ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 4, Issue 3, March 2017

Radio Frequency Identification: A Technology for Humanity

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Abstract: The RFID technology is a well-known wireless application for traceability, logistics and access control. In business and in our everyday lives (ticketing, fees, visas, car keys, etc.) it has become omnipresent. RFID is today a standardized system that offers decisive practical advantages, which lead to new advances in technology and applications, such as unitary identification, wireless communication and low tag cost. The market prediction, but the application of this phenomenon in the health field (intelligible hospital), the funding for individuals, anti-contraception, and the possibility of new paradigms for integrated environmental intelligence and the Internet of Things, reinforce this trend. The first part of this article reviews and shows its link with radio science the basic concepts of RFID technology. There is also a description of the state of the art, including recent achievement and innovations. The second section illustrates the impact of RFID on our society with an emphasis on autonomy and disability applications. Finally, the last part highlights a panorama of views of RFID applications devoted to humanity and the future directions.

Keywords: Augmented tags, EAS, EPC, RFID, Sensor-tags.

INTRODUCTION

On 4 August 1945 the Soviet Union offered a magnificent gift to the US Ambassador, in which he embedded the "L thing" spying device. Theremin (Theremin). The unit, found just years later, used the reverse dispersion technique to spy out the ambassador's conversations. It was born the first name! H explained and published the concept of radio transmission through reflected waves, which is also known as the principle of back-scatter. The first time Stockman was in 1948. In the sixties, in the first consumer application based on back-scatter technique, the anti-theft system EAS (Electronic Product Surveillance)... The latest RFID is born! The current RFID is born! Nowadays RFID is a well-known wireless technology, which is now over 70 years after the discovery of its operating principle for traceability, logistics, access control and is becoming omnipresent in business and everyday lives (ticketing, payment, passports, car keys etc.). RFID is a standardized technology that delivers decisive practical advantages inherent in unified identification, wireless communication and low-cost tags which lead to new concepts and applications [1], [2]. RFID is therefore increasingly attractive for the use of applications to support our environment and civilization and will continue to be desirable. The consumer demand, but also the application of the phenomenon in the field of health (intelligent hospital), help for people and counterfeiting, as well as its prospect of new paradigms for distributed environmental knowledge and the Internet of Things, largely expose this trend. Today, more than a hundred countries around the globe already have thousands of RFID applications, many of which serve our society and our humanity.

This review paper consists of three main sections. The first segment outlines the basic concepts of RFID technology and its association with radio science. The second section focuses on the current state of the art. The next section is devoted to an overview of RFID implementations in the autonomy and disability fields and thus emphasizes the effect of the RFID on our

ISSN (Online) 2394-2320

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society. Ultimately, the RFID system shows the positive possibilities and future directions [3].

The physics behind the RFID:

RFID is a contactless technology that recognizes objects, animals and persons related to a transponder (called tag), which can be carried, stood, installed and inserted, etc. as the initial and main feature (as provided as its name). There is a link between a dedicated reader and the tag and the reader's collected information is usually passed to a remote database. For example, the object's identities, known as the Electronic Product Code (EPI), are only 96 bit(s), allowing relatively low data transmission between tag and reader (indicating business name, object type / class and serial number). The concept of RFID passive communication is based on the "back-scatter" principle: the emitter (reader in the emission mode) radiates an electromagnetic wave with a certain frequency and constant amplitude; this wave is a source of energy for the target (tag) and retro moduled wave aid to send out the ID objective; Any RFID system is therefore made up of three major elements: a tag that incorporates specific information on an item it attaches; a reader that allows the tag to read, and a database that processes and executes the global RFID application.

The tag is probably the most popular RFID system tool. In fact, one can at least highlight among the criteria and properties the tag needs to fulfill: passive character, reduced size and cost, material comply and sufficient electromagnetic environmentally robustness. Also, the tag is often a fully passive device and, thanks to the back scatter method, responds to the reader request. Fig.1 portrays a simple template for any name [3]–[5]. The tag includes an antenna with an impedance (equivalent to an RFID chip input impedance), which, by means of an electronic button (usually a transistor), can have two different values (Zmatch and Zreflect). Fig.2 displays the two main tag contact configurations corresponding to the two states. Each state, in fact, corresponds to one certain absorbed and certain reflected signal from the tag under the same CW signal from the reader. Type in anything that you want.

Otherwise there are two RFID categories: Near field, permitting a distance of some ten centimeters, and far field, allowing the typical communication distance of several meters. The principal difference between the two categories is the frequency of operation as well as the type of tag and antennas. In case near Field, reader and tag loop antennas are used and magnetic interaction between the two loop antennas allows communication to take place, reducing the contact distance. UHF or microwave antennas, which enable long communication distances of up to 25 meters are used for Far Field.

Therefore, a multitude of tags of different shapes and sizes are available depending on the target application. Nonetheless, the three main components of the Tags are a common denominator: the substrate (material support) and the antenna which, in terms of their ergonomics and efficiency, depend largely on the applicative environment, as well as the chips (integrating intelligence, memory and processing features) [5]–[7].

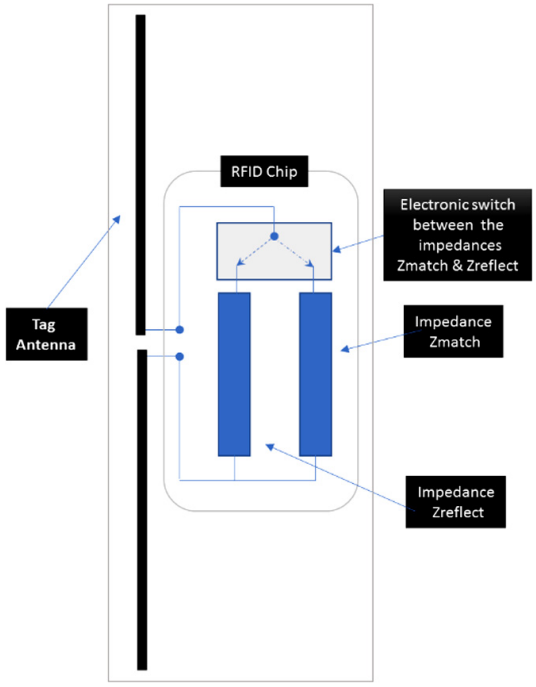

Fig.1.Simplified tag architecture.

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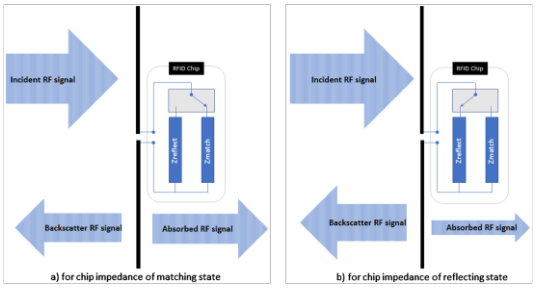

Fig.2.Back scattered and absorbed RF signals in RFID Communication.

The technological advancements in the area of RFID, particularly RFID chips, are very quick, and some chips today have as little activation power as µWall can combine various sensors. Fig.3 portrayed the simplified architecture of RFID chips. Those advances open up the research sector for ever more advanced Internet of Things (IoT) applications.

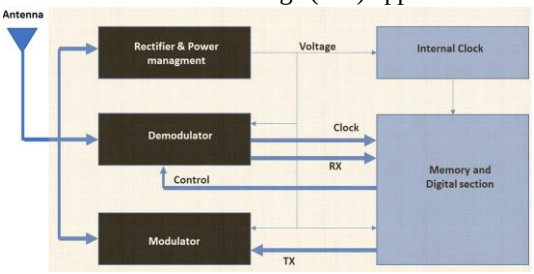

Fig.3.Simplified architecture of RFID chip.

There exists many variants and various standards. They mainly depend on a geographic location (for example, the approved UHF frequencies in Asia, the United States and Europe are not the same) and related techniques for physical layer with more or less latitude can also involve more or less future functional capabilities. The frequencies involved (microwaves, UHF, High Frequencies (HF), Low-frequencies (LF), etc.) and the autonomy of the tags (passive, or partial).

RFID at the service of humanity: focus on the fields of autonomy and handicap:

There are numerous examples of applications, and making an exhaustive list is illusory. Without ever knowing it every day, millions of people use RFID systems: passes, motorway bills, tolls, access to work areas, passports, electronic car keys, cargo tracking etc. RFID is now nearly inevitable for access control and logistics applications for which it is used for its key function, namely identification. The RFID technology is however also used for less frequent applications and offers specific services. RFID is used in particular to provide options for protecting and tracking at-risk individuals (such as elderly and children) and/or disabled people [8], [9]. One of the most important applications in this context is aimed at improving the autonomy of visually impaired people. Seasoned is notably a system that in 2006 was designed and developed in a variety of forms. The concept of these systems is to put tags into the soil; a white electronic cane (including a reader) may be used for the tags; their ID implicitly gives a position; the information is sent to the person via sound. Such devices can be used in buildings or outdoor environments and can also communicate with the environment: detect a footbridge, challenge a portal, etc. RFID LF or HF are chosen among the different standards, since they are well known in many other situations and are used in many other situations. Alternatives suggest replacing the white "editor" cane by including this element in your guide dog's harness or in a sort of ankle band. Additional approaches based on other techniques (e.g., ultrasound obstruction detectors, wireless Internet location or ZigBee network) have also been studied, but the use of passive RFID tags is relatively undisputed. Eventually, the most promise able way for future applications seems to be mixed approaches integrating other methods with RFID. A number of applications use RFID recognition for the purpose of supporting, tracking and autonomy for people with disabilities and/or the elderly.

These examples show that LF and HF RFID technology are widely used in many autonomy and disability applications. The identification system is in most cases combined with other technologies of information, capture and/or communication. For branded domestic products and identifiable by voices, RFID gradually incorporates intelligent environments where domestic automation is becoming omnipresent. Such new services are becoming more important to disabled people, but also to all [10]–[12].

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New perspectives and trends for future applications of RFID:

RFID's capabilities do not interrupt recognition functions: its features drive new advances in sensors as well as in wireless sensor networks and IoT and distributed environmental intelligence. Although the vast majority of applications listed using RFID technology in their original frequency ranges (e.g. LF or HF), in the UHF frequency range new functionality and innovations are required to take the next steps. The high level of interest in UHF RFID is mainly due to its long range of readings and its flexible nature and geometry. The antenna is, in fact, mainly a magnetic loop for LF and HF RFID (the coupling is very seldom capacitive). Therefore, UHF RFID can conceive very unique tag antennas that allow for different radiation patterns and efficiency. The rapidly evolving RFID-chip sensitivity that allows more than 25 m of read range is another feature. In fact, UHF RFID also has a very important potential in addition to its advantages with respect to tag size, read distances, data rates and collision management protocols compared to LF and HF standards, especially in the areas of location and information collection: with respect to localization and the phase exploitation, predictions of the order of some are also possible. Two approaches are planned for the design of sensor tags: Special tags coupled with special transduction sensors or tags. Apart from identification information inherent to traditional sensors, sensor tags also serve as input-output nodes in a data collection infrastructure (which can be heterogeneous), with numerous application perspectives; and passive UHF RFIDs with power consumption control and a slow hardware footprint. Additional developments in UHF RFID, for example: co-field-and far-field applications, that combine advantages in each case, are also being investigated, the innovation of the RFID opens up a variety of viewpoints and will lead to new concepts for use.

There may also be new RFID standards and applications associated with them. Many works concern the so-called "chip less" RFID that involves removing the chip. The identifier is part of the radiation structure of the tag itself. This is the electromagnetic signature. This solution requires more complex players to complete than traditional readers as an inconvenience, but it is completely passive and provides multiple options in terms of day sensors, as seen by UHF RFID. An additional factor is the increased frequency to the millimeter wave (MMID) domain, and this is always possible with the possibility of disposing of tag sensors. Many recent technological breakthroughs also enable new perspectives to be envisaged: very fine and versatile tags combined with printed sensors, impressed batteries, and photovoltaic cells, 3D tags, more specific memories built into tags with more processing capacities, tags actuator, and so on.

CONCLUSION

Finally, while RFID technology is now a renowned technology that is present in many everyday applications, it continues to develop and renovate itself. RFID remains one of the' top ten' key technologies and, thanks to its potential for extremely sophisticated applications such as the IOT paradigm and its numerous exploitations, especially for the benefit of humanity, will remain as such.

A last major issue is the contribution of RFID to the green and recyclable technology concept. Indeed, although the vast majority of RFID's components are not truly green or environmentally compatible, several works have shown that tags are designed with unconventional substrate such as fabrics, papers, woods, plants and trees. However, RFID technology makes a positive contribution to waste recycling, reducing emission levels of radiofrequency and electromagnetic radiation, because of its practical characteristics.

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