Radio Frequency Identification [RFID] Technology: A StudyonDawning Issues, Challenges and Future Modifications

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Abstract
Presently everyone is working for automation in every field so, to aid the tedious work we can use radio frequency identification system that works on current issues faced while data organising or tagging in supply chain management. This paper provides a study on radio frequency identification (RFID) technology. RFID tags were originally designed to basically replace the barcodes in supply chains. Their advantages are that they can be read wirelessly and with no line of sight, contain more information than barcodes and are more robust. The paper describes current technology, including the ranges of frequencies and specifications used. However, privacy became a problem with increasingly omnipresent RFID tags. This paper discusses potential attacks that could infringe your privacy and also explains countermeasures. The RFID technology did not stop at item-level tagging. This paper also provides up-to-date research to find and track objects. Due to such widespread use of RFID tags, a significant reduction in the cost of producing them is of considerable interest. It turns out that printing tags can be a viable option to conventional production.

Keywords
RFID, OCR, ISO, IEC, POS, EPCIS, tags, supply chains, tracking, IR sensons

1. Introduction

Radio Frequency Identification (RFID) is a generic term for technologies which use radio waves to automatically identify individuals or objects from a distance of several inches to hundred feet. This is an Automatic Identification (Auto-ID) technology which is used to automatically identify any object. Barcode, magnetic strip, IC card, OCR, voice recognition, fingerprint Identification technologies, and Optical Strip etc. RFID technology uses automatic data capture system that helps increase the efficiency of the system. For identification purposes the combination of tag and reader is used. A code is stored in the RFID tag, and a physical object is attached to it. Now that object is easily recognizable. Then, object will transmit tag code. In this way the reader gets information about object. RFID is not a new technology in fact, but it is being applied in new ways. RFID is technology which is growing rapidly. RFID offers much advantage over traditional devices such as barcode identification. The barcode scanner must be in line of sight with the label to read the barcode. This means the items or detectors need to be manually relocated [3]. RFID, however, will read tag data without a line of sight. The RFID system also needs no alignment. RFID has a high read speed and in the presence of a barrier this may work. This technology is more effective when longer reading range, fast scanning and flexible data carrying capabilities are required. RFID system has received increasing attention in many areas, such as manufacturing companies, agriculture, transportation and industries [5] etc. 13.56 MHz and 860-930 MHz for passive RFID; 433 MHz for active RFID and 2.45 GHz. A significant issue is global standardization of the RFID system. Different manufacturers implemented the RFID in different ways. There is no universal norm that can be used everywhere. For different RFID applications various standards or protocols are proposed. Those standards include physics of hardware Specification, specification of the tag-reader air interface,

and specification of the reader host command. A number of organisations, including the International Organization for Standardization (ISO), the International Electro Technical Commission (IEC), and global, have set standards for RFID. The following is a short list of RFID standards [2]: ISO 10374, ISO 10536, ISO 11784, ISO 14443, ISO 15693, IS0 18000, EPC globally Both standards manage communication between the tag and the RFID reader. These standards operate on specified frequency bands (e.g. 860 – 915 MHz for UHF or 13.56 MHz for HF). Different aspects of RFID technology will be provided here.

1.1. Motivation for the paper

Given the breath of the fields contributing to RFID technology and the rapidly changing nature of the technology, finding a comprehensive survey of the entire landscape is difficult for students and others who wish to start research in this area. There are some good survey papers on certain particular aspects of the technology as outlined in the next section, but there is no source where a new researcher exists Can get an overview of the major research efforts in the field as a whole to help determine where one might want to concentrate one's research.

1.2. Our Contributions

In this paper we look at ongoing research activities in the RFID field as a whole and begin by discussing the major challenges facing RFID technology today and next, we discuss the ongoing research efforts to try and address these challenges. We also draw attention to three areas that we believe need more research, so that this technology is widely adoptedin this work we aim to illustrate the interdisciplinary nature of the contributions to this technology in the research.

2. Current RFID Technology

This section describes which parts consist of RFID tags, how they work in principle, and what types of tags do exist. It focuses on how tags are powered and what ranges of frequencies are used. The section concludes by covering some key standards.

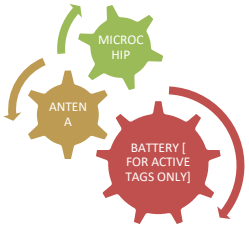

Figure 1: Parts of an RFID system

The chip size also depends on the Antenna. The size and shape depend on the frequency of use of the tag. The size of a tag depends also on the area of use. For implants, it can vary from less than a millimetre to the size of a container logistic paper. Some tags also have rewritable memory attached in addition to the microchip, where the tag can store updates between reading cycles or new data such as serial numbers [6].

Figure 2 shows a RFID tag. The antenna is visible quite clearly. As said before the tag's size has the greatest impact on the antenna. The microchip is visible in the middle of the tag and there is no internal power source since this is a passive tag.

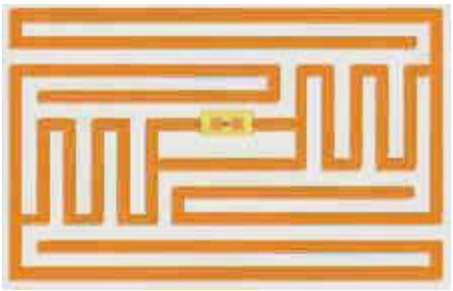

Figure 2: A passive RFID tag (from [Wiki-RFID], used under the GNU Free Documentation License)

An RFID tag works as follows in principle: the reading unit generates an electro-magnetic field which induces a current into the antenna of the tag. Uses the current to power the chip. The current also charges a condenser in passive tags which guarantees the chip uninterrupted power. In active tags the condenser is

replaced by the battery Shortly explaining the difference between the active and passive tags. Once the tag is activated, it receives commands from the read unit and answers by sending its serial number or the information requested. The tag generally does not have enough energy to create its own electro-magnetic field, but instead uses back-scattering to modulate (reflect / absorb) the field sent by the read unit. Because most fluids absorb electro-magnetic fields, and most metal represents those fields, it is difficult to read tags in the presence of those materials.

The reader has to keep on powering the tag during a reading cycle. The field created is called continuous wave, and because the strength of the field decreases with the distance square, the readers must use a rather large power That field overpowers any response a tag could give, so tags respond directly below and above the continuous wave frequency on side channels.

We distinguish 3 types of RFID tags in relation to power or energy:

2.1. Role of RFID in IT Infrastructure and DataManagement

To get maximum benefits from RFID technology, applications will need to be fully integrated into the IT infrastructure of the enterprise. The RFID systems serve as data sources (or inputs) in this infrastructure; however, when tags are inserted into sensors and other tools, the tagged object will act as a network node with data flowing between the node and backend in both directions [7][8]. The amount of data generated by an RFID system depends on the number of items tagged, the number of readers in the supply chain and if any, the security protocol used. To deal with issues such as multiple reads of an item at a given location, this data must be sent to backend systems where its is' scrubbed.' Several security protocols have been proposed that rely on the tag identifier being stored in a central database, while the tag stores a key or PIN that is linked to the tag identifier by some mathematical function [9][10]. The key stored on the tags changes ' randomly,' typically after each reader's response to a query, giving the tag anonymity. In these security schemes the central database must be available at all times, hence these schemes are also referred to as online security protocols. This latter condition will further strain network resources for systems that adopt these protocols online. These safety protocols will need to be studied from the perspective of network scalability and availability.

EPCglobal's Electronic Product Code Information Services (EPCIS) standard allows seamless interchange of RFID information across organizations and within them (EPCglobal 2007). Further study is also needed to address issues such as: Occasional missed reads of a tagged item in a multi-tracking location supply chain, resulting in a partially complete tracking record for the tagged item.

Assessing the potential of current networking protocols to accommodate RFID systems ' mass-market adoption. This standard, however, is based on sharing data from Class 1 tags and as Oren and Shamir (2006) have already shown this process is not secure. In an environment with secure RFID systems, the exchange of RFID information between business partners is an area that still requires some research once the secure RFID systems are developed. More analysis is also needed to address issues such as: Occasional missed readings of a tagged object in a multi-tracking location supply chain, resulting in a partially full tracking record for the tagged item.

Assessing the potential of current networking protocols to accommodate RFID systems ' mass-market adoption.

2.2. Analytics and Enterprise Use of RFIDData

Data from RFID systems provides at a minimum a three-dimensional view (product, spatial and temporal) of an item; the product is identified by the tag ID, the reader provides the location where the tag was read and the time when it was read. Each data dimension may be used to track items individually or in aggregate. Additional data measurements may be given by adding more memory to the tag to allow monitoring of additional states, such as date of manufacture or date of expiry. To explore ways:

- use this data to improve business functions such as supply chain management and product pricing; more research is needed.
- Utilize this data to improve business functions, such as supply chain management and productpricing.
- Combine and present these data dimensions in meaningful ways to potential users, in order to facilitate better businessdecisions.

2.3. RFID based Consumer Post-PurchaseUses

Mass-market RFID adoption must be driven by consumer demand. There is a delivered value versus acceptable risk (in terms of privacy, cost, safety and other concerns) equation for the consumer and any successful RFID application will have to consider this equation from the point of view of the consumer (Eckeldt 2005). Research into post-purchase uses of tagged products and RFID systems at home will be an ongoing process, and the more consumers can directly benefit from RFID technology the more suppliers will demand RFID-enabled products. Some of the reputed post-purchase uses are (Günther, and Spiekermann 2005: 75):

3. Attacks against RFID Systems

We describe different kinds of attacks and exploits that an RFID system may suffer from several attacks which are as follows:

Figure 3: Types of RFID Tags and their working respectively.

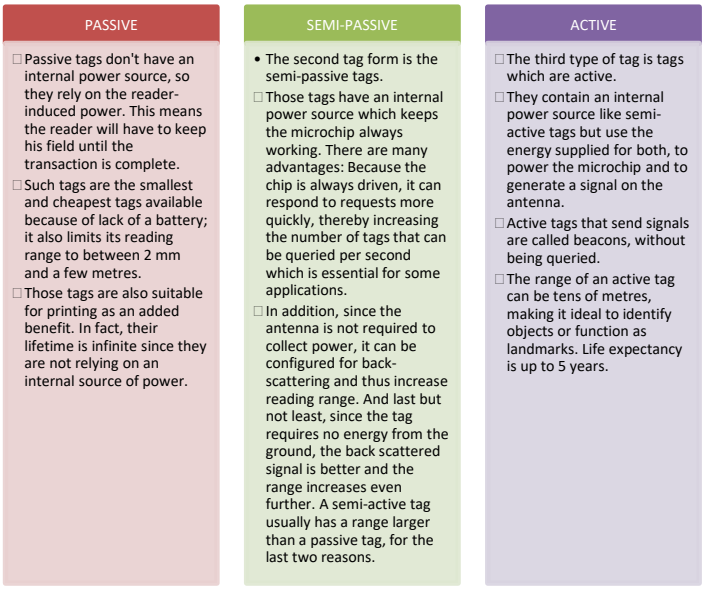

Figure 3: Types of RFID Tags and their working respectively.

Figure 4: RFID based Post Purchases Uses.

It is becoming increasingly apparent that technology alone is not enough to solve all of the above-mentioned problems; it needs support from the legislature. Some US states have already introduced laws such as the 2005 "Identity Data Protection Act" in California. Even if a sophisticated tag could be built with strong encryption etc. it would raise the price of tags and thus make it uninteresting for most applications.

Many important issues are addressed in this section. Next, possible vulnerabilities have been discussed and ideas have been put forward that try to fix such problems. Those proposals range from simple measures like destroying the tag with the kill command to more sophisticated approaches like the guardian Attachment. Then it described authentication in RFID systems. This is a difficult issue, mainly due to the limited resources on the chip. Last but not least, there were talk of several attacks against the RFID system. Although the RFID tags are simple, many exploits are possible.

4. CHALLENGES OF RFID

Today, many supply chain inefficiencies originate from inaccurate data about where products are in the supply chain. Retailers may provide point of sale (POS) data to the manufacturer, but without the knowledge of existing inventory levels and stock in transit, these data points are not sufficient for accurate demandplanning.
While there is increasing pressure on manufacturers, distributors, and retailers to maximize efficiency, minimize cost and provide the best value to the endcustomer

- Buffer stocks, out-of-stocks and late shipments impact on margins ofproducts.
- Inaccurate data causes expensive manual interventions 30 per cent of supplier transactions containerrors.
- Discontinuous data flow across the supply chain leads to redundant data entry/duplication ofeffort.
- Inability to trace products and ingredients to suppliers and customers makes information sharing and product recalls complex andexpensive.
- Cost effectiveness of RFID technology
- Lack of standardisation in RFID becomes the challenge for selecting the besttechnology.

5. DRAWBACKS OF RFIDTECHNOLOGY

- **Dead areas and orientation problems**
  RFID functions close to cell phone or wireless network technologies. Like these systems, some places may have weaker signals and lower read rates are sometimes a concern when the tag is rotated into a direction that is not well suited to the reader.
- **Security concerns**
  Since RFID is not a bar-coding line-of-sight system, new security issues may arise. For example, a competitor could set up a high-gain directional antenna for scanning tags in trucks that go to a warehouse. This competitor could determine flow rates of different materials based on received information. Furthermore, hacking is always a risk when using RFID for high-security operations, such as payment methods.
- **Ghost tags**
  In rare cases, if multiple tags are read simultaneously, the reader will sometimes read a tag that is not present. Therefore, some type of read check, there are CRCs, should be implemented either in the tag, reader, or tag read data.
- **Prone/vulnerable to damage**
  The tags may be damaged by water, static discharge or high-powered magnetic surges (such as lightning strike).
- **Unread tags**
  When reading several tags at the same step, certain tags may not be read and when the items are not in sight there is no sure method to establish this. The issue does not happen for barcodes, for this when the barcode is scanned, it is automatically checked when the scanner is read by a beep and the data can then be entered manually if it is not scanned.
- **High costing**

The parts and tags are more expensive compared to barcodes, because this technology is still new. Like software and support

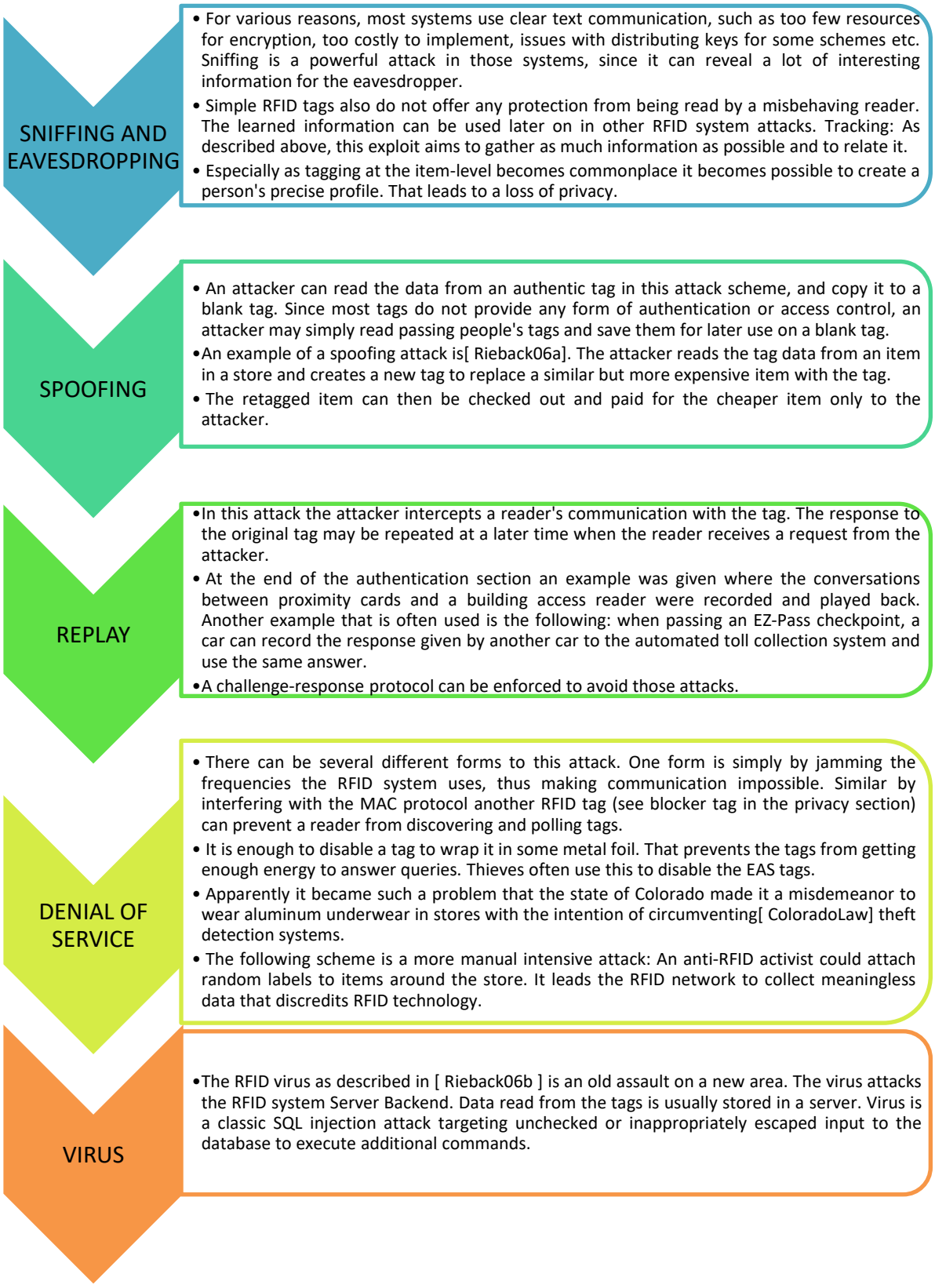

Figure 5: Types of Security Threats

staff needed to install and operate the RFID read systems (for example in a warehouse) may be more expensive to use.

- **Collision with RFID Reader**
  Reader collision happens when two or more reader signals overlap. The simultaneous queries tag is unable to respond, and to avoid this question, systems must be carefully set up; other devices use an anti-collision protocol (also known as a simulation protocol. Anti-collision protocols require tags to turn over when they are sent to a reader.
- **RFID tags are problematic to remove**
  RFID tags are difficult for customers to remove; some are very small (less than half a millimetre square and as thin as a sheet of paper); others can be covered or inserted inside a product where they can be removed. Where customers are unable to see these. New technologies allow RFID tags to be "printed" directly on a product, and may not be removable at all. When consumers barred documents with RFID tags, they are apprehensive about their privacy

5.1. Perquisites of RFID technology

- **Library mission**
  Some libraries view RFID as an opportunity to improve other parts of their mission, possibly neglected, by automating elements of their circulation activities and redeploying staff. Library outreach programs such as language training, children's programming and new Canadian services can take advantage of the energies of qualified and interested staff redeployed from a more automated circulation system.
- **Speed of circulation**
  RFID has been shown to reduce circulation congestion at both self-checking stations and at the circulation desk, allowing for the simultaneous check-out of stacks of items. Most librarians agree that that waits for delivery translates into better customer satisfaction.
- **Best Usage of Money**
  Return on investment calculation for RFID, depending on some variables, shows a three to seven-year investment payback period. Libraries that have completed a full ROI calculation believe they can enjoy significant hard and soft future savings.
- **Future growth**
  RFID productivity gains may not be a current necessity, but in rapidly growing populations, library directors and boards are worried about being able to offer the current level of services in the future. Rising populations means increasing circulation, increasing demands and stretching library services. Some libraries see the implementation of a staged RFID as a solution to future library resourcing problems.
- **New library**
  The best time to discuss RFID is when designing and constructing a new library or renovating an existing building. The architect can accommodate siltation and other measures more easily Planning equipment and RFID investment appear to be less significant when rolled into a capital building or budget for renovation

6. Expectations fromRFID leading to Future modifications

RFID technology will only be used more commonly in libraries as the cost of tags continues to decline and the security issues are resolved. Because there is greater demand for the product, basic economic rules will apply, there will be greater supply and lower costs. The same applies to the information security provided by RFID, as there is a greater demand for increased security, the technology must evolve and become usable. The industry will respond to its customers ' will,

commercial as well as public, just as these will respond to the public's will.

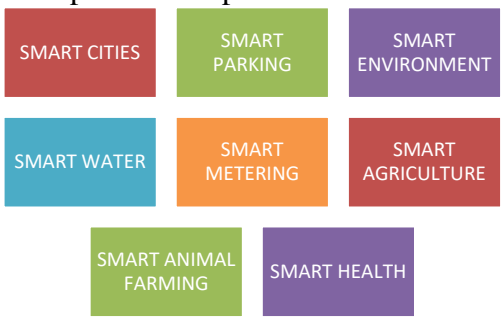

Figure 6: RFID based SMART approaches

Security analysis of RFID based devices can be used for which many smart applications are integrated with educative environments. One or more of following smart approaches may be integrated with educative environments as shown in the figure above.

7. APPLICATIONS OF RFID

- **Tracking system for student'ssafety**

Tracking system for the safety of students Safety and security of students is a challenging task for the management of the school as well as for the responsibility of parents or guardians. With regard to the behaviour and safety of the students, school management and teachers face major challenges in introducing security within the educational environment. It is easy to trace the children and the school bus location. The bus speed can also be controlled while the activities inside the school bus are continuously monitored. Through the new communication technology such as RFID systems [26], the happiness of parents, teachers and school staff can be achieved so far, monitoring and recognition.

- **CampusManagement**

One of the issues in educational environments is the protection in campus management. Managing large amounts of data is still a complicated issue because security is not effective. There are many vulnerabilities in current campus management systems when the data is handled manually or using conventional methods. Thus, all these flaws can be perfectly solved by introducing RFID devices integrated with security in campus management system. Here the level of security according to the applications should be considered.

- **LibraryManagement**

The library system now uses online approach for most of the day-to-day operations that include e-book collection and storage and administration. Short range of RFID devices can be used within library environment with reasonable security. Library uses Internet facilities with existing network infrastructure to provide fast information. Internet security is used to prevent unwanted data from accessing the library management system. The new RFID network management for next generation network is being built with versatile protection to improve security in educational environment. For example, the anti-theft gate RFID EAS (Electronic Article Surveillance) can be used for library management system that is easy to integrate with next-generation network.

- **Employee's access andmanagement**

The education system should provide a secure solution for all workers to access and confidentially handle their personal information. In keeping with security, the access and management system of the employees may be concerned after two problems. Security-rich password management Integrates with enterprise identity management system Single sign-on approach is used in above cases to enhance the security [28]. Available protection algorithms can be applied to increase efficiency in order to improve security in educational environments via

RFID devices [24]. Authentication variables, access agent, identity wallet etc are some of the security solutions that can be studied to improve access and management for the employees. There are plenty of other choices that can be examined in educational environments through the RFID tools or systems used [27].

Password self-service and Strong RFID authentication are also exampling for improving security in selected educational environment fields. Efficient safety according to the field should be implemented in the access system of the employees. RFID-based security system can be introduced as a new device to handle these problems, which will solve a number of potential problems in educational environments [24, 25].

The e-reader, which is integrated with most wireless devices, is available for those interested in reading academic books and relevant academic support books. Wireless tools are merged with wireless networks and RFID devices. The wireless networks employ a number of security algorithms. Using RFID devices, the e-reader can be interacted which will provide instance output of reading ability for students. Wireless network security provides a number of benefits for those who use RFID devices within the educational environment[24]. There are many RFID-based devices that are used around or in educational environments where safety is one of the potential challenges. In this paper, specific RFID-based devices needing some form of low and high complexity security will be considered as a basic understanding and illustration of the potential issues. This device will detect what students have done for the last 12 hours, because to understand the lessons, physical and mental conditions should be relaxed. This system will not only support the learning and listing attitude of students but also provide full enhancement of the appropriate security for academic curriculum used in educational environment[25].

8. Literaturereview

- **RFID technology intracking**

RFID technology tracking consists of two primary components-tags and readersAn RFID tag comes with a microchip and antenna. The microchip stores information about objects (such as the serial number), while the antenna allows the microchip to forward information about objects to the reader. The reader creates a magnetic field with the tag antenna, and the tag uses this magnetic field to send the reader information about the objects. There is also a third component in an RFID system–a computer used to interpret and store data and perform required actions (Attaran, 2007).

An RFID tag may be used for the same purposes as a barcode but an RFID tag has some additional features that traditional barcodes do not have:

(I) Reading RFID does not require visual contact.

(II) The RFID tag information may be changed while reading, which also allows the reuse of RFID tags

(III) Several RFID tags may be read at the same time

(IV) The RFID tag information capacity is greater than that of traditional barcodes

(V) RFID tags are much more durable than barcodes (Wyld, 2006). RFID is mainly used for tracking and tracing pur-poses in supply chain management. Tracking systems are based on checkpoints which record monitored item movements (Loebbecke and Powell, 1998).

Tracking systems have the main function of connecting the physical material flow with information systems (Stefansson and Tilanus, 2001). The benefits of monitoring are: real-time

synchronization of material flows and individual tracked objects, such as merging-in-transit; providing an efficient link between physical reality and information systems, such as improved inventory count and product receipt transactions; improved logistics management metrics and analyzes (Ala-Risku et al., 2003; Ka¨rkka¨inen&Holmstro¨m, 2002; Ka¨rkka¨inen et al.2004) Implementation of RFID tracking system challenges Although articles on RFID tracking in the supply chain field usually focus on explaining the solutions and opportunities of supply chain management technology, most articles also mention the challenges and obstacles to RFID technology being adopted for this purpose. There are even posts that concentrate on posing certain difficulties and different points of view around the subject or providing a list of potential problems or even obstacles. The remainder of this subchapter addresses the difficulties of following the RFID monitoring contained in the literature. Different standards and insufficient technology Deficient standards are commonly mentioned as an issue, because globally agreed RFID standards are a relatively new phenomenon (e.g., Ngai & Gunasekaran, 2009; Attaran, 2007). A somewhat standard-related issue is the different frequency cies used around the world (e.g. Wu et al., 2006; Moon & Ngai, 2008). Another technological challenge often mentioned is a tag reading problem. Poor reading can be caused by materials which absorb radio waves (e.g. metal or water) around or under the tags (e.g. Li et al., 2006). The other reasons for poor reading may be the wrong position of antennas relative to the direction of the reader, or collisions with radio transmission caused by too many RFID tags, or just the different quality of tags (e.g. Asif & Mandiviwalla, 2005).

- **Challenges for RFID tracking system implementation**

While articles on RFID tracking in the supply chain sector typically concentrate on describing the technology's solutions and opportunities for supply chain management, most articles often address the challenges and barriers to RFID technology being implemented for this purpose. There are even articles that focus on presenting some challenges and different points of view around the topic, or presenting a list of possible challenges or even obstacles. The remainder of this subchapter discusses the challenges of adopting the RFID tracking found in the literature.

- **Different standards and the in sufficient technology**

Deficient standards are commonly mentioned as a problem, because RFID standards agreed on globally are a relatively new phenomenon (e.g. Ngai & Gunasekaran, 2009; Attaran, 2007). The various frequencies used around the world are somewhat related to norms (e.g. Wu et al., 2006; Moon & Ngai, 2008). Another technological challenge frequently mentioned is the problem of reading tags. Bad reading can be caused by materials which absorb radio waves (e.g. metal or water) around or under the tags (e.g. Li et al., 2006). The other reasons for poor reading can be the incorrect position of antennas relative to the direction of the reader, or collisions caused by too many radio transmissions

- **Ethics and privacy**

Many articles focus on the ethics and privacy issues related to the RFID technology (Visich et al., 2009). By applying RFID technology for tracking purposes, some businesses are afraid of the negative reaction of customers and public organisations. Benetton's 2003 RFID trial is one example of the power of public opinion. The company ordered 15

million RFID tags for item-level pullover monitoring, but the company never implemented the pilot because the consumers began to boycott Benetton's shops, with customers worried about privacy loss (Blanchard, 2003; McGinty, 2004).

- **Security and data sharing problems**
  A slightly related issue with privacy is security concerns. If the tags contain considerable information about the history of product handling, the other supply chain partners may obtain confidential information about the supply chain practices of competitors, such as shares of various suppliers and the product delivery time (Santos & Smith, 2007). In theory, some outsiders may be able to break the code and read the tag information by using their own RFID reader, and without physical access to the item (Asif & Mandiviwalla, 2005). Another more serious fear is that somebody could change the RFID tag information using their own RFID reader (Li et al., 2006).To work effectively, a supply chain-wide RFID tracking system requires information sharing, which creates an indirect security concern when companies may hesitate to share with other companies all the information necessary to obtain the full benefits of visibility of the supply chains. However, even if companies are willing to share all the information obtained by RFID readers, Asif & Mandiviwalla (2005) also points out the reverse issue that too much information causes problems for the handling and storage capacity of the information systems, especially if the companies have not agreed on common procedures to restrict the amount of data.
- **Dual tracking systems**
  RFID tracking is estimated to replace ancient long-term tracking systems. However, RFID can not replace the barcode, which is currently the most common tracking technology used at the moment. Numerous articles describe this problem of dual tracking system situations (e.g., Ngai & Gunasekaran, 2009; Ross et al., 2009).

- **Lack of the information about existing RFID tracking implementations**
  Visich et al., (2009) pointed out that the information about the existing RFID tracking implementations is confusing. Technology providers usually have signed non-disclosure agreements with their customers, thereby preventing them from discussing these implementations. Lee & O¨ zer (2007) highlight the fact that the best- known papers and reports about the benefits of RFID tracking have been written by technology consultants and other experts representing organizations which gain when RFID technology adoption increases. Consequently, the knowledge about unrealistically high standards of RFID tracking capacity, combined with the lack of quantitative data from actual cases, frustrates the executives responsible for implementing RFID tracking decisions (Lee & O¨ zer, 2007; Visich et al., 2009).

8.1. Summary of the RFID tracking implementation challenges

In the reviewed articles, the journal's viewpoint and target group appear to affect the topics considered challenges or obstacles and how they are classified. There are also various obstacles and challenges which are interrelated. For example, most of the technological problems can be solved by buying more expensive technology and using the assistance of external experts.Also the need to reorganize business processes in order to better exploit the possibilities of RFID tracking can be seen either as a cost problem or as a matter of the capacity of the management to understand the strategic opportunities of improved tracking.

9. Conclusion

The crux of this paper lies in the blooming scope of work lined up for RFID technology. it is quite easy to implement

which would help in easing our work load. The past is gone which used manual working now it is the 21st century which needs such technology to solve real world problems by making everything efficient. RFID technology has some drawbacks but now we could put few innovative minds behind it to clear the path for smooth workflow. few more amendments can be done is the security areas leading to more reliable system by use of IOT and Artificial intelligence which can enhance the performance.

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