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RFID technology in apparel manufacturing

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Abstract

The Indian textile and apparel industry is one of the largest in the world with an enormous raw material and manufacturing base. Today's manufacturers are looking towards more advances and benefits with their focuses shifted to many different types of networking tools. Radio-frequency identification (RFID) is a technology that uses communication via radio waves to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking. Three main components of RFID system i.e. tags, reader and antenna. RFID reader is a device used to gather information from an RFID tag, which is used to track individual objects. The antenna attached to a reader is to transmit an electromagnetic field that activates a passive tag when it is within reading range. Automatic Identification and Data Capture (AIDC) methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID technology applied in Apparel & Textile industries, Automatic toll collection, bridges or tunnels, Animal tracking, Infant identification in hospitals and Counterfeit prevention (e.g. in the pharmaceutical industry) and many more. RFID in textiles may be expected to impact consumers by giving them more information about the garment in a RFID chip, thus increasing consumer information, in particular at the point of sale. e.g. smart shelves, smart dressing rooms and a smart mirror were installed. In this articles we discussed RFID Technology, its working, how to use in garment industry.

Keywords: RFID, textile and apparel, memory, future trends in RFID

Introduction

The Indian textile and apparel industry is one of the largest in the world with an enormous raw material and manufacturing base. As the manufacturing industry becomes more globalized, the multi-factory supply-chain model has emerged. The garment-manufacturing industry always aims for new product development and efficiency improvement in production. In past years, advanced computer technologies already facilitate new manufacturing operation and build up management tools. Today's manufacturers are looking towards more advances and benefits with their focuses shifted to many different types of networking tools. In past era people record the information of product to maintain a proper register. Then Barcode systems introduced in textile industry due to advancement of technology, Using advanced technologies, which can reduce lead time, cost and most importantly efficiently manage the inventory. But some drawback of Barcode system in which amount of information stored in a barcode is very less as compared to RFID. RFID (radio frequency identification) is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object.



Application: Tracking cars, access control, such as keyless entry and employee identification, Apparel & Textile industries, Automatic toll collection at the entrances to turnpikes, bridges or tunnels, Animal tracking, with no need for physical capture, for instance in forests or mountain, Vehicle tracking in cases of theft, Infant identification in hospitals, Controlling access to restricted areas, supply chain management and Counterfeit prevention(e.g. in the pharmaceutical industry).

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RFID System Components

Tags (Transponders), Smart labels, Reader/Interrogator, Antenna, Interface and Host/Controller (PC/Laptop). Now I will explain one by one in details.

RFID Tags: Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. The tag is also composed of a protective material that holds the pieces together and shields them from various environmental conditions

Types of RFID tags- Passive RFID tags: which have no power source and require an external electromagnetic field to initiate a signal transmission.

Active RFID tags: which contain a battery and can transmit signals once an external source ('Interrogator') has been successfully identified.

Battery assisted passive (BAP) RFID tags: which require an external source to wake up but have significant higher forward link capability providing greater range.

RFID tag memory- 1. Read-only tags -Tag ID is assigned at the factory during manufacturing, can never be changed and no additional data can be assigned to the tag. Write once, read many (WORM) tags- Data written once, e.g., during packing or manufacturing, tag is locked once data is written. 2. Read/Write -Tag data can be changed over time, part or all of the data section can be locked.



Smart labels: Smart labels differ from RFID tags in that they incorporate both RFID and barcode technologies. They're made up of adhesive label embedded with an RFID tag inlay, and they may also feature a barcode and/or other printed information.

RFID readers: RFID reader is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. RFID is a technology similar in theory to bar codes. Functions of Reader: Establish a bidirectional data link, Communicate with networked server(s), Can read 100-300 tags per second, Readers (interrogators) can be at a fixed point such as-Entrance/exit and Point of sale

Antenna: The antenna attached to a reader is to transmit an electromagnetic field that activates a passive tag when it is within reading range. Once a passive tag is activated it can transmit information from its antenna to that of the reader where it is processed. During rewriting applications the antenna of the reader acts as a relay device in the reverse direction, the reader communicates a message through its antenna, which transfers and stores the new data to the activated transducer via its antenna.

Interface: Is a device or program enabling to communicate with a computer.

Host/Controller (PC/Laptop): Computer with suitable software controls RFID readers

Working of RFID- RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention.

Applications of RFID in Apparel & Textile- RFID applied in manufacturing process management system, Inventory management, Production control, Tracking, Labor Movement, Retail management, Product Distribution, Store Management and Checkout & Payment Process.

Manufacturing process management system

a. RFID Token: A low frequency (13.56MHz), passive tag with unique ID that is associated with a bundle of cut- raw materials (i.e. sleeves, cuffs and hoods) that are to be used fulfill each order.

b. RFID readers: Installed in the cutting department next to each sewing machine and QC table. Readers attached to sewing machine is for reading data only and features simple button to inquire about previously scanned data, whereas that installed in the QC table has a key board on which the inspector input defect code (e.g.0-low quality, 1-missing step, 2-fabric problem, 3-size problem) after a particular piece of the garment has been scanned and has the memory to store data of up to 3000 records in case of power shortage.

Inventory management: The use of RFID system assists in better inventory management and enhances customer shopping experience indicate the type of clothing selling faster or slower, which provide customized advertisement on picked clothes according to the RFID tags. The received goods are registered and the data stored on RFID transponders can be read for each good though received in pallets or individual fashion item on hanger.

Production control: Inside the stores of the production department the stock level can be quickly monitored which helps in a real-time and efficient inventory management. The location and movement of the components, semi-finished and finished products can be detected by the RFID system, which helps in production monitoring and control. Barburski *et al.*2008. Stated that RFID technology can be used for the identification and monitoring of a single product in textile factories. However, because of the harsh environment in textile production (high temperatures, chemicals, physical processing), RFID tags have to be properly packaged in order to be protected from damage during the production process.

Tracking

a. Equipment Tracking and Management: The heavy equipments such as ginning machines, cotton cleaners, lap former, combers, as well as drafting and drawing machines need to be routinely monitored and maintained.

b. Product tracking in spinning industry: In spinning industry it is used to avoid product mix, which is one of the prevailing problems faced in the quality control department. The areas such as carding, drawing and combing (sliver and hanks mix-up), simplex (bobbin

mix-up), ring spinning (cop mix-up) can be avoided by placing the tag in the corresponding semi-finished materials.

- c. **Tracking of Labor Movement:** Knowing where an employee is at a particular time would allow the management to dispatch the closest-qualified employee to a location requiring assistance.

Retail management: It is used in retail to monitor and control the floor level out-of-stocks. It is mostly required where there is high product display density, low staffing level and chances of mishandling is very high. The stock level of the items is properly maintained and the items can be grouped according to their demand. Mostly the retailers verify the accuracy and integrity of the shipment by open-box audit prior to stocking or storing of goods. RFID provides a new horizon to the retailers in receiving materials, which eliminates the invoice disputes, mixing of different quality products etc. Nikolicic *et al.* 2015. Conducted a study on impact of RFID technology on logistic process efficiency in retail supply chains. The result found that the application of RFID contributes to costs reduction and business efficiency increase through the automation of the entrance and exit of goods, commissioning and operation of personnel. The utilization of RFID tags on packages can reduce processing costs by 26% and the total active time by 9%. Elsheikh and Fek, 2015. Investigated the printed RFID technology and its deployment in the Egyptian fashion retailing, discovered the benefits and pointed out the barriers preventing the proper deployment of this technology in the Egyptian apparel retailing market. The results showed that using conventional electronic article surveillance (EAS) was not effective in securing store's goods, and it caused damage for about 0.05% of garments. An innovation in conductive ink allowed RFID tag providers to print RFID antenna on tagging substrates, instead of using a conventional solid-copper antenna, which was more expensive and less flexible.

Product Distribution: The products are delivered in cartons or as hanger-goods as ordered by the stores, and transported without storage at the logistics service provider. The distribution center staff equipped the goods with Serial Shipping Container Code (SSCC) tags and brought them to the outgoing goods area. At the warehouse entrance of distribution center, RFID readers track the merchandise as it came in delivered products are registered, distinguishing stackable and hanger goods. The data stored on the RFID transponders are read automatically for each individual product.

Store Management: Intelligent Clothes Racks are equipped with an RFID antenna. The moment the article was returned was, also registered. The time that lapsed before a customer returned an item to the rack, provides valuable information: If a customer put a blouse back on the clothes rack after five seconds, she possibly did not like the material. If five minutes went by, it is likely that the customer tried on the article. Smart Shelves offers similar functionalities for stacked goods.

Checkout & Payment Process: Selected cash registers are equipped with RFID readers and connected to the merchandise management system. In order to complete the checkout and payment process, staff merely places the fashion

goods onto the cash desk. The total amount to be paid displayed at the cash register, customers then continue the check out with traditional payment procedures (credit card, cash, etc.).

Care labeling: The electronic labels use RFID tags for storing information electronically on a garment. Additional tags are needed for the wash care instructions, which will increase the cost of the garment. In addition, the consumers need special readers to extract the information stored in the RFID tag. Wang *et al.* 2015^[14]. Studied the impact of washing on epoxy-coated copper fabric textile RFID tags. Tag samples were washed in a household washing machine, in a 40°C washing program with detergent and spinning, and tested wirelessly after each washing cycle. The epoxy-coated tags achieved attainable peak read ranges of approximately 8 meters.

Future trends in RFID

The use of RFID technology for individual identification of garment pieces, or packages of garment can be used to support more direct delivery of garment from production plants to retailers. This can eliminate the need to root them by default through supplier, warehouses for order –specific picking. Direct delivery requires more flexible allocation of articles to customer order in apparel supply chains, which have to cope with large no. of different products variants. Further research should try to further explore the application of the concept of autonomous control to apparel logistic and refine and expand the model of apparel pieces and bundles as autonomous logistic objects with in transport scenarios. The validity of the concept has to checked by additional test trials or a limited roll-out for individual product line. Ngai *et al.* 2015^[15] found that both technology push and need pull factors influence the adoption intention of the garment factory to adopt RFID technology. Technology push factors include relative advantage, compatibility, complexity, extendibility, and cost of the technology while need pull factors include competitors and customers pressure. Technology push forces stem from a well recognition and proven RFID technology which can improve manufacturing process as well as its efficiency and accuracy and can enhance a firm's performance. Nash 2010^[13]. Stated that no doubt companies can grow with the use of the technology and its contribution to the next era in inventory management. The challenges and issues can be overcome, if more development is completed within the technology. One thing is certain after completing the research, technology is here to stay and the effect it had on the supply chain will contribute to our future economy.

Conclusion

Radio-frequency identification (RFID) is a technology that uses communication via radio waves to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking. In future almost all the manufacturers, distributors and retailers in textile business will be using the RFID system. The apparel industry is characterized by short product life cycle, frequent style changes, a wide range of product designs and hence input materials; variable production volumes; high competitiveness and often high demand on product quality. In addition to these challenges, the use of RFID increases the cost and maintaining privacy creates extra challenges

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