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RFID FOR BLOOD BAG IDENTIFICATION

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Abstract: This paper mainly deals with the Implementation of RFID in health care. It is primarily driven by a desire to improve patient safety and enhance the efficiency of the supply chain. This guideline, following a short technical overview and some examples from industry, assesses high level advantages and disadvantages of using RFID in transfusion medicine and identifies specific areas where RFID solutions might beneficially apply. It covers the use of RFID in the blood product supply chain from bag manufacturing to the donor and to the patient. This paper has focused on RFID solution components and a number of technical recommendations including choice of the radio frequency to be applied, tag capacity, functionality, and data structure to be considered when deploying RFID technology for transfusion medicine. The data structure of the blood bag tag accommodates the needs of all stakeholders in the transfusion medicine supply chain, including: RFID tag manufacturers, bag manufactures, blood centers, and hospital transfusion services. RFID may also increase accuracy of tracking time and temperature and reduce product waste, thus increasing quality and availability of blood products for patients. RFID technology can help ensure appropriate transfusion of the right blood to the right patient, thus reducing errors at the bedside and increasing patient safety.

Keywords: RFID Technology; Blood Bag; Safety.

1. INTRODUCTION

RFID stands for "Radio-Frequency Identification." RFID is a system used to track objects, people, or animals using tags that respond to radio waves. RFID tags are integrated circuits that include a small antenna. They are typically small enough that they are not easily noticeable and therefore can be placed on many types of objects. RFID systems can be used just about anywhere, from clothing tags to missiles to pet tags to food - anywhere that a unique identification system is needed. The RFID technology is called “a successor” to bar codes, though not intended to be a full replacement. Use of barcodes will dominate some areas of the marketplace and in others a combination of bar codes and RFID technology may predominate, for example Smart Label Tags. The tag includes a small chip with antenna and memory. RFID tags represent a basic element for collection and transfer of information through the electro-magnetic waves [1].

2. RFID

RFID is a complete system solution that operates in the electromagnetic spectrum to transmit data without contact or line of sight. It is an automatic identification and data collection technology utilizing “electronic” programmable tags for tracking, tracing and identification of objects [3]. RFID is a system with the following components:

1. Transponder (or Tag)
2. Reader/Writer (Interrogator)
3. Antenna
4. Host computer

2.1 Transponder or Tag

The transponder is at the heart of the system and consists of a small electronic circuit with an attached silicon chip. The RFID tag can be affixed to an object and used to track and manage inventory, assets, people, etc. For example, it can be affixed to cars, computer equipment, books, mobile phones, etc. In social media, RFID is being used to tie the physical world with the virtual world. RFID in Social Media first came to light in 2010 with Facebook's annual conference.

Fig-1:RFID Tag

RFID tags are powered and classified as two categories:
1 Active Tags.
2 Passive Tags.

2.2 Active Tags

Active tags have an internal battery that allows for long-read ranges. They are typically read/write capable and are often seen in toll collection applications. These transmit information to the receiving antennas by using a battery resulting in read ranges of up to 300ft. The combination of the larger antenna and battery result in a higher cost tag.

2.3 Passive Tags

Passive tags do not have a battery and powered by a separate source typically the interrogator. These are less expensive and can be write once read many (WORM), read only or read/write. These tags typically operate in one of three frequencies: 13.56MHz, 915MH (UHF) or 2.45GHz.

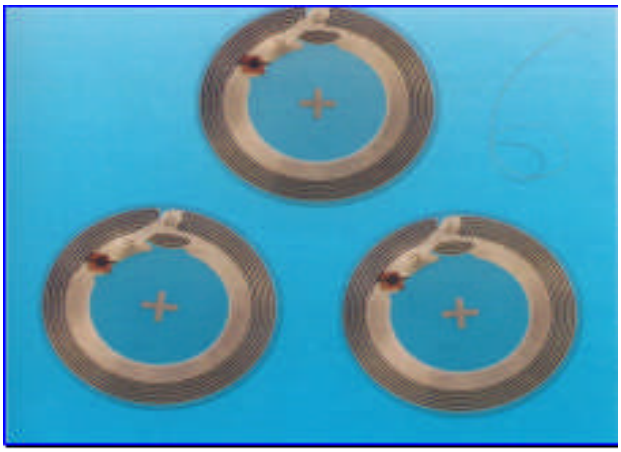

Fig-2: Passive RFID Tags

2.4 READER

A typical reader contains an antenna to transmit information to the tag as well as receive it from the tag. The size and form of the antenna will be dependent on the specific application as well as frequency chosen.

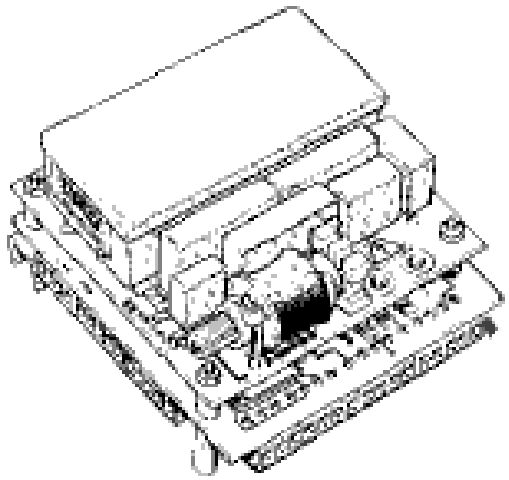

Fig-3: RFID Reader

3. RFID application in health care

RFID application in health care can be very useful in many aspects. In healthcare, RFID tags may be applied to people, patients, and staff and to objects, allowing readers on door frames, wards and treatment areas to detect and record interactions [4]. Some of the applications that use RFID are:

1. Patient identification.
2. Asset and equipment tracking.
3. Making new borns more secure.
4. Reducing drug and blood administration errors.

This technology can be generally used in logistic chains to simplify and intensify the logistic processes, such as in the distribution of medical material. Few laboratories have conducted practical tests, for example marking of breast implants or intraocular lenses by RFID to simplify identification. [2] RFID technology application in health care brings many benefits, namely elimination of mistakes connected to patient identification of medical application, speeding and improvement of the main logistic processes in hospitals, economical treatment of blood and blood products by automatic identification of a blood bag with temperature monitoring. Since 2004 a number of U.S. hospitals have begun implanting patients with RFID tags and using RFID systems, usually for workflow and inventory management.[47] The use of RFID to prevent

mixups between sperm and ova in IVF clinics is also being considered [5]. In October 2004, the FDA approved USA's first RFID chips that can be implanted in humans. The 134 kHz RFID chips, from VeriChip Corp. can incorporate personal medical information and could save lives and limit injuries from errors in medical treatments, according to the company. Anti-RFID activists Katherine Albrecht and Liz McIntyre discovered an FDA Warning Letter that spelled out health risks [6].

4. RFID usage in Health care

In the US, the Massachusetts General Hospital is using RFID to prevent blood transfusion errors. A warning alerts staff to possible mismatches and helps to prevent errors in busy areas such as Operating theatres. The pharmaceutical industry, meanwhile, is testing tags that will uniquely identify drugs. Such tags could also be used to alert staff to incorrect drug dosages or adverse reactions, reducing the potential for errors to be made. Suppliers like MBBS are already incorporating RFID tags into instruments, and they could also be incorporated into prostheses, which would support the automated recording of procedures for audit, recalls and risk management. Eventually, cheaper passive RFID tags could allow all goods to be uniquely identified. Equipment, drugs, devices and staff could then be linked to the care record, allowing detailed care pathways to be created and managed.

5. Blood bags with RFID chips

Blood is necessary for the human beings. Blood donations save lives. But it does happen that donations become mixed up en route from the donor to the recipient, or the blood deteriorates because it has not been sufficiently cooled – things which are very difficult to verify before a transfusion takes place. A consortium led by Siemens, in conjunction with the Medical University in Graz, Austria, has developed an RFID system with temperature sensors. The radio labels contain all the blood data and monitor the entire cooling chain with a temperature sensor, ensuring that the blood is correctly preserved. The chip is not removed at any point during the entire transport chain – even in the centrifuge. This electronic system comprising a temperature sensor, battery and chip is so robust that it is able to withstand being centrifuged at up to 5,000 times the acceleration of gravity [7].Before the donation, a reader is used to read the chip data and check its accuracy. This system is the first to enable a complete chain of documentation to be maintained from the donor to the recipient, significantly increasing patient safety.

Fig- 4 BLOOD Bag with RFID tag

In the initial test phase, about 1,000 bags of blood are being labelled, and all steps—from assigning each bag to a patient to the start of a blood transfusion—are being tracked and recorded. Before the system was implemented, bags of blood were tracked with bar codes and human-readable text. With the new blood-tracking system, hospital workers attach a self-adhesive 1.5-by-1-inch RFID label to each bag of blood arriving at the hospital. The label's passive 13.56 MHz RFID chip has 2 kilobytes of memory for storing a unique identification number, the hospital tracking number (used by the blood bank system) and information on blood type [8].

6. Procedure for donating Blood

1. The patient first enters the clinical room, where information such as patient identification number and blood type are recorded in the computer system, and an RFID-enabled wristband with 16 KB of memory is assigned. The wristband contains the patient's personal data along with a picture of the patient, encrypted with Autentica's secure protocol, called IFC*.

2. The patient then enters the blood donation area, which contains the mobile point-of-care (POC) trolley shown in below figure. The trolley has a wireless-enabled 1.7 GHz

Laptop PC using Intel® Centrino TM mobile technology, and a wireless-enabled RFID reader and programmer (PDA). The trolley can be used anywhere within the blood transfusion center. This is the first verification.

3. Before the blood donation, a staff member-a nurse or other clinical staff member-with a portable RFID reader reads the patient's wristband. This information is copied onto the blood bag tag. The staff member uses a PDA to compare the wristband against the blood bag tag, ensuring that they are identical. This is the second verification.

4. Staff members then scan their RFID badges, which contain their personal data, into the system at this

point. This completes the “triple verification” process, and the donation can begin.

5. When the donation is complete, a staff member again compares the full blood bag and wristband via PDA scan. The blood is then sent off for storage in the blood bank [9].

Fig-5 Mobile (POC) trolley Intel® Centrino TM mobile technology laptop PC, plus RFID reader and programmer

These radio nodes will be able to continuously monitor the temperature of the blood to ensure it is not getting too warm to be used. The nodes can also interact with other nodes on the patient's bracelet, sound an alarm, and flash a red light if the wrong blood type is presented for patient use. The intelligent radio nodes were developed by researchers at the Fraunhofer Institute for Integrated Circuits IIS and the Fraunhofer Working Group SCS in collaboration with T-Systems, Vierling, delta T and the University of Erlangen-Nuremberg. Another big improvement of these radio nodes compared to more traditional RFID chips is that the RFID tag can only be read when activated by the RFID reader whereas radio nodes broadcast continually. The continual transmitting of the radio nodes also makes them a good option for tracking important equipment within a hospital. Equipment routinely gets moved between departments at the hospital and finding the equipment can be a challenge. Equipment with the radio nodes attached could send constant location updates to a central location [10].

7. CONCLUSION

There is a large area of RFID use in medical purposes. The internal memory of tags can store all the important information for each of product life cycle step. The blood bag can be equipped by RFID semi-passive or active tags with sensors of temperature, acceleration or moisture, so we can store and monitor all the information along the product transportation. The stored data can give a proof of technological conditions of transportation and consequently save much used blood products with respect to the safety of patients. This brings improvement of efficiency of blood products economies. The possibility of storing and sharing the blood product tag information induce the necessity of global standards development for blood products labeling and tag data structure. These activities are under development and cooperation with worldwide standard organization GS1 Global, which historically introduced the global standard for use of bar codes.

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