SOCIAL RFID

internet *for* things

SUPERVISOR
Rob van Kranenburg

EMMA
EUROPEAN MEDIA MASTER OF ARTS

Patrick Plaggenborg
Rotterdam, August 2006

Utrecht School of the Arts
European Media Master of Arts
Digital Media Design

SOCIAL RFID

internet *for* things

Patrick Plaggenborg

Rotterdam, August 2006

Version 1
August 2006
Rotterdam, The Netherlands

Thing:189THS
http://www.thinglink.org/

Printed at Koopman & Kraaijenbrink
http://www.deprintservice.nl/

Patrick Plaggenborg
patrick@plaggenborg.nl
http://patrick.plaggenborg.nl

More information about project and thesis:
http://www.socialrfid.org/

FOREWORD

It was quite enervating to explore RFID, starting almost from scratch. Especially the first period a lot of plain reading was involved. But the more I learned about this technology, the more enthusiastic I got. Theoretically it is bringing a lot of possibilities. While the RFID infrastructure is still taking off it's interesting to make up future scenarios.

For accessibility reasons I chose to write this thesis in English. Being a native Dutch speaker that made the whole process quite time consuming. I do think the greater reach weighs up against the extra effort.

I want to thank my supervisor Rob van Kranenburg for his incredible enthusiasm and for often being available at unusual times of the day. It was very inspiring and motivating working with him. I also want to thank my girlfriend Priscilla for her support in this very busy period, where work and free time mix up inconveniently.

I hope you enjoy reading this thesis. More about the project involved and a PDF version of this thesis can be found at www.socialrfid.org.

Patrick Plaggenborg

CONTENTS

ILLUSTRATIONS

APPENDICES

1. EPCGLOBAL, 2004, *EPCGlobal Network*, available online: http://www.epcglobalinc.org/about/EPCglobal_Network.pdf (last accessed 2006/07/31)

2. PLAGGENBORG, P. 2006, *Onderzoek RFID-toepassingen*, Research (Dutch), May 2006, available online: http://patrick.plaggenborg.nl/wp-content/uploads/2006/05/Onderzoek%20RFID-toepassingen%20-%20Patrick%20Plaggenborg.pdf (last accessed: 2006/07/08)

INTRODUCTION

RFID (Radio Frequency Identification) has been used by many of us for years already, even without many people knowing this. It's the technology behind automatic toll collection systems, identification chips in cats or dogs and electronic door keys for offices and cars. But a couple of years ago RFID became a hype. Especially in the supply-chain RFID was expected to bring changes: prosperity, but at the same time the technology had a negative atmosphere surrounding it.

This thesis is looking into these supply chain changes. On one hand its purpose is to understand the motives behind creating a global product information infrastructure, and on the other hand the privacy intrusions it is causing. The main objective of this thesis is to look for alternative uses for RFID as a technology and especially for its application in the supply chain. The core research question this is intended to answer is: "How can social applications take advantage of RFID?

To understand why RFID is suddenly getting this huge amount of attention, it's important to first find out what technology is dealt with. Chapter one is answering the general sub question "What is RFID?" Here RFID as a technology is explained. Tag functionality is explained to get a good idea of the technical possibilities and also the standards of the commercial automatic identification structure are covered.

The massive adoption of RFID in the supply chain is bringing changes, both positive and negative, on a larger scale. The positive aspects that are brought to attention are mainly coming from commercial parties, and involve technological and commercial progression. To general public, primarily negativity is surrounding RFID. This negativity consists of privacy intrusions and human health issues. To understand the situation, both the sub questions "What are the motives behind RFID application in the supply chain?" and "What are the motives behind the privacy and human health advocates?" are answered.

When looking for RFID's positive use, like a social application, and a lot of negativity such as privacy intrusion is surrounding it, the research question cannot be answered without first asking the sub question "Is negativity interconnected with RFID as a technology?" If that would be the case, it would be useless trying to lift RFID out of this negative atmosphere. There would be no progression. Next to the supply chain application of RFID, a lot of other applications have been developed, commercial and non-commercial and artistic. The interconnection of positivity and negativity with RFID as a technology is examined by studying the added value of RFID in these applications.

After examining RFID as a technology, the infrastructure created for its supply chain application is looked at. Although its developed by and for the commercial sector, this thesis is looking for the prospect of its social application. The sub question "What possibilities does supply chain infrastructure give social applications?" is dealt with. To answer this question social applications for the web also get a look at.

The project interconnected with this thesis is placing itself in that part of the design field expanded by RFID. While taking advantage of those things learned about RFID it's taking a critical stance on RFID data collection in the supply chain.

1 RFID

1.1 History

It's hard to say when the development of RFID started. Technology based on radio frequency dates back to the 1920's with the development of radar (Radio Detection And Ranging) systems. Radar can be seen as the ancestor of RFID although with radar it wasn't possible to actually identify the detected objects. This became possible with the technique called IFF (Identification Friend or Foe), invented by the British in 1939 and used in World War II to identify enemy or friendly airplanes (Goebel, 2005).

Although Harry Stockman in 1948 was the first to explore RFID it took about 30 years to see the first real RFID examples as the true ancestors to RFID. These applications were like passive radio transponders equipped with memory and look a lot like modern RFID. The development of RFID depended on the development of other techniques. It was impossible without the development of the transistor, the integrated circuit, the microprocessor, development of communication networks and changes in ways of doing business (Lendt, 2001).

It took until the 1970s when developers, inventors, companies, academic institutions, and government laboratories were actively working on RFID. Mario Cardullo's U.S. Patent 3,713,148 in 1973 can be seen as the first true example of RFID (Cardullo, 2001), but also the Los Alamos Scientific Laboratory was very advanced on RFID. They demonstrated their work 'Short-range radio-telemetry for electronic identification using modulated backscatter' in 1975.

The 1980's were the decade of full implementation and commercialization of RFID with applications in transportation, access control and animal identification. Especially toll implementation gave the technique a boost in the early 1990's. In the end of the 1990's and the beginning of the 21st century standards were adopted, RFID became wide spread and part of every day life (Lendt, 2001).

1.2 Adoption

The massive distribution of RFID is mainly caused by the aim for business to identify and track the movements of their products. For a long time barcode was the solution. But even with barcodes retailers missed about 4% of their 2003 sales because of items being out-of-stock (McFarlane, 2003). Reported theft and other loss of stock totalled $31.3 billion for American companies in 2003 (Deutsch, 2003). RFID is being pushed as the successor of the barcode. All eyes are on this technique because it's expected to solve parts of these problems with its significant advantages.

Barcodes are usually printed on paper labels or on the outside of packaging. The paper might damage resulting in bad reads from the barcode scanner. This means a person will have to manually type the number corresponding with the barcode. RFID uses radio frequency, which allows the tags to be attached to items inside boxes or pallets. RFID will even work behind walls. The tags do not have to be visible in contrast with barcodes, an optical technique. Barcodes can store unique identifying numbers usually on class level, while RFID can store

instance level identification numbers: a number for every unique product. Next to that there is space available for additional information like expiration, use-by and sell-by dates or instructions. RFID systems are automated able to consecutively read out a lot of tags at nearly the same time. These advantages show us the potency RFID has to bring the global supply system a lot of efficiency.

1.3 Hardware

Tags

RFID tags consist of two important components. Usually in the middle of the tag there is an Integrated Circuit (IC, also microchip) which can contain a unique identification number (ID) or a small amount of other data. Around the chip there's an antenna, used to send and receive the radio waves. The tag can be very small since the IC and antenna do not take up a lot of space. The antenna is a flat conductive coil around the IC and the IC does not have to be bigger than a few millimetres. In fact, the smallest IC right now measures 0.15 x 0.15 mm and is 7.5 μm thick (Hitachi, 2006). The chip and antenna are usually part of a plastic tag. The size of the whole tag depends most on the size of the antenna, resulting in tags from the size of a postage stamp up to the size of a postcard. Because the tags can be small and thin they can easily be embedded in packaging, plastic cards, clothing labels, paper tickets and books. There are two types of tags. Tags without battery are called passive tags and active tags have a small battery on board.

Readers

The reader is the device interrogating nearby tags and reading out their information. The reader will send out a radio signal, received by nearby tags. They will process the signal and respond with information. How the response is sent depends on the type of tag. Some readers can only read but a lot of RFID readers used are also able to write to the memory of tags with read/write memory. Readers can be fixed in for example doors or toll gateways, or be part of a handheld device such as a phone or PDA. Class 5 RFID tags itself can even function as reader and are able to communicate with other tags.

Types of tags

Passive

Passive tags do not have an internal battery. On receiving a radio signal the antenna in the chip induces a small electrical current providing just enough power for the IC to work and send a signal back. The tag backscatters[1] the signal received from the reader. The response range is limited by the strength of the reader's signal. Of course the signal should be strong enough to reach the tag, but not much of the power received can be used to send a response, because the maximum range of a passive tag is limited anyway (around 4 to 5 metres).

Because passive tags do not need a continuous power source they theoretically have an unlimited life span. Their design is simple, making them easy to produce. The lowest cost tags with the standard chosen by the big companies Wal-Mart, Tesco and Metro AG are available at a price of 5 cents (SmartCode, 2006). Because of their low price they are great for use on individual products in applications like supermarket checkouts and smart cards.

Semi-passive

Semi-passive tags are quite similar to passive tags but contain a small battery to power the logic of the IC. The battery can also provide the antenna with power to send a response, which removes

1 Backscatter is the reflection of waves, particles, or signals back to the direction they came from.

the need for the antenna to be designed to collect power from the incoming signal. It can therefore be optimized for signal reception only. The semi-passive tags have a shorter life span because of their reliance on the battery. They are more fragile and are a lot more expensive.

Active

Active tags have their own internal power source so they don't have to harvest their power from the incoming radio signal. Because they have an active radio frequency transmitter they can communicate in a 'session' with the reader, resulting in fewer errors. Their read range is a lot higher than that of passive tags: effectively around hundreds of meters. Being able to transmit higher powers active tags can also be more effective in difficult environments with water and heavy metal. With passive tags it's nearly impossible to communicate in such conditions. Active tags can be read at very high speeds as well. Very suitable for full speed toll collection are the high frequency active tags, which can be read at speeds of 150 miles per hour (Sabetti, Texas Instruments). It's also possible to create monitoring tags by combining them with sensors for temperature, light, humidity vibration or other purposes. Active tags also have a much larger memory and are more secure because of their IC's high processing capabilities.

Classes

Although we have the rough division of tags in passive and active tags, even within those types there are differences in functionality. To provide a framework for the discussion and development of these different functionalities the Auto-ID Center defined an RFID Class Structure (Engels, Sarma, 2005). The different classes form a hierarchy of function sets, starting from Class 1 going up to Class 5, with each set increasing the tag's functionality (Fig. 1).

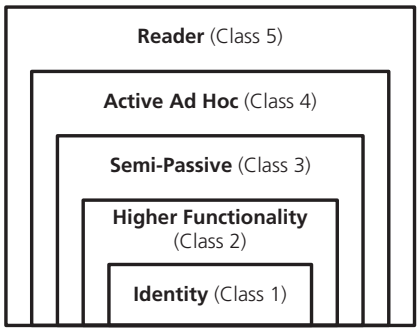


Fig. 1. *Hierarchy in RFID Class Structure*

C	Name	Functionality set
5	Reader Tag	Can act as reader to passive tags.
4	Active Ad Hoc tag	Active. Communication with other Class 4 tags or passive reader.
3	Semi-Passive tag	Wake-up system. On-board power source.
2	Higher Function-ality tag	Read/write memory.
1	Identity tag	Passive. Min. functionality required for identification. Write once, read many.

Fig. 2. *Class Functionality*

Memory

The information in an RFID tag can be either pre-loaded and read or randomly accessed and changed. Tags with their data already stored in the fabrication process used to be called Class 0 tags. The memory is called Read Only Memory (ROM). Most tags however are shipped empty and can have their memory set only once. After

data has been written to the tag, the tag can only be read, called Write Once Read Many (WORM). The dynamically variable memory is called Static Random Access Memory (SRAM) and can be unlimited written to. To save power, memory size is kept to a minimum. Passive tags can typically contain about 32 bits to 128 kilobyte of data. Because active tags have embedded batteries their memory can be higher. Some systems operate with up to 1 Megabyte of memory (AIMGlobal, 2006).

Frequencies

There are four different frequency bands, each with own characteristics (IEE, 2005). While low frequency signals are able to penetrate objects or water easier, they are also slower. Higher frequency signals can provide a higher speed but also lose their strength when going through objects. Penetrating metals is impossible on higher frequencies. The different characteristics suit different applications.

Although the HF 13,56 MHz frequency (primarily used for smart cards but also other tags) is used worldwide, there are no Internationally agreed frequencies. For example there are frequency differences between Europe and the U.S. and also power levels vary, even on the 13,56 MHz band.

Physical differences

There's a big physical difference between the way short distance and long distance RFID tags work. With short distance tags (LF and HF) a magnetic field is created between the reader and the tag. This induces an electric current in the tag's antenna, which is used to power the IC and its logics. This process of transferring energy from one circuit component to another through a shared magnetic field is called inductive coupling. By varying the load on the antenna's coil the current in the reader's coil changes. This is how the reader is receiving information from the tag. The use of inductive coupling for short distance communication is called near field communication (NFC). There is also an active variant, where both initiator and target device communicate by generating their own field.

For longer ranges the ultrahigh and microwave frequencies are used. In this case the reader and tag are too distant to make use of the same magnetic field. Instead the tag reflects or

Band	LF (Low Frequency)	HF (High Frequency)	Ultra High Frequency		Microwave
Typical RFID Frequency	120-135 kHz	13,56 MHz	433 MHz	860-960 MHz	2450 MHz
Read range	< 0.5 m	< 1.5 m	< 100 m	< 5 m	< 10 m
Aprox. data rate	< 1 kbit/s	25 kbit/s	30 kbit/s	100 kbit/s	100 kbit/s
Characteristics	Slow. Expensive.	Medium speed. Multiple concurrent reads (<50 items)	Fast. Active tag.	Fast. Passive tag. Multiple concurrent reads (<100 items) Different frequencies wordwide.	Inexpensive
Typical use	Animal ID Car immobiliser	Smartlabels Smartcards Acces & Security	Logistics		Vehicle toll

Fig. 3. *RFID Frequencies*

'backscatters' the electric radio waves sent by the reader. The IC encodes the tag's information by modulating the radio waves sent by the reader before reflection. This long-range technique of backscattering radio waves can be called far field communication.

1.4 Standards

It's important to have standards in the RFID applications since a lot of different companies, from different countries have different tasks in the supply chain, but are working with the same products. For all of them to work together standards have to be agreed upon.

There are four different areas where RFID standards have been proposed:

- The air interface protocol (communication between tags and readers)
- Data content and encoding (data formatting or organisation, numbering schemes)
- Conformance (testing products on meeting standards)
- Applications (how standards are used on shipping labels, for example)

The Auto-ID Center was set up in 1999 to develop code to identify products and track them through the global supply chain: the Electronic Product Code (EPC). Goal was to develop a low-cost RFID system, based on UHF because only the ultra-high frequency band delivered read range suitable for supply chain applications. They wanted the system to be global and based on open standards, with a layer integrated with the internet. This way companies could share information easily and at low cost.

After the Auto-ID Center came up with the structure of different classes for tags with different sets of functionality, they adopted a Class 0 tag. Class 0 tags are read-only as well and are programmed at the time of manufacture, where Class 1 tags are read-only but can be programmed once by the first user. But both tags use a different protocol, so end users had to buy multi-protocol readers to read both Class 1 and Class 2 tags.

In 2003 the Auto-ID Center licensed their EPC to the Uniform Code Council. The UCC had developed the Universal Product Code (UPC), which is the code used in most bar code systems in the US. In Europe the European Article Number (EAN) was used, developed by EAN International. EAN International and UCC joined forces and set up EPCGlobal to commercialise the EPC technology. In 2004 they began developing a new protocol, not backward compatible with either Class 1 or 0. This protocol was developed to create a single global standard, close to the ISO (International Organisation

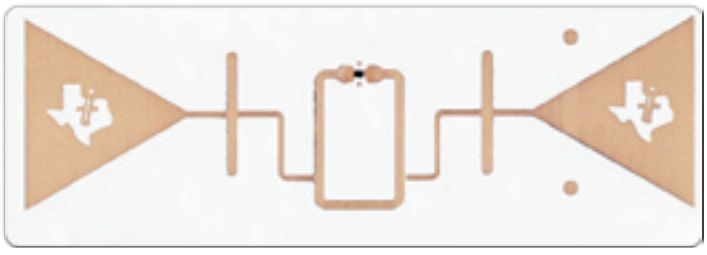


Fig. 4. *A full-scale Gen 2 RFID tag*

for Standardization) UHF protocol, which was found to be too complex earlier. This second-generation tag got referred to as Gen 2 (RFIDJournal, 2005).

The history of the Gen 2 RFID standard is quite complex, and did not lead to a globally accepted standard yet, although the ISO is planning to incorporate the Gen 2 protocol as a new part into ISO UHF standards. Work on the new part document is expected to be complete by mid 2006 (Porter, 2005). In the mean time Gen 2 is being adopted on a wide scale by customers and hardware manufacturers, including DHL, Michelin and Wal-Mart and its suppliers.

Automatic identification structure

An RFID-based automatic identification system contains the following elements (McFarlane, 2003):

1. A unique identification number assigned to a particular item
2. An identity tag attached to the item, capable of storing - at a minimum – a unique identification number
3. Networked RFID readers and data processing systems
4. One or more networked databases to store product information associated to the unique ID.

When developing its Auto ID system the Auto ID Center wanted to establish specifications for low cost tags and readers. It was important that the system used global standards for its numbering system and product information. To enable a global, seamless interchange of product data, an open, global network specification was developed. This together resulted in specific features of their system:

1. Reference specifications for write-once read-many (WORM) tags, which only contain a unique product identification number. All other product information is stored in a database.
2. Use of the Electronic Product Code (EPC), providing unique product identity
3. An Object Naming Service (ONS) resolving the EPC to the location of the actual product information
4. Physical Mark-up Language (PML), an XML[2] based language and structure for the product information

The maintenance and installation costs of these elements in the structure of automatic identification can be spread across several organisations. Each of the organisations can benefit from having uniquely identified items moving in, through and out of the organization's operations.

2 *Extensible Mark-up Language, describing information text-based in a tree-based structure (http://www.w3.org/XML/)*

2 PUBLIC DEBATE

2.1 The supply chain

In the supply chain the by RFID enabled automatic identification can help improve four basic logistic processes (McFarlane 2003):

1. Shipping
2. Transportation
3. Receiving
4. In-facility operations

Shipping

For shippers one of the most important reasons to adopt RFID is the extended visibility it provides for the decisions to be made during the process from the time the product is ready to ship until the transportation starts. Once products are ready for shipping, the shipper has to decide how to distribute the products over the shipments. While shippers typically look at shipments 'on hand' to make the optimal choice, with RFID they can read the content of trailers 'through its walls' and have a good overview of where the products are. This allows them to further optimize their shipment distribution by opening up trailers and taking off a shipment or adding one. The challenge is not to decide how to load, but the speed and efficiency of the loading process. That is where RFID tops scanning barcodes manually.

Transportation

There are three elements of transportation that can be optimized by automatic identification. The tracking of trucks is very important in order to optimise the loading of trucks and their routes. This is usually implemented with GPS. RFID can provide significant advantage in the tracking of sub-conveyance including containers, pallets, racks etc. and in the tracking of individual items. Because the management tracks the whereabouts of the pallets and containers, fewer goods would have to be in circulation. Also by tracking individual items carriers know immediately what they pick up. Barcodes already solve this, but systems based on RFID tags speed the reading process, allowing loading and unloading and terminal operations to be speeded up reducing costs and time. Additionally, shippers can provide their customers with up to date information about the specific items they deliver.

Receiving

Upon receiving goods, retailers start a time consuming process to verify what was actually delivered. With RFID a shipper can immediately send retailers information about the content of the shipment. Once the carrier delivers the goods, the retailer can directly verify this. This process is not just sped up by RFID, it also removes the uncertainty about late delivery, shortage or wrong shipments. There are fines involved with these infractions of contract terms, which often cause friction between the parties. After verification the delivered products will be stored. Knowing which reader or stock room has identified particular items can provide inventory managers with its location.

In-facility operations

Internal processes in facilities can take most advantage of automatic identification. In manufacturing plants for example a lot of bar code scanning is involved in the entire production. Workers are building parts separately and put them together on the main production line,

while throughout this process workers have to identify the parts. This happens with every item manufactured, so automatic identification will save a lot of time. In warehouses the advantages are for a big part in locating where items can be found. With the real time inventory checking automatic identification provides, staff will also know which items are in stock. Also inventory can extend to virtual inventory like items on the move or in storage. RFID can make this extension more seamless. The automatic and continuous checks on outgoing shipment can make sure that the right shipments get routed from inbound to outbound facility and this improve accuracy.

On RFID based systems make an even bigger impact in retail stores. McFarlane describes these stores as "a chaotic warehouse where non-employees (consumers) are allowed -- in fact, even encouraged -- roaming the isles and performing picking and packing operations". By continuously checking shelves, out-of-stock can be reduced and new products can be ordered automatically. Retailers miss a lot of sales because of these out-of-stock situations so a continuous inventory system can increase sales. Checkout counters can also be automated, reducing labour, and 'smart' shopping carts can show customers the total of their purchasing. Theft-sensitive goods can be monitored. After recognising unusual patterns the system warns personnel to actually prevent the theft.

2.2 Proponents

Wal-Mart

When in the 1980's hardly anyone was sure whether to use barcodes or not, Wal-Mart went ahead and implemented it. Suppliers were afraid to be left behind and followed. Nearly the same happened in June 2003, when Wal-Mart announced its plan to implement RFID in its supply chain. Although it would require compliance from its top 100 suppliers by the 1st of January 2005, even more - around 129 suppliers - already started implementing, afraid of being left behind.

To get the RFID system Wal-Mart is aiming for up and running, huge investments have to be made. It has enormous strategic implications for their suppliers as well as the vendors of products. A case-study on Wal-Mart however shows an estimate of what might be saved annually when RFID is deployed (Roberti, 2003):

- $6.7 Billion: Reducing labour of people scanning bar codes on pallets and cases.
- $600 Million: Reducing out-of-stock.
- $575 Million: Reducing employee theft, administration errors and vendor fraud.
- $300 Million: Improved efficiency in distribution centres.
- $180 Million: Reducing inventory and cost of carrying it.
- $8.35 Billion: Total pre-tax saving.

These huge amounts really show why Wal-Mart, is adopting RFID. After the first real tests a study showed that by using RFID the retailer was able to reduce it's out-of-stocks by 16 percent (Wal-Mart, 2005). Wal-Mart being the world's largest retailer, they are a front-runner in the deployment of RFID in retail systems. Their success will make many other companies also want to adopt RFID.

Availability to consumers

RFID in the supply chain is mainly used and controlled by business. Being implemented in human identification systems the technology is getting closer to consumers. Examples are RFID tags in smart cards for access control or to make payments. Sony introduced their payment system called FeliCa, while Philips created MiFare, a

similar but inexpensive technology. Worldwide MiFare has currently the widest installed base (Philips). Both technologies still only bring the chips and not the readers to consumers, but they allow people to use RFID themselves. They provide users with a fast and convenient way to pay for toll, public transport or concert and airline tickets. They primarily started in pass cards but later on moved to the mobile phone, a more personal device.

Near Field Communication

In these former cases interaction is always initiated from the other party. Nokia together with Philips and Sony founded the Near Field Communication (NFC) Forum. The NFC technology provides short-range wireless communication that can be initiated from both sides. It is compatible with both FeliCa and MiFare. Nokia already implemented this technology in some of their phones (Nokia, 2004) and other manufacturers including Samsung follow (Philips, 2006). Users can use the technology to retrieve timetables at bus stops or the access of promotional websites when holding the phone next to a commercial poster containing an RFID chip. Next to the retrieval of data users can also share data from device to device. People can share their favourite links, contacts, ring-tones or other information. While this all would be possible with existing wireless protocols such as infrared or Bluetooth communication, NFC changes the way users initiate this communication. Instead of having to set up your device, NFC provides an intuitive way of initiation by simply holding the NFC enabled device against another. Here, NFC's short range is it's key feature. With longer range protocols such as Bluetooth, devices are within each others range while communication is not always wanted. With NFC's short range of approximately 5 cm, being in each other's range is almost always intended. With semantic combinations of NFC enabled devices nearly 'touching' each other, convenient interfaces can be created. According to the NFC-Forum "NFC's intuitive operation will change the way we interact with technology, ensuring that we can make the most of our environment and reap the full benefits of total connectivity."

2.3 Opponents

Privacy invasion

CASPIAN

According to Katherine Albrechts, founder and director of the organisation called CASPIAN (Consumers Against Supermarket Privacy Invasion and Numbering), it all started with Supermarket Cards. They first appeared in the 1990's, and were promoted as cards to obtain discounts, but they became devices for supermarkets to collect huge amounts of information on customers' purchase and eating habits. Modern marketers are eager to use the information gathered with those cards, and while supermarkets claim in their privacy policy that they will not share their data with third parties, they actually do (Albrechts, 2002).

Albrecht sees the automatic identification with RFID "poised to enter all of our lives, with profound implications for consumer privacy". The EPC (see par. 1.3.8) assigns a unique number to every single item manufactured. Proponents of the technique work towards a pervasive global network of millions of receivers along the entire supply chain, in airports, seaports, highways, distribution centres, warehouses, retail stores and in home. This way companies would be able to identify and track items continuously and can always determine the whereabouts of their products. So how does this invade our privacy?

Self-determination

RFID tags can be easily hidden: sewn into the seams of clothes, moulded into plastic or rubber, and integrated into consumer package design. This can even be done without the individual using the product knowing about it. The radio waves go easily through plastic, fabric and other materials. This has impact on a person's informational privacy, because "information about an individual belongs to that person, and is to be communicated or not, as the individual determines", also known as self-determination (Canada, 1972). Losing control of your personal information would mean losing control of your life.

Law and conflict of interests

One of the deepest fears of privacy advocates is the abuse of RFID capabilities by governments (Campbell, 2005). GPS[3], another tracking technology, is already used in court. Using RFID as well will not be a big step. Collected data can serve as evidence in lawsuits, although private affairs may be brought to the trial. Public prosecutors are looking forward to use RFID to prevent and to solve crime (Brouwer, 2005). Governments will have to work together with commercial businesses, because they are the ones realising the RFID infrastructure and are gathering the information. Brouwer also states the danger of this situation. Examples are companies selling their customers' personal information or Latin American brokers providing the U.S. government with identity information. The situation of governments and companies forming a 'grand coalition' where personal information circulating should be avoided.

Digital tracks

Due to digitalisation the amount of tracks people leave is increasing. The amount of phone calls, SMS and e-mails is rising, with more communication tracks as a result. Next to tracks like clothing fibres, RFID is giving objects a digital layer of tracks. Massive amounts of data are collected and improving technology is making the storage of this data become less of a problem. Because there will be no memory loss, all movement of both man and machine can be logged and stored forever. Everyday life is becoming a Digital Territory: a world where a layer of digital connectivity has been programmed on all things analogue (Kranenburg, Van 2006). People might think they do nothing wrong, based on current laws, and might see this as a positive development. But if lifetime records are kept, changes in legislation might make previous behaviour illegal. Next to that, there is no or limited transparency in the interpretation of the data. Even when you think you know what is illegal, in the data interpretation process certain aspects might get more important than you think they are. Van Kranenburg comes up with an interesting example about his upcoming book covering this theory: "Who knows, you may even get in trouble for reading this book. In the analogue days we could get away with claiming 'Hmm, I'm not sure where I've picked that up…..' In Digital Territory this is no longer possible."

Health Insurance

Records of people's habits can easily show monitoring organisations who's leading a healthy life and who's not. The data collecting companies know when a person is eating too much sugar or fat, smoking a lot, drinking too much alcohol or is going to unhealthy places like smoky bars or smoggy streets. Health insurance companies for example could make this information have direct influence on the person's health insurance policy. These insurance companies could make

3 *Global Positioning System, a satellite navigation system used to accurately determine your location anywhere on earth.*

personal policy rates according to a person's habits. They could also deny coverage or even deny medical procedures if the person's records reveal an unhealthy lifestyle. Instead of coming from publicly known readers in for example shopping malls, the information could also be collected by secretly placed transmitters without court approval.

Mark of the beast

The mark of the beast is a concept from the Book of Revelation of the Christian New Testament often written as 666 in modern texts. A mark supposedly forced by the devil on everyone's right hand or forehead. No one could buy or sell unless he has the mark. With RFID fast being integrated in passports and payment cards, and replacing bar codes rapidly, Katherine Albrecht sees in this new technology the mark of the beast (Baard, 2006). Closest resemblance is coming from the RFID implants designed for humans coming from VeriChip Corporation. She also links the 'foul and loathsome sore' the mark would inflict on man to the electromagnetic radiation coming from these RFID devices.
On the other hand, specialists like Boston University professor Richard Landes say new technologies have always been triggering alarms. People already saw bar codes and social security numbers, GPS, credit cards, microcomputers and the year 2000, as the end of time. RFID is the the logical next victim.

Health implications

Electro Magnetic Fields

Levels of electromagnetic fields (EMF) from human-sources have increased steadily over the past 50-100 years. An increasing concern arises about the possible health consequences of EMF emitted by mobile phones, radar installations, power lines and other sources. Some claim the GSM wave emission of a mobile phone base station on the roof of their home is influencing their health. Research is unsure about the possible health effects. First studies indicated that UMTS[4] exposure might produce effects on well-being and cognition (TNO, 2004). A more recent study however claims there is no evidence of adverse effects on well being as a result of UMTS signals (Achermann, Kuster, Röösli, 2006). With research focusing on rather new technologies, it's hard to say anything about the long-term health effects of EMF. With RFID readers in shelves, doorways, mobile devices and other places, EMF values are increasing. With every object radiating it's unique ID through RFID tags we are subject to even more EMF.

Although there is no expert consensus about the dangers, it is wise to keep EMF radiation as low as possible. To some extend it can be compared with bandwidth and computing power. Low file-sizes, and smart programming keep things faster, even though bandwidth and computing power are increasing. EMF should be considered too when creating applications. For example do not continuously check for RFID tags but trigger the event.

On a larger scale, the solutions to this problem could be moved out of the applications. In his lecture at Dorkbot Ghent, Rob van Kranenburg proposed to divide cities in different EMF zones. Every zone would allow radiation up to a certain level. Most importantly it raises questions about the responsibility for EMF. Do we want to cure or do we want to prevent this radiation, if even possible?

4 Universal Mobile Telephone System, standard of the 3rd generation of mobile phone networks that supports multimedia services such as internet or videoteleconferencing.

3 POSITIVE RFID

3.1 Division

At the moment, RFID is mainly used in logistics, access control and supply chain applications. According to the University of Wisconsin Dr. Veeramani (CNN, 2005) "It's wrong to blame the technology. It's the people that develop applications for it. We are still trying to figure out what role RFID will play in the larger scheme of things."

This thesis divides research on the positive application of RFID in two domains:

1. RFID technology itself
2. The ubiquitous RFID future

First the technology itself is covered. It's important to get a good overview of possibilities of RFID as a technology, without being influenced by current business applications. A lot of applications use RFID, but what is the added value of this technology?

Second, the ubiquitous RFID future will be looked at. Current retail developments lead to a world where every object is identifying itself through RFID technology. History will be saved in global databases. With NFC development, reader capabilities move to devices such as mobile phones, available to consumers as well. What new possibilities are available to the public?

3.2 Technology examples

Added value

An analysis of the RFID function in existing applications was made to create a good overview of technical possibilities. Because art is often showing matter from a different perspective, the main focus of existing applications was on art projects. By analyzing these art projects, and describing the new or old, positive or negative role of RFID in these projects (Plaggenborg, 2006), an evolution of the function of RFID can be seen.

The added value of RFID is similar in a lot of projects. By grouping these similar functions categories can be made that evolve from one to another chronologically:

- Binary identification
- Unique identification
- Descriptive identification
- History collection
- Pattern recognition
- Masses
- Medium
- Symbolic medium
- Interface
- Sensors

Binary Identification

The earliest example of identification quite similar to RFID can be found in the airplane identification system developed by the British in World War II. The system called 'Identification Friend or Foe' (IFF) was used to identify British aircraft from enemy aircraft. Where radar systems gave notice of aircraft nearby, it

did not show the difference between them. IFF distinguished these aircrafts, and described them as either friend or foe.

Although later aircraft got assigned unique numbers, principally there was no difference between for example two friendly aircraft. Because it had two options, friend or foe, 1 or 0, the name binary identification is suitable for this category.

Unique Identification

By assigning unique numbers to objects, binary identification evolves from two options to a certain number of unique options. First objects were placed in either of two categories. Now every object can be distinguished, creating unique identification. The system is really looking at who or what it's dealing with.

A good example of unique identification is access control by smart cards. In this system every person has his own pass with a unique identification number. The pass is used at the entry of offices or certain areas in buildings. If the number on the pass is allowed access, the door is opened. The system does not care about the name, sex or function of the person trying to gain access. It's a basic form of identification, only checking privileges.

A free condom campaign in Shanghai can also be seen as an example. The government placed 200 condom vending machines across the city and handed out 10,000 RFID cards to citizens. It's however unclear if citizens were able to get condoms more than once. If each person would be allowed to get only one item, we would talk about unique identification. In that case the system would have to remember id numbers, making sure nobody would get an item twice. Each card has to be distinguished.

Descriptive Identification

In previous examples objects or persons were identified and there was distinction between them. The systems did care about other related information available. It is possible though, to associate descriptive information to the identification number. The RFID chip itself only contains the number, but a database would link it to the actual information. It goes beyond noticing the 'being' of the object, and distinguishing it. The object's properties are stored.

Examples can be found in applications that retrieve product information when identifying an object. Japanese sushi bars for example started adding RFID tags to sushi plates, enabling customers to retrieve sushi properties. Sushi type, time of cooking, time of serving, cook, price and other information was stored. There is a direct relation between the information and the object.

Instead of describing objects with RFID, it's also possible to describe humans. VeriChip Corporation for instance developed an RFID chip in a glass ampoule, suitable for human implants. In Baja Beach Club nightclub in Barcelona and Rotterdam these chips are used for both access control and descriptive information. Properties such as name, sex, age and a photograph are stored. Employees can charge customers for their drinks by reading out the chip in their arm. Customer description is retrieved and costs could be charged on a prepaid account or saved credit card number.

History collection

The descriptive information associated to the identification number can be used to pay if one of the properties is describing credit or a bank account. The payment would have to be done right away. To pay a total sum in the end, all previous expenses should be known. History of the identity would have to be stored. In this

example the history contains information about the costs of each drink bought. The total can then be calculated.

The location of the read-out is one of the most saved properties when storing the history of an object or person. A lot of applications use it to track the whereabouts of people. In public transport for example, it's used in combination with payment. When starting the travel, people swipe their RFID cards at the entrance. At the end, people swipe their card again, so the system can calculate the travelled distance.

The tracking of locations is also used in elderly homes to keep track of inhabitant movements or to restrict their access to certain areas. Comparable are the products that save the locations of school going children. Arriving at school their location is logged. Parents are warned in case of emergency. These applications collect location history for safety measures, but do bring up earlier mentioned privacy problems.

An art project called 'Growable Media' is using history to visualize human relationships. Every time you communicate with a friend this is logged in a database. Communication can be physical as in seeing your friend at home or is based on telephone calls. This information is visualized with a growing plant. Database information is used to supply the plant with water or light. A good relationship with your friend will result in a fast growing plant. A bad relationship will make the plant grow slow or even die.

Pattern recognition

A history of valuable information can be saved. Instead of looking back, we can look forward for new information. Patterns can be recognised in history data. Using these patterns it's possible to predict new information. Intel developed the iGlove, a monitoring glove equipped with an RFID-reader. In environments where all objects contain RFID tags the glove is used to log its users actions. Picking up objects in a certain order matches a pattern to make it clearer what is happening. Some actions like picking up a toothbrush are quite clear already but making a cup of tea would need more detail.

Instead of tracking behaviour some projects use patterns to actually help people, for example at home. Patterns can be used to alert people when forgetting something. If a wallet or keys are read before the doorknob, a watch with built-in RFID reader reminds its user to not forget them.

Masses

Instead of examining individuals, collected RFID data can be used to track entire masses. We're not looking at a lot of individuals but see them as whole groups. This way information is collected about the majority.

It's appealing for railway companies to use history collected by their RFID based payment applications. By recognizing patterns in the movement of travelling masses, they can improve their railway systems.

Medium

In all the categories mentioned above the information associated is also related to the object containing the RFID tag. If we unlink the relation between information and object we create a medium. All the object is doing in this case is carrying content. An object could carry any kind of data, because the data is not saved to the RFID chip but is linked to the unique identification number.

A Japanese project called Moo-pong is using RFID as a medium for video. A portable device is capturing video and with a built-in RFID reader it then associates that video to the unique

number in the tag of a plastic moo-pong ball. Putting one of those balls into the moo-pong viewer will play the associated video clip. The project is using RFID to give digital content a physical body.

Symbolic medium

In the previous example the object's appearance had no relationship at all to the content it was carrying. If we recreate that relationship, but this time the other way around, the result is a symbolic medium. With descriptive information the content served the object. When using RFID to create a symbolic medium the appearance of the object is serving the content. The object and its looks are used to describe the more important aspect: the content.

The Symbolic Table by Mediamatic is an example of using RFID as a medium. Objects containing tags start video or audio clips when placed on a table embedded with an RFID-reader. The content of objects used is relevant to the appearance of the objects. The table was demonstrated using animal toys as objects. When placing a toy elephant on the table the sound made by the elephant is heard.

Interface

To be able to do more than just starting and stopping the audiovisual content, a basic interface would have to be created. With additional RFID-readers different areas can be created. Each of these areas can have a different function. A good example is the photo album Deal-Me-In project by Simone Pia. It's using playing cards to resemble photos or photo albums. Playing chips are used for extra parameters. The December chip would show all photos from that month. With these extra functions a combination is created between a basic medium and an interface.

By totally unlinking object appearance and content a true interface is created. Instead of content, functions are associated to the RFID tags used. This way RFID will transform into a contact free actuator, launching designated actions upon connection.

Using RFID as an interface a VJ tool was created that allowed the VJ to join the people on the dance floor. The VJ would pin RFID tags all over his body. An RFID-reader glove reads out the tags to create an input device for visuals. Making dance moves the VJ can move his glove over different tags.

Another example of RFID as an interface is Sony's DataTiles project. Perspex tiles with embedded RFID tags are placed on a grid created on a tablet monitor. The tiles represent areas on the display. Each of the tiles has it's own function telling the system what to display where.

Sensors

Not really in line of this evolution of RFID is the addition of sensors. Active RFID tags provide enough power for small sensors with their onboard battery. These tags can be combined with sensors for temperature, heartbeat, humidity, light, vibration or others.

Interesting interfaces are created combining identification with sensors. Mitsubishi Research developed location aware objects with light sensitive RFID tags. A handheld device equipped with both an RFID reader and a small projector is used to give visual feedback in order to precisely locate products. The handheld device is first aimed in the direction of the products. It projects a pattern over the products of which each pixel is showing a different code. This code together with its identity is then communicated with the handheld device. It is then using the (x,y) coordinate to project human understandable

visual feedback for its user.

Instead of creating interfaces with sensor enabled RFID tags, they can be used for data collection. On a bigger scale sensors can be added to RFID to turn every object in a source of information. Annenberg Center for Communication Research Fellow Julian Bleecker is imagining a world full of objects collecting environmental data to create a more habitable world (Bleecker, 2006). Urban creatures like pigeons would be equipped with smog sensors to collect data on air quality and cars would broadcast information on their emission. These objects as information sources he calls 'blogjects', deriving from the words blogs and objects.

Evolution

The range of RFID applications shows an evolution of RFID functions. While the technology started out with pure identification, soon extra functions were added around it. While the basis is still the same, especially the association with the unique number is where the versatility of RFID is coming from. To go from descriptive functionality to interfaces the content associated to the tag is removed, and new functionality is associated.

It's questionable whether RFID equipped with sensors can still be called RFID. The tags mutate into little stand-alone computers equipped with RFID to identify themselves. But also here, the principle of identification remains. These sensing capable objects identify themselves and their environment.

The artistic applications, especially in the categories medium, symbolic medium, interface and sensors, show RFID from an alternative perspective. Data collection and object tracking are not the main purpose anymore. As from the category medium, functionality has been lifted to a higher level, while at the same time they get more abstract.

Both the artistic and commercial applications can be seen as a layer on top of RFID's technical possibilities. In the more abstract categories, positivity or negativity shifts from functionality (collecting data or tracking objects or people) to the application layer on top of the functionality.

People create applications causing privacy problems, but as Dr. Veerimani says, it's wrong to blame RFID as a technology (CNN, 2005). Not seeing RFID as a neutral technology will hinder development into useful applications that might have nothing to do with it's original intentions. Because of the disconnection of negativity and positivity and the functionality, most is to gain in the more abstract categories.

3.3 Ubiquitous RFID

In the evolution of RFID (Par. 3.2) the object-level tagging in the supply chain can be seen as an application of RFID possibilities. Although it's going little further than history collection and pattern recognition, it's global implementation does have consequences. Business aims at item-level tagging. With continuing business efforts, a ubiquitous RFID world is coming up, where all objects contain an RFID tag and where an incredible amount of information about these objects is stored in a global database. What aspects do applications need to remain free of privacy problems and to be accepted by it's users?

The answer will not be the solution to the major privacy implications of supply chain implementation. It does however show the direction for new products aimed at consumers. How can they benefit from the RFID structure retailers are setting up?

Transparency

EPC is committed to open use of its network, but does not save the product information in a central database (See appendix 2, 'EPCGlobal Network'). This is done by the companies dealing with the product. Each company is keeping object related data in their local database. They decide for themselves who is allowed to access their data.

That means already within the supply chain itself companies have to trust each other. But obviously they cannot. Companies do not allow competitors to have access to valuable information. No full transparency will be created even within the supply chain.

End users are at the bottom of the line. A lot of data is saved, but there is hardly any influence for them. Self-determination is lost because the data does involve them, with friction as a result.

User influence

According to Klaas Kuitenbrouwer, organiser of RFID workshops at Mediamatic Amsterdam, end user influence can be distinguished on 3 domains:

1. Infrastructure
2. Content
3. Use

It's important to question who is responsible for the infrastructure of the application. On this level decisions are made on how data is collected and what will be done with it. When companies design the infrastructure, end users already lose great influence. So with most commercial applications influence is already lost beforehand.

Even though infrastructure decisions are out of control of end users, applications are useless without content. In supply chain applications companies still decide on the content. Consumers use the applications, but cannot control what objects are scanned. Neither can they influence the information about the objects. Other RFID applications like the Moo-pong video capture device enable you to create your own content. End users in that case are in total control about the content.

The last domain of influence on applications is about the way people use the applications. They might be created for a purpose not suiting the end user, but the end users will always find a way to make the application suit them. If the application does not allow alternative usage, it might be hacked and modified to user needs.

Social applications: RFID 2.0

The World Wide Web traditionally hosted static web pages and later became more dynamic. The second generation of web services however, let people collaborate and share information online. It changed the nature of the web. O'Reilly Media and MediaLive International came up with the name Web 2.0 for these more social applications, and analysed their features (O'Reilly, 2005).

Although Web 2.0 can be seen as a buzzword, the aspects of these second-generation web services that lead to success are most interesting. Most important were their bottom up and self-organizing nature. These programs, as O'Reilly says, "have embraced the power of the web to harness collective intelligence". They are based on an architecture of participation, and are getting better the more people use it.

With a unique ID for every object, the ubiquitous RFID world created by business is already serving the long tail[5], but the way the informa-

5 Distributions with a high-frequency or high-amplitude population are followed by a low-frequency or low-amplitude population which

tion in the EPC databases is treated is more like the first generation web services. The information stored is dynamic but can only be changed by the appropriate companies, quite similar to first generation content management systems[6]. A public object data system would become available if RFID object information was managed like a wiki[7]. All users should be allowed to access and change it.

The EPC databases were especially set up to make global logistics more efficient and accurate. It can be seen as an application for RFID. If a platform would be created instead, end users would get more influence on both content and their usage of RFID. The usage would not rely on predetermined behaviour, and more interesting services for this platform would be created.

gradually 'tails' off: the long tail.

6 Content Management System, a computer software system that assists in automating various aspects of web publishing.

7 Wiki, a type of website that allows any user to add or change content.

4 PROJECT

4.1 Project target

The aim of this thesis is to discover the motives behind at one side the privacy advocates and on the other side business pushing the use of RFID, eventually creating a pervasive RFID world. The project interconnected with this thesis wants to take advantage of this RFID infrastructure that without business would never exist. What kind of social applications can be created, using that RFID infrastructure? The project learns from current privacy issues. Will success formulas for the Internet work for the RFID 'Internet of things' as well?

4.2 Context

The accuracy and efficiency provided by RFID will make business push the technology. Although current technology is not ready for item-level tagging yet, it's the industry's next objective (Dioro, 2005). With item-level tags, a pervasive RFID world will be the result. Each object will have it's own unique number, and by collecting and saving data about these objects informational 'blogs' are created. They resemble an object's history, but are controlled by business, resulting in no influence for the users of these objects. At first, influence on this history seems unimportant. But information on for example

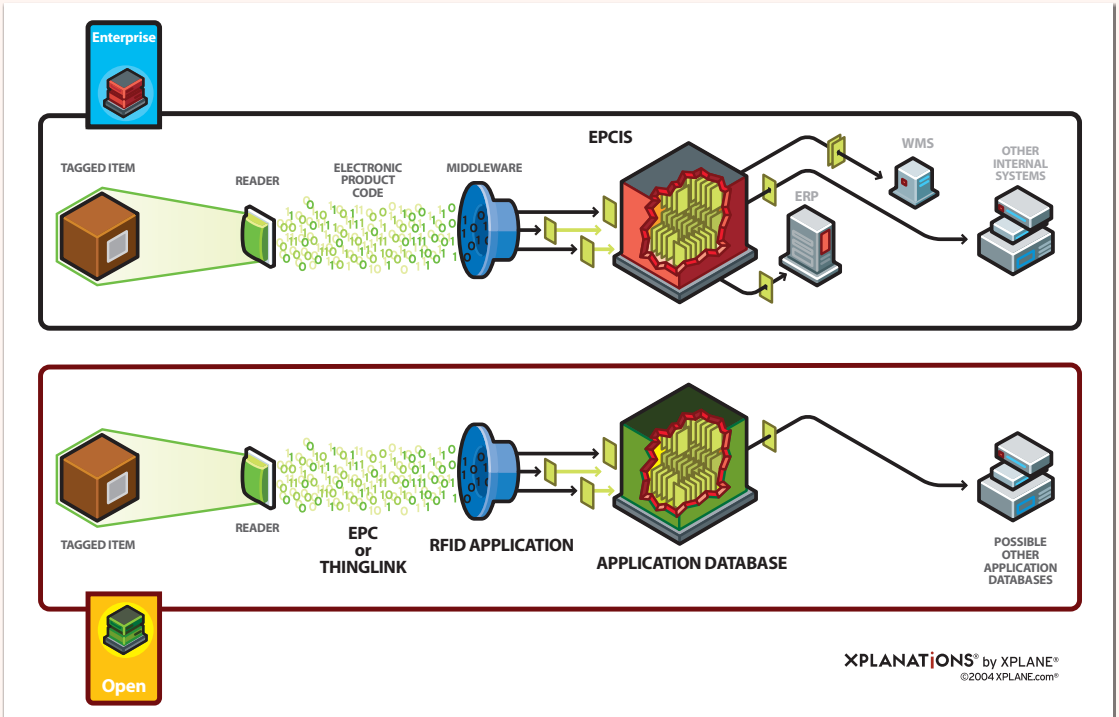


Fig. 5. *EPC Global RFID network vs. an open RFID platform*

the whereabouts of objects provides a lot of information about the user of the object as well. User privacy is undermined.

This project does not try to solve that privacy problem. Instead, it takes a first step into the direction of a public system on top of the upcoming RFID infrastructure. If end-users do not have influence on the infrastructure, nor content of the system. For as long as transparency is prevented from above, all that's left for them is the use of the system. We then have to try to bend the existing infrastructure, and build a new and public infrastructure around it.

4.3 Open platform

When building upon an existing infrastructure we are depending on that infrastructure. Right now, cost-effective Gen 2 RFID tags do not have any security and encryption features built in the tag (Dioro, 2005). To extend the specification for item-level use, these features will be necessary. A new public infrastructure will stand or fall by the ability to use the lowest level of the existing infrastructure: reading and identifying the tags.

Product code

The Electronic Product Code is available to commercial products only. The Thinglink[8] by Ulla-Maaria Mutanen provides an alternative for non-commercial objects like crafted work. The two complement each other and provide a unique code for every object around: commercial and non-commercial. The global EPC network is only making use of the EPC. But by combining both EPC and Thinglink, a numbering system becomes available to end-users, serving as basis for an open RFID platform.

8 Thinglink: a free product code to identify document creative work (http://www.thinglink.org).

Application layer

Information about commercial products is saved by each participant in the network (see supplement 'The EPCGlobal Network'). When for example a retailer needs information from a transporter the retailer accesses the transporter's internal EPC database. Where this internal EPC database can be found is recorded by the ONS (Object Naming Server). Because unauthorized access is prohibited, this data is inaccessible to anyone outside of the EPC network. Besides, all EPCGlobal subscribers pay an initial subscription fee and annual renewal fees, forming a high threshold for public to join.

The tags however, could be used for public and non-commercial systems. Software is handling the unique ID of tags with either the EPC or a Thinglink. Middleware in the EPC Global network could be replaced by custom applications (Fig. 5). This way applications could make use of the tag part of the infrastructure to create an open system. This open system should allow end-users to add their own information to objects. Based on this information various applications could be created. These applications based on participation could range from basic product commenting or rating applications to applications based on object related special interests.

Layered description and content

These applications would need their own database. This data could be shared with other applications, creating mashups[9] like done on the web with for example Flickr[10] and Google

9 Mashup, a website or web application that uses content from more than one source to create a completely new service.

10 Flickr, a digital photo sharing website and web services suite, and an online community platform, generally considered an example of a Web 2.0 application.

content.

The thinglink.org website is providing the unique identifier and allows you to associate content to the object. It's hosting descriptive information about the object and allows you to add a picture. Google Base (www.googlebase.com) takes describing objects further. Although more targeting the commercial, it's much more detailed and to some extent it allows you to create a digital representation of just about anything by attaching files like Adobe PDF, Microsoft Word, Microsoft PowerPoint and others.

So Thinglink is assigning unique identifiers to objects, and Google Base is forming a central database describing these objects. This description is forming a primary content layer. Applications with various themes can form a secondary information layer.

Imagine social software for typophiles[11]: a standalone application that allows people to add or access information about certain type used on objects. The typography reveals interesting relations between similar objects. It would form a discussion platform about type used on objects.

You're walking the streets and want to discuss the ugly type used on this new building, or you find a book or poster with an interesting design. It could also be linked to an online PDF file forming the primary description layer of the object. Another application in the second layer, for example printing (books) on demand, would allow you to recreate that book or poster using the descriptive information in the primary layer.

The previous mentioned applications form examples of possible second layer information application. The unique identifier, either EPC or Thinglink, is gluing them together.

11 Typophile, a person having an ardent interest in typography.

4.3 Project description

Because public is not ready yet, now would not be the time to actually create a second layer application for the graduation exposition. Instead of trying to create a structure totally open to public, the project criticizes the object history collection by business, by making an emotional alternative history, and is thus becoming critical design (Dunne, Raby, 2003).

Emotional history

Even without RFID, objects have their own history. They all lead their own life. Some are used intensively and might build very strong relationships with people. Others are destined to a lonesome stay on shopping shelves. Objects collect human emotion and experiences. Unfortunately this emotional history is invisible to strangers.

The project's goal is to let people look at objects differently, by making the unforeseen emotional history visible. In this project users are able to digitally construct that emotional history by telling their own audiovisual stories about the objects. An object looking worthless at first sight will become more interesting when listening to stories about others' experiences. Hidden emotions are revealed.

With a future pervasive RFID infrastructure and mobile devices capable of interacting with the 'digital' objects, this hidden emotional history can be revealed. Via a database these stories are associated to the object equipped with an RFID tag. Together these captured stories form a visual folksonomy, describing the objects with emotions and visuals instead of textual tags. RFID is creating a digital emotional memory, making it possible for objects to carry the story of their

own history.

History parallel
A mobile device will be used to view emotional stories about the object. A parallel is created between the descriptive history of EPCGlobal or Thinglink data and the emotional history of object stories. The user can go for the descriptive history and retrieve manufacture, transport, retail or usage information. On the other side of the screen the parallel of emotional history is displayed. A list of currently added stories is displayed here. The usere can then select any of the stories and listen to it. In the end the goal is be able to expand the collection of stories about an object by letting the users of the system record their own.

Mobility

With the mobile device users are able to explore the digital layer on top of the analogue world. Being mobile a close relationship with the object can be initiated. This way the interaction is directly the opposite of moving the object to a fixed reader at a standalone computer. The user is approaching the object instead of moving the object away from himself.

Fig. 6. *Extracting the story with a PDA*

Hardware

In the future world of pervasive RFID, mobile devices are able to access RFID information. Manufacturers like Nokia already have mobile phones available that come with NFC technology (Nokia, 2004) and PDA's can also be equipped with RFID readers through their SD or CF extension slot. Both systems are quite new, and have their up- and downsides. While making a decision the following aspects were considered:

- Concept: what system improves the idea of an open system?
- Graphical: what system allows the associated data to be visually attractive?
- Technical: what system is technically realizable?
- Budget: what system is affordable?
- EMMA Expo: what system is interesting to uninformed people?

Although a Java application for the Nokia NFC enabled phone would best suit the concept because of the hardware integration and availability to consumers, it is visually less interesting, technically possible but unrealizable, and for the EMMA exposition it is less interesting to people unaware of the RFID debate.

A PDA using Macromedia Flash is visually more interesting, but technical possibility is unsure. The main idea of extracting emotions from objects through RFID is fully realizable though. More important for the EMMA exposition: it's more interesting to general public.Unfortunately hardware has not advanced enough for a perfect setup. However with current hardware it is possible to build a working prototype. The prototype is built from a PDA running the Macromedia Flash standalone player for Pocket PC. Although at first the HP Labs Mobile Bristol Toolkit was planned to be used, only the future release of this location-based software is compatible with RFID, coming too late for this project. It would have allowed smooth integration of software and reader.

Now instead, the Socket RFID 6E Compact-Flash reader is used, which is capable of sending virtual key strokes to any active application. A hardware button on the PDA starts the scan for RFID tags. On a succeeded scan the ID is sent to the Flash Player. Flash hosts the animated graphical user interface. In Flash the video

Fig. 7. *Fisher Price roller skate*

Fig. 8. *Hand crafted puppet*

stories are played as well.

Stories

The emotional value of an object can lie in experiences with that object, or intensive use. Perhaps the object was a precious gift or it reminds you of pleasant or unpleasant times. Crafted objects can be self-reflecting, and souvenirs can remind you of a location. In this project emotional stories are narrowed down to childhood nostalgia.

The objects used are a Fisher-Price roller skate, a stuffed animal, a plastic military tank and a handcrafted puppet.

Because these items were collected in The Netherlands, they might be emotional to only Dutch. The emotional stories come from people questioned on Union Square, San Francisco. The place attracts people from all over the world. It was most interesting to see that all of these objects brought up emotions for people from different nations. The story-telling people came from Canada, the US, Hong Kong, Ukraine, Spain, Germany, Russia, France, Scotland and England. This is giving the project internationally interesting emotions.

Different kinds of emotions came up for the interviewed people. Some people talked about the emotions they had with exact the same object. Especially the roller skate was recognised a lot. Others had emotions that came up with a fresh look at the object. Most stories about the puppet were like that. It shows that people relate to objects in various ways.

Fig. 9. *Stuffed animal*

Fig. 10. *Plastic military tank*

CONCLUSION

Money as a motive is not uncommon. Looking at the millions of dollars RFID can save companies throughout the supply chain, it's quite clear why big investments are made for its adoption.

Experts have not reached consensus about the risks of the resulting pervasive electro magnetic fields. This danger, along with the problems of privacy intrusion, should be considered when designing RFID applications. Although these aspects should not be trivialised, they are creating a negative atmosphere around the technology. For the supply chain application of RFID they might be justified, but at the same time they are holding back RFID development from another perspective.

RFID is more than a supply chain application, as we can see from the number of projects using it in different ways. Continuously using the terms NFC, smart labels and smart cards instead of RFID is a good idea to get the public to see the technology from another perspective, but proper explanation about it would be better. In comparison, for some people music downloads stay permanently related to copyright infringement. A name change might be the best step in the right direction.

In that right direction we find applications for RFID with abstract functionality, with the creation of interfaces being the most interesting one. Additionally, social software could benefit from a public platform on top of the EPC and commercial tag layers in the EPC network. That way, a possibility is created to interact with objects and their digital identity.

A world with all objects being tagged and uniquely identified is still not very close, but we can think of scenarios and applications for it. The infrastructure will be rolled out slowly, starting with the bigger and more expensive items. In the mean time designers can speed up this process with Thinglinks and their own RFID tags to create test beds for their own interest. Using this infrastructure, small applications will take off as forerunners to a world where digital interaction with every day objects will be common.

This is not the 'Internet Of Things', where objects connect to create smart environments and where they collect and exchanging data with sensors. This is about the 'Internet *For* Things'.

Recommendations

The analogue of RFID tags and spychips is easily made when companies start collecting information about consumers without them knowing. The same is done on the Internet. Websites log user behaviour and use that information to personalize their pages. Software called spyware reports everything you do on your computer to spammers or online marketers. But instead of letting third parties monitor you, certain software allows you to monitor yourself.

Last.fm for example (www.last.fm), released software recording information about the music you listen to. Your listening habits show people with a similar taste, and new music can be discovered. The software calls itself 'myware', referring to the earlier mentioned 'spyware'.

In that perspective, Julian Bleecker's blogjects can be seen as a myware RFID application sensing the environment. It would be interesting to shift research focus from content determination by end-users and further explore the use of RFID myware for people. After controlling content, myware would allow data collection about objects people carry around, but only about information with permission of its owner. This would require relative longer range RFID tags. How can the objects around a person automatically profile him, with him still being in control? And how can users learn and benefit from relations between these user profiles?

Lessons learned

From the thesis research I learned how to better balance technical knowledge and concepting. Although you need to be familiar with the technology you are using, while creating a concept you should not restrict yourself. While working out the concept it's very important to dive back into technology at the right moment. Being too soon will restrict your concept, being too late will transform your concept into a bubble.

One of the most important things learned from making the project is the danger of going to deep into the matter causing you to lose your less informed audience. The EMMA Mock Exam made this clear. It's interesting to see that after taking a step back, the same audience was directing me to my first idea. There is a process involved in getting your idea out. A struggle to redefine your idea is not always the solution. Guide your audience step by step.

SUMMARY

RFID (Radio Frequency Identification) is quite an old technology, already used for over a decade in for example animal identification chips and electronic door keys. RFID chips contain a unique number or a small amount of data that can be transmitted wirelessly without the need for an onboard battery.

Investments in the technology are enhancing its development. Business aims to use RFID to track objects throughout with a unique product code (the EPC) along the entire supply chain and make information about the objects globally available. This would improve accuracy and efficiency for all parties in the supply chain, including shipping, transportation, receiving and in-facility operation, saving millions of dollars.

The information stored relates to the tracked objects, but can relate to the users of these objects as well. The information might end up at companies with a conflict of interest. People lose self-determination and their privacy is invaded. Public prosecutors see the advantages of RFID in trials, as due to digitalisation people leave an increasing amount of tracks. But there is no assurance that future laws will tolerate previous behaviour. This is a precarious situation because digital information has no memory loss, so lifetime records can be kept.

These negative aspects of the supply chain application of RFID need to be stated and taken care of, but they don't do justice to RFID as a technology. The supply chain network (EPCGlobal) is a usage layer on top of technology. Usage is where negativity should be associated to. RFID technology can be more than the supply chain application. Example projects show RFID functionality can be abstracted to a medium, interface or sensors. Further development in this abstract direction will be hindered if RFID remains interconnected to privacy infringement.

Adoption in the supply chain is creating a pervasive RFID world where all objects get a digital identity and history. In addition to the commercial interests in this infrastructure, social software could also benefit from this digital layer. Unfortunately the EPC network is not transparent to public because of security reasons. However a public platform can be built on top of the only available layer of the network: the RFID tags and the EPC. With the EPC for commercial products, and the openly available Thinglink code for crafted objects, every object can have a unique identifier.

Standalone applications can be created for communities based on various interests. They each have their own database but can all refer to the same object. The unique number associated with each object would be able to connect these separate applications.

In the so-called 'Internet Of Things', objects connect, and interact with each other. That's not what the open platform mentioned in this thesis is about. Instead, its describing the 'Internet *For* Things'.

BIBLIOGRAPHY

ACHERMANN, P., KUSTER, N., RÖÖSLI, M. 2006, *Short-term UMTS radiation does not impair well being*, Press Release, Zurich, 6th June 2006, available online: http://www.mobile-research.ethz.ch/var/TNO/Medienmitteilung_E.pdf (last accessed: 2006/07/03)

AIMGLOBAL 2006, *What is Radio Frequency Identification (RFID)?,* Association for Automatic Identification and Mobility, http://www.aimglobal.org/technologies/rfid/what_is_rfid.asp (last accessed: 2006/06/17)

ALBRECHTS, C.M. 2002, *Supermarket Cards: The Tip of the Retail Surveillance Iceberg*, Denver University Law Review, Summer 2002, Volume 79, Issue 4, pp. 534-539 and 558-565, available online: http://www.spychips.com/documents/Albrecht-Denver-Law.pdf (last accessed: 2006/06/20)

BAARD, M. 2006, *RFID: Sign of the (End) Times?, Wired News*, 6th June 2006, http://www.wired.com/news/technology/0,70308-0.html (last accessed: 2006/07/04)

BLEECKER, J. 2006, *A Manifesto for Networked Objects — Cohabiting with Pigeons, Arphids and Aibos in the Internet of Things*, Manifesto, February 2006, available online: http://research.techkwondo.com/files/WhyThingsMatter.pdf (last accessed: 2006/07/06)

BROUWER, Mr. H.N. 2005, *Radio-frequentie identificatie (RFID) en de opsporing*, Lecture by Chairman of the Board of procurators-general, the Netherlands, 8th eNederlandcongres, Zeist, 10th November 2005

CANADA, 1972, *Privacy and Computers*, Department of Communications and Department of Justice, Ottawa: Information Canada, 1972

CAMPBELL, D. 2005, *RFID Policy May Not Wait*, RFIDJournal Expert View, 28th March 2005, available online: http://www.rfidjournal.com/article/articleview/1461/ (last accessed: 2006/06/21)

CARDULLO, M.W., *Genesis of the Versatile RFID Tag*, RFID Journal, http://www.rfidjournal.com/article/articleview/392 (last accessed: 2006/06/16)

CAVOUKIAN, A. 2004, *Tag, You're It: Privacy Implications of Radio Frequency Identification (RFID) Technology*, Information and Privacy Commissioner of Ontario, February 2004, available online: http://www.ipc.on.ca/docs/rfid.pdf (last accessed: 2006/06/20)

CNN 2005, *Lab dedicated to RFID technology*, CNN Article, 30th August 2005, available online: www.uwrfidlab.org/news/docs/LabpressCNN_RFID.pdf (last accessed: 2006/07/05)

DEUTSCH, C., FEDER, B. 2003. *A Radio chip in every Consumer Product.* New York Times. 25th February 2003.

DIORIO, C. 2005, *Gen 2—The Tough Questions, Part 2, Article by one of the architects of EPCglobal's Generation 2 standard*, RFIDJournal, 22nd August 2005, available online: http://www.rfidjournal.com/article/articleview/1784 (last accessed: 2006/07/31)

DUNNE, A., RABY, F. 2003, *Value fictions and the suspension of disbelief*, Dunne And Raby Design Partnership, April 2003.

ENGELS, W.E., SARMA, S.E 2005, *Standardization Requirements within the RFID Class Structure Framework*, Auto-ID Labs, Massachusetts Institute of Technology, January 2005, available online: http://autoid.mit.edu/CS/files/11/download.aspx (last accessed: 2006/06/17)

FERGUSON, R.B. 2006, *Gen 2 Spec Gets Major Acceptance*, eWeek, 1st March 2006, http://www.eweek.com/article2/0,1759,1932902,00.asp (last accessed: 2006/06/18)

GOEBEL, G. 2005, *The British Invention Of Radar*, In The Public Domain, 1st February 2005, available online: http://www.vectorsite.net/ttwiz.html (last accessed: 2006/06/16)

HITACHI 2006, *World's smallest and thinnest 0.15 x 0.15 mm, 7.5µm thick RFID IC chip*, Press Release, Hitachi Ltd. Tokyo, 2nd February 2006, available online: http://www.hitachi.com/New/cnews/060206.pdf (last accessed: 2006/06/16)

IDTECHEX 2005, *Standards overview,* IDTechEx, 15th October 2005, http://www.idtechex.com/products/en/articles/00000105.asp (last accessed: 2006/06/17)

IEE 2005, *Radio Frequency Identification Device Technology*, Fact File, Institution of Electrical Engineers, July 2005, available online: http://www.theiet.org/publicaffairs/sectorpanels/control/rfid.pdf (last accessed: 2006/06/17)

LENDT, J. 2001, *Shrouds of Time, The history of RFID,* Association for Automatic Identification and Mobility, 1st October 2001, available online: http://www.aimglobal.org/technologies/rfid/resources/shrouds_of_time.pdf (last accessed: 2006/06/16)

KRANENBURG, R. VAN 2006, *Contested Spaces and RFID*, Lecture at The Futuresonic 2006 Conference, Manchester, 21st July 2006

McFARLANE, D. 2003, *The Impact of Automatic Identification on Supply Chain Operations*, Paper, Auto ID Center-Cambridge Laboratory, available online: http://web.mit.edu/sheffi/www/selectedMedia/genMedia.sheffi-McFarlane.pdf (last accessed: 2006/06/18)

NOKIA 2004, *Nokia Unveils the world's first NFC product - Nokia NFC shell for Nokia 3220 phone*, Press Release, 2nd November 2004, available online: http://press.nokia.com/PR/200411/966879_5.html (last accessed: 2006/07/04)

O'REILLY, T. 2005, *What Is Web 2.0*, Article O'Reilly Media, 30th September 2005, http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html (last accessed: 2006/07/06)

PHILIPS, *MIFARE – contactless smart card ICs*, Philips Semiconductors website, http://www.semiconductors.philips.com/products/identification/mifare/ (last accessed: 2006/07/04)

PHILIPS 2006, *Philips, Samsung and Telefonica Móviles España demonstrate simplicity of Near Field Communication technology at 3GSM World Congress*, Press Release Philips, Eindhoven, 7th February 2006, available online: http://www.semiconductors.philips.com/news/content/file_1216.html (last accessed: 2006/07/04)

PORTER, L. 2005, *The Gen 2 Standard: What Is It, and What Does It Mean?*, Paxar Corporation, March 2005, available online: http://www.hegrobelgium.be/files/RFID_gen2.pdf (last accessed: 2006/06/18)

RFIDJOURNAL 2006, *A Summary of RFID Standards*, RFIDJournal Article, http://www.rfidjournal.com/article/articleview/1335 (last accessed: 2006/06/17)

ROBERTI, M. 2003, *Case Study: Wal-Mart's Race for RFID*, eWeek.com Article, 15th September 2003, http://www.eweek.com/article2/0,1895,1492297.asp (last accessed: 2006/06/18)

SABETTI, A., *Applications of Radio Frequency Identification (RFID)*, Texas Instruments, Association for Automatic Identification and Mobility, available online: http://www.aimglobal.org/technologies/rfid/resources/papers/applicationsofrfid.htm (last accessed: 2006/06/17)

SMARTCODE 2006, *SMARTCODE™ CORP. announces the world's first 5 cent RFID tag*, Press Release, SMARTCODE™ CORP. New York, 1st May 2006, available online: http://www.smartcodecorp.com/newsroom/01-05-06.asp (last accessed: 2006/05/01)

TNO 2004, *TNO study on the effects of GSM and UMTS signals on well-being and cognition*, Electromagnetic Fields Committee of the Health Council of the Netherlands, 28th June 2004, available online: www.gr.nl/pdf.php?ID=1042 (last accessed: 2006/07/03)

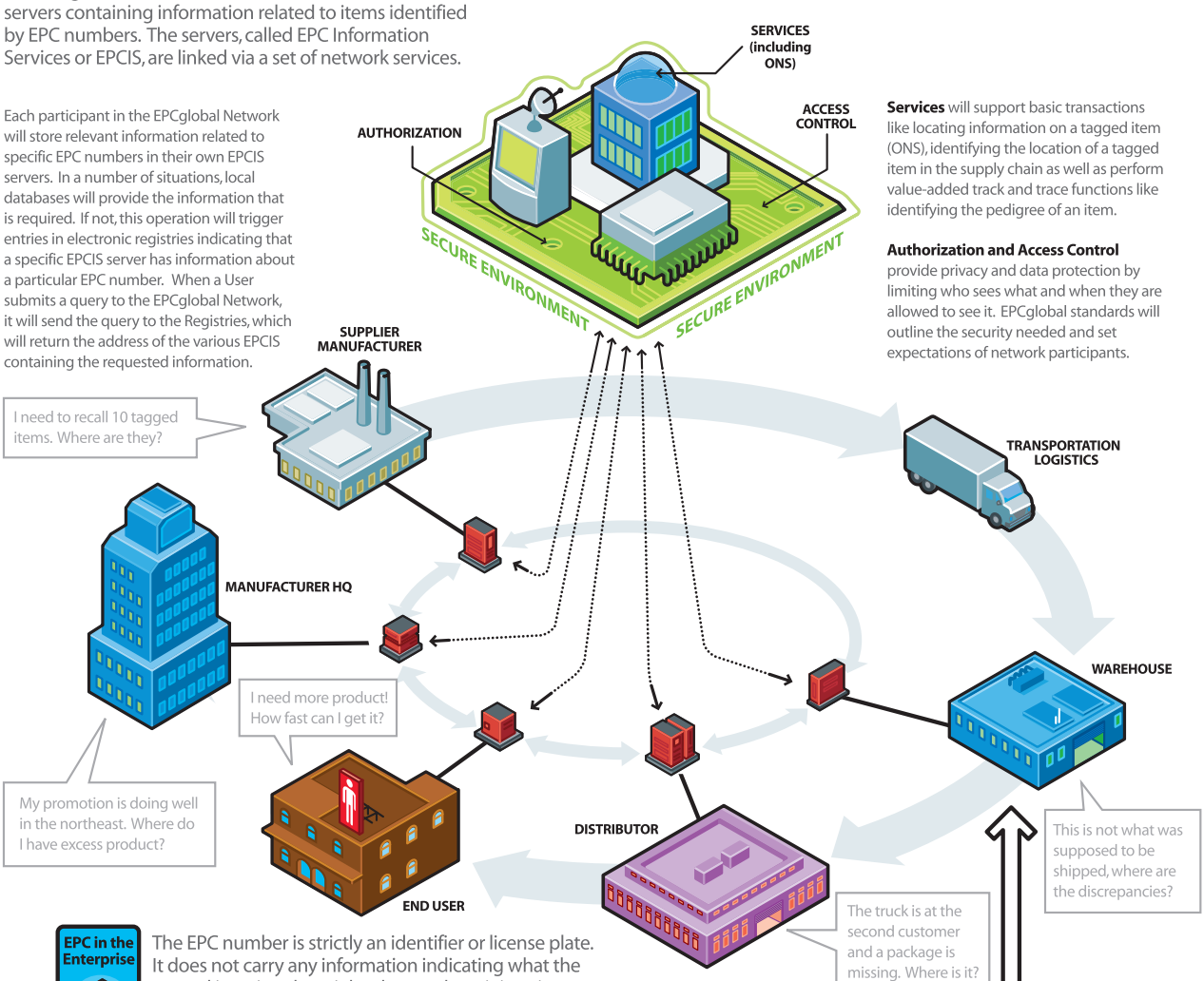
WAL-MART 2005, *Wal-Mart Improves On-Shelf Availability Through the Use of Electronic Product Codes*, Press Release, 14th October 2005, Bentonville, Arkansas, available online: http://www.wal-martfacts.com/articles/1937.aspx (last accessed: 2006/07/04)

The EPCglobal Network™

EPCglobal

The EPCglobal Network is a secure means to connect servers containing information related to items identified by EPC numbers. The servers, called EPC Information Services or EPCIS, are linked via a set of network services.

Each participant in the EPCglobal Network will store relevant information related to specific EPC numbers in their own EPCIS servers. In a number of situations, local databases will provide the information that is required. If not, this operation will trigger entries in electronic registries indicating that a specific EPCIS server has information about a particular EPC number. When a User submits a query to the EPCglobal Network, it will send the query to the Registries, which will return the address of the various EPCIS containing the requested information.

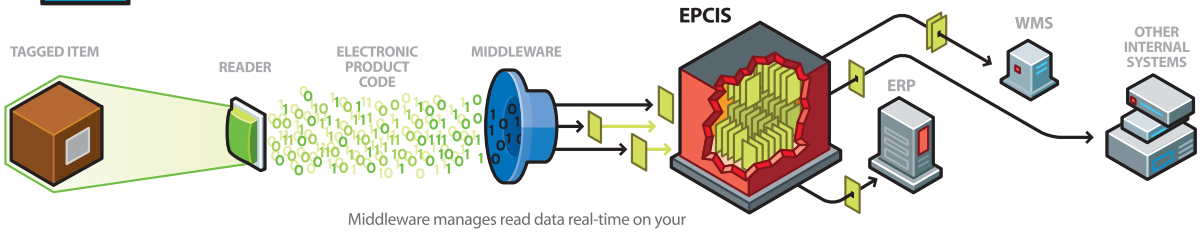


Services will support basic transactions like locating information on a tagged item (ONS), identifying the location of a tagged item in the supply chain as well as perform value-added track and trace functions like identifying the pedigree of an item.

Authorization and Access Control provide privacy and data protection by limiting who sees what and when they are allowed to see it. EPCglobal standards will outline the security needed and set expectations of network participants.

EPC in the Enterprise

The EPC number is strictly an identifier or license plate. It does not carry any information indicating what the tagged item is, where it has been, where it is going, what is its shelf life, etc.



Readers scan and pass EPC numbers to local implementations of EPCglobal Middleware which manages and stores the read data.

Middleware manages read data real-time on your internal network sorting, filtering, and batching information, passing on only relevant info. It adds the location and event info enabling the EPCIS and internal systems to act on the data.

EPC Information Services (EPCIS) connect your EPC data with information such as business events. Event-based rules trigger 'intelligent networking' and true automation is achieved. The greatest benefit is when EPC Information Services are shared among trading partners.

Onderzoek RFID-toepassingen

Steeds meer bedrijven zijn geïnteresseerd in de steeds populairder wordende techniek genaamd RFID (Radio Frequency Identification). De interesses lijken vooral uit te gaan naar het gemak en de extra controle die RFID brengt in de logistiek. Extra controle over goederen maar ook extra controle over de consument. Nog niet veel consumenten weten van deze techniek af, maar de mensen die er vanaf weten spreken al snel van ernstige privacyschending. Niet zo heel vreemd als je nagaat wat bedrijven en overheden over burgers te weten kunnen komen zodra ieder object zijn eigen tag krijgt en dus informatie over zichzelf of zijn eigenaar uitzendt.

Het aantal testprojecten met deze techniek op het gebied van logistiek en het volgen van identiteiten is groot en blijft groeien. Jammergenoeg maken deze privacygevoelige projecten het grootste deel uit van het totaal aan experimenten met RFID. Deze experimenten hebben voor het grote publiek een vooral negatieve tendens. Het is van belang dat er ook positieve experimenten gedaan worden zodat RFID tags niet alleen worden geassocieerd met doemscenario's. De techniek maakt namelijk zo veel meer mogelijk dan alleen het stroomlijnen van logistiek en het identificeren van mensen.

Er kunnen ook mooie, leuke en handige dingen gedaan worden met RFID. De al bestaande positieve experimenten op dit gebied bewijzen dat. Blogger Régine Debatty verzamelt op haar website www.we-make-money-not-art.com de meest uiteenlopende mediakunstprojecten waarvan ook een groot aantal gebruik maken van RFID. Voor toekomstige projecten is het interessant om te weten welke gebieden bestaande RFID projecten al betreden hebben. In dit document behandel ik alle door haar verzamelde op RFID gebaseerde (kunst)projecten. Elk project is geanalyseerd op zijn toegevoegde waarde, nieuwe invalshoeken, voor- en nadelen, positieve benadering of herhaling van iets wat eerder is gedaan.

Patrick Plaggenborg, mei 2006

patrick@plaggenborg.nl

Dit document is tot stand gekomen met dank aan Rob van Kranenburg en Régine Debatty.

1. RFID telefoon reader

RFID reader in een mobiele telefoon behuizing

+ De rollen van tag en reader worden omgedraaid. De reader is nu mobile en de tag kan passief blijven.
+ Gewonnen informatie kan direct via het GSM systeem worden verzonden.
+ Gebruikers kunnen producten zelf scannen op hun persoonlijke apparaat.

http://www.we-make-money-not-art.com/archives/000285.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/000307.php
http://www.we-make-money-not-art.com/archives/001955.php

2. nTag Interactive

RFID tag ter grootte van een PDA die om de nek gedragen kan worden. Deze tags kunnen met elkaar en met een centrale server communiceren. Een tijdsschema voor een meeting wordt weergegeven en er wordt melding gemaakt als er mensen in de buurt zijn met gelijke interesses.

+ Drager geeft persoonlijke informatie op aan centrale server
+ Gebruikers kunnen producten zelf scannen op hun persoonlijke apparaat.
- Communicatie met elkaar via infrarood, met server via RFID
- Persoonlijke informatie wordt niet vanzelf vergaard.

http://www.we-make-money-not-art.com/archives/000336.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/007062.php

3. RFID tags aan sushi borden

Sushiborden krijgen een RFID tag met gedetailleerde informatie over prijs, sushi type, kok en tijd waarop het gerecht gemaakt is.

+ Gedetailleerde informatie over eten
+ Kwaliteit van het eten wordt gemonitord en is dus beter.
+ Gebruikers kunnen zelf de sushi scannen
- Niet meer dan informatie over het product.

http://www.we-make-money-not-art.com/archives/000491.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/004707.php

4. Betaal-implantaat

Bezoekers krijgen een RFID-chip geimplanteerd waarmee betaald kan worden.

+ Automatisch betalen op rekening en automatische toegangsverschaffing
+ Geen los object nodig maar eigen lichaam wordt gescand.
- Gaat puur over de identiteit van een persoon

http://www.we-make-money-not-art.com/archives/000582.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/002078.php
http://www.we-make-money-not-art.com/archives/004210.php
http://www.we-make-money-not-art.com/archives/008127.php

5. Betalen voor parkeren

Een kaart voor onder de vooruit die dmv RFID door een controleur uitgelezen kan worden. De betaling zelf wordt geactiveerd en gedeactiveerd met een mobiele telefoon.

+ Controleur kan zijn apparaat snel informatie laten controleren zonder zelf een parkeerkaartje te hoeven lezen of over te typen. Het gaat hierbij om de identificatie van de auto.
- Het activeren en deactiveren gaat niet automatisch met de RFID tag maar moet met een mobiele telefoon.

http://www.we-make-money-not-art.com/archives/000654.php

6. RFID productinformatie gecombineerd met dieet

Met een cameratelefoon kan een foto gemaakt worden van een barcode van een product. Aan de hand van de barcode wordt productinformatie gegeven. RFID wordt aan gedacht.

+ De informatie wordt gecombineerd met een dieetprogramma op de computer thuis: personalisatie van de productinformatie
- Geen gebruik van RFID dus met de hand foto's maken ipv in de buurt houden van het apparaat.

http://www.we-make-money-not-art.com/archives/000657.php

7. RFID in handschoen

Een systeem waarmee ouderen of gehandicapten gemonitord kunnen worden. Een handschoen met RFID-reader erin leest uit welke activiteiten plaatsvinden. De tijd wordt gelogd. Aan de hand daarvan wordt gekeken of er iets mis is en kan er alarm geslagen worden. Activiteiten gaan van medicijnen tot het suikerpotje en de toiletbril.

+ Men weet niet alleen dat je suiker en koffie in huis hebt maar kan zelfs bijhouden hoevaak je het drinkt en hoe vaak en of je naar de wc gaat. Het gaat dus om activiteiten.
- Activiteiten worden bepaald aan de hand van patronen. De volgorde van het scannen van objecten kan duidelijk maken welke activiteiten plaatsvinden.
- Ernstige privacy schending. Niet alleen wat je koopt maar juist wat je doet wordt bijgehouden.

http://www.we-make-money-not-art.com/archives/000694.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/007369.php

8. RFID in een golfbal

Door een RFID chip in een golfbal te plaatsen kan deze met behulp van een portable RFID reader makkelijk teruggevonden worden. De reader begint sneller te piepen zodra de bal dichterbij is.

+ De afstand tot de bal wordt gemeten. Zo wordt de locatie bepaald.
+ Grote afstanden zijn mogelijk (12-30 meter).
+ De afstand tot de chip wordt gemeten.

http://www.we-make-money-not-art.com/archives/000898.php

9. RFID ism WiFi en VOIP om patienten te identificeren/behandelen

Met RFID tags op de armbanden van patienten, de penningen van medewerkers en op het ziekenhuisapparatuur kunnen patienten zonder fouten geidentificeerd worden. Met een PDA met RFID reader kan een patient gescand worden en krijgt de medewerker direct alle benodigde gegevens op zijn scherm.

+ Patienten moesten al geidentificeerd worden. Dit proces is nu geautomatiseerd met RFID. Medewerkers hoeven veel minder handelingen te verrichten, waardoor de kans op fouten ook daalt.
+ Patientgegevens zijn nu mobiel beschikbaar zonder dat ze op vaststaande plaatsen benaderd kunnen worden.

http://www.we-make-money-not-art.com/archives/000985.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/003790.php

10. Locatie-tracking

Alle inwoners van een bejaardenresidentie in Oregon dragen een RFID penning bij zich waarmee ten alle tijden de locatie van de personen in de gaten gehouden kan worden.

+ Het in- of uitgaan van een gebouw wordt in de gaten gehouden.
- De bejaarden kunnen ten alle tijden in de gaten gehouden worden. Hun locatie is altijd bekend wat privacyproblemen met zich meebrengt.

http://www.we-make-money-not-art.com/archives/001132.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/001614.php
http://www.we-make-money-not-art.com/archives/001656.php
http://www.we-make-money-not-art.com/archives/001783.php
http://www.we-make-money-not-art.com/archives/002180.php
http://www.we-make-money-not-art.com/archives/002312.php
http://www.we-make-money-not-art.com/archives/003601.php
http://www.we-make-money-not-art.com/archives/004499.php
http://www.we-make-money-not-art.com/archives/004551.php
http://www.we-make-money-not-art.com/archives/006515.php
http://www.we-make-money-not-art.com/archives/008344.php

11. RFID armband voor leeftijdscheck en meer

Een RFID armband die in eerste instantie bedoeld is om leeftijden te controleren voor het schenken van alcoholische dranken. Dit systeem kan verder gebruikt worden om bij te houden hoeveel en welke drankjes gekocht worden. Ook is er de mogelijkheid om de betaling van deze drankjes automatisch te verrichten.

+ Gebruikers hoeven niet met los geld of muntjes te betalen. Dit kan nu automatisch.

+ Het is makkelijk statistieken te maken over wat welke leeftijdsgroepen drinken en deze informatie te gebruiken in de marketing.
- Er kan bijgehouden worden wat iemand precies drinkt, waardoor de privacy in gevaar komt.

http://www.we-make-money-not-art.com/archives/001284.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/003607.php

12. RFID in fiches in het casino

Fiches in casino's voorzien van RFID tags om bij te houden waarop en hoeveel er ingezet wordt. Zodra er grote veranderingen gemaakt worden is er misschien sprake van vals spelen.

+ Het inzetgedrag kan gecontroleerd worden. Hier kunnen patronen in ontdekt worden.
- Privacygevoelige maatregel. Ook kunnen mensen zonder aanleiding van vals spelen beticht worden.

http://www.we-make-money-not-art.com/archives/001388.php

13. RFID in horloge

Zonder grote aanpassingen aan het horloge kan een RFID tag in of aan het glas gezet worden. Ook zijn er horloges verkrijgbaar met een reader ingebouwd.

+ In plaats van een speciale armband of pas kan een horloge gebruikt worden. Een horloge is minder opvallen als identificatieobject en bovendien dragen veel mensen een horloge.
+ Met de reader in het horloge komen opgepakte objecten automatisch in de buurt van de reader en kan er op het horloge informatie verschaft worden.
+ Een reader in een horloge is handiger dan een reader in een telefoon.
- Wederom identificatie van een persoon of persoonlijke betaling.
- Scherm horloge is kleiner dan scherm telefoon of PDA en kan dus minder informatie bevatten.

http://www.we-make-money-not-art.com/archives/001878.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/001105.php

14. Automatische gepersonaliseerde montage

Een RFID tag in duivenzaad dat bij het opeten in de maag van de duif terecht komt (Niet schadelijk aangezien vogels ook stenen eten voor hun spijsvertering). Zodra een duif in de buurt van een camera komt wordt er een foto of een video gemaakt. Deze kunnen op een speciale URL bekeken worden. Na ongeveer 12 uur verdwijnt de RFID tag uit de spijsverteringskanalen van de duif.

+ RFID in de ingewanden van een organisme.
+ Niet de camera volgt de RFID tag maar meerdere camera's gebruiken de delen van hun opgenomen materiaal van wanneer de RFID tag in de buurt komt.

Een automatische gepersonaliseerde montage.

http://www.we-make-money-not-art.com/archives/001880.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/008005.php
http://www.we-make-money-not-art.com/archives/008351.php

15. RFID gecombineerd met photosensor

RFID tags met fotosensors uitgerust. Een handheld projector projecteert een beeld op objecten met deze 'RFIG' tags uitgerust. Omdat elke pixel (x,y) van de projectie verschillend is kan de RFIG tag terugsturen welke pixel(s) op zijn fotosensor geprojecteerd worden. Aan de hand van die informatie kan de projector voor mensen te onderscheiden visuele feedback geven.

+ Visuele feedback dmv een projector
+ Locatie doorgeven dankzij licht
- RFID met fotosensor zijn een stuk duurder
- Line-Of-Sight nodig

http://www.we-make-money-not-art.com/archives/002310.php

16. Gotcha kindermonitoringsysteem

RFID tag in apparaat voor kind en voor ouder. Zodra de afstand tussen beide apparaten te groot wordt zal er voor de ouder alarm geslagen worden.

+ Niet tracken waar de ander is of wat de ander doet maar de afstand tot de ander. Zodra de afstand te groot is (contact via RFID is verbroken) wordt alarm geslagen.

http://www.we-make-money-not-art.com/archives/002317.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/002243.php

17. Betaling met RFID betaal-object

RFID Tag in pas of sleutelhanger die de gebruiker identificeert

- Extra object nodig om te identificeren. Je lichaam of je telefoon heb je altijd bij je.

http://www.we-make-money-not-art.com/archives/002133.php

18. RFID chips met muziekrechten

Kaartjes met RFID tags erin die niet het muziekbestand zelf bevatten maar de rechten er van met een verwijzing naar de muziek op het netwerk.

+ Een object is ook gelijk een track ipv een object voor meerdere tracks. Aangezien de objecten klein blijven kan dit overzichtelijker zijn.
+ Met snelle netwerken is het makkelijk om een kleine verwijzing te vervoeren. Het fysieke bestand staat niet op het medium maar op het netwerk.

http://www.we-make-money-not-art.com/archives/002378.php

19. Menselijke huid voor dataoverdracht

Persoon draagt armband die via de huid communiceert met het apparaat waar door de persoon met zijn vinger op gedrukt wordt.

+ Niet draadloos maar zorgt er wel voor dat er alleen gecommuniceerd wordt met het apparaat dat de persoon zelf aanraakt. Geen ongewenste communicatie dus. Alternatief voor objecten dicht bij elkaar brengen.

http://www.we-make-money-not-art.com/archives/002994.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/003394.php

20. RFID gecombineerd met thermometer

De lichaamstemperatuur van een dier wordt in de gaten gehouden. Zodra deze boven een bepaalde waarde uitstijgt of onder een bepaalde waarde komt dan zullen de medewerkers gewaarschuwd worden en kunnen ze het 'zieke' dier helpen.

+ Temperatuur wordt samen met de identificatie van het dier doorgestuurd.

http://www.we-make-money-not-art.com/archives/003037.php

21. RFID lezende huishoudrobot

De robot leest de RFID tags van objecten in huis zodra hij in learn-mode staat. In fetch-mode kan hij dan de producten halen en weer op de plek zetten die hij geleerd heeft.

- Lokaties van objecten zouden met de identiteit van de objecten worden gecombineerd. Het is uit dit stuk onduidelijk hoe de robot erachter komt welk object het zekere RFID signaal heeft uitgezonden.

http://www.we-make-money-not-art.com/archives/003302.php

22. Horloge waarschuwt voor vergeten objecten

Met een persoonlijke server in de broekzak kan het horloge bijhouden welke objecten de persoon bij zich heeft en waarschuwen welke hij vergeten is. Daarnaast houdt hij je agenda bij, waar je heen moet en onthoudt hij de locaties van objecten.

+ De objecten in de omgeving praten met elkaar en waarschuwen je. Het helpt je dingen onthouden.

http://www.we-make-money-not-art.com/archives/003379.php

23. Paspoort en rijbewijs uitgerust met RFID

Biometrische gegevens maar ook ziekenhuisgegevens kunnen bewaard worden en snel opgevraagd worden.

+ Ziekenhuizen hebben direct beschikking over de benodigde gegevens van de patient zoals bloedgroep, medicijngebruik en andere gegevens over zijn conditie.

+ In plaats van bepaalde voorkeuren of een klantnummer loop je nu niet met een aan jou geassocieerd profiel rond maar loop je rond met je daadwerkelijke identiteit.

- Het is belangrijk om uit te kijken met wie deze draadloos verspreide gegevens kan benaderen.

http://www.we-make-money-not-art.com/archives/003428.php

24. Op RFID gebaseerd winkelsysteem in supermarkt

De producten en planken in een supermarkt zijn voorzien van RFID. De server ontvangt van het mandje welke producten erin zitten en stuurt gerelateerde producten of zelfs aanbiedingen terug.

+ Geschiedenis gekochte producten wordt bijgehouden en daarop worden aanbiedingen afgestemd.

+ Gerelateerde producten worden aangeprijsd. Producten waar de gebruiker waarschijnlijk naar op zoek was.

http://www.we-make-money-not-art.com/archives/003478.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/001661.php

25. RFID naamkaartje vergrendelt computer

Een RFID naamkaartje vergrendelt de computer zodra de persoon van zijn computer wegloopt en zijn naamkaartje meeneemt. Op eenzelfde manier kan hij zijn computer weer ontgrendelen.

+ Het naamkaartje staat in dit geval voor de aanwezigheid van een persoon. Er worden verder geen gebruik gemaakt van inhoudelijk details.

http://www.we-make-money-not-art.com/archives/003499.php

26. RFID in de lift

De lift detecteert met RFID gecombineerd met beeldverwerking of een persoon de lift wil nemen of niet. Ook weet de lift waar de persoon heen wil.

+ Personalisatie van een lift.

+ Patronen in het gedrag van de mensen worden herkent.

- Liften zullen niet altijd op dezelfde manier gebruikt worden.

http://www.we-make-money-not-art.com/archives/004076.php

27. Condoomautomaat met RFID

Condoomautomaten verschaffen gratis condooms met een RFID kaart die uitgedeeld is.

+ Productpromotie. Niet de producten zelf worden uitgedeeld maar het recht op het product wordt uitgedeeld. Dit product kan zelf opgehaald worden. Een soort tegoedbon die automatisch en anoniem werkt.

http://www.we-make-money-not-art.com/archives/004185.php

28. Rekeningrijden met RFID

Er moet betaald worden voor het gebruik van drukke wegen en wegen in de spits. Deze rekeningen worden thuisgestuurd. Er kan ook automatisch betaald worden.

+ Geen tol betalen via een tolhuisje maar achteraf de rekening thuiskrijgen of het geld automatisch laten afschrijven.

http://www.we-make-money-not-art.com/archives/004278.php

29. Pratende pop die reageert op RFID tagged medicijnen

Een pop die praat en ook ziek kan worden. Je kan hem snoep, eten of bepaalde medicijnen geven. Er zit een reader in de pop die reageert op de RFID tags in de spullen die je de pop kan geven.

+ Meer feedback bij het spelen met het speelgoed. Kinderen worden door de pop geleerd wat goed en fout is.

http://www.we-make-money-not-art.com/archives/004545.php

30. SMS aanbiedingen dankzij RFID treinkaartjes

RFID treinkaartjes geven door waar een reiziger zich bevindt. Deze krijgt dan locatieafhankelijke aanbiedingen van het desbetreffende station op zijn telefoon.

+ Locatietracking dmv RFID gecombineerd met reclame (SMS aanbiedingen).

- Dit wordt al gedaan op basis van GSM positionering.

http://www.we-make-money-not-art.com/archives/004911.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/002096.php

31. RFID Tagzapper en RFID washer

Klein mobiel apparaat dat RFID tags opspoort en ze uitschakelt (kapotmaakt).

+ Preventie ongewenste RFID uitzending.

http://www.we-make-money-not-art.com/archives/004957.php

32. RFID in straten

Uitgerust met een PDA kunnen wandelaars geholpen worden met hun weg door de stad en kunnen ze informatie krijgen over de plek waar ze zich op dat moment bevinden.

- Dit wordt al gedaan op basis van GPS positionering. Het is dan onnodig om overal RFID tags te plaatsen.

http://www.we-make-money-not-art.com/archives/004957.php

33. VJ performance in RFID pak

Een pak met een reader in de hand en RFID tags op andere plaatsen op het pak geeft de gebruiker de mogelijkheid om zijn VJ performance te besturen. Met hand- en lichaamsbewegingen kan hij de RFID tags activeren en zo commando's sturen. Dit geeft hem de mogelijkheid om midden in het publiek zijn performance te doen.

+ In plaats van sensors en actuators in een pak kan er nu zonder al te veel elektronica draadloos iets geactiveerd worden.

http://www.we-make-money-not-art.com/archives/005017.php

34. RFID muziekspeler

Een RFID reader in een muziekspeler speelt SID bestanden af die zitten in de RFID tags naast de speler. Een stapeltje RFID tags kan zo een playlist vormen.

+ Een fysieke interface. Tracks zijn fysieke objecten en ook een playlist is een collectie van objecten.

http://www.we-make-money-not-art.com/archives/005060.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/006720.php

35. RFID in koeienmaag

Een RFID tag uitgerust met een thermometer bevindt zich in een koeienmaag. Uitbreidbaar met hartslagmeter, ademhalingsmeter en geboorteinformatie.

+ Tags in het lichaam. Dit keer niet in spierweefsel geïmplanteerd maar met een redelijk grote chip (15mm diameter x 90mm; 100gr) in de maag gestopt.

http://www.we-make-money-not-art.com/archives/005596.php

36. Productjingles op een RFID chip

Een RFID tag met 1kb geheugen bevat een geluidsbestand gecodeerd in het muziekformaat dat de Commodore64 ook gebruikte. Deze chip wordt gebruikt op product die dan zodra ze gescand worden bij de kassa van de supermarkt het muziekje afspelen.

+ Daadwerkelijke muziekbestanden op een chip. Geen verwijzing naar data maar bevat zelf de data.

+ De productbelevenis (uitstraling, verpakking, vormgeving) is uitgebreid met geluid.

http://www.we-make-money-not-art.com/archives/005597.php

37. Productiviteitsverhoging transport door RFID

Door producten te voorzien van een RFID tag kunnen ze beter in de gaten gehouden worden. Door bijvoorbeeld kronen en bruggen al het laboratorium van RFID tags te voorzien kan beter verzekerd worden dat ze bij de juiste patient aankomen.

+ Identificatie van producten is eenvoudiger. Geen gegevensverificatie nodig.

http://www.we-make-money-not-art.com/archives/003533.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/001496.php
http://www.we-make-money-not-art.com/archives/005203.php

38. Straatsurveillance met RFID

Mensen (kinderen) hebben een RFID tag bij zich met drukknop erop. In geval van nood kan er op de knop gedrukt worden. Verkoopautomaten in de buurt zijn met camera's uitgerust en kunnen dan snel beelden naar de politie doorsturen.

+ Surveillance wordt geactiveerd door de mensen in de buurt. Ze helpen de medewerkers in de controlekamer.

http://www.we-make-money-not-art.com/archives/004911.php

39. RFID gecombineerd met motion sensor

Een CD-doosje bevat een tag die linkt naar de geassocieerde muziekbestanden op de server. Zodra het doosje op een reader wordt geplaatst begint de muziek af te spelen. Met de motion sensor worden de play controls gecreëerd. Door het hoesje naar beneden te schuiven kan er naar het volgende nummer gesprongen worden. Rotatie van de CD past het volume aan. Door de CD weer weg te halen stopt de muziek.

+ Geen extra controlepaneel nodig. Het af te spelen object (de CD) biedt tegelijk een intuïtieve besturing.

http://www.we-make-money-not-art.com/archives/005624.php

40. Tweeweg gebruik RFID in winkels

Winkelend publiek met een RFID telefoon kan zijn favoriete winkels in zijn telefoon toevoegen aan een favorietenlijst door de telefoon bij een reader in de winkel te houden. Ze krijgen zo informatie over hun winkel waar ze ten alle tijden over kunnen beschikken. Daar tegenover staat dat de winkel ook weer informatie over de klanten kan verzamelen. Zij kunnen deze geïnteresseerde klanten aanbiedingen sturen.

+ Omdat de informatiestroom twee kanten op gaat is het gevaar van protest om privacy minder groot. Het is een win-win situatie. Mensen zijn eerder geneigd om informatie te verstrekken aan winkels waar ze zelf graag winkelen.

- Winkels kunnen ongevraagd meer met de informatie doen dan ze in eerste instantie doen geloven waardoor er alsnog privacyproblemen kunnen ontstaan.

http://www.we-make-money-not-art.com/archives/005645.php

41. Publieke gedachten in tekstvorm dankzij RFID

Mensen krijgen een RFID-tag waar een gedachte in tekstvorm aan gehangen kan worden via een website. Op een publieke plek worden deze teksten geprojecteerd. Woorden die vaker voorkomen zijn prominenter te zien. Oude woorden vervagen terwijl nieuwe woorden duidelijk op de voorgrond komen.

+ Weer identificatie maar dit keer publiek. Het gaat vooral om de gelijkenissen tussen de mensen die langskomen. Zo is het individu terug te vinden maar nog meer mening van de massa.

- Pure tekst is visueel weinig aantrekkelijk.

http://www.we-make-money-not-art.com/archives/005647.php

42. Spionagestenen

Realistische stenen met daarin computerchips en RFID technologie. De stenen zijn zo geluidsgevoelig dat ze voetstappen kunnen horen op een afstand tot zo'n 9 meter. Via radiosignalen wordt dit signaal teruggestuurd.

+ Niet objecten worden geïdentificeerd maar de situatie op bepaalde plekken.

- Hoewel de stenen ongetwijfeld geïdentificeerd kunnen worden om te weten welke steen welk geluid opvangt speelt de radiofrequentie hier meer de rol van het medium waarover informatie wordt verzonden.

http://www.we-make-money-not-art.com/archives/005822.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/008220.php

43. RFID hulp voor dwangneurose

RFID aan/uitschakelaars op apparaten en een masterswitch om mensen die constant willen checken of de apparaten uitstaan te helpen. Apparaten worden aangezet door de RFID tag op het apparaat te kleven. Door de tags van de apparaten af te halen worden de apparaten uitgeschakeld. Ook is er een masterswitch die met een RFID tag in- en uitgeschakeld kunnen worden. Zodra de tags buiten gebruik zijn worden ze opgeborgen in bijvoorbeeld een handtas. Zo kunnen ook buitenshuis de apparaten gecheckt worden.

+ Een RFID toepassing dat zich richt op sociale problemen en deze ook probeert op te lossen.

- Het probleem wordt niet bij de oorzaak aangepakt. Wel kan het geruststelling geven zodra de persoon weg van huis is.

- Omdat het makkelijker gemaakt wordt om te checken kan het tot gevolg hebben dat de tas met de schakelaars vaker gecheckt wordt dan dat de apparaten werden gecheckt voor gebruik van deze toepassing.

http://www.we-make-money-not-art.com/archives/005832.php

44. RFID Kledingkast

RFID tags op kleding worden bij het dragen van de kleding opgeslagen in een database dankzij een RFID reader bij de spiegel. Met deze database kan de gebruiker bijhouden wanneer hij bepaalde kleding heeft gedragen. Door extra gegevens in te voeren als kleur, prijs en hoe het kledingstuk zit zijn er bepaalde verbanden te leggen.

+ Het gebruikersgedrag van een product kan hiermee in kaart worden gebracht. Dit is niet nieuw maar aangezien kleding als zeer persoonlijk wordt gezien kan dit gezien worden als het in kaart brengen van identiteiten.

- In dit geval is de informatie beschikbaar voor de eigenaar van de kleding. Bedrijven zouden veel met deze informatie kunnen doen. Bepaalde combinaties van kleding worden voor bepaalde gelegenheden gedragen. Bedrijven kunnen zo veel over het gebruik hun kledingstukken te weten komen wat het erg privacygevoelig maakt.

http://www.we-make-money-not-art.com/archives/006144.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/008466.php

45. Kaartspel als metafoor invoerapparatuur fotosoftware

Een invoerapparaat dat speelkaarten als metafoor heeft. De doelgroep zijn mensen die van de standaard invoerapparaten als toetsenbord en muis niet zo veel begrijpen. Door de spelkaarten en fiches met RFID tags erin op bepaalde plaatsen met een RFID reader te leggen kunnen ze navigeren door de interface op het scherm.

+ RFID metaforen als interface van een standaardcomputer. Drempelverlagend omdat het concept van de metafoor al bekend is en er dus geen totaal nieuwe manier van werken hoeft aangeleerd te worden.
- Een bekende werkwijze gebruiken is drempelverlagend. De commando's die uitgevoerd worden staan op kaarten en zijn dus duidelijk. De manier waarop deze kaarten moeten worden gecombineerd kan ingewikkeld blijven en is weinig intuïtief. Totaal verschillende acties gebruiken allen als metafoor het neerleggen terwijl het resultaat van de actie misschien weinig op elkaar lijkt.

http://www.we-make-money-not-art.com/archives/006448.php

46. Video's geassocieerd met fysieke RFID objecten

Bij het project genaamd Moopong zijn er ballen die RFID tags bevatten. Een camera neemt videobeelden op en associeert ze met deze ballen. Zodra ze in een apparaat met een reader worden gestopt kan de video afgespeeld worden.

+ Digitale informatie krijgt een fysieke vorm. Dit keer met videobeelden in plaats van geluid/muziek.
- Bij het zien van ballen wordt niet direct aan video gedacht. Het kan gezien worden als datadrager.

http://www.we-make-money-not-art.com/archives/006485.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/006925.php
http://www.we-make-money-not-art.com/archives/007396.php
http://www.we-make-money-not-art.com/archives/007397.php
http://www.we-make-money-not-art.com/archives/008466.php

47. Video RFID objecten als interface

Een camera neemt video op en associeert deze aan een RFID munt zodra de videobeelden naar de computer worden gestuurd. Deze video munten kunnen dan gebruikt worden om video's af te spelen maar ook om montages te maken door bepaalde munten in een bepaalde volgorde te leggen. Ook kunnen geluidseffecten die aan andere munten geassocieerd zijn worden toegevoegd.

+ Naast fysieke objecten ontstaat ook een fysieke interface tot digitale data die als creatieve tool kan worden gebruikt. Het gaat dus een stuk verder dan afspelen van bestanden.

http://www.we-make-money-not-art.com/archives/006617.php

48. RFID om spelregels te handhaven

Met RFID tags in de bal en aan de spelers kan op 5cm nauwkeurig bepaald worden of iemand buitenspel staat of niet. De scheidsrechter krijgt via een oortje een geluidssignaal binnen dat hem helpt beslissen.

+ RFID wordt in dit geval gebruikt om menselijke tekortkomingen op te vangen. Een menselijke scheidsrechter of grensrechter kan fouten maken. Dit systeem helpt hem daarbij.
- Er wordt gezegd 'computers maken geen fouten' maar zolang dit systeem niet 100% waterdicht is zal het alleen als hulpmiddel gebruikt kunnen worden. Dit betekent dat de wel/niet buitenspel discussies nog steeds niet zullen verdwijnen.

http://www.we-make-money-not-art.com/archives/006671.php

50. Koeienidentificatie met RFID om misbruik te voorkomen

Koeien vormen een verkeersprobleem. Zodra er een gevonden is kan hij worden teruggebracht voor een beloning. De koe wordt dan aan een nieuwe eigenaar verkocht. Om misbruik (dezelfde koe steeds als gevonden brengen) te voorkomen krijgt de koe een RFID chip in zijn buik. Alleen koeien die geen eigenaar hebben komen in aanmerking voor een beloning.

+ Geen gedrag- of locatiebepaling maar puur identificatie van de koe.
- Het systeem biedt meer mogelijkheden maar deze worden niet in het voorbeeld genoemd. Teruggebrachte koeien met RFID chip zouden bijvoorbeeld kunnen aantonen welke eigenaar veel koeien kwijtraakt.

http://www.we-make-money-not-art.com/archives/006723.php

51. Een netwerk van kleding met RFID

Zendende en ontvangende RFID tags in kleding communiceren met elkaar en creëren zo een netwerk waarin ondermeer ontwerpen kunnen worden uitgewisseld. De kleding laat de ontwerpen zien doordat het zijn eigen uiterlijk kan aanpassen.

+ Objecten praten met elkaar in plaats van met een 'server'. Many-to-many in plaats van one-to-many.
+ In plaats van een onzichtbaar netwerk van informatie dat je met je meedraagt wordt een zichtbaar (kleding) netwerk gecreëerd.

http://www.we-make-money-not-art.com/archives/006867.php

52. Display en RFID tag zonder batterijen

Een standalone display met RFID tag die beide hun energie uit een elektrische veld halen.

+ Directe informatie is te benaderen zonder interface en zonder afhankelijk te zijn van acculading.
+ Omdat het apparaat geen interface heeft biedt het veel vrijheid om interactie te creëren die gebaseerd is op de manier waarop het apparaat bij readers wordt gehouden.
+ Het object zou als datadrager kunnen dienen waarbij de

display een visualisatie geeft van waar de RFID tag naar verwijst.

http://www.we-make-money-not-art.com/archives/007057.php

52. Audioperformance met RFID objecten

Objecten met een RFID tag activeren geluidsfragmenten zodra ze bij een reader worden gehouden.

+ In plaats van hele tracks worden alleen losse geluiden afgespeeld. De objecten met RFID tag kunnen dus gecombineerd worden om een muziekstuk te 'componeren'.

http://www.we-make-money-not-art.com/archives/007098.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/008466.php

53. RFID magneetbord als interface van telefoon

Magneetjes met RFID tags erin stellen contactpersonen voor. Zodra ze in bepaalde gebieden op het magneetbord worden gezet wordt de daarbij horende actie uitgevoerd. Zo is er een gebied om een nummer te wijzigen, een gebied om berichten van die persoon te beluisteren en een gebied om die persoon op te bellen. Door meerdere personen in het bel-gebied te plaatsen kunnen er conference-calls gemaakt worden.

+ RFID tags in magneten. Dingen kunnen opgehangen worden in plaats van ze op een bepaalde plek te leggen.
+ Een fysieke gebruikersinterface die doormiddel van combinaties van tags op verschillende velden een intuïtieve navigatie creëert.
+ Visueel is direct duidelijk wat er met elk contactpersoon gedaan wordt.

http://www.we-make-money-not-art.com/archives/007116.php

54. Alomtegenwoordige stad

Een Koreaanse stad als testbed voor een situatie waar alle informatiesystemen met elkaar in contact staan. De pas die de voordeur van je huis opent wordt ook gebruikt om de parkeermeter te betalen en om naar de film te gaan. De pas is anoniem en zodra je hem verliest kun je een vervangende pas aanvragen.

+ Zodra informatiesystemen met elkaar kunnen communiceren kan dit extra comfort voor de gebruiker opleveren. Zo scheelt de pas behoorlijk in sleutels en betalingsmiddelen.
- Er wordt geopperd dat het systeem anoniem is en niet aan je identiteit wordt gelinkt. Toch zullen de verschillende levenspatronen identiteiten vormen die dan geen naam hebben maar wel jouw persoon voorstellen. Een nieuwe pas zal snel hetzelfde patroon opleveren en kan dus simpelweg gelinkt worden aan jouw vorige identiteit.

http://www.we-make-money-not-art.com/archives/007153.php

55. RFID handbewegingsarmband met productinformatie

Een armband met RFID reader die zodra een object wordt opgepakt hier informatie over opzoekt. Zodra er informatie beschikbaar is krijgt de gebruiker dit te horen en kan hij door bepaalde handbewegingen te maken het geluidsfragment over het object laten afspelen.

+ Productinformatie zoals al eerder te zien was op horloges en telefoons maar nu op een toetsenloze en schermloze manier. De interactie heeft zich dus verplaatst van het apparaat naar het vastgehouden object.
+ Slechtzienden kunnen dit product ook gebruiken.
- In tegenstelling tot tekstuele informatie is informatie in de vorm van een geluidsfragment is niet snel op informatie te doorzoeken.

http://www.we-make-money-not-art.com/archives/007240.php

56. RFID tag blocker

Een broekzak gemaakt van een stof die geen radiosignalen doorlaat. Deze 'Kooi van Faraday' moet gebruikers beschermen tegen ongewenste uitzending van RFID tags in hun eigendommen.

+ Tags worden tijdelijk uitgeschakeld en niet kapotgemaakt. De objecten kunnen nog gebruikt worden. Bijvoorbeeld handig voor objecten die dienen als sleutel of betalingsmiddel.

http://www.we-make-money-not-art.com/archives/007153.php

57. Groeicontrole voor planten op basis van RFID

Gebruikers met een RFID tag worden geassocieerd aan een groeisysteem voor een plant. Hoe vaker de specifieke ID langskomt hoe beter de plant met water en licht (van LED's) wordt verzorgd. Komt een gebruiker niet zo vaak dan zal de plant slechter groeien.

+ De plant is de metafoor van de relatie met de persoon waar de plant bij hoort. Zodra de plant dreigt dood te gaan is goed te zien hoe de relatie met de persoon verwaarloosd. Relaties van mensen worden uitgebeeld met het leven van een plant.
- Het gebruik van RFID gaat niet verder dan de identificatie van een persoon. Er wordt verder niets met de RFID chip gedaan.

http://www.we-make-money-not-art.com/archives/007249.php

58. Fysiek en grafische interface met doorzichtige RFID tegels

Doorzichtige tegeltjes met een RFID tag kunnen op een TFT scherm met een speciaal raster gelegd worden. Door de tegeltjes heen wordt per tegeltje een grafische interface afgebeeld. De tegeltjes hebben verschillende functies. Zo zijn er applicaties-tegels, portal-tegels (stellen o.a. objecten uit de fysieke wereld voor), parameter-tegels, container-tegels en remote-tegels. Sommige tegels hebben een kleine opdruk, andere hebben groeven om de

gebruiker te geleiden. Deze tegels kunnen gecombineerd worden en creëren zo een gebruikersinterface waarbij de tegels elkaar kunnen manipuleren of besturen. De gebruiker maakt hierbij gebruik van een drukgevoelige pen.

+ Het beste van twee werelden: een fysieke interface die houvast geeft met de flexibiliteit van een grafische gebruikers interface.
- Zodra de tegels van het scherm afgehaald worden is minder duidelijk wat ze voorstellen. Er staat tekst op de tegels maar bij bijvoorbeeld een container-tegel is niet te zien wat het bevat. Een combinatie met de accu-loze display zou daar weer erg goed werken.

http://www.we-make-money-not-art.com/archives/007291.php

59. Winkelmandje met virtuele RFID producten

In plaats van de fysieke objecten in het mandje te stoppen bij het winkelen worden kubussen met een hologram van het fysieke object gepakt. Deze kubussen bevatten een RFID tag. Bij de kassa wordt het fysieke object verkregen.

+ Virtuele objecten worden ingeruild voor hun door RFID aangeduide fysieke versie.
+ De virtuele objecten kunnen bekeken worden maar diefstal is onaantrekkelijk.

http://www.we-make-money-not-art.com/archives/007333.php

60. RFID op bezoekers winkelcentrum

Visualisatie van het idee dat medewerkers bewakingscamera's in de gaten zouden kunnen houden waarop direct te zien is wat de mensen aan spullen bij zich hebben doordat de RFID tags die ze bij zich hebben automatisch worden uitgelezen.

+ Er is veel informatie te verkrijgen over de bezoekers.
- Het totale gedrag van mensen kan in de gaten gehouden worden. Hun eetgedrag of rookgedrag zou kunnen leiden tot maatregelen van de ziektekostenverzekeraar. Ernstige privacyschendig.

http://www.we-make-money-not-art.com/archives/007371.php

61. Voetstappen vastleggen met RFID

Er bevinden zich RFID tags in de zool van slippers waarmee gebruikers lopen over een vloer met RFID readers erin. Deze RFID readers geven het systeem door waar bepaalde gebruikers lopen en kunnen zo de verschillende patronen waarin gelopen wordt vastleggen. Daarnaast wordt er direct feedback gegeven met een lamp.

+ Niet alleen de locatie van de gebruiker is bekend maar zelfs waar hij zijn voeten plaatst. Met de informatie over timing en afstand is het loopgedrag van gebruikers vast te leggen en ook te herkennen.
+ De visuele feedback die de gebruiker krijgt doormiddel van projecties op de vloer kan visueel aantrekkelijk zijn.
- Het aantal RFID lezers zorgt voor de nauwkeurigheid waarmee bepaald kan worden waar de stappen gezet worden. De afstand tot een lezer is niet te bepalen. De tag is binnen bereik of niet.

http://www.we-make-money-not-art.com/archives/007399.php

62. Televisiepersonalisatie via RFID afstandsbediening

Gebruikers hebben RFID tags bij zich die bij het gebruik van de afstandsbediening met reader uitgelezen worden. De persoon

+ Gebruiksgemak ontstaat doordat persoonlijke voorkeuren automatisch herkent worden.
- Zodra de televisie weet wie erachter zit kan ook zijn kijkgedrag worden vastgelegd en kan hierop ingesprongen worden. Privacygevoelig.

http://www.we-make-money-not-art.com/archives/007503.php

63. Unieke ervaring van spel met RFID

Een groot gebouw stelt een groot spel voor. In dat spel kunnen de spelers geïdentificeerd worden door RFID. Ook wordt hun locatie bepaald. Puzzles die je oplost en spellen die je speelt zorgen ervoor dat alleen voor jou de toegang tot bepaalde gebieden wordt vrijgegeven. In het spel kan zo door meerdere gebruikers gespeeld worden.

+ Meerdere gebruikers kunnen gebruikmaken van dezelfde 'applicatie' doordat het systeem de vorderingen van iedere speler bijhoudt.

http://www.we-make-money-not-art.com/archives/007604.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/007855.php

64. RFID Pacman in de fysieke wereld

Een spel in de fysieke wereld. Iemand speelt pacman en moet 'pillen' pakken door met zijn telefoon met RFID reader gele borden met RFID tags aan te raken. Ondertussen wordt hij door spelers die als spook meedoen achternagezeten. De spoken kunnen pacman 'opeten' door de RFID tag op zijn rug aan te raken met hun telefoon. Iedere keer als pacman of een spook een pil aanraakt worden de locaties geupdate.

+ Een digitaal spel in de fysieke wereld. RFID tags stellen in dit geval objecten en personen voor. Personen kunnen objecten aanraken maar personen kunnen ook andere personen aanraken.
+ Deze vorm van locatiebepaling laat eigenlijk goed zien hoe gebrekkig locatiebepaling soms kan zijn. Pacman of de spoken kunnen overal rondlopen maar pacman moet de pillen aanraken om het spel te spelen. De spoken moeten om pacman te vinden ook de pillen aanraken wat er direct voor zorgt dat ook pacman op de hoogte is van waar de spoken zich bevinden. Dat in tegenstelling tot GPS niet precies bekend is waar de personen zich bevinden is in dit geval juist positief.

http://www.we-make-money-not-art.com/archives/007619.php

65. Automatisering kookproces met RFID recepten

Receptenkaartjes met RFID tags vertellen een kookplaat met RFID lezer hoe hij om moet gaan met het gerecht in de pan. Op deze manier kan het hele proces van verwarmen en afkoelen automatisch in de hand gehouden worden.

+ RFID identificeert in dit geval het recept en roept een voorgeprogrammeerd kookprogramma aan. Omdat de receptenkaart ook een foto en een omschrijving bevat is dit stukken makkelijker dan een voorgeprogrammeerd nummer te kiezen.

http://www.we-make-money-not-art.com/archives/007845.php

66. Narratief met RFID over oplossen moord

In de grond zijn RFID tags geplaatst die gelezen worden door 3 karretjes met video panels. De tags op de grond laten aanwijzingen op de videoschermen zien. De 3 panels moeten samen op de goede plek gezet worden zodat de scènes getoond worden waarmee het mysterie opgelost kan worden. Omdat de panels steeds verplaatst worden verandert ook de ruimte waarin de gebruikers zich bevinden. Alle scènes spelen zich af in dezelfde woonkamer maar op een ander tijdstip van de dag. Bij iedere scène is een andere combinatie van 3 aanwijzingen nodig om verder te komen. Daarnaast is er feedback via geluidsfragmenten en licht op de panels.

+ Zeer complexe puzzel in de fysieke ruimte.

+ RFID wordt gebruikt om een abstracte maar fysieke ruimte in gedachten om te zetten in de virtuele ruimte van het narratief.

- Het spel zou complexer gemaakt kunnen worden door de aanwijzingen onderling te verwisselen in de loop van het spel. Of dat bij dit project past is een tweede.

http://www.we-make-money-not-art.com/archives/004483.php

67. RFID robotassistentie in winkels

Een robot met ingebouwde RFID reader die in verschillende winkels kan helpen met het dragen van boodschappen en het geven van productinformatie. De robot navigeert door de winkel door RFID tags in de vloer af te tasten. Daarnaast is er de mogelijkheid om spullen veilig in de robot op te bergen. Alleen geregistreerde gebruikers kunnen gebruik maken van de robot.

+ Het zijn niet de mensen die RFID tags gebruiken om te navigeren maar robots die zich automatisch door de winkel kunnen rijden.

http://www.we-make-money-not-art.com/archives/008019.php

68. RFID als keurmerk

Een RFID tag in een vis om de herkomst vast te leggen.

+ RFID wordt gebruikt als keurmerk. Consumenten kunnen de herkomst van een product bepalen. Diefstal wordt voorkomen.

http://www.we-make-money-not-art.com/archives/002595.php

Gelijkende projecten:

http://www.we-make-money-not-art.com/archives/008084.php

69. In kaart brengen van beweging met RFID

Een RFID treinpas die gebruikt wordt om in- en uit te checken legt vast op welke plaatsen ze geweest is. De informatie op de pas kan gebruikt worden om te visualiseren waar de pas is geweest. Zo kan er een kaart gemaakt worden

+ Het in kaart brengen van beweging met RFID. Door gegevens van meerdere passen te gebruiken kan ook een visualisatie gemaakt worden van de beweging van een massa.

http://www.we-make-money-not-art.com/archives/008164.php

70. Aandacht opmerken door RFID

Alle gebruikers krijgen een RFID tag waarmee ze bij het kijken naar verschillende video's kunnen zwaaien als ze de video aandacht willen geven. De video's die minder aandacht krijgen zullen aandachtvragende filmpjes afspelen,

+ Een geavanceerde versie van Radúz Çinçera's Kinoautomat waarbij de mening van het publiek wordt gepeild. In dit geval wordt niet gevraagd een keuze te maken maar wordt gevraagd aan te geven dat je aandacht schenkt.

+ Met de RFID kaart wordt het menselijke proces van aandacht schenken omgezet worden naar een digitaal proces.

- De aandacht van de persoon kan niet zo makkelijk worden omgezet als het de bedoeling is dat de persoon zelf aangeeft wanneer hij iets aandacht schenkt. Hij kan ook bewust of onbewust iets anders aandacht schenken en dan vergeten de aandachtskaart te gebruiken. Het systeem is in die zin dus meer gebaseerd op beloning.

http://www.we-make-money-not-art.com/archives/008372.php

71. Componeren door gebruik RFID

Gebruikmakend van feedbackgeluiden die bepaalde op RFID gebaseerde systemen geven kan door herhaaldelijk gebruik in een bepaald ritme een muziekstuk gecomponeerd worden. In tegenstelling tot RFID systemen gebaseerd op samples die aan bepaalde RFID-tags gekoppeld zijn is in dit geval de RFID tag niet bedoeld om geluid te maken maar kan het wel zo gebruikt worden.

+ Onconventioneel gebruik van feedback geluiden van systeem met een totaal ander doel dan muziek maken.

http://www.we-make-money-not-art.com/archives/008386.php


thing:
189THS
www.thinglink.org