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The Role of New Technologies in Automatic Identification Systems Case Study Radio Frequency Identification

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ABSTRACT

In recent years, automatic identification technologies among the industries, professions, various companies have become popular. However these methods for collecting information about people, animals, goods and products be used in transportation. Radio identification technology is used in the technical industrial countries; the technology is used in products and services, marketing and mobile commerce order of identifying new technologies to increase the efficiency of the management to industrial and service organizations. The kind of formation, function and system components, types and frequency tags used in industrialized countries, a variety of applications industry and commerce, the advantages and the risks to be quite comprehensive and practical expressed.

KEYWORDS: Automatic Identification System, Radio Frequency Identification, tags, antennas, mobile commerce

INTRODUCTION

New technology is enabling the automatic identification, or auto-ID, of physical objects. Auto-ID is a core component of automated inventory control systems and supply chain management. Inventories once taken by hand will be conducted automatically.

One auto-ID system lacking the flaws of optical barcodes is based on radio frequency identification (RFID). The term "RFID" could be applied to systems in use for more than sixty years. Perhaps the first radio identification technology was the "Identify Friend or Foe" system used in Allied aircraft during World War II [1]. In early 1940, the British Royal Air Force outfitted airplanes with radio transponders that would respond when interrogated. This allowed pilots and ground crews to distinguish the RAF airplanes from the Luftwaffe's, which proved to be a decisive advantage in the Battle of Britain.

RFID transponders, or *tags*, carry object identifying data. This data may include the manufacturer, brand, model and a unique serial number. Collectively, this data is often referred to as the tag's identity, or ID. An ID may be of any length. In practice, a 96 bit ID would suffice for most applications.

RFID tags consist of a small microchip attached to an antennae or other coupling element. The tag communicates via radio frequencies (RF) with a transceiver, or *tag reader*. The tag ID may be read automatically: without line of sight, through non-conducting material .such as cardboard or paper, at a rate of several hundred reads per second and from a distance of several meters.

Since tags typically are silicon-based microchips, functionality beyond simple identification may be incorporated into tag designs. This functionality might range from integrate sensors' to read/write storage to encryption and access control support.

RFID systems have emerged as a practical auto-ID platform in industries as varied as automobile manufacturing, microchip fabrication and even cattle herding. The latter examples actually one of the first commercialized RFID systems [2]. A rugged RFID tag with a unique ID was attached to each cow's ear, allowing herders to track a particular animal as well as take temperature readings. These tags could have also contained vaccination records or any other special information (e.g. "this cow is kosher"). This offers a great advantage over traditional animal identification such as collars, tattoos or branding.

The potential benefits of a pervasive RFID system are enormous. Worldwide, over five billion barcodes are scanned daily [3]. However, barcodes are typically scanned only once during checkout. Manufacturers, transport companies and retailers may each use their own incompatible auto-ID systems. To offer in sight in to the potential size of the RFID market.

By integrating a unified identification system on all levels in the supply chain, every party involved in the lifespan of a product may reap the benefits of an RFID-based object identification system. This includes not only manufacturers and retailers, but also consumers, regulatory bodies such as the United States Food and Drug Administration, and even waste disposal or recycling firms. RFID-enabled systems may greatly lower the cost

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of supply chain management, inventory control and retail checkout. In fact, the aggregate savings are so great that RFID tags will likely become one of the most widely deployed microchips in history.

How RFID works?

Simply put, RFID technology may be seen as a means of identifying a person or object using electromagnetic radiation. Frequencies currently used are typically 125 kHz (low frequency), 13.56 MHz (high frequency), or 800-960 MHz (ultra high frequency). RFID enables the automated collection of product, time, place, and transaction information.

A RFID system consists of two main components:

1. A transponder to carry data (e.g. a tag), which is located on the object to be identified. This normally consists of a coupling element (such as a coil, or microwave antenna) and an electronic microchip;
2. An interrogator (or reader) to read the transmitted data (e.g. on a device that is handheld or embedded in a wall). Regardless of whether this interrogator is a read only or read/write device, it is always referred to as a "reader". [4].

Table1: RFID development

Event	Time period
Faraday discovered electromagnetic energy	**1840-1950**
Radar defined and used Major World War II development efforts. RFID invented in about 1948.	**1940-1950**
Early explorations of RFID technology Laboratory experiments	**1950-1960**
Development of the theory of RFID. Early field trials.	**1960-1970**
Explosion of RFID development. Tests of RFID accelerate. Early adopter implementation of RFID.	**1970-1980**
Commercial RFID applications enter the mainstream	**1980-1990**
Emergence of standards RFID more widely deployed.	**1990-2000**
Innovative applications emerge. Combination of RFID with personal mobile services. Subcutaneous RFID emerges for animals, humans. RFID becomes part of daily life.	**2000-2010**

RFID System Components

Tags

Every object to be identified in an RFID system is physically labeled with a tag. Tags are typically composed of a microchip for storage and computation, and a coupling element, such as an antenna coil for communication. Tags may also contain a contact pad, as found in smart cards. Tag memory may be read-only, write-once read-many or fully rewritable.

A key classification of RFID tags is the source of power. Tags may come in three flavors: active, semi-passive and passive. Active tags contain an on-board power source, such as a battery, as well as the ability to initiate their own communications; possibly with other tags. Semi-passive tags have a battery, but may only respond to incoming transmissions. Passive tags receive all power from the reader and necessarily cannot initiate any communications.

A tag's power source determines both its range and cost. Passive tags are the cheapest to manufacture and incorporate into packaging, yet have the shortest read range. Semi Passive tags have moderate range and cost, while active tags have the greatest range and cost. Semi-passive and active tags' on-board power source may also power a clock or integrated sensors.

Every object to be identified in an RFID system will need to have a tag attached to it. Tags are manufactured in a wide variety of packaging formats designed for different applications and environments. The basic assembly process consists of first a substrate material (Paper, PVC, PET...), upon which an conductive materials including Silver ink, Aluminum and copper is deposited. Next the Tag antenna made from one of many different chip itself is connected to the antenna, using techniques such as wire bonding or flip chip(see Fig 1.). Finally a protective overlay made from materials such as PVC lamination, Epoxy Resin or Adhesive Paper,

is optionally added to allow the tag to support some of the physical conditions found in many applications like abrasion, impact and corrosion.[5].

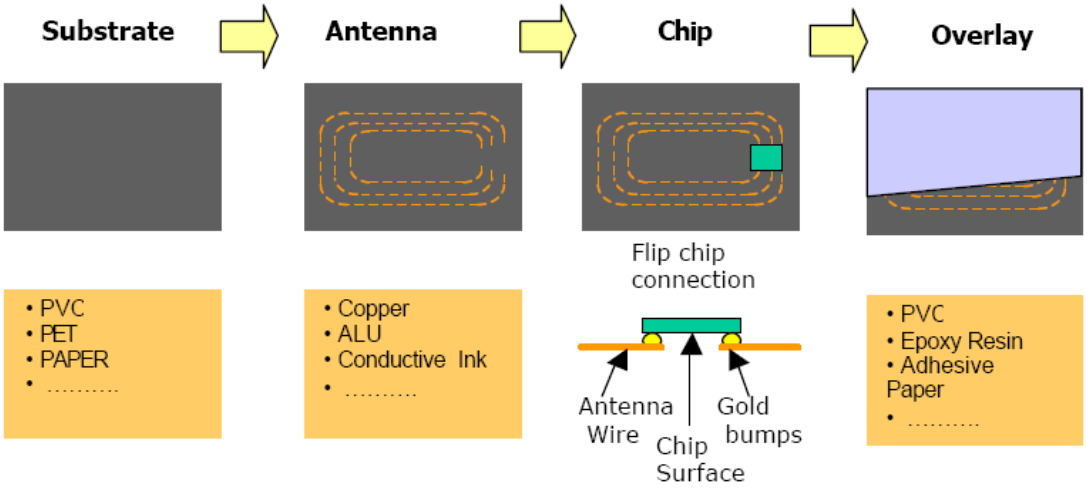

Figure 1: Construction of RFID tags

Table2. Comparison of Passive and Active Tags

Advantages	Disadvantages	Tag
Longer life time Wider range of form factors Tags are more mechanically flexible Lowest cost	Distance limited to4 - 5m (UHF) Strictly controlled by local regulations	**Passive**
Greater communication distance Can be used to manage other devices like sensors (Temp°,pressure etc)	Expensive - due to battery, and tag packaging Reliability – impossible to determine whether a battery is good or bad, particularly in multiple transponder environments.	**Half** **Semi** **Passive**
Do not fall under the same strict power regulations imposed on passive devices		**Semi** **Passive** **Active**

It is also convenient to classify tags by their functionality. The MIT Auto-ID Center [6.] has defined five classes based on functionality [7.]. We offer similar classifications defined below and in Table 3.

Class 0: Class 0 tags are the most primitive tag, offering only *electronic article surveillance* (EAS) functionality. EAS tags only announce their presence and do not contain any unique identifying data. Class 0 tags may be "chipless" – containing no logic. They are frequently found in library books or compact discs.

Class 1: Class 1 tags contain unique identifying data stored in read-only or write-once read-many (WORM) memory. Class 1 tags will typically be passive, although may be semi-passive or active. Class 1 tags function as simple identifiers and are the focus of this thesis.

Class 2: Class 2 tags have read-write memory, which allows them to act as logging devices. Class 2 tags may be recycled and used to identify many different items throughout their lifetime. Although Class 2 could be passive, they are more likely to be semi-passive or active.

Class 3: Class 3 tags contain on-board environmental sensors. These may record temperature, acceleration, motion or radiation. To be more useful than a memory less sensor, Class 2 tags require writable storage. Since sensor readings must be taken in absence of a reader, Class 3 tags are necessarily semi-passive or active.

Class 4: Class 4 tags may establish ad hoc wireless networks with other tags. Since they may initiate communication, Class 4 tags are necessarily active. Functionally, these tags lie in the realm of ubiquitous computers or "smart-dust" [8].

[5]. Table 3 Different tag classes

Application	Power Source	Memory	Known as	Class
ID Ant-theft	Passive	EPC None	EPC EAS	**0**
Identification	Any	Read -Only	EPC	**1**
Data logging	Any	Read-Write	EPC	**2**
Sensors	Semi-Passive Active	Read-Write	Sensor Tags	**3**
Ad Hoc networking	Active	Read-Write	Smart Dust	**4**

Readers

Readers may be integrated into handheld computers or they may be stationary and positioned at strategic points, such as a facility entrance or on an assembly line. The handheld readers offer portability, however, the stationary devices offer a larger reading range.

As stated above, readers have an antenna for sending and receiving signals and a processor for decoding them. The reader receives instructions and information from the antenna through the scanner, which is a part of the reader that examines analog output from the antenna. The scanner's information is then converted into a digital format by the reader, which the computer or processor can then use for data analysis, recording, and reporting. There are readers today that can simultaneously read 100 to 2000 tags per second.

Antenna

The function of the antenna (which is attached to a reader) is to transmit an electromagnetic field that activates a passive tag when it is within a given 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. The RFID tag antenna is practically maintenance free and can be configured in a variety of shapes and sizes ranging in size from a grain of rice to the size of a brick.[9].

Back-End Database

Readers may use tag contents as a look-up key into a back-end database. The back-end database may associate product information, tracking logs or key management information with a particular tag. Independent databases may be built by anyone with access to tag contents. This allows unrelated users along the supply chain to build their own applications.

It is assumed that a secure connection exists between a back-end database and the tag reader. For protocol analysis, it may sometimes be useful to collapse the notion of reader and back-end database into a single entity. In other cases, the reader may be treated simply as an entrusted channel between tag and database.[10].

In many ways, tags are only useful if corroborated with a database in some way. This is particularly true if tags do not contain explicit data, such as manufacturer and product codes. Tags could contain pointers, randomized IDs or encrypted data. While anyone could build a database from scratch using these values, it will often be more economical to subscribe to a database already containing tag associations.

Comparison of Bar codes and RFID

Bar codes are predominately used today for identifying and tracking products throughout the supply chain. Even though they can achieve efficiencies in the order of 90%, there are still a number of deficiencies in the technology, for which RFID, is able to provide a better solution [11].

Table 4 Comparison of RFID and barcode systems

Barcode Systems	RFID systems	Parameter
In a few kilobyte	In a few kilobytes	The amount of information
low	Top	Density data
Limited	Impossible	The possibility of being read by people
Very effective	Niminy-piminy	Unaffected by the angle reading
Top	Niminy-piminy	Unaffected by wet, dirty
Non-contact	Non-contact	Card Type
very Low	low	Price tag / card
Medium / Top	Top	The price tag reader / card reader
low	Non /very low	Cost function
possible	difficult	May be copied or changes
Impossible	In some types may	Ability to update the information
(4. s<)Very low	(<0/5s) Very fast	Speed read the label / card
0-50cm	30cm-1500m	The maximum distance between the carrier and the reader
Non	Developing	Terms development
Low	Top	The ability to trace a product in the supply chain

Security

Many businesses use RFID to control access to hotels and business facilities by attaching a tag to an employee's room card or ID badge. Such technology ensures that only authorized persons are allowed access to particular rooms or entrances. This application is also becoming more common in nursing homes and hospitals where the management and tracking of individuals is very important, and alarms are more discrete.

Other security features include RFID chips embedded into automobile keys that enable the car only to start if the key has the proper chip embedded into it. Video stores and libraries are also applying radio frequency devices to checkout rentals to detect stolen or misplaced items. Law enforcement officers are now able to track credit cards, jewelers, vehicles, and artwork by radio frequency tags embedded in these objects.[9].

Supply-chain management

RFID represents one of the most significant advances in supply-chain management since the first bar code was scanned in 1974. Coupled with wireless systems and intelligent software, RFID has the potential to further revolutionize the supply chain37. Already, supermarkets are tagging pallets, cases, and other returnable transit containers such as plastic crates used for fresh foods. Tagging these items permits transparent and total visibility of assets and inventory. The ability to write to the RFID tag also allows the entry and management of information such as contents, expiry date, manufacturer and country of origin. In this manner, RFID enhances the accuracy of shipments and deliveries. In addition, it can address what is known as "product shrinkage" or product theft. The majority of this loss occurs between the manufacturer's front door and the retailer's back office. Electronic product codes transmitted through RFID can determine product arrival and departure at all points of the supply chain, thereby pinpointing the location where a given product was last reported seen. RFID can be used in the tourism and hospitality industries, for instance, to manage uniforms for their staff.[10,11].

Applications:

RFID is imaginable some uses and applications. High flexibility and plenty of variety in the manufacture of the components of this system has caused to be used this technology in the most conditions and areas of land under water, ranging from planting in the human body to paste on the cover of the Passport and so on [12].

RFID applications include:

Supply chain management. Effects of the payment system Smart card (Non-contact payment systems in stores, logistics, management, and monitoring and tracking of funds and assets, the car starter system on sports (for example, identify the individuals in the marathon) Sports ticketing, access control, tracking animals Track of people and people in the health and safety goals, tracking tools and luggage, passport control, as library in the Vatican Library, Berkeley, file manager in pharmacies and medicines. Track and identify items, inventory control, anti-theft, electronic payment applications Better management for retailers, less pollution of the environment, smart shelves, management and monitoring of the fleet of the logistics, distribution and tracking-smart of warehousing, mailing package. Detect the identity of travelers, the application in amusement park and recreational areas, monitoring of environmental issue, crowd control, identify golf balls, oil and gas and petrochemical industry. Identify the types of export and import goods at the ports of identifying and rejecting the issue of Iranian carpets [4,10,12,13,14,15,16,17,18,19,20,21,22].

RFID technology in mobile commerce:

RFID will help in gathering information related to the products in the mobile commerce. also The technology increases the profitability, competitiveness and so on will be. For example, proactive identification of products during transportation can be very beneficial. That can be used during transport, the quality of the products was examined. Table (5) a variety of trade of Mobile RFID has different areas in a practical manner to the show [23].

Table 5: Classification of RFID technology applications in mobile commerce

Example	Type	Applications	Row
Toll road (Los Angeles), buy drinks at the pool (Baja coast of Spain)	(B2C)[1]	Mobile payment applications	1
Tracking goods, boxes, etc. and reviews deficiency and excess inventory (Tesco store)	(B2B)[2]	Mobile Inventory Management	2
Transmission of information related to distributed components were distributed to retailers (story7-Eleven)	(B2B)	Management of overactive	3
Locating people and objects in stores or vehicles (Park logond Denmark, Jacobi Hospital)	(B2C,B2B)	Placement and routing	4
Improve supply chain efficiency by monitoring and asset management (Wal-Mart stores and suppliers)	(B2B)	Reengineering wireless RFID technology	5
Traffic control persons and items in organizations (America's Army)	(B2G,G2G)[3]	Security	6
nspection and rapid transit (Exxon-Mobil)	(B2C,G2C)[4]	Maintenance transaction	7

[1] Buseiness 2 Customer
[2] Business to Business
[3] Government to Government
[44] Government to Customer

CONCLUSION

The use of new technologies in the field of industrial and economic and abandon traditional methods, leading to increased productivity. The update and use of new technologies in the industrial sector and explore new approaches to economic, always requires careful consideration and expertise in order to achieve the lowest cost of sustainable profitability, is to achieve optimal utilization. It can also increase the speed and accuracy, reduce customer response time, reduce rework, and improve the quality and flexibility of the chain [24]. The RFID system with integrated GPS, allowing the measurement and positioning of containers and pallets of product per minute, therefore provides protection from theft and taking control of the product from the beginning of time, to be beneficial.[22]. RFID technology can verify the efficiency and increase process speed can also keep your costs, reduce transportation and distribution.

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