Future of RFID Technology in Health Care Systems: A Review Paper

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Abstract - Radio-frequency identification (RFID) technology is making inroads in healthcare. Such kind of up gradation must be provided to health care industry. It reflects better results in; improvement of patient assistance, medication flaws will be omitted, patient identification becomes easier, and to locate and track capital instruments in the hospital. Meanwhile RFID technology seems effective; in coming years, in case of matching and tracking blood for transfusion, combating the counterfeiting of medical products, tracking pharmaceuticals.This paper highlights an overview of RFID systems and its applications which helps us in elaborating the health care system in modernized way.

Keywords: RFID technology, RFID tags, RFID readers, Antennas

Objective - The comprehensive information calibrated in the paper defines the contingencies emerged by the technology and its main advancements in health care field. Whilst it is equally relevant to the enormous fields which indulge in tracking of goods. People are awake of barcoding, but RFID is at the edge of awareness. It reveals the information regarding usage of RFID systems to modernize health care systems.

1.INTRODUCTION

RFID (Radio Frequency Identification Device) is an emerging technology which enables to identify and track. It can help hospitals to quickly locate expensive equipment. From the overall perspective, it helps to improve patient care; maintenance of logistics, pharmaceutical dealings by efficiently managing the moveable assets. The usage of radio frequency identification technology seems to be growing rapidly in health care field. In medical industry, RFID products are used in enormous ways.In medical field RFID products can be implemented in lots of new ways. Moreover, lab samples, medical instruments, wrist bands embedded with minute RFID tags can be easily traced. Meanwhile, it also provides a great help in the automation of data entry in the health industry. So, it is crystal clear, in order to remove medical flaws RFID products provides the best solution.Unlike, primarily Bar code technology was used all most in every sector. It can only detect the product if it is in a line of sight. On the other hand, RFID technology can simply identify the products without placing the product in a line of sight. In addition to it, it can also identify the product from the measurable far distance also.

1.1 RFID TAGS

Active and passive are the two main classes of RFID tags.
An Active RFID tag is a hardware component connected to goods or person with a unique assigned identification and tags have the capability to emit radio signals on their own. In addition to this, sensors are embedded in the tags which help in the automatic data transmission, information detection, and any kind of movement detection. For the smooth working of Active Tags power source is essential. This power can be consumed from internal energy of any integrated battery previously. While, some devices are also designed which harvest energy from environment around the tags.
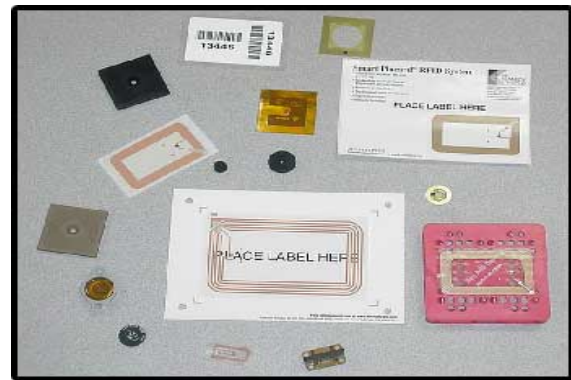
Fig 1: Various types of Tags

Another category of tags is Passive RFID tags. These tags do not have their own source of power and it usually use the energy produced by reader in the form of electromagnetic waves. Passive RFID tags do not work automatically they need human interaction to scan the tag to get product information in detail.

These tags provide a great help in healthcare systems which include patient, staff and objects. For detecting and recording the interactions the RFID readers are used that are fixed in treatment areas of hospital like wards/ patient room, operation theatre.

The most commonly used RFID product tag includes HF (High Frequency) product tags and UHF product tags.The both tags have difference in their reading range, which is up to 3 inches for HF tags, while in UHF tags it is have much longer read ranges. The main applications of these tags differ from each other. The first one HF tags are helpful in labeling blood and critical fluids and tissue samples.HF tags have the

major applications which include care around the bedside, matching of baby with mother.

Another tag UHF tags are important in tracking and identifying patients, inventory management of medical items and medical devices.UHF is useful for determining the movement of patient and if required it can set up geo-fencing also.

Fig 2: Information contained in RFID Tags

To implement the technology two essential devices are Tags and Tag readers. Comparing to the usage of barcode systems, RFID technology is very effective in its working. It consumes very short time in scanning and further effect improves the quality of work. In order to make the simplicity in the process of identification of out dated or missing items, items must be tagged.

Moreover, nowadays one of the most common technologies used for tracking of patients are RFID technology. For verifying, authenticating patients and tracking new born infants to old aged people it plays a vital role. Meanwhile implementation of such tools in the health industry ensures the timely availability of ambulance, recovery rooms and Ors.

2. IMPLEMENTATION

The foremost requirement for the implementation of RFID technology is presence of wireless infrastructure. In hospitals wireless technologies can be integrated. Radio Frequency Identification systems use transponders and tags for storing the information accessible from remote locations. For retrieving the information from different locations RFID readers are used. RFID uses radiofrequency tags for identifying equipment's and people by the unique identification assigned to them. Such objects can easily be tracked and it also provides security which is essential in every implemented system.

"Patients can be tagged with unique codes, reducing or eliminating medical errors."

2.1 RFID tags are always fixed with the objects and for tracking the object it should come in line of sight or placed at some measurable range of reader. The tags are automatically activated when they come in the range of radio frequency signals coming from the reader. It starts sending the information back to the reader.

Fig 3: RFID tags implanted on equipments

The **RFID readers** are kept at the entrance, door frame or anywhere in the rooms or hospital. Whenever any object moves reader reads the stored information automatically, decode the information and pass it to remote computers. The more is the number of receivers more precisely equipments can be located. The size and shape of antenna vary in tag and readers. These tags are of small size so they can be fitted anywhere. A computer system is used to monitor the RFID signals and solve the queries related to the access of the required information. Moreover other benefits are also linked with it cited as expiration dates, service schedules, tracking equipments and their warranties, misplaced and lost equipments which increase the hospital expenses can be reduced or eliminated.

Once the technology is implemented, there comes the turn of implantation. The RFID tags implantation is to be completed for patients, technicians, doctors, nurses, other hospital personnel, surgical instruments and other equipments are also added to the system.
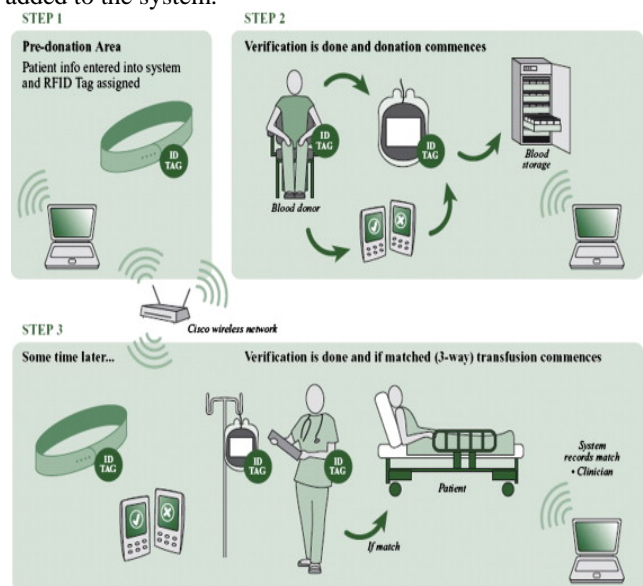

Fig 4: RFID tags implantation in employee tags, patient wristband.

For patients special wristbands are designed to track their movement, treatment details and medical history. The persons who are authorized to check the system monitoring all the technology can easily locate the location of hospital staff; time spent with the patients by nurses can also be traced.

In the next stage, inventory management can also be handled efficiently due to the implementation of technology. As the items enter or leave the inventory their details are updated in the system automatically. The expiration date of time sensitive medicines can be easily traced and system can monitor the supply of such medicines also. Item location can easily be maintained. Meanwhile, the medications provided to the patients, supplies entering the patient room can easily be recorded. The cost of passive tags is very high so the implementation of the technology to record information related to each patient is very costlier.

2.2 Examples of Implemented Technology

The first RFID chip was developed by a company named Verichip. This implantable RFID chip includes the technology which helps to achieve wander prevention, access control and infant protection. The passive tags are implanted under the skin which interacts with the database to collect the information related to the patient.

Another company is SurgiChip which deals with the development of patient tags. The tags are specially designed to identify the patient correctly. So, it eliminates the incorrect identification. This process includes a verification process which includes three steps netted as patient identification, the site of operation and retrieving the critical data related to the medical procedure. The secure audit trail is achieved due to electronic documentation provided by the tag.

Chris Ranger, head of safer practice at the UK's National Patient Safety Agency (NPSA), says: "Between November 2003 and June 2005 there were eight incidents in the UK of problems related to crash trolleys, where the relevant equipment was not on the trolley or drugs were out of date. It was not due to negligence. There are three different items on those trolleys, and there are processes to check that they are in place, but it is a difficult task, especially in an emergency room."

3. APPLICATIONS

RFID provides a solution which enables an authorized employee to determine the location of equipment. It generates reports by executing queries. The parametric search provides inventory related information, graphical representation of the location where equipment is kept. It also helps to maintain the service of the equipment.

- The tracking system has also helped with infection control by ensuring that equipment receives preventive maintenance at the appropriate time.
- Systems using passive tags are rapidly entering the pharmaceutical market to aid the fight against the circulation of counterfeit drugs.

- Systems using passive tags are rapidly entering the pharmaceutical market to aid the fight against the circulation of counterfeit drugs.
- Some of the proposed applications which will provide advantage to the health industry are : patient identification with the help of tags which includes care information, medications management, remotely monitoring of patients via implantation of tags identification and tracking of patients
- Equipment maintenance and management.
- Controlling and management of Inventory and its related items which prevents theft.
- Reducing errors related to Blood Administration.
- Special security measures for newborns.
- Vehicle Access Control.

The proposed Application/System can be improved by adding additional features in it. As the movement of items is traced when items enter or leave the inventory. The list of items which are tagged with the RFID technology would appear on the screen and the person removing the item from the inventory would add some additional data such as entering the details of the patient for whom items are designated.

This makes the tracking of supplies to a patient much easier to perform. The bill generation process will also effect. The items used for a patient are recorded in the system during tracking. So, while making bill they will be automatically added to the bill.

CONCLUSION

Similar technology could help to improve the efficiency of drug inventory and medical device management within the hospital supply chain. RFID is used to improve healthcare marketing efforts, operational effectiveness and efficiency, and patient satisfaction. RFID systems are seen as valuable because of their ability to collect data in real-time. As a result, these systems may have a valence toward surveillance, such that the location of individuals is tracked and analyzed under the rubric of management paradigms like "workflow management."

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