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Overview: RFID & Its Healthcare Applications

Somya Bhatt
Student, Parul Institute,Vadodra,Gujarat
Contact ID :Somya.bhatt123@gmail.com

Abstract – Radio Frequency Identification Device (RFID) is the name given to the wireless, radio wave technology that allows for a small RFID chip to be embedded in any physical object and uniquely identified by an RFID reader. With an unlimited amount of possibilities for connected devices we are now seeing consumer packaged goods, animals, waste management systems and even humans tagged with RFID chips. RFID is not a new technology and has passed through many decades of use in military, airline, library, security, healthcare, sports, animal farms and other areas. Industries use RFID for various applications such as personal/vehicle access control, departmental store security, equipment tracking, baggage, fast food establishments, logistics, etc. The increasing ageing population around the world and the increased risk of falling among this demographic, challenges society and technology to find better ways to mitigate the occurrence of such costly and detrimental events as falls. The most common activity associated with falls is bed transfers; therefore, the most significant high risk activity. Several technological solutions exist for bed exiting detection using a variety of sensors which are attached to the body, bed or floor. In this paper, present and evaluate a novel method for mitigating the high falls risk associated with bed exits based on using an inexpensive, privacy preserving and passive sensor enabled RFID device.

Keywords - RFID, Application, RFID component, RFID in healthcare.

I. INTRODUCTION

RFID[1] stands for Radio Frequency Identification and is a term that describes a system of identification. RFID is based on storing and remotely retrieving information or data as it consists of RFID tag, RFID reader and back-end Database. RFID tags store unique identification information of objects and communicate the tags so as to allow remote retrieval of their ID. RFID technology depends on the communication between the RFID tags and RFID readers. The range of the reader is dependent upon its operational frequency. Usually the readers have their own software running on their ROM and also, communicate with other software to manipulate these unique identified tags. Basically, the application which manipulates tag deduction information for the end user, communicates with the RFID reader to get the tag information through antennas. Many researchers have addressed issues that are related to RFID reliability and capability. RFID is continuing to become popular because it increases efficiency and provides better service to stakeholders. RFID technology has been realized as a performance differentiator for a variety of commercial applications, but its capability is yet to be fully utilized.

II. RFID SYSTEM WORKS FUNCTION

Most RFID systems consist of tags that are attached to the objects to be identified. Each tag has its own “read-only” or “rewrite” internal memory depending on the type and application. Typical configuration of this memory is to store product information, such as an object’s unique ID manufactured date, etc. The RFID reader generates magnetic fields that enable the RFID system to locate objects (via the tags) that are within its range. The high-frequency electromagnetic energy and query signal generated by the reader triggers the tags to reply to the query; the query frequency could be up to 50 times per second.

As a result large quantities of data are generated. Supply chain industries control this problem by using filters that are routed to the backend information systems. In other words, in order to control this problem, software such as Savant is used. This software acts as a buffer between the Information Technology and RFID reader.

If the reader is on and the tag arrives in the reader fields, then it automatically wakes-up and decodes the signal and replies to the reader by modulating the reader's field. All the tags in the reader range may reply at the same time, in this case the reader must detect signal collision (indication of multiple tags). Signal collision is resolved by applying anti-collision algorithm which enables the reader to sort tags and select/handle each tag based on the frequency range (between 50 tags to 200 tags) and the protocol used. In this connection the reader can perform certain operations on the tags such as reading the tag's identifier number and writing data into a tag. The reader performs these operations one by one on each tag. A typical RFID system work cycle can be seen in figure.

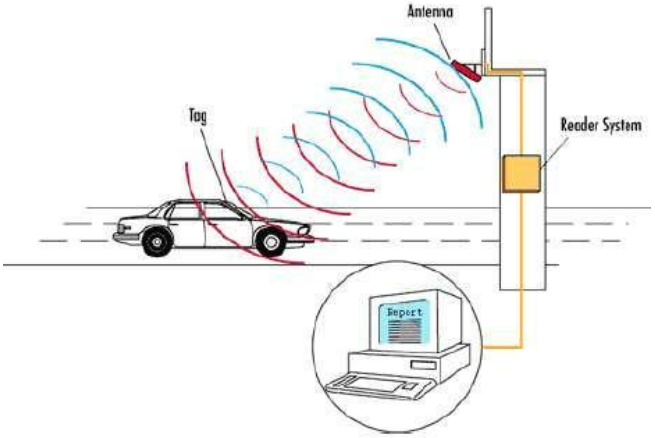

Figure 1: A typical RFID System

III. RFID SYSTEMS COMPONENTS

The RFID system consists of various components which are integrated in a manner defined in the above section. This allows the RFID system to deduct the objects (tag) and perform various operations on it. The integration of RFID components enables the implementation of an RFID solution. The RFID system consists of following five components.[2]

- Tag (attached with an object, unique identification).
- Antenna (tag detector, creates magnetic field).
- Reader (receiver of tag information, manipulator).
- Communication infrastructure (enable reader/RFID to work through IT infrastructure).

•Application software (user database/application/ interface).

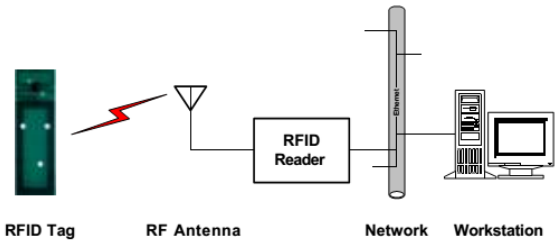

Figure 2: RFID Components

[1] Tags:

Tags contain microchips that store the unique identification (ID) of each object. The ID is a serial

number stored in the RFID memory. The chip is made up of integrated circuit and embedded in a silicon chip. RFID memory chip can be permanent or changeable depending on the read/write characteristics. Read-only and rewrite circuits are different as read-only tag contains fixed data and cannot be changed without re-program electronically. On the other hand, re-write tags can be programmed through the reader at any time without any limit. RFID tags can be different sizes and shapes depending on the application and the environment at which it will be used. There are three types of tags: the passive, semi-active and active. Semi-active tags have a combination of active and passive tags characteristics. So, mainly two types of tags (active and passive) are being used by industry and most of the RFID system.

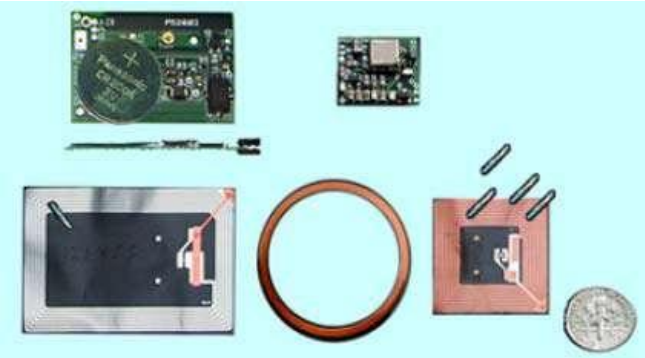

Figure 3: Variety of RFID Tag

[2] Antennas

RFID antennas collect data and are used as a medium for tag reading. It consists of the following:

(1) Patch antennas, (2) Gate antennas, (3) Linear polarized, (4) Circular polarized, (5) Di-pole or multi-pole antennas, (6) Stick antennas, (7) Beam-forming or phased-array element antennas, (8) Adaptive antennas, and (9) Omni directional antennas.

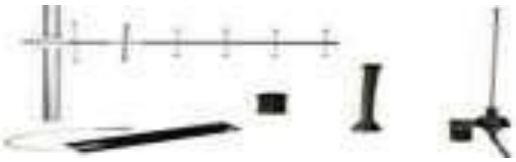

Figure 4: RFID Antennas Types

[3] Reader

RFID reader works as a central place for the RFID system. It reads tags data through the RFID antennas at a certain frequency. Basically, the reader is an electronic apparatus which produce and accept a radio signals. The antennas contains an attached reader, the reader translates the tags radio signals through antenna, depending on the tags capacity. The readers consist of a build-in anti-collision schemes and a single reader can operate on multiple frequencies. As a result, these readers are expected to collect or write data onto tag (in case) and pass to computer systems. For this purpose readers can be connected using RS-232, RS-485, USB cable as a wired options (called serial readers) and connect to the computer system. Also can use WiFi as wireless options which also known as network readers. Readers are electronic devices which can be used as standalone or be integrated with other devices and the following components/hardware into it.[3]

(1) Power for running reader, (2) Communication interface, (3) Microprocessor, (4) Channels, (5) Controller, (6) Receiver, (7) Transmitter, (8) Memory.

Readers use near and far fields of methodology to communicate to the tag through its antennas. If a tag wants to respond to the reader then the tag will need to receive energy and communicate with a reader. For example, passive tags use either one of the two following methods.

Near Fields: Near field uses method similar to transformer, and employs inductive coupling of the tag to the magnetic field circulating around the reader antenna.

Far Field: Far field uses method similar to radar, backscatter reflection by coupling with the

electric field.

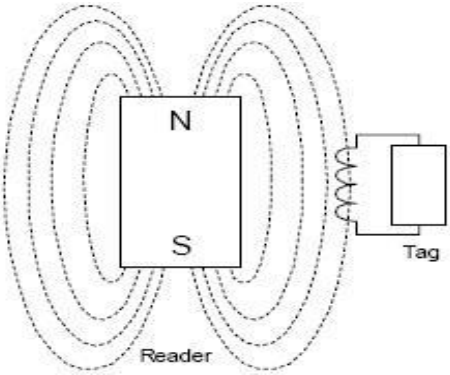

Figure 5: RFID Near Field Methodology

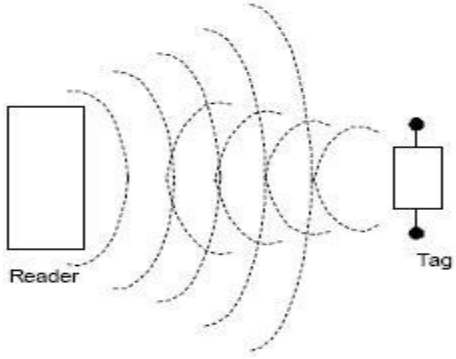

Figure 6: RFID Far Field Methodology

The distinction between the RFID systems with far fields to the near fields is that the near fields use LF (lower frequency) and HF (higher frequency) bands. While RFID systems with far fields usually use longer read range UHF and microwave.

IV. RFID ADVANTAGE, DISADVANTAGE AND APPLICATIONS

Advantage	**Disadvantage**
High speed	Interference
Multi and Many Format	High cost
Reduce Man power	Some materials may create signal problem
High accuracy	Overloaded reading(Fail to read)
Complex duplication	
Multiple reading(tags)	

Object identification can be given through various ways such as barcode, biometric and RFID. RFID has two basic categories (short & long range). The **short range** applications need tags to be near reader, it is useful in various conditions such as when a patient is required to come near the door/reader and only one person can get access (access control). The **long range** applications may not need tags that are closer to reader.

- Healthcare applications
- Security and control applications
- Patrolling log applications
- Baggage applications
- Toll road applications

V. RFID IN HEALTHCARE APPLICATION

RFID applications in healthcare could save important resources that can further contribute to better patient care. RFID applications could reduce the number of errors by tagging medical objects in the healthcare setting such as patients' files and medical equipment tracking in a timely manner. RFID further improves the situation for patients' care by integrating medical objects involved throughout the patients' care. RFID based timely information about the location of objects would increase the efficiency and effectiveness of paramedical staff leading to improved patients' experience.

Firstly, our proposed approach to use RFID in healthcare application utilizes a light, low cost, inexpensive, battery free RFID tag called Wearable WISP (Wireless Identification and Sensing Platform) or W^2ISP. This sensor is worn by elderly patients attached to their clothes (Figure 8).

Fig 8. Elderly volunteer with Wearable

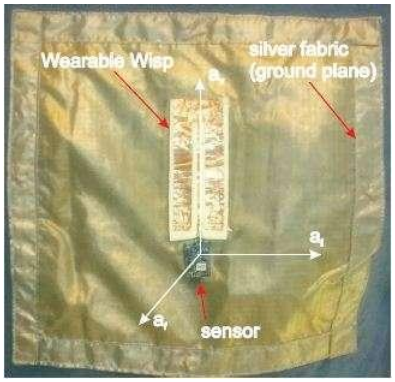

Fig 9. Wearable WISP sensor and accelerometer axes WISP attached to garment.

Secondly, in order to improve the system responsiveness we keep the computational cost low by using a single accelerometer per person and minimum data preprocessing by eliminating filtering steps. Responsiveness is a key consideration because of the urgency of attending to a high risk situation (such as bed exiting) requires a prompt system response to provide a timely alert to a caregiver to proceed to an intervention in a hospital environment. Thirdly, to consider the dependency among consecutive activities, we use CRFs to model and predict activities with flexibility of introducing various features to improve the performance of previous approaches. Finally, since the use of video images for monitoring systems has been perceived as intrusive to a patient's privacy, our approach preserves the privacy of a person. In summary, the contributions of this paper are as follows:

We designed a simple approach for supporting bed exit classification using a single truly wearable device for the first time (to the best of our knowledge). The device is small, low cost, battery-less and can be worn continuously; moreover, the device relies on a single accelerometer sensor and is able to protect a patient's privacy.

Utilize noisy and incomplete information effectively for activity classification by using conditional random fields based algorithm.

VI. CONCLUSION

In healthcare, RFID has the potential to achieve improvements in both supply chain productivity and patient safety applications. However, the technology is more likely to be successful if evaluated for closed-system applications first, where deployment and subsequent changes are within the control of the individual organization. The introduction of a new technology like RFID often causes a stir of interest and excitement about its capabilities. However, RFID will likely go through a stage where initial enthusiasm is
tempered by practical cost-benefit considerations. The outcome of these will be appropriate deployment of the technology.

REFERENCES

[1] http://www.simonsothcott.com/2011/11/what-is-rfid-10-examples-of-rfid.html
[2] IJCSI International Journal of Computer Science Issues, "RFID Applications: An Introductory and Exploratory

Study", Vol. 7, Issue 1, No. 3, January 2010

[2] 2013 IEEE International Conference on RFID "Sensor Enabled Wearable RFID Technology for Mitigating the Risk of Falls Near Beds"