Barcoding though relatively an old technology, is one of the important steps in library automation and is still not widely used in libraries in India. This paper discusses the benefits of barcode technology and gives guidelines for selecting the hardware/softwares highlighting the features of scanners and printers.

The paper also gives guidelines for retrospective conversion, which becomes the core issue in any library with a very large collection. Some tips necessary for software customization have also been provided. This paper is a case study based on the barcoding and retrospective conversion project undertaken at IGIDR Library, Mumbai, India.

INTRODUCTION

Barcoding is a computer aided process of generating codified information, which is subsequently printed on a predefined stationary, invariably on a self-adhesive label for several later applications.

Barcoding was first introduced in industries/departmental stores for operational efficiency, fast and accurate inventory, distribution, billing etc. Presently this is widely used in almost all business transactions at one stage or other.

Librarians started using this technology for charging and discharging of library documents and also for stock verification for the same reasons - operational efficiency, speed and accuracy.

Barcoding in the context of library applications can be described as a process of generating machine-aided and machine-readable unique and document specific code. The code, which is invariably a unique accession number, when scanned, gets decoded and identifies a specific document in the database for circulation and stock verification related activities. Needless to say that there is an interface between the scanner and the library housekeeping software.

This paper attempts to explain the tools required for implementing the technology and also gives guidelines for planning and scheduling retrospective conversion.

OBJECTIVES

The main objectives of library barcoding are:

i. to improve operational efficiency;

ii. to achieve accuracy;

iii. to make stock verification an easy process;

iv. to reduce overall cost.

In a barcoded system, the accession number and member code which are scanned at the time of charging/discharging will ensure the accuracy. On the other hand in a manual or semi-automated system, the typographical error may result in charging/discharging a wrong document to a wrong member.
The cumbersome nature of the manual system is well known for charging/discharging of documents through issue cards. Barcoding eliminates book issue cards and even the book label used for class numbers, thus reducing the cost. It will also reduce the transaction time as it eliminates procedures of taking signature and subsequent filing of issue cards after charging and discharging.

RETROSPECTIVE CONVERSION

The barcoding technology is not yet widely used in most of the libraries in developing countries. Therefore, while undertaking the barcoding project, the retrospective conversion becomes a core issue in any library having a very large collection. Implementing the barcode system necessitates very good planning and scheduling.

The following points are worth considering while planning the project:

Collections should not be barcoded before the library has selected its local system

Barcoding is one of the steps in library automation which starts only after developing an exhaustive bibliographic database of available documents on a suitable library house keeping software. The reason is simple - without an exhaustive database it is not possible to implement barcode aided circulation system. Secondly, in the absence of such an exhaustive database it will not be possible to generate barcode labels with both accession and class number. Printing of only the accession numbers, which many libraries prefer to do, has its own future implications.

It is also important that library software provides features for sorting and printing of desired fields.

Type of collection

Selecting the type of collection for barcoding is the second important consideration. In any library some collections are strictly meant for reference and such documents need not be barcoded. Theses, reference collection, loose issues of journals are usually omitted from barcoding.

Determining the fields for printing on the label

Accession number will be the mandatory field that needs to be barcoded. Call number is the other field recommended for inclusion while printing the labels as it serves dual purpose. Firstly, it serves as barcode label and secondly as a book label. The labels with both accession and call numbers are called as ‘SMART’ barcode. The job of retrospective conversion consumes less time if the labels are printed call numberwise due to the fact that the sequence of the printed labels will be parallel to the sequence of the books/documents on the shelves and the pasting job needs very little supervision.

HARDWARE AND SOFTWARE

The software and hardware that will be discussed here are different from that of what is required for the library house keeping operations.

Thermal and laser printer

Barcode labels can be printed either by using Thermal Transfer Printer or a normal Laser Printer. Labels generated on a thermal printer have better legibility and are durable compared to the labels generated on a laser printer. In either case, software preferably a customized one is needed for the purpose.

Thermal Transfer Printer

A Thermal Transfer printer uses a thin plastic ribbon with a thin coating of wax or resin based pigment. The ribbon and labels fed from separate rolls are squeezed together by a roller as they pass under the thermal printhead.

This printer produces a durable, high-quality image, and can be used with many types of label stocks (paper and synthetics). Printers are durable and offer relatively fast printing speeds varying from 3 inches per second to 12 inches per second depending on the model. The cost of printer depends on the speed, DPI (Dots per Inch) and print width. The cost of printing a single color label (usually black) is reasonable, but multi-color printing would be expensive considering the printer and ribbon cost. For library applications 203 DPI single colour printer
with a speed of 3 inches per second is most preferred.

Laser Printer

On a laser printer, labels can be printed on a quality A4 size paper or on a customized A4 sheet of self-adhesive labels. Laser printer uses toner to print images. Printing of barcodes on an A4 size paper will not be a good idea, as one has to cut these in to proper sizes before pasting on the books. Secondly, if printed on an ordinary paper the barcodes will not be durable and legible. However, customized labels sheet will offer better quality and durability.

One difficulty in using labels on the customized A4 sheets paper is that, there could be possibility of labels getting stuck to the drum or any other part of the printer during printing. The speed and DPI of the laser printer varies from model to model.

Scanner

Scanners available to scan barcodes are of three types viz. LED, CCD and Laser. Each uses a different technology to read the barcode label.

LED [Light-Emitting Diode]

In a LED scanner, a single light-emitting diode illuminates a small spot on the barcode and photocell measures the amount of light reflected. As the LED and photocell move across the barcode the pattern of bars and spaces is captured and decoded. In a wand scanner (pen like scanner), light is focused through a small transparent ball at the tip. While scanning, the user just swipes the wand across the barcode. The tip of the wand generally has to be in physical contact with the surface of the barcode.

In this case the width of the barcode is limited and the scanner reads it as long as the operator can swipe the scanner from one end of the barcode to the other at an even speed without wandering off the code.

CCD [Charge-Coupled Device]

CCD stands for Charge-Coupled Device; it refers to a single row of photocells on a single semiconductor chip. Unlike a single photocell, which can see only one spot on the barcode at a time, a CCD can see a cross-section of the whole barcode at once. The barcode is generally illuminated by a row of light-emitting diodes built into the scanner.

CCD scanners do not have to be in direct contact with the surface of the barcode, but their depth of focus is somewhat limited. Most CCD scanners have a working range from roughly 0.25-inch (6.35-mm) to 1.0-inch (25.4-mm); there are some products available with a slightly greater range. The width of the CCD sensor array in the scanner limits the maximum width of a barcode that can be scanned; if the barcode is wider than the scanner, it cannot be read. The distance from which a label can be scanned ranges approximately between 0 to 6 inches.

Laser

Laser scanners use a moving pinpoint of light to illuminate the barcode, and a single photocell receives the reflected light. Most laser scanners sweep the laser beam horizontally using an electronically controlled mirror. Laser scanners tend to be quick and precise and can often read denser barcodes than the other technologies. A primary advantage of a laser scanner is depth of focus; since a laser beam diverges very little with the distance, scanners of this type generally have a working range from roughly 1 inch (2.54 cm) to 12 inch (30.48 cm).

Out of these three types of scanners, CCD scanner is most widely used in libraries. CCD and Laser scanners can also be fixed to a stand in case of heavy circulation transactions and also to minimize wear and tear. The price of a CCD scanner is less than the Laser scanner.

Interface between the scanner and the computer

The interface between the scanner and the computer can be made in various ways using keyboard wedge or Serial Port or USB or short range Radio Frequency or Wireless Radio Frequency.
Out of these, the most widely used interface is the keyboard wedge. In this case the scanner is plugged in between the keyboard and the computer using a Y cable or similar connection. Data from the barcode appears at the computer's keyboard port just as though it has been typed manually. This is an excellent type of interface since it does not need any software modification and the technology is inexpensive compared to other types of connections.

**Software and its customization**

The software for generating barcode labels comes along with the printer and the vendor will usually take care of any customization as per the local requirements.

The software acts as an interface between the computer and printer and is developed incorporating the printer and scanner barcode technology standards. There are three types of barcodes - Numeric, Alphanumeric and 2-dimensional barcodes. (Please refer to Appendix I)

Even though there are many standards available in all these three cases, the Code 39 is widely used in many industries and is the standard for many government barcode specifications, including the U.S. Department of Defense. Code 39 can be read by most of the scanners available in the market.

In addition to this essential standard, one also has to seek for certain customization. The suggested additional customized features are:

* Printing of labels on different types of stationery, i.e. single or two across of different size
* Number of copies in both the above mentioned types
* Printing of necessary information on the labels such as Accession number, call number and Library's name
* Font size of the barcode. The size depends on number of characters to be printed

* Options to accept data input from the keyboard as well from a file; usually an ASCII file from a predefined path
* Option to print both Numeric and alphanumeric characters. It is better to have two alpha characters as prefix
* Printing of both Accession number and the call number will be the best feature suggested, as it serves dual purpose. First it acts as a barcode label and secondly as a book label

**STATIONARY**

In case of thermal printer, the standard stationary required are - Self-adhesive labels and Ribbon. The standard size of the label measures 50 mm x 25 mm. The most preferred color of the label is white as it provides best background. The barcode vendor will usually supply the stationary.

The specification for the ribbon depends on the blank label rolls which come either in single row or two across each of dimension 50 mm X 25 mm. In the former case a two inches ribbon is generally used, where as in the latter it would be four inches ribbon.

Even though the thermal printer is the most preferred printer, some libraries even use laser or dot matrix printer. In such cases, a customized label sheet or ordinary paper can be used to print the labels. The quality of labels printed on thermal printer is always the best. Apart from the quality, use of ordinary non-adhesive paper involves cumbersome additional jobs such as cutting and application of some adhesive.

The pasted labels can be made more durable by putting a piece of thin cello tape over it. This would also work as protective layer against deliberate scratching.

**TIPS FOR SELECTING HARDWARE/SOFTWARE**

At the time of selection of hardware one has to give utmost importance for the configuration. Library in general neither requires a heavy-duty
printer or the kind of scanner used in a supermarket or industries.

Below mentioned points are worth considering for selecting the hardware/software:

- **Software capability:**
  Ensure that it generates barcodes with any two desired alpha characters as prefix.

**STOCK VERIFICATION**

The stock verification which most of the libraries undertake at fixed intervals can be simplified by using barcode technology. For stock verification, use of portable scanner will be ideal as it carries a memory chip of 40-MB capacity. It is a handheld portable scanner, which can be used to store the accession numbers of the scanned books. Once its memory is full the stored data i.e., accession numbers can be transferred to the PC to clear its memory and later the scanning work can be continued. Its prohibitive price may discourage its use.

With other type of hand held scanners i.e. CCD or Laser stock verification work can be carried out by attaching a scanner to a Laptop PC. Scanning of books can be done by moving the scanner along the bookracks.

**CONCLUSION**

The implications of barcode technology are many. It minimizes errors and increases the efficiency at the circulation desk. It also reduces the operational cost, eliminating book cards and book pockets. Barcoded labels with both accession and call numbers on it can also be used as a book tag.

Barcoding is recommended only for such libraries where transaction is very high or likely to be high in future. It may not be cost-effective in a small corporate library with few members and transactions.

**REFERENCES**


Appendix I

1. Numeric Barcode:

2. Alpha-numeric Barcode:

3. 2-Dimensional Barcode:

4. SMART Barcode: