A COMPREHENSIVE REVIEW ON BARCODE TECHNOLOGIES FOR PRODUCT IDENTIFICATION

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A Comprehensive Review on Barcode Technologies for Product Identification

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ABSTRACT

The paper provides an overview of some latest bar code technology, which involves the insertion of a small RFID (radio-frequency identification) tag. This beneath the skin to enable individuals to carry personal identification information or other data with them at all times. In particular, the paper considers the potential benefits and risks associated with the use of bar code implants for medical purposes, such as patient identification, monitoring and tracking of medical treatments, and emergency responses. Because of the importance of maintaining track of all products in one location, barcodes have become important elements of sales and product services. This Paper explores the different bar code technologies and applications used in segments of the retail grocery as well as consumer goods industries. It will examine the history and development of barcode technology, including the various applications it has been proposed for, and the ethical and legal considerations that arise from its use. Further, focus on the potential benefits and risks associated with bar code implants in the medical context used for patient identification, tracking of medical treatments, and emergency response. Authors also performed a comparative study on some characteristics like technology used, advantages in industry or market and also mention the future recommendation.

KEYWORDS

Barcode Scanner, RFID Technology, Ethical Considerations, Legal Considerations, Healthcare Providers, QR Code

INTRODUCTION

Bar code implant technology, also known as sub dermal RFID (radio-frequency identification) tags, involves the insertion of a small microchip under the skin, which can store personal identification [1]. Information or other data can be read by scanner. Generally, barcodes are symbols shaped in the form of rectangles which consist of thin or thick parallel lines parallel to each other. Barcodes provide means for automatic rapid data input into the computer. Since the last decade, barcodes are being used in many areas such as market products and electronic devices. The lines on barcodes contain the reference number of the product. This information should be recorded in computers to store each product separately for counting company sales and purchase quantities. When reading barcodes on products using some laser scanning device, a signal is generated by the system and processed in the computer by software. There are several types of barcode that being used within the industrial field nowadays [2].

RFID technology has gained attention in recent years as a potential solution to a range of problems, from providing secure identification to facilitate medical treatments. However, its use has also raised ethical and legal concerns about privacy, security, and informed consent. The purpose of this review paper is to provide an overview of the current state of bar code implant technology. Our analysis will draw from a range of sources, including academic research, government reports, and media coverage. We will also consider the perspectives of stakeholders such as patients, healthcare providers, and policymakers, in order to provide a balanced and comprehensive view of the issues surrounding bar code implant technology.

Ultimately, we argue that while bar code implants hold promise as a valuable tool for individuals and healthcare providers, their use must be carefully considered and implemented with appropriate safeguards to ensure privacy, security, and informed consent. By examining the current state of the technology and the issues it raises, we hope to provide a useful resource for those seeking to understand the

potential benefits and challenges of bar code implant technology in the medical context and beyond.

Image processing techniques have shown great potential for improving the accuracy and speed of 2D barcode recognition. These techniques can be used to enhance the quality of barcode images, detect and correct errors, and improve the performance of recognition algorithms. Further research is needed to develop more efficient and robust image processing methods for 2D barcode recognition. The method used a combination of edge detection, thresholding, and morphology operations to accurately detect and decode 2D barcodes from low-quality smartphone images. The method used a combination of edge detection, thresholding, and morphology operations to accurately detect and decode 2D barcodes from low-quality smartphone images. Despite the potential benefits of barcode implants, there are also ethical and privacy concerns associated with their use. For example, some individuals may feel uncomfortable with the idea of being permanently marked with an identification tag, and there are concerns regarding the potential misuse of personal data obtained through the use of barcode implants.

QR(Quick Response) code[3] recognition from an image, which can be used to insert the image into a QR code reader The code can identify the image and retrieve the portion of the file, which can include details about specific individuals and organization logos, for example. The QR code is located in this section. Barcodes are of two types: i) 1D barcode and ii) 2D Barcode**.** 1D Barcode encodes the information or data between the parallel lines and spaces between them, these parallel lines have different widths and different spaces between them. A 1D barcode can only store the alphanumerical data if more information is to be stored then the length of the barcode should be increased. When a barcode reader device scans the barcode, the reader uses a laser to read those unique parallel lines and spaces. The barcode reader reads the code from left to right when scanning it.

After that, the barcode reader reads the pattern of shaded lines on the black and white bar and converts the encoded data into binary code. After the information is extracted into a binary form the computer reads the binary codes and the decoded information or data is displayed in the screen of the computer screen. Barcode implants have numerous applications in different area like patient identification, tracking of medical treatments, emergency response in medical area, personal identification, access control, tracking of inventory and assets in non-medical area. Potential benefits for patient identification, treatment tracking, and emergency response, risks associated with privacy, security, and informed consent.

LITERATURE REVIEW

Barcode techniques have various dimensions and numerous applications. Here we are presenting review for some of the latest and important research papers to understand the technology used, advantages and its future recommendations.

SN	Author Name and Title	Year	Technology Used	Advantages	Future Recommendation
01.	Sun Hong-Ying[1], The Application of Barcode Technology in Logistics and Warehouse Management	2009	Barcode scanners, Identification (RFID) technology , Electronic Data Interchange (EDI)	Improve efficiency of logistics operations, it can reduce the error rate of data collection	Artificial intelligence, machine learning, (IoT) to provide even more advanced logistics and warehouse management solutions
02.	Keng T. Tan et al., A New Perspective on First Read Rate of 2D Barcodes in Mobile Applications	2010	High-quality barcode scanners, Mobile device optimization, Lighting optimization, Barcode verification	Time saving, improved accuracy, enhanced user experience, increased productivity, cost savings	Implement image processing algorithms ,Optimize lighting technologies, Leverage machine learning and artificial intelligence
03	Lei Ma et al., Designing and Implementation of management system in EMU important parts based on barcode technology	2014	Emu, important parts, barcode, SKUs (stock keeping units), lifecycle management	Improved asset tracking, increased efficiency, enhanced safety, improved accuracy	Inventory Management , Maintenance Management , Work Order Management , Integration with other technologies
04	J.Vidhya et al., A Survey on Various Techniques Used for Barcode Scanning in Android Applications	2015	Barcode scanning Mobility Android application Segmentation Digital Camera	Tracks stock levels, products and prices Time saving, scalability, productive	Camera-based barcode scanning is one of the most commonly used techniques for barcode scanning in Android applications , Laser-based scanning

05	Yu Zhang et al., A Fast Color Barcode Detection Method through Cross Identification on Mobile Platforms	2015	2D barcodes; color barcodes; detection, Computer vision algorithms, Machine learning algorithms, Color-based barcode encoding	Improved detection speed, greater flexibility, greater reliability, improved user experience	Real-Time Detection, Robustness to Lighting Conditions, Platform Compatibility: This method's compatibility with mobile platforms is critical to its widespread adoption
06	Changsheng Chen et al., PiCode: a New Picture-Embedding 2D Barcode	2016	2D barcode, embedded picture, perceptual quality, Decoding robustness	More compact and efficient than traditional barcodes ,Higher storage capacity, Enhanced security, Improved readability	Ensuring consistency and compatibility, developing robust security measures to prevent unauthorized access and ensure the protection of sensitive information
07	Lijun Mao et al., Application of 2D Barcode Technology based on Image Processing	2018	barcode; Automatic identification; Picture processing	Increased storage capacity, Improved readability, Reduced costs, Improved tracking and inventory management	Improved Supply Chain Management. 2D barcodes can be used for security purposes
08	Andleeb Zahra et al., Forensic STR profiling based smart barcode, a highly efficient and cost Effective human identification system	2018	DNA profiling Human identification Barcode HIBS	improved sample tracking, highly secure and accurate, scalable and efficient	Integration with Mobile Devices , Future research can focus on identifying new and innovative applications for smart barcode technology
09	Hassan Yusuf Ahmed et al., Barcodes Technology	2018	Barcode scanner, Barcode software applications, Identification (RFID) technology	It improves data accuracy, increases speed and efficiency, is cost-effective	Advancements in QR Codes, Use in Emerging Markets, In the future, barcode.
10	Hui Zhang et al., Detection and identification method of medical Label Barcode based On Deep Learning	2018	Deep learning, Barcode Detection, Distortion Correction, Barcode recognition	It improves accuracy, increases efficiency, is versatile, reduces human error, enhances security, and is scalable	Deep learning algorithms can be integrated with healthcare systems to provide real-time tracking , Customized Detection and Identification Models
11	Yiming Ren et al., Barcode detection and decoding method based on deep learning	2019	barcode detection, deep learning, Morphological method, affine transformation correction	It improves accuracy, increases speed and efficiency, is versatile, reduces human error, enhances security, and is scalable	Use in Emerging Markets , Future research can focus on developing customized models for specific types of barcodes
12	Geke A. W. Denissen et al., Generic implant classification enables comparison across implant designs: the Dutch Arthroplasty Register implant library	2019	arthroplasty register; hip prosthesis; knee prosthesis; classification	Including improved data analysis, implant performance monitoring, transparency, research capabilities, and international collaboration	Integration with Electronic Health Records ,Expansion of Applications , developing standardization protocols for implant classification systems, Collaboration between Manufacturers and Regulators
13	Natalia Wilson et al., Nurses' Perceptions of Implant Barcode Scanning in Surgical Services	2019	Barcode scanning, Implants, Unique device identifiers, Electronic medical records (EMRs), Radio frequency identification (RFID) technology	It improves patient safety, enhances communication, improves accuracy, and standardizes documentation	Future research can focus on developing effective training and education programs for nurses ,Integration with Electronic Health Records

14	Luca CATARINUCCI et al., 3D-Printed Barcodes as RFID Tags	2020	Barcode, UHF RFID tag, Fused Deposition Modeling, 3D Printing	It allows for customization, durability, cost-effectiveness, flexibility, high accuracy, and integration with other technologies	Improved Durability, RFID tags, such as using recycled materials or reducing waste
15	Nikash Pradhan et al., Barcode Recognition Techniques: Review & Application	2021	Barcode, Graphical User Interface, MATLAB, Recognize, Produce	can read the encoded information at high speed and more accurate which makes the process faster and efficient.	Future research can focus on developing more advanced algorithms that can recognize barcodes more accurately and quickly
16	Thanapart Sangkharat et al., Application of Smart Phone for Industrial Barcode Scanner	2021	Android smart phone, Image processing, Barcode scanner.	Cost-effectiveness, convenience, mobility, a user-friendly interface, data integration, and cloud connectivity.	Friendly and customizable applications to meet the specific needs of different industries, Enhanced Security, Cloud-Based Solutions.
17	Yuka Umeki et al., DNA barcoding and gene expression recording reveal the presence of cancer cells with unique properties during tumor progression	2022	DNA barcode ,Gene expression, recording Cancer stem cell stg RNA, NANOG POU5F1	Improved accuracy, early detection, personalized treatment, and high-throughput analysis. Leading to improved treatment options and better patient outcomes.	Integration with Machine Learning Standardization of Methods, Future research can focus on developing ethical guidelines and policies to ensure the responsible use of genomic data.
18	Jaroslava Kubánˇová et al., Implementation of Barcode Technology to Logistics Processes of a Company	2022	RFID technology, management systems (WMS), Transportation management systems (TMS), Electronic data interchange (EDI)	Inventory Control , Accuracy (2D, 3D Barcodes), Error reduction	Barcode technology can be integrated with Blockchain technology to provide an immutable record of supply chain transactions and enhance supply chain security

CONCLUSION AND FUTURE SCOPE

The presented paper reviews the technology about the barcodes creation, category, data stored by barcode, several scanners and scanners and their method of recognizing the barcode. The barcode is a symbolical representation of the encoded information or the data that can be scanned by the barcode scanner in a fast, accurate, and efficient way. RFID technology is generally used everywhere in the modern world to make the data entry, searching, tracking of items simpler. This technology is mostly used by Courier service, Library in universities, Flight Boarding pass, Aadhaar card, Student ID Cards, Point of Sale System, etc. This can read the encoded information at high speed and more accurate which makes the process faster and efficient. The papers performed a critical review on available and important barcode techniques and present the importance and future recommendation of each technique.

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