Automatic Data Capture Systems - RFID

CP4014 Internet and Communications Technology
Assessment 2

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1. Introduction

RFID – Radio Frequency Identification is an Automatic Data Capture System, it is a generic term for technologies that use radio waves to automatically identify objects. Its main position is as a next generation bar coding system incorporated with EPC – Electronic Product Code. It is not yet widely used due to high costs involved in wide spread implementation of the technology, but it is considered that it will infiltrate our daily lives over the next ten years as costs decrease, the technology becomes internationally standardised and concerns over individuals privacy are diminished. RFID technology is already in use in certain industries most prominently supply chains and animal identification. The most likely area where we will see the expansion of RFID technology into our daily lives is in retail, where it already co – exists with barcode technology. We are already seeing an increase in human implantation of RFID tags, although this is reserved to almost cult status at the moment, I will discuss this, and other uses of RFID further in section 6.

2. Origins of RFID

RFID is not a new technology; it was first used by British Military in World War 2 to identify enemy or friendly aircraft in the IFF (Identify Friend or Foe) transponder. RFID technology was developed further in the 60's and 70's by USA for tracking nuclear material and cows and was patented in 1973. RFID's benefits for retail were first realised in the 70's when the technology was commercialised as an Anti Theft Device known as Electric Article Surveillance Tags. We are familiar with these and see them on all sorts of products from CD's to books – although they are more likely to be Magneto-acoustic than RFID.

RFID technology was given a major boost in 1999 when 2 professors at the Massachusetts Institute of Technology, Sanjay Sarma and David Brock, received funding from Proctor & Gamble, Wal-Mart, Gillette, EAN (European Article Number) International, and the UCC (Uniform Code Council) for research into developing low cost RFID tags for use on all products to track them through the supply chain. They established the non profit organisation, Auto ID Center, which developed RFID technology until 2003 when the organisation was closed, passing all it's technology over to EPC Global, a joint venture between UCC and EAN, who are today responsible for developing standards for RFID used with EPC (Electronic Product Code).

Funding and development of RFID has mostly been geared toward its use in the supply chain in conjunction with EPC. Other research has also been undertaken developing RFID technology as implants, developed from its use in US agriculture for tracking cows to ensure they were correctly medicated into ID chips for Domestic Pets. Further development has been controversial (see section 7). Industry leaders in this development, VeriChip Corporation, pertain to research in human implantable RFID chips as having numerous benefits ranging from data security to medical care.[1]

[1] I used the following websites as sources of information:
Gerrard Khan, Eastern Caribbean Oracle Users' Group(March 2005) *Conference and AGM* [online] Cited 9th Jan 2006 [www.ecoug.org/oracle_rfid_Gkhan.ppt].
Carey Hidaka, ISM (Institute for Supply Management) (May 2005) *RFID: Enhancing Supply Chain Processes and Delivering Increased CustomerSatisfaction* [online] Cited 9th Jan 2006 [http://www.ism.ws/ResourceArticles/Proceedings/2005/AEHidaka.pdf].
Wikipedia, the free encyclopedia (no date) *RFID* [online] Cited 9th Jan 2006 [http://en.wikipedia.org/wiki/RFID].
Verichip Corporation (no date) [homepage] [online] Cited 9th Jan 2006 [http://www.verichipcorp.com/].

3. How RFID works

3.1 Overview

For RFID technology to work successfully there must be 3 main components in place, a Tag, a Reader and a Host Computer. A tag or transponder is a small radio device. There are different types of tag (see section 3.2 Tags); all tags have a scanning antenna which receives and sends the radio frequency signals and a microchip that holds information. The tags can be attached to different items or implanted and are read remotely by a reader. The reader, sometimes referred to as either a transceiver, an interrogator or a scanner, also has a scanning antenna which it uses to send and receive data to and from the tag. The reader may have multiple antennas and can read many tags at once. It does not rely on line of site to read the tags which is one of RFID's greatest benefits. A reader can be hand held or built into doorways or walls for example, it reads the tags as they come into range. The reader transmits the data it receives from the tag to a host computer which may run specialist RFID software or middleware to filter the data and process it into useful information.

3.2 Tags

There are 3 types of RFID tag, Active, Passive and Semi Passive. Active tags are battery powered, they have a limited lifespan, a maximum of 10 years. They have a read range of up to 100 metres, read range being the distance from which the reader can communicate with the tag. Active tags may be read-write and can hold more data than passive tags, this coupled with their greater read range makes them more expensive. They are most likely to be used to track high value goods. Passive tags are smaller than active tags and do not require a battery to operate. They have an unlimited life span - one of their great benefits, but have much shorter read ranges typically 3 metres or less. These tags are most likely to be used with EPC to replace barcoding. Passive tags are considerably cheaper than Active tags at less than £1 each compared to £5 - £20 each. The third type of tag, the semi passive tag, has attributes of both active and passive tags. It is most similar to a passive tag except that its chip is powered by a battery. By not relying on an incoming signal through the scanning antenna to power the chip, the antenna be used to reflect back to the reader radio waves from another reader, usually at the same frequency. The reflected signal is modulated to transmit data; this is called backscattering. Semi passive tags respond quicker than passive tags meaning they have a higher data rate. All types of tag can have one of three type of micro chip, read-only, read-write or write-once, read-many (WORM) – a chip that can be written to only once by a reader and then becomes read only.

In addition there are two types of Passive and Active tag. Inductively Coupled and the newer technology, Capacitively coupled. There are three parts to an Inductively Coupled tag, a silicon microchip, a metal coil, which acts as the antenna, made of either copper or aluminium wire that is wound in a circular pattern on the tag. The final part is the encapsulating material which is either glass or polymer. Capacitive coupled tags also contain 3 parts. They also use a silicon chip that can be as small as only $3mm^2$. The chip can store up to 96 bits of information. Instead of using a metal coil as their antenna these tags use conductive carbon ink, using conventional printing methods it is applied to paper, the final part of the tag. The tag is disposable, it can be bent, torn or crumpled and still transmit data. A low cost tag that can be integrated with barcode labels used today it is the technology most likely to be implemented by retail chains. An example of a capacitively coupled tag is the Motorola's BiStatix Smart Label.

3.3 Radio Frequency

The main components communicate over 4 bands of radio frequency. Each frequency offers a different read range, Low-frequency, 125 - 148 KHz, is short range, having a read range of less than 1 metre. Tags, typically passive, are required to have long copper antennas making them more expensive. Tags using this frequency are primarily used for access control, asset tracking and domestic and agricultural animal identification and car security. High-frequency, 13.56 MHz has a read range of up to 1.5 metres, and a medium data rate. It is not susceptible to interference from water or metal, (which can block the signal entirely or create noise at some frequencies) and typically offers the cheapest solution when using inductive tags. It is most commonly used for identifying clothing and smart cards such as London Underground's Oyster card. Ultra-high frequency, 850 MHz - 950 MHz offers long read ranges of up to 3 metres and a high data rate. They have the potential to be an inexpensive option when purchased in bulk making it a viable option for many industries to adopt. The final frequency is Microwave, 2.45 GHz and 5.8 GHz, provides the fastest data rate and has the largest read range of up to approximately 30 metres. It is however the least cost effective with tags costing double that of those using lower frequencies, primarily because the frequency can only be used with Active or Semi-Passive tags. All lower frequencies can penetrate different solid materials and liquids however microwaves are reflected by metals and other conductive surfaces and are absorbed by water and water-based solutions, it offers the most direct signal. It is most commonly used for road toll collection and vehicle fleet identification. See section 3 for information on regulations surrounding these frequency ranges. [2]

Fig 1. Examples of Tags (transponders)

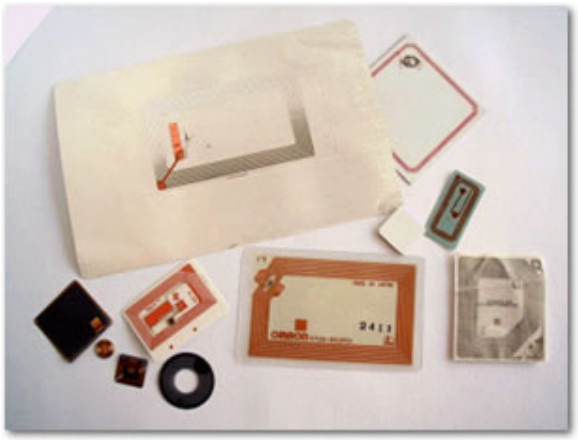

Image source - www.rfidc.com

[2]I used the following websites to obtain my information:
RFID Journal (no date) *Glossary of RFID Terms* [online] Cited 9th Jan 2006 [http://www.rfidjournal.com/article/articleview/208].
Wikipedia, the free encyclopedia (no date) *RFID* [online] Cited 9th Jan 2006 [http://en.wikipedia.org/wiki/RFID].
rfidusa.com (no date)[Homepage] [online] Cited 9th Jan 2006 [http://rfidusa.com/superstore/index.php?cPath=84].
RFID Centre (no date) *RFID Technology*[online] Cited 9th Jan 2006 [http://www.rfidc.com/docs/rfid.htm].
rfid-101.com (no date) *Info Guide to Radio Frequency Identification (RFID) Technology* [online] Cited 9th Jan 2006 [http://www.rfid-101.com].
howstuffworks.com (no date) *How RFIDs Work* [online] Cited 9th Jan 2006 [http://electronics.howstuffworks.com/smart-label1.htm].
rfidusa.com (no date)[Homepage] [online] Cited 9th Jan 2006 [http://rfidusa.com/superstore/product_info.php?cPath=21_39_69&products_id=134].

4. Standards and Regulations

Two main organisations are responsible for developing standards for RFID, these are ISO (International Standards Association) and EPC Global. There cannot at present be an international standard governing frequencies as each country has different frequencies available for RFID. European frequencies are regulated by three organisations, ERO (European Radio communications Office), CEPT (European Conference of Postal and Telecommunications Administrations) and ETSI (European Telecommunications Standards Institute). In Britain radio frequency bands are further regulated by communications regulator Ofcom. Toward the end of 2005 it was announced that Ofcom have created a standard stating that equipment using UHF RFID technology will be exempt from Wireless Telegraphy licensing. This will save UK businesses between £100m and £200m over 10 years[3].

If RFID is to become a mainstream technology it is important that standards are created to ensure interoperability and to increase trust in the technology. If enough standards are in place hopefully controversy and privacy concerns will be reduced, it is also hoped costs will decrease making it easier for companies, even individuals, to implement the technology.

Most development of standards is based around UHF (Ultra High Frequency) technology, insinuating that UHF will be the technology adopted globally in the supply chain. This has been lead by Wal-Mart issuing a mandate in June 2003 instructing all of it's suppliers to be implementing RFID by 2005. The commercial power of Wal-Mart created an urgency for standards to be created relating to EPC and its use of RFID.

EPC Global is a subsidiary of GS1, an organisation made up of EAN International and UCC. EAN and UCC have been responsible for governing the barcode system since its inception. There involvement with RFID is solely linked to EPC and its integration into the supply chain. On the back of the Wal-Mart mandate GS1 has developed a Traceability Standard, which gives a standard for monitoring products and materials through the supply chain. One of the big pushes forward for UHF RFID technology has been the release of EPC Global's standard for EPC, Gen 2.

"The EPCglobal UHF Generation 2 standard is the first royalty-free, global standard that will allow companies to harness the power of radio frequency identification (RFID) to provide greater product visibility in their supply chains worldwide. With greater product visibility companies and consumers alike are expected to benefit with fewer out-of-stock products, safer drugs and fresher produce, among others. The standard was developed through a collaborative process which involved more than 60 leading global companies that subscribe to EPCglobal Inc, a not-for-profit standards organization." (EPC Global)[4]

Gen2 has been created to fuel an international adoption of RFID/EPC technology. It is hoped that by producing tags that meet Gen2 standards costs will fall and more companies will be able to adopt the technology. Tesco are the biggest UK Company investing in RFID/EPC technology and were involved in the process of creating the Gen2 standard.

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[3] Jo Best, Silicon.com (Wednesday 9 November 2005) *No Licences Necessary* [online] cited 9th Jan 2006 [http://networks.silicon.com/lans/0,39024663,39154064,00.htm].

[4]EPCGlobal (no date) *UHF Generation 2 Standard FACT SHEET* [online] cited 9th Jan 2006 [http://www.epcglobalinc.org/news/FINAL_Gen2_Ratification_Fact_Sheet.doc .

Where as GS1 and EPC Global are concerned only with creating standards for RFID's use with EPC ISO have been developing international standards for general implementation of RFID.

Below is a list of ISO standards sourced from the ISO website:[5]

- **ISO/DIS 17363**: Supply chain applications of RFID -- Freight containers
- **ISO/DIS 17364**: Supply chain applications of RFID -- Returnable transport items (RTIs)
- **ISO/DIS 17365**: Supply chain applications of RFID -- Transport units
- **ISO/DIS 17366**: Supply chain applications of RFID -- Product packaging
- **ISO/DIS 17367**: Supply chain applications of RFID -- Product tagging
- **ISO/IEC DTR 18047-2**: Automatic identification and data capture techniques RFID device conformance test methods -- Part 2: Test Methods for Air Interface Communications below 135 KHz
- **ISO/IEC DTR 18047-6**: Automatic identification and data capture techniques -- RFID device conformance test methods -- Part 6: Test methods for air interface communications at 860 - 960 MHz
- **ISO/IEC 19762-3:2005** Automatic identification and data capture (AIDC) techniques -- Harmonized vocabulary -- Part 3: Radio frequency identification (RFID)

Below is a list of ISO standards sourced from Wikipedia:[6]

- **ISO 11784 & 11785** - These standards regulate the Radio frequency identification of animals in regards to Code Structure and Technical concept
- **ISO 14223/1** - Radio frequency identification of Animals, advanced transponders - Air interface
- **ISO 10536** - Identification cards - Contactless integrated circuit cards
- **ISO 14443** - Proximity Card (a high speed RFID device used for security access or payment systems)
- **ISO 15693** - vicinity cards (a low speed RFID device used for security access or payment systems)
- **ISO 18000** - RFID Air Interface Standards

[5] ISO (no date) *Combined search result for 'rfid'* [online] cited 14th Jan 2006. [http://www.iso.org/iso/en/CombinedQueryResult.CombinedQueryResult?queryString=rfid:].

[6] Wikipedia, the free encyclopedia (no date*) RFID* [online] cited 9th Jan 2006 [http://en.wikipedia.org/wiki/RFID].

5. Costs

Costs to implement RFID technology vary depending on each individuals business requirements. Equipment can be relatively in-expensive, but it might not provide 100% accuracy. For individuals experimenting with RFID technology parts can be in-expensive and purchased from numerous international companies and not surprisingly from eBay. For companies wanting to implement RFID, costs at present are likely to be in the billions. This is the fundamental reason why RFID has not had widespread implementation.

One example of cost breakdown for the implementation of RFID technology in the supply chain as a replacement for Barcode technology uses Wal-Mart as an example[7]. The academic research report sets Wal-Mart's costs as being $3 billion dollars for the first stage of implementation assuming 100 suppliers implemented the technology. When the benefits of implementing the system were analysed it showed Wal-Mart with a total saving of $8.35 Billion. If the information on the document is accurate it goes to explain why Wal-Mart and other companies are so keen to invest in RFID technology.

As with any new technology prices for RFID equipment are more likely to decrease rather than increase over time. Once costs do become more reasonable then we will undoubtedly see RFID becoming a mainstream technology, opening it up to smaller companies.

[7] Gaurav Dargan, Brian Johnson, Mukunthan Panchalingam, Chris Stratis.Carnegie Mellon University. (March 5, 2004) *45-877 Final Project Strategic Uses of Information Technology, The Use of Radio Frequency Identification as a Replacement for Traditional Barcoding* [online] Cited 9th Jan 2006 [http://www.andrew.cmu.edu/user/cjs/cost.html]

6. Utilising RFID Technology

RFID can provide solutions for identifying, tracing or tracking, animals, products, vehicles and people. It can also benefit security by controlling physical access and data access. Below are some examples of how RFID has been implemented internationally, both commercially and domestically and also some potential future uses for RFID technology.

6.1 Access Control

6.1.1 Current Uses

- Implants and smart cards can hold passwords for computers only allowing access to certain people. This works individually but also for companies who may have sensitive information only some people have the authority to access; e.g. Mexican Attorney General's office implanted 18 of its staff members with the Verichip to control access to a secure data room.[8]
- Allow delivery vehicles to enter warehouses.
- Secure entry to offices/work premises or company vehicles.
- Secure entry into own house or vehicle – you can buy RFID door security on eBay. There are quite a few instances on the internet of DIY taggers, implanting themselves and setting up RFID access control to their own homes and vehicles.[9]

6.1.2 Future Uses

- Only allow machinery to work if the user has a safety certificate to use it.
- Only allow access to car park if have the authority to park, or automated payment for car parking.

6.2 Military

6.2.1 Current Uses

- Artillery and supplies are tagged in Iraq so that their location can be traced and officials be notified if they are intercepted.

6.2.2 Future Uses

- Troops could be implanted and military vehicles tagged so that their locations can be traced, it would be easier to identify the enemy.
- To aid hostage situations, workers in war torn countries could also be tagged then their locations identified in case of kidnap.

6.3 Supply Chain (inc. Distribution, Retail)

6.3.1 Current Uses

- Pallet and container tracking, road and rail.
- Cargo tracking in shipping yards.
- EPC – likely to be used with barcoding until RFID technology gets considerably cheaper.
- Many manufacturers and retailers use RFID tags on products, only used in warehouses at present, not on shop floor as yet. Improves stock control. Marks & Spencer, Woolworths and Tesco are leading the way in the UK.

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[8] Wikipedia, the free encyclopedia (no date*) RFID* [online] cited 15th Jan 2006 [http://en.wikipedia.org/wiki/RFID].

[9] Steve (no date) *Steve's em4102 RFID tag implant* [online] cited 14th Jan 2006. [http://pyrodisiacs.com/tag/].

6.3.2 Future Uses

- No cashier in supermarket – all products chipped when the customer leaves the shop, readers in the doors identify which stock has been purchased updating stock inventory and sending the information to the customer's bank to authorise payment for the products. Would help to combat shop lifting, although once customer has left the shop, what does the shop do if the customer has no funds to pay for the products?
- Refrigerators and cupboards could contain a reader which would keep an inventory of all products it could then alert when products out of date or used and add to a shopping list, this could be sent to the supermarket and items dispatched.
- Clothing could contain tags with laundry details that would inform readers in appliances how to wash/dry the items.
- By tagging food products the tags can provide tamper evidence increasing food safety and providing a control for bio terrorism.[10]

6.4 Medical

6.4.1 Current Uses

- Tags supplied by Verichip were implanted into unidentified victims of Hurricane Katrina, staff then recorded information about location, physical condition and characteristics. Photographs could also be stored. The data could then be cross checked with the missing person database. The victim could easily be located again. [11]
- All packages of Viagra in the US contain RFID technology and EPC so that they can be identified by pharmacists and retailers as a genuine product. Viagra is one of the most counterfeited medicines in the U.S. it is hoped RFID technology will help reduce counterfeiting and eventually black market sales.[12]

6.4.2 Future Uses

- Allow relevant hospital staff to access medical records.
- Tag all newborn babies so no unauthorised person can access them.
- Tag patients so their whereabouts are always known, especially mentally ill patients or the elderly.
- If individuals had implants that held all their medical details, if the patient was admitted in an emergency and was unconscious they could be identified and any allergies or medical conditions would be known. Also could contain next of kin information so they could be notified.
- Tag all medicines to combat counterfeit medicines entering supply chain and also decrease black market sales of prescription drugs as the products will be traceable. Although some US pharmaceutical companies have added EPC tags to some medications, it has not been fully implemented.

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[10] RFID Centre (no date) *RFID Technology*[online] Cited 9th Jan 2006 [http://www.rfidc.com/docs/rfid.htm].

[11] Michael Kanellos, Silicon.com (Monday 19 September 2005) *RFID tags used to track Hurricane Katrina dead* [online] cited 9th Jan 2006 [http://networks.silicon.com/lans/0,39024663,39152382,00.htm].

[12] rfidwatch weekly *(*January 11, 2006*)* Pfizer turns to RFID to secure Viagra supply chain *[online] cited 14th Jan 2006*

[http://www.dcvelocity.com/articles/rfidww/home.cfm].

6.5 Travel

6.5.1 Current Uses

- The following countries embed RFID chips in their passports, Pakistan, Norway, Malaysia and New Zealand. "…as of October 2006 all US passports will contain RFID chips with some security features. The passports will be shielded to prevent skimming. The department will also implement Basic Access Control (BAC), which functions as a Personal Identification Number (PIN) in the form of characters printed on the passport data page. Before a passport's tag can be read, this PIN must be inputted into an RFID reader. The BAC also enables the encryption of any communication between the chip and interrogator" (Wikipedia)[13]. Eventually utilising RFID with Biometrics will make passports a unique identifier for every citizen.
- The Oyster Card, London U
- .nderground's potential replacement of the Travelcard uses RFID technology. It provides prepaid travel which eliminates the need to buy tickets and allows you to travel by train, bus or tube. Other similar schemes are in operation in various countries.
- Road tolling, a lot of toll roads in the USA now use RFID technology in smart card to receive payment. Eventually removing the need for manned toll booths.

6.5.2 Future Uses

- Instead of road tax – pay as you go taxed per miles you drive.
- Ticketing for parking or speeding fines.
- Congestion charging.
- Baggage track and trace on airlines, potentially there is less risk of baggage being lost or stolen.
- Possible replacement to satellite navigation systems.

6.6 Animals

6.6.1 Current Uses

- Pet ID – used to re unite missing pets with owners.
- Tracking livestock
- Trace migrating birds for research and to monitor rare breeds.

6.6.2 Future Uses

- Track animals released back into wild and monitor levels of rare breeds.
- Combat pet stealing by being able to locate a tagged pet.
- Access medical history of pet if found and taken into rescue centre, vets would know if vaccinations were up to date or if the animal needs medication.

6.7 Law

6.7.1 Current Uses

- Prisoners of some US prisons are tagged so that inmates can be tracked as a measure to increase security and combat violence. Computers are alerted if the devices are tampered with.[14]
- US Dollars and Euro bank notes are embedded with RFID chips. It is a measure put in place to combat counterfeit currency.[15]

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[13] & [14] Wikipedia, the free encyclopedia (no date*) RFID* [online] cited 14th Jan 2006 [http://en.wikipedia.org/wiki/RFID].

6.7.2 Future Uses

- Tag people on parole and check they don't break conditions.
- Track remand prisoners to stick to curfew or house arrest – cut prison numbers.
- Tag inmates in prisons so can trace them if they escape.
- If individuals had an implant could trace kidnap victims or missing persons, identify murder victims or accident victims.

6.8 Leisure (inc. Extreme RFID)

6.8.1 Current Uses

- Some casinos in Las Vegas use RFID to monitor standards of service, checking serving times and checking all areas are serviced. Chips contain RFID chips to highlight if counterfeit chips are being used. [16]
- A bar in Barcelona has implemented RFID to an extreme, implanting VIP guests with a Verichip RFID tag. Implanted VIP's can then have access to the VIP lounge where drinks are not paid for at the bar but automatically taken from the guests account via communication with the tag.[17]
- Ski lift passes in some resorts use RFID technology.
- Either as a hobby creating secure access as discussed in 6.1.1 or as a body adornment in line with body piercing and tattooing, there are a lot of people internationally, experimenting with RFID technologies, in particular implanting chips. [18]

6.9 Services

6.9.1 Current Uses

- Some libraries already tag books, CDs and DVDs but in future the technology could be improved so that the item could be traced if not returned and the borrower automatically charged for the item.
- Postal service could be made more reliable by each item being tagged so it could be traced in real time. If a package went missing it would be easy to locate. This could be used as an anti theft method. Postal services like DHL and Fed Ex already use RFID technology. [19]
- Some laundry services use RFID tags to trace laundry items e.g. Hotel or Hospital sheets can be tagged with name and location, then the items can easily be identified and dispatched to the correct establishment.

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[15] Alex Jones, Prisonplanet.com (no date) *RFID Tags in New US Notes Explode When You Try to Microwave Them* [online] cited 14th Jan 2006
[http://www.prisonplanet.com/022904rfidtagsexplode.html].

[16] Will Sturgeon, Silicon.com (Friday 15 April 2005) *Exclusive: Las Vegas casino goes for RFID* [online] cited 9th Jan 2006
[http://www.silicon.com/research/specialreports/gambling/0,3800010160,39129583,00.htm].

[17] Simon Morton, BBC.co.uk (Wednesday, 29 September, 2004) Barcelona clubbers get chipped [online] cited 9th Jan 2006
[http://news.bbc.co.uk/2/hi/technology/3697940.stm].

[18] The "Tagged" RFID implant forums (no date) [Homepage][online] cited 9th Jan 2006
[http://tagged.kaos.gen.nz/].

[19] rfidwatch weekly (Wednesday, January 4, 2006) RFID is poised to transform the parcel express industry, but it won't happen overnight [online] cited 9th Jan 2006
[http://www.dcvelocity.com/articles/rfidww/rfidww20060104/parcel.cfm].

7. Controversy

Most new and emerging technologies are met with controversy until implications of the technology are fully understood. RFID is no exception, in fact RFID seems to have the market share of controversy. There is a lot of conflicting information about RFID in its uses and how it works that I am not surprised by the scare mongering surrounding the technology. One of the leaders in controversy is consumer group CASPIAN who run a website (www.spychips.com) initiating protests against RFID technology, especially in the supply chain and, along with Christian groups, hailing human RFID implants as the 'Mark of The Beast'. Trials in a Cambridge Tesco implementing RFID as an anti-theft device using tagged Gillette razors, hailed a call for a boycott by Caspian, until eventually the trial was halted. The main opposition I can empathise with are concerns over privacy, and big brother philosophy. I am against the idea of governments and big corporations monitoring my every move, even more than how we are monitored already. Without the presence of enough regulations and standards to govern the use of RFID technology, it does increase anxieties over privacy. If standards and regulation were to increase then some of the benefits of the technology may be felt by the wider population. There also needs to be more research done into health risks posed a, by increasing the amount of radio frequency around towns and cities and b, in risks of implanting chips before people will warm to the technology. [20]

[20] spychips.com (no date) [Homepage][online] cited 9th Jan 2006 [http://www.spychips.com/].