play a significant role in input design. Inputs should be as simple as possible and designed to reduce the possibility of incorrect data being entered. The needs of system users *must* be considered. With this in mind, several human factors should be evaluated.

The volume of data to be input should be minimized. The more data that is input, the greater the potential number of input errors and the longer it takes to input that data. Thus, numerous considerations should be given to the data that is captured for input. These general principles should be followed for input design:

- *Capture only variable data.* Do not enter constant data. For instance, when deciding what elements to include in a SALES ORDER input, we need PART NUMBERS for all parts ordered. However, do we need to input PART DESCRIPTIONS for those parts? PART DESCRIPTION is probably stored in a database table. If we input PART NUMBER, we can look up PART DESCRIPTION. Permanent (or semipermanent) data should be stored in the database. Of course, inputs must be designed for maintaining those database tables.
- *Do not capture data that can be calculated or stored in computer programs.* For example, if you input QUANTITY ORDERED and PRICE, you don't need to input EXTENDED PRICE, which is equal to QUANTITY ORDERED × PRICE. Another example is incorporating FEDERAL TAX WITHHOLDING data in tables (arrays) instead of keying in that data every time.
- *Use codes for appropriate attributes.* Codes were introduced earlier. Codes can be translated in computer programs by using tables.

Second, if source documents are used to capture data they should be easy for system users to complete and subsequently enter into the system. The following suggestions may help:

- *Include instructions for completing the form.* Remember that people don't like to have to read instructions printed on the back side of a form.
- *Minimize the amount of handwriting.* Many people suffer from poor penmanship. The data-entry clerk or CRT operator may misread the data and input incorrect data. Use check boxes wherever possible so the system user only needs to check the appropriate values.
- *Data to be entered (keyed) should be sequenced so it can be read like this book, top to bottom and left to right.* Figure 14.3(a) demonstrates a good flow. The system user should not have to move from right-to-left on a line or jump around on the form, as shown in Figure 14.3(b), to enter data.
- *When possible, use designs based on known metaphors.* The classic example of this is the personal finance application *Quicken.* The program's ease of use is greatly enhanced by its on-screen re-creation of the checkbook metaphor. The user writes checks by filling in a graphical representation of the check. And the check register looks exactly like its paper equivalent. Not all inputs lend themselves to metaphors, but some are greatly enhanced by the imitation (see Figure 14.4).
- There are several other guidelines and issues specific to data input for GUI screen designs. We'll introduce these guidelines as appropriate when we discuss GUI controls for input design later in this chapter, as well as in the chapters on output design and user interface design.

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