A Review of Various Industrial Applications of Barcode Technology

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ABSTRACT: In recent years, significant advancements in the wireless networks, electronic communications, information technologies, and computers have provided fruitful environment for the development and effective growth of the Barcode technology. Moreover, these Barcode systems have found a large row of applications in various different sectors of business, ranging from baggage tracking, logistics, internet payment systems, supply chains, data management systems, healthcare services, retail business, to complete industrial automation. Barcode technology is being presumed to be providing a vision to the computers to gain a managerial control over various aspects of the business. In this paper, we analyse various such possible industrial applications of the barcode system in real time.

KEYWORDS: Barcode Technology, Barcode Systems, Industrial Applications, Tracking, Industrial Automation

I. INTRODUCTION

Today, the use of barcodes is widespread in almost all types of business. Bar coding is a system of labelling with spaces and bars printed side by side on the object. Barcode is basically a visual form of information that consists of a machine recognizable data. Bar Codes store their data in the printed parallel lines along the widths and spacings that can be easily read by the optical Barcode Scanners. The dark bars and the white bars absorb and reflect the light, respectively coming from the laser in the barcode scanner. The quality of the barcode label is an important factorfor the guaranteed success of a barcoding system. "Print Contrast Ratio (PCR)", the ratio of thedifference between the light reflected from the white bar and the dark bar to the light reflected from the white bar, must be in a minimum range of *60 to* 70 percent for the scanning process to be successful. Barcode automates the business process and procedures and thus increases the productivity and also reduces the human errors completely. Hence, wherever there is a need of accurate tracking or identification, the barcode systems can be used without any second thought. For example, in an environment where the work of data entry is done, the employee might be required to enter a huge amount of data into a database system to be used later for various purposes. There, instead of manually enteringthe datasuch as a unique identification number into the database, the data entry operator may simply scan thebarcode and easily getthe information is encoded in the white and black bars of the barcode. This would definitely increase the automation and also reduce the human error.

II. INDUSTRIAL APPLICATIONS

A method for managing the inventory of spare parts for the nuclear power sector has been explained in [1]. A data driven approach has been used to design a 4 step method that includes influence diagrams, weighing of influences, grouping of parts based on their criticality and the structuring of the inventory policy for every group of parts. This method allows continuous improvement by the use of continuous inputs from the specially employed personnels. A novel, integrated and comprehensive techniques for the management of the spare parts has been suggested which can either be used together to manage the complete process, or used separately to manage a part of the process.

The use of Barcode system for healthcare applications is described in [2], where the Barcode technology is used along with information and communication technologies. A system, where the identification of the patients in the hospital has been automated using Barcoded cards; real time locating and tracking of medical equipments; and an easy

to use drug inventory management using smart Barcode labels and the Barcode readers. A due attention has also been placed on the privacy and security of the patient's and medical personnel's data. All these tasks were backed by a software application to provide an easy to use graphical user interface between the barcode system and the user. This system saved a lot of time for the hospital ward and thus resulted in an increased productivity and efficiency of the entire hospital. This system also reduced the errors related to patient mix up and various drug administration errors.

The system provides automated uploading for medical and patient data, secure information exchange with the central server, generation of electronic patient prescriptions, proper accounting of nursing activities in a ward, etc.

Use of various technologies such as wireless system, bar coding and RFID for materials management in construction projects in order to overcome human errors and to make tracking and management of materials easier is shown in [3]. The paper shows that how a proper materials management process in a construction project can improve the time requirements, overall quality of the project, as well as the monetary requirements leading to reduced project costs.

Materials Management is a field of huge importance due to various common problems faced by the construction projects such as, supply delays, volatile prices of raw material, shortage of materials, insufficient storage facilities, damage of materials, wastage of materials, and many more.It presents a real time materials tracking process using RFID and Barcode technologies for materials management at the construction site.

A barcode based conditional maintenance approach has been proposed in [4] for the production as well as spare part inventory control to increase the effective throughput of a manufacturing process that depends on the equipment maintenance procedures and the availability of the spare parts. The objective here is to minimize the amount of investment in the spare parts and the reduction of the operation costs. Here a specific unit of manufacturing equipment is monitored continuously for any degradation during the operation of the equipment, and as soon as the degradation value reaches a certain threshold, a replacement action is triggered. All of these are achieved using the degradation limit maintenance policy along with a base stock spare part inventory control policy.

Approximation of least squares and an optimization technique based on the simulation are used as a 2-step process for the determination of the amounts of stocks of the barcoded spare parts. The approach used is heuristic, and is implemented as a computational algorithm that helps in performing preventive maintenance of the system under use, and to control the inventories of the spare parts. Using this approach, the operating costs of the production processes had been shown to have reduced considerably to a larger extent.

Various applications of the barcode technology in the field of automated storage and retrieval systems have been discussed in [7]. Various different types of identification systems are also discussed in brief such as RFID, OCR, Magnetic Stripe, Datacode Technology and Barcode Technology. 'Two to Five Bidirectional', 'Two to Five Unidirectional', 'Interleaved Two to Five' and 'Code Three of Nine' barcode symbologies are also illustrated with proper examples. A different method for the generation of barcode labels and the different types of barcode readers such as Hand Held Readers, Fixed Mount Readers, and High Speed Conveyor Mounted Readers has been illustrated.

In [5] authors have done a thorough survey of the current supply chain model of the company to find out all the inventory related problems and have suggested a new model that performs a demand forecasting analysis to solve the problem. A vendor rating method has been used to rectify the irregular raw material supplies from the vendor, and an ABC analysis has been proposed to regularize the purchasing activity of the company.

An activity chart to find the value added as well as non-value added activities is drawn. This helps in the reduction of the lead time just by removing the non-value added activities that are of least importance.

The efficiency of the suppliers is judged on the basis of quality by calculating a value for the sigma level for each of the supplier. At the end, a bar coding system that solves the problem of wrong issuing of raw materials to different departments has been recommended for the company which is a small medium scale manufacturing company according to which, a supplier has to compulsorily paste barcode labels on every box of material.

A Management Information System (MIS) is shown in [8] for Universities and Educational Institutions, that uses a client server model for the detection of students using a barcoded identity card and a barcode reader. The Management Information System provides complete information about the student, staff, and report generation, to be used by the University or an Educational Institution.

The security in this Management Information System is provided by performing the encryption of all the communications occurring between the client and the server by using a system level password.

A traceability code system is designed in [9], using the UCC/EAN-128 Barcode rules for the cereal and oil products that tracks and traces the quality information which helps the user and the inspector of the quality and safety to judge the product quality. The barcode that is used here comprises of various useful information such as enterprise identification code, batch code, item code, etc. This barcode is pasted on the packages of oil and cereal products, using which the users can easily track the quality and safety information about the product.

This helps in protecting the consumer's right to information related to the purchased product, also it helps the enterprises to maintain transparency about the quality of their product which acts as an essential factor in increasing the popularity, brand awareness and thus, indirectly increasing the sales of the enterprise and their brand loyalty. Thus, the barcode system proves to be a win-win solution for the enterprises as well as the consumers.

III. CONCLUSION

Even though there are huge benefits of adopting this emerging barcode technology, a lot of major quantity of deployments of such barcode systems are yet to be done. Main obstacles to the proper adoption of this technology includes initial cost of investment, deficiency of enough of successful examples to justify their full efficient utilization in the businesses, the lack of the need to adapt the new practices for efficient processing and analysing of data, the need for the customizations in the software for every different applications and businesses, etc. Many of these problems have, however been give considerable attention by the researchers resulting in a significant progress in terms of reduction in the requirement of time, labour, elimination of out of stock conditions, and an increased overall efficiency, reliability & robustness in the complete area of its application. Currently one-dimensional barcodes are being used in a variety of applications, and is also cheap, but it contains only a limited amount of information. With the increasing amount of information to be used for the complete description about the product, the two-dimensional barcodes that store much more information will gradually make their way in the near future.

REFERENCES

1. AnjumAsKim La Scola Needy, Natalie M. Scala and JayantRajgopal, "Managing Nuclear Spare Parts Inventories: A Data Driven Methodology", IEEE Trans. on Engg. Mgmt., Vol. 61, No. 1, pp. 28-37, 2014.
2. G. Gregoriou, A. Dimitiou, P.C. Polycarpou, A. Blestsas and J.N. Sahalos, "On the Design, Installation, and Evaluation of a Radio-Frequency Identification & Barcode System for Healthcare Applications", IEEE Antennas and Propagation Magazine, Vol. 54, No. 4, pp. 255-271, 2012.
3. AlinaShamsuddin, NarimahKasim, NaadiraCheKamarudin and RozlinZainal, "Implementation of Barcode & RFID Technology for Real-Time Materials Tracking Process in Construction Projects", IEEE Colloquium on Humanities, Science & Engineering Research (CHUSER 2012), pp. 472-476, 2012.
4. Mitchell Rausch and Haitao Liao, "Joint Production and Spare Part Inventory Control Strategy Driven by Condition Based Maintenance", IEEE Transactions On Reliability, Vol. 59, No. 3, pp. 507-516, 2010.
5. P. Gupta, S.K. Garg, A. Jayant and S.K. Jhamb, "SCM: An Integrated Approach for Effective Management: A Case Study of Manufacturing Unit", ICCAE, The 2nd International Conference, Vol. 5, pp. 221-225, 2010.
6. Sun Hong Ying, "The Application of Barcode Technology in Logistics and Warehouse Management", First International Workshop on Education Technology and Computer Science, pp. 732-735, 2009.
7. K. VishwanathaRao, ThotaSriram, Basheer Ahmed and S. Biswas, "Applications of Barcode technology in Automated Storage & Retrieval Systems", IEEE IECON 22nd International Conference on Industrial Electronics, Control, and Instrumentation, pp. 641-646, 2006.

8.   Syed Sohail Ahmed, UsmanHaider and AimanNadeem, "Client/Server Model of Security with Bar-coded Identity Cards", IEEEComputer Science and Information Technology (ICCSIT), Vol. 9, pp. 687-691, 2010.
9.   ZHENG Huoguo, LIU Shihong, MENG Hong, HE Pengju, "Design and Implementation of Quality Traceability Label for Cereal and Oil Products Based on UCC/EAN-128 Bar Code", IEEE World Automation Congress (WAC), pp. 469-473, 2010

BIOGRAPHY

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