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BENEFITS OF BARCODE TECHNOLOGY IN ACADEMIC LIBRARIES

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Abstract: Barcode technology offers substantial benefits within academic libraries, revolutionizing traditional inventory and resource management systems. This paper explores its advantages. Implementing barcodes streamlines library operations by enabling efficient circulation of documents, tracking of books, journals, and other materials. Barcode used for automate check-in/check-out processes, and accurately locate resources, saving valuable time and minimizing errors. Additionally, barcoding aids in inventory control, preventing loss or misplacement of materials while optimizing collection organization. The technology also supports data analysis, offering insights into resource utilization and demand patterns, enabling libraries to make informed decisions about acquisitions and resource allocation. Ultimately, barcode technology significantly enhances the overall efficiency, accuracy, and user satisfaction within academic libraries, shaping modern library management practices.

Keywords: Automation, Inventory management, Resource tracking, User experience, Efficiency, Error reduction, Data analysis, Collection organization, Self-checkout, Resource utilization

1.0 Introduction:

Barcode, in its simplest form, is a set of bars and spaces representing alphabet or numeric data for identification of a particular product, service or a process.

In the realm of academic libraries, embracing barcode technology heralds a transformative shift in operational efficiency and user experience. By employing barcoding systems, libraries revolutionize their traditional methodologies, streamlining inventory management, cataloging, and resource tracking processes. This innovation not only expedites the check-in/check-out procedures but also significantly reduces errors, fostering a more accurate and efficient system. Furthermore, barcode technology facilitates data-driven insights into resource utilization and aids in optimizing collection organization, ultimately enhancing the overall functionality and user satisfaction within academic library environments.

Barcode technology is the best-known and most widely used method of Automatic Identification. Automatic identification or "Auto ID" encompasses the automatic recognition and recording of data, most commonly through the printing and reading of information encoded in barcodes thereby eliminating risk of human error.

Barcodes have been instrumental in revolutionizing, and significantly increasing efficiency and productivity across the entire supply chain from manufacturers to distributors to retailers worldwide. The packet of Wrigley's chewing gum was the first-ever product to be barcoded and scanned at Marsh's supermarket in Troy, Ohio in the year 1974. It now resides in the Smithsonian Museum, alongside other objects of distinction.

2.0 What is barcode?

A barcode is a graphical representation of data that consists of a series of parallel lines or geometric patterns. It's a machine-readable form of information that can be quickly and accurately scanned by barcode readers or scanners. Each barcode typically contains encoded information about the item to which it's attached, such as product details, inventory numbers, or identification codes. Barcodes serve as a universal method for automatic identification and

data capture in various industries, including retail, logistics, healthcare, and libraries. The pattern of bars and spaces in a barcode corresponds to alphanumeric characters, allowing machines to interpret and process the encoded data swiftly. Barcodes facilitate efficient inventory management, improve checkout processes, and enable accurate tracking and tracing of items throughout their lifecycle. They come in various formats, including linear (1D) barcodes and more complex two-dimensional (2D) codes, offering different levels of data storage and versatility in applications.

2.1 Benefit of Barcode:

Barcodes in academic libraries revolutionize resource management, expediting tasks like circulation, stock verification, gate entry, cataloging and inventory control. This technology enhances efficiency by automating check-in/check-out processes, reducing human error, and enabling fast item tracking. Students and faculty benefit from streamlined services, enjoying faster access to materials through self-checkout options. Barcoding systems also empower libraries with valuable data insights, facilitating informed decisions on resource allocation and collection development. They optimize organization and prevent loss or misplacement of materials, bolstering the library's functionality. Ultimately, barcode technology elevates the academic library experience by modernizing operations, improving accuracy, and catering to the evolving needs of its users.

2.1.1 Some other benefits are:-

- Increased Accuracy: Accurate data entry is possible with barcode. Studies have shown that with manually collected data the error rate is 01 in 300 characters whereas in automated data capturing system, the error rate is almost nil;
- High Speed: Data entry is very fast; typically, key entry personnel can enter data at a rate of two or three characters per second. Barcode data entry rates are often 30 characters per second;
- More Timely Information: Information must be timely to be valuable. The storage and retrieval process by scanning the barcodes is instantaneous. Information can be updated and kept current all the times;
- Lower Labour Cost: Automated data collection eliminates time-consuming manual data entry work. Provides greater accuracy and saves from the trouble of deciphering erroneously entered data and reduces administrative time wasted in correcting the errors.
- Better Services with faster process and timely information, better services could be provided to the users.
- Cost Effective:solutions and fast return on investment where effectively applied. Average ROI for barcode systems are as low as 6 months, besides contributing significantly towards cost savings due to better processes and management.
- Efficient : as effective usage of technology yields significant improvements in efficiency, productivity, profitability and competitive advantage for businesses
- Better Decision Making by providing a technological platform for effective integration with other communications and information management technology. Improved management and as a result better decision-making due to automated data collection technology could be the best benefit of a bar code system.
- Significant Opportunities for item-based process improvement and innovation in virtually every sector of industry, commerce and services where items and data have to be managed.

3.0 Different types of barcodes:

There are many kinds of barcodes technology available in modern libraries. The most prevalent barcode symbologies include:

- UPC (Universal Product Code): Widely used for retail and grocery items, UPC barcodes consist of 12 numeric digits primarily in North America.

- EAN (European Article Numbering): Similar to UPC but with 13 digits, EAN barcodes are standard in Europe and globally recognized, utilized in retail and logistics.
- QR Codes (Quick Response Codes): Highly versatile and rapidly adopted in the world, QR codes store data in both vertical and horizontal directions, accommodating various information types. They're used for payments, marketing, and information sharing, website url, library user/document information, render text information by using QR code.
- Code 39: This alphanumeric barcode is commonly employed in industries like healthcare and automotive for product identification, inventory management and library management.
- Code 128: Known for its high data capacity, Code 128 is utilized in packaging, shipping, and logistics due to its ability to encode large amounts of information in a small space.
- GS1 DataBar: Designed for smaller items and perishables, GS1 DataBar barcodes are used in healthcare and retail, enabling encoding of expiration dates, batch numbers, and other vital data.

In the modern library, these barcodes serve diverse purposes, for checkin/checkout in library and beyond, playing a vital role in accurate data capture, traceability, and efficient library operations. The adoption of these barcodes continues to grow as library recognize their efficacy in enhancing processes and customer experiences.

3.1 Some symbologies are mentioned below in tabular forms:-

Symbology	Description	Barcode Types	Example of Barcode
Code 39	The Code 39 barcode is the easiest to use of alpha-numeric barcodes and is designed for character self-checking, thus eliminating the requirement for check character calculations.	HIBC LIC LOGMARS MIL-STD-1189B MIL-STD-129 MIL-STD-2073-1C MIL-STD-129N	
Code 128	Character set A allows for uppercase characters, punctuation, numbers and several special functions such as a return or tab.	CANADA POST USPS ISBT 128 USS Code 128 ISS Code 128	
	Character set B allows for upper and lower case letters, punctuation, numbers and a few select		

Symbology	Description	Barcode Types	Example of Barcode
	functions.		
UPCa	The Universal Product Code (UPC) barcode is used in the retail industry. UPC-A consists of 12 numbers.	UPC UCC12	
UPCe	UPC-E consists of 12 numbers that are compressed into 8 numbers for small packages.		
EAN13	The European Article Numbering System (EAN) is a superset of U.P.C. EAN-13 consists of 13 numbers.	ISBN ISSN Bookland JAN	
EAN8	The European Article Numbering System (EAN) is a superset of U.P.C. EAN-8 and consists of 8 digits for small packages.		
Interleaved 2 of 5	Interleaved 2 of 5 (ITF) is a numeric-only barcode used for encoding pairs of numbers in a high density barcode format similar to code 128 character set C.	ITF-14 EAN-14 SCC-14 GTIN DUN14 USPS	

Symbology	Description	Barcode Types	Example of Barcode
Codabar	The symbology of the Codabar character set consists of barcode symbols representing characters 0-9, letters A to D and the following symbols: - . $ / +.	Rationalized Codabar USD-4 NW-7 2 of 7 Code	
MICR E13B	The MICR E13B font is a special font that is used on bank checks and drafts in the United States, Canada, Puerto Rico, Panama, UK, and a few other countries to print MICR characters for magnetic recognition and optical character recognition systems.		
MICR CMC7	The MICR CMC-7 font is a special font that is used on bank checks in Mexico, France, Spain and most Spanish speaking countries.		
OCRa OCRb	The OCR-A and OCR-B character sets contain both upper and lower case letters, numbers, and several special characters. The OCR-A font characters were created from ANSI X3.17-1981 specifications and the OCR-B font	OCR-B1 Eurobanking OCR-A1 Eurobanking	

Symbology	Description	Barcode Types	Example of Barcode
	characters were created from ANSI X3.49-1982 specifications.		
QR-Code	QR-Code is an efficient, two-dimensional (2D) barcode symbology that allows easy encoding of MECARD data including phone numbers and web URLs. This symbol can withstand damage without causing loss of data.		

4.0 How Barcode works:

Barcodes function as unique identifiers that encode information in a visual pattern of parallel lines, dots, or shapes. These patterns, typically scanned by specialized devices like barcode readers or scanners, translate into alphanumeric characters. Each digit or character within the barcode corresponds to specific details about the product or item, such as its manufacturer, type, or serial number. When scanned, the barcode reader emits light onto the barcode, measures the reflected light, and interprets the varying widths and spaces between lines or shapes to decode the information. This swift decoding process allows for rapid retrieval of data, enabling efficient inventory management, tracking, and identification across various industries.

5.0 Conclusion

In conclusion, the integration of barcode technology stands as a vital advancement in modernizing academic libraries. Its implementation revolutionizes the management of resources, enhancing operational efficiency, accuracy, and user convenience. By automating cataloging and tracking processes, it minimizes errors, expedites transactions, and facilitates a more seamless borrowing experience. Moreover, the data gleaned from barcoding systems empowers libraries to make informed decisions, optimizing resource allocation and collection organization based on actual usage patterns. Ultimately, the adoption of barcode technology reshapes the landscape of academic libraries, ensuring they remain dynamic, efficient, and responsive to the evolving needs of students, faculty, and researchers. This technology is very cheapest & easy to use. So that this technology are used widely in the world.

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