International Journal of Computer Science and Informatics

Volume 3 | Issue 1 Article 11

July 2013

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Consumer Contactless Transactions Using ARM9 Processor

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Abstract **-** Traditionally, mobile bills are paid either by cash, or credit/debit cards by standing in the queues at the operator's showroom. Else it's paid using some recharge coupons. This paper is a part of industrial project for users helping them to participate in value added services offered by mobile operators. Using their RFID tags, users can carry out transactions such as bill payments (postpaid), content downloads, recharge their prepaid connections, etc.., Mobile users can perform cash-less transactions. All this with easy-to-use, simple but intuitive touch of their handset to 'target icons'. This solution with anytime, anywhere electronic talk time charging and bill payment in self service mode offers Mobile Network Operators a quantum leap in operational efficiency of their revenue assurance systems. It simplifies and speeds up day-to-day mobile transactions by their customers

Key words - *contact less payment, RFID in mobile payment, Smart Simcard.*

I. INTRODUCTION

RFID (Radio Frequency Identification) is a relatively new technology. RFID is a technology, which includes wireless data capture and transaction processing. RFID is easily integrated with Barcode technologies to optimize data capture and exchange. It uses radio frequency waves to transfer data between a reader and a tag. As the tag enters the RF field, the RF signal powers the tag or turns it on. The tag then transmits the ID and data that has been programmed to the reader. RFID readers (Interrogators) translate the radio frequency information into digital information that can be read by software on the host computer. The computer determines the required actions and instructs the reader, which in turn transmits data back to the tag. Radio-frequency identification is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves.

RFID tags are often a replacement for barcodes, having a number of important advantages over the older barcode technology. The storage of data associated with tracking items will require many terabytes. Filtering and categorizing RFID data is needed to create useful information. It is likely that goods will be tracked by the pallet using RFID tags, and at package level with Universal Product Code (UPC) or EAN from unique barcodes. The unique identity is a mandatory requirement for RFID tags, despite special choice of the numbering scheme. RFID tag data capacity is large enough that each individual tag will have a unique code, while current bar codes are limited to a single type code for a particular product. The uniqueness of RFID tags means that a product may be tracked as it moves from location to location, finally ending up in the consumer's hands. This may help to combat theft and other forms of product loss. The tracing of products is an important feature that gets well supported with RFID tags containing a unique identity of the tag and also the serial number of the object.[2]

II. RFID AND ITS APPLICATIONS

Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies. Unlike ubiquitous UPC bar-code technology, RFID technology does not require contact or line of sight for communication. RFID data can be read through the human body, clothing and non-metallic materials. A basic RFID system consists of three components:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically programmed with unique information.
- The antenna emits radio signals to activate the tag and to read and write data to it.
- The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal.

The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing. The purpose of an RFID system is to enable data to be transmitted by a portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc. RFID quickly gained attention because of its ability to track moving objects.

Fig. 1 : 2.4 GHz active tag, tag Providing location as well as Identification information.

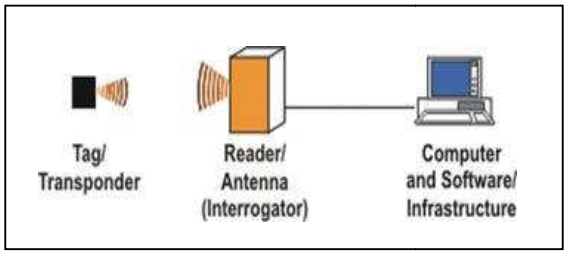
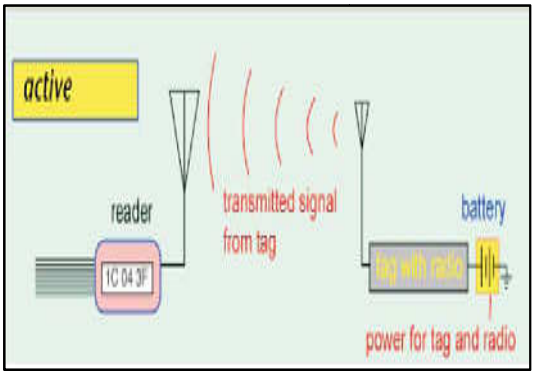


Fig. 2 : A basic RFID system

A typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate. The chip can store as much as 2 kilobytes of data. To retrieve the data stored on an RFID tag, we need a reader. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. The reader then passes the information in digital form to a computer system. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions.



The second is antenna for receiving and transmitting the signal. There are generally three types of RFID tags: active RFID tags, which contain a battery and can transmit signals autonomously, passive RFID tags, which have no battery and require an external source to provoke signal transmission and battery assisted passive (BAP) which require an external source to wake up but have significant higher forward link capability providing great read range.[2]

Fig: 2-External and internal images of semi passive used for automated toll collection

Applications :

RFID has many applications. They are used in different fields as mentioned below.

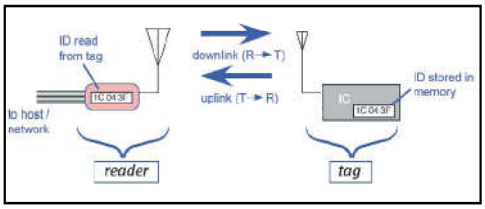
Identification :

Animal identification

A sheep with an ear tag. RFID tags for animals represent one of the oldest uses of RFID technology. Originally meant for large ranches and rough terrain, since the outbreak of Mad Cow Disease, RFID has become crucial in animal identification management.

Human identification :

The success of various animal identification uses since the early '90's has spurred RFID research into various human tracking alternatives. In addition to information contained on the visual data page of the passport, they record the travel history (time, date, and place) of entries and exits from the country.



Security expert has suggested that a mugger operating near an airport could target victims who have arrived from wealthy countries, or a terrorist could design an improvised explosive device which functioned when approached by persons from a particular country if passengers did not put their cards in an area close to their body (high liquid and saline content) or in a foil-lined wallet.

Fig. 3 : For Race timing

Champion Chip transponder next to receiver mat. The athlete wears the chip on his shoe. Many forms of RFID race timing have been in use for timing races of different types. It is used for registering race start and end timings for animals or individuals in a marathon-type race where it is impossible to get accurate stopwatch readings for every entrant.

In foot races, racers wear passive tags which are read by antennae placed alongside the track or on mats across the track. UHF based tags instead of Low or high frequency last generation tags provide accurate readings with specially designed antennas. Rush error, lap count errors and accidents at start time are avoided since anyone can start and finish anytime without being in a batch mode.

In Library :

RFID tags used in libraries: square book tag, round CD/DVD tag and rectangular VHS tag. Among the many uses of RFID technology is its deployment in libraries. This technology has slowly begun to replace the traditional barcodes on library items (books, CDs, DVDs, etc.). The RFID tag can contain identifying information, such as a book's title or material type, without having to be pointed to a separate database.

The information is read by an RFID reader, which replaces the standard barcode reader commonly found at a library's circulation desk. It can also act as a security device, taking the place of the more traditional electromagnetic security strip. Since RFID tags can be read through an item, there is no need to open a book cover or DVD case to scan an item. Where the books have a barcode on the outside, there is still the advantage that borrowers can scan an entire pile of books in one go, instead of one at a time.

Hospital operating room :

In 2008, Clear Count Medical Solutions introduced the Smart Sponge system, the first RFID-based system approved for use in the operating room (OR). The system, consisting of an electronic reader and high frequency RFID-tagged disposable gauze, sponges, and towels, is designed to improve patient safety and OR efficiency. The system aims to reduce or eliminate the most common and costly surgical *never event*, unintentionally retained foreign objects in surgery. The system automatically provides a device-reconciled count by directly matching the unique identifier on each tagged item both entering into and then out of the surgical case. The system also provides a reusable wand which may be used to scan the patient as an additional safety measure or to assist in locating misplaced sponges.

Besides this RFID is also used in many fields such as

- Mobile payment
- Transportation and logistics
- Human implants
- School and universities, museums etc.

Controversies :

Logo of the anti-RFID campaign

The use of RFID technology has engendered considerable controversy and even product boycotts by consumer privacy advocates. The two main privacy concerns regarding RFID are:

- Since the owner of an item will not necessarily be aware of the presence of an RFID tag and the tag can be read at a distance without the knowledge of the individual, it becomes possible to gather sensitive data about an individual without consent.[16]

  If a tagged item is paid for by credit card or in conjunction with use of a loyalty card then it would be possible to indirectly deduce the identity of the purchaser by reading the globally unique ID of that item (contained in the RFID tag). This is only true if the person doing the watching also had access to the loyalty card data and the credit card data, and the person with the equipment knows where you are going to be.

III. RFID IN MOBILE PAYMENT

The product proposed in this paper is a RFID-software enabled smart SIMcard. The RFID chip embedded in the SIMcard will be detected by a RFID reader installed at various places when the chip is within the range. The RFID chip will have a read-write memory to store the current balance of the SIMcard account and history of last few transactions. The user has to hold his mobile phone against a RFID reader which will recognize the SIMcard number and check the current amount in that SIMcard account. A confirmation message will be displayed on mobile phone screen of the user to allow the transaction. Transactions will be performed on the approval of the user.

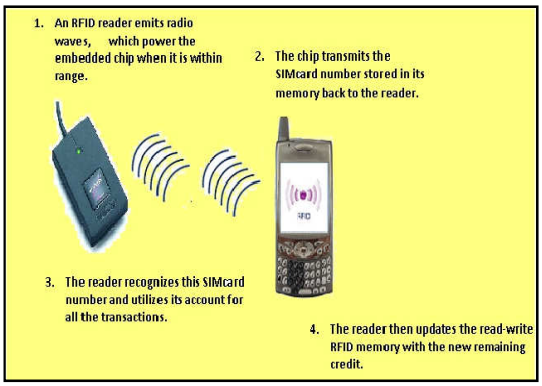


Fig. 4 : Working RFID enabled smart simcard

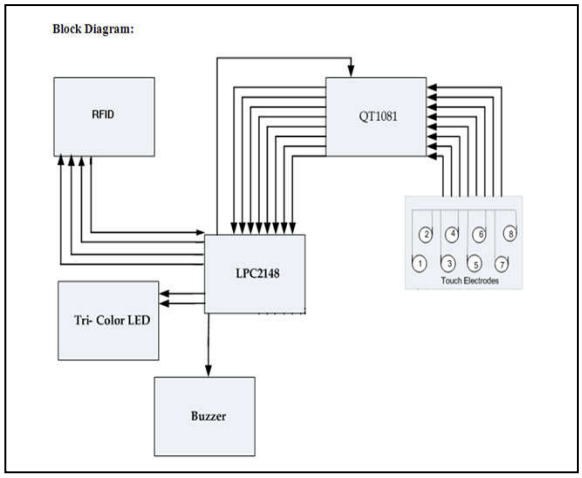
A consumer presents a contactless MasterCard, Visa or American Express payment card or keychain device to within a couple of inches of the POS terminal. The terminal automatically reads payment account information stored on the smart chip embedded in the card and securely processes the payment transaction. Inside the card or keychain device a contactless smart chip is wired to an antenna. Contactless payment terminals emit high frequency radio waves which are used to both provide power to the contactless payment device and communicate information between the device and the reader.[6]

When the contactless payment device is brought close to the reader (typically less than 4 inches away), the contactless smart chip is powered on. Once the chip is powered on, a wireless communication protocol is established between the contactless device and the reader. The card and the terminal exchange security information, then conduct a secure payment transaction, all in less than one-third of a second.

What is the advantage of contactless payment for consumers?

Contactless payment offers consumers the speed and convenience of "touch-and-go" or "pay with-a-wave" payment devices. No more fumbling for cash, counting change, or worrying about whether you have enough cash for a purchase. In many cases, consumers also don't need to sign a receipt or enter a personal identification number (PIN). Perhaps the biggest benefit however is that it will give consumers a fast alternative to cash payment.[6]

Contactless payment cards use the latest technology to send card data via radio frequency to a contactless card reader. The cardholder simply holds or waves their card in front of the secure reader, waits for an LED and a beep which signals that the transaction has completed. The contactless payment card reader is attached through a cable to a standalone terminal or a point of sale system and is similar to, and might even be embedded within, Chip and Pin readers/ pin pads.



A smart SIM card is a small piece of technology with many big uses. Whether boosting cell phone memory or allowing secure mobile bank transactions, these small chips are a popular component in many industries. Lightweight construction and massive memory capacities help them edge out traditional smart card technology.[15]

RFID(Radio Frequency Identification) -enabled SIM (Subscriber Identity Module) card to carry out money transfer. RFID-enabled SIM is a special SIM card that includes RFID (Radio Frequency Identification) chip in the SIM casing. We propose an architecture to integrate RFID and normal SIM features into a single specialized RFID-enabled SIM. This specialized SIM can be used for normal phone applications as well as contactless payment.

IV. CONCLUSION

Now RFID is one of the most efficient ways of transmitting information with the least cost. As the technology is growing, the RFID systems are speeding up the gear with the improvements in its application s, and one of the most important things is the advantage of providing security. The RFID enabled smart SIMcards can completely reshape the society because of its anytime, anywhere approach. The benefits of using this kind of technology are:

1. Flexibility: With mobile in your hand there is no need to carry several cards: your mobile can simultaneously be an ID, a credit card, a stored-value cash card, token at metro stations, airports etc.
2. Time and Manpower reduction: Using mobile as payment device the user can save his/her time by using various services at anytime and anyplace and avoiding long queues. Also need of human beings at various cash and ticket counters can be minimized. This improves efficiency and reduces ticket frauds.
3. Safety: Using mobile phones is safer than carrying cash for an individual.
4. Mobility: Access can be made available in geographical locations where on-line communication is not possible.

The research shows that convenience, culture, privacy, regulation, and security are the principal factors influencing the consumers acceptance of RFID [12] However at present,

V. FUTURE ENHANCEMENTS

In any field there is always the possibility of enhancements and improvement. We can't have anything perfect in itself, hence, there can be possibilities of enhancing this project. A great deal of research and development is currently under way in the RFID security field to mitigate both known and postulated risks. Manufacturers, business managers, and RFID systems engineers continue to weigh the trade-offs between chip size, cost, functionality, interoperability, security and privacy with the bottom-line impact on business processes.

Security features supporting data confidentiality, tag-to reader authentication, optimized RF protocols, high assurance readers, and secure system engineering principles should become available. Security and privacy in RFID tags aren't just technical issues; important policy questions arise as RFID tags join to create large sensor networks and bring us closer to

ubiquitous computing [13]. There can also be other issues regarding erroneous billing, SIMcard or RFID chip malfunction., unauthorized use in case of theft or lose of mobile phones. So in future these concerns can be taken care of with high level of authentication.

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