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The Human Interactive Mobile Utilization by Touching Technology- A Simplified View

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Abstract

The numerous technologies are evolving in the world which can make life easier. Near Field Communication is also a one offers tremendous potential, not only because it can be rolled out for mass adoption but also makes the life simpler. This document provides background on NFC including an explanation of what the technology can achieve, how it works and how it can be implemented and integrated by SOC techniques and where it to be used.

Keywords: Near Field Communication; System on Chip; Integration.

Abbreviations: NFC - Near Field communication; RFID - Radio Frequency Identification; SoC - System on Chip.

Introduction

NFC is a short range wireless technology that allows communications to take place between devices that either touch or are momentarily held close together. NFC is an open platform technology and was approved as an ISO/IEC global standard (Fig.1). The technology works via magnetic field induction and operates on an unlicensed radio frequency band (NFC forum). "Tags" are embedded within devices (these could be mobile devices such as mobile phones or PDAs, or NFC stations such as ticket barriers or cash registers). NFC enables devices that are held together to share information either in one direction or both. NFC is based on Radio Frequency Identification (RFID) technology. NFC is an important technology for a number of reasons (Fig.2):

Fig. 1. NFC Features

Reach and availability

NFC has the potential over time to be integrated into every mobile handset in the world. This would give the technology a potential reach as global as the mobile phone itself. By integrating NFC technology into a mobile handset, users could gain access to a number of new services via their phone.

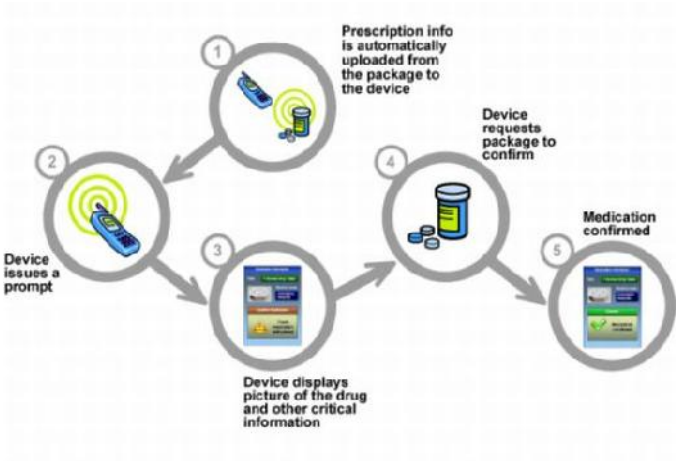

Fig.2. Monitoring through NFC

Variety of use

NFC can be used for a number of tasks, from payment for goods to ticketing and from pairing devices to sharing information or discovering new services.

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Ease of use

Because NFC only requires that two devices touch in order to communicate, NFC can simplify many tasks, from opening a web browser on a mobile phone to pairing two Bluetooth devices automatically to accessing wireless hotspots simply and easily.

Security

NFC requires a user to actively wave or hold their mobile device against another device or NFC station to activate a service or to share information. In so doing, the technology requires the user to make a positive action to confirm the transaction or exchange. In addition it is possible to build multiple levels of security into an NFC enabled device.

Value added services

NFC enables users to access value added services that would otherwise be unavailable with a traditional ticket or payment card. Just as users of prepay mobile services are able to access their current credit balance through the phone's menu system, so users of an NFC enabled phone will be able to access similar information through their device. Furthermore, NFC enabled devices could access the mobile network to add credit to the device when it runs out or is low, or alternatively on a set date each week or month.

Infrastructure

NFC is compatible with the current contactless infrastructure used as a platform for ticketing, transportation, and increasingly payment, across the world (Fig.3). NFC mobile devices could easily be made compatible with the major transport systems world-wide that use contactless access to services, for example those based on the MIFARE system (In the works). It is also compatible with the increasingly popular "wave to pay" credit and debit cards that are being rolled out in many countries. The roll out of NFC to existing contactless environments is straight forward. Users know how the system works and much of the infrastructure is in place already. The roll out of NFC is an extension to services that already exist, but enhanced with the additional element of a mobile phone's user interface and a connection to the internet.

Fig.3. Using NFC Enabled device as a debit/credit card

How NFC should be implemented

Integration

Moving to System on Chip (SoC) integration Near Field Communication

The success of Near Field Communication across a broad range of applications depends on its large-scale adoption by enterprises and consumers. This implies the need for simple, low-cost implementation of the technology in a wide variety of devices, from mobile phones and laptops to point-of-sale terminals and ticket machines. One way NFC technology can be integrated cost-effectively in mass-market electronic devices is through System on Chip (SoC) implementation (Integration Innovision Research and Technology, 2009) in other common chipsets, including those for Bluetooth, WiFi and UWB. In high-volume products, SoC implementation of NFC offers significant unit-cost savings and very efficient integration, with lower overall space, processing and power requirements – while adding great value.

Integration is an established 'fact of life' in the consumer electronics product lifecycle. In consumer electronic devices, integration of new technologies follows a well-trodden path. When a new technology comes along, the first products might be external devices that can be connected via

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a cable to, say, a PC, digital camera or mobile phone. Next there are card accessories that can be plugged into the PC or phone. Then comes a chipset that sits on the motherboard. And finally there could be even closer integration of the technology with other functionality on the motherboard, where this makes technical and economic sense. Technologies undergo a similar process of integration within the devices themselves, of course. Initially, however, the different RF parts were implemented as separate blocks, as digital logic and RF technology were developing at different rates, and market demand for the different combinations of RF bands was not well established. Today, RF design and market acceptance have moved on to the point where the RF part is common for all frequencies, and even the previously separate antennas for the different bands have become integrated into one planar design.

As with other technologies, NFC is going through a classic integration process. The first prototype implementations of NFC in mobile phones were as cover units that clipped on to the back of the phone – analogous to a plug-in line card. While these devices were useful for accessing and testing the market for NFC-enabled mobile phones, they were unlikely to take off as a mass-market consumer product, as the NFC covers cost about the same for 10,000 units as complete phones cost for 10 million units (Integration Innovation Research and Technology, 2009). Now, as NFC moves to the next level of integration, designers have the choice of developing NFC chipsets to sit on electronic device motherboards, or moving to SoC implementations. The benefit of greater integration is a significant cost benefit in high-volume production, which should more than cover the up-front design and development costs.

Implementations in Many Fields

Medical Field

A promising approach to establish an interactive link between patients and their caregiver is the utilization of mobile phones, because of their absolute mobility and ubiquitous availability. Powerful computing capabilities and the ability to access web-based systems render them applicable to act as patient terminal to transmit health status information and receive feedback, alerts, and reminders.

Using mobile phones enabled with near field communication (NFC) technology goes one step further. NFC is a wireless connectivity technology evolving from a combination of contactless identification and networking technologies, that enables convenient short-range communication between electronic devices, contactless smartcards, and RFID tags. It offers the ultimate in convenience for connecting all types of consumer devices and enables rapid and easy communications just by bringing them close together. This intuitive and touch based communication technology in combination with the mobile phone's features enhances this handheld device to a powerful e-Health toolbox (Morak, 2008).

The NFC enabled mobile phone acts as an intuitive and secure gateway between the patients' surrounding and the connected world. Just by touching NFC enabled medical devices or RFID tagged items all of the patient's relevant health parameters can be acquired and relayed without the need of further user interaction. NFC communication module, JAVA software for mobile phones and a corresponding web-based tele-monitoring service had been developed. Medical devices like blood pressure cuffs and weight scales were equipped with the NFC module to enable read out the data from those devices by means of mobile phones with NFC capabilities. The software running on the mobile phone additionally supports recording of non-measurable parameters like intake of medication, physical activity, and wellbeing by timely reading the static content from passive RFID tags. NFC can be used in a number of ways. Some of the most compelling applications are outlined below.

Ticketing and Payment

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Many major cities around the world use contactless payment systems within the transport infrastructure. These systems rely on Radio Frequency Identification (RFID) (Ernst Haselstiner, 2011) smart cards to provide access to transport services and tenable quick and convenient payment. Typically, a user purchases a plastic card with a certain monetary value embedded on a chip within the card (Fig.4). As the user accesses the public transport system, the cost of the ticket is taken from the card, leaving a new card balance. Once the card has no value, the user can either discard it or "top up" the balance by adding more money to the card to enable further journeys (Fig.5).

Fig.4. NFC Enabled device to purchase things

Fig.5. NFC device for withdrawal

This approach has great benefits in terms of ease of use and speed of access to transport systems. There is no need for users to purchase a card every day. Access to online top ups and monthly access fees also ensure less queuing at ticketing booths and the need for less staff. By replacing a smart card with a NFC enabled mobile device, users can access all of the services they have with a smart card, with the added functionality of a user interface providing additional information, as well as access via the mobile network to online top up facilities at the touch of a button. The phone could also use current mobile network technology to access the latest traffic information (such as when trains are delayed or cancelled) or mapping information (Ernst Haselstiner, 2011).Users of an NFC enabled mobile device are not necessarily limited to topping up a card. It is possible to add a credit card element to an NFC device, enabling the user to "wave to pay" at any compatible station or retail outlet. It is also possible to add multiple separate credit or debit cards to an NFC mobile device. In this scenario, the mobile device becomes a "virtual wallet" (Wall street journal blog, 2011), carrying a number of different cards, some credit, some debit, some loyalty, within the device (Fig.6).

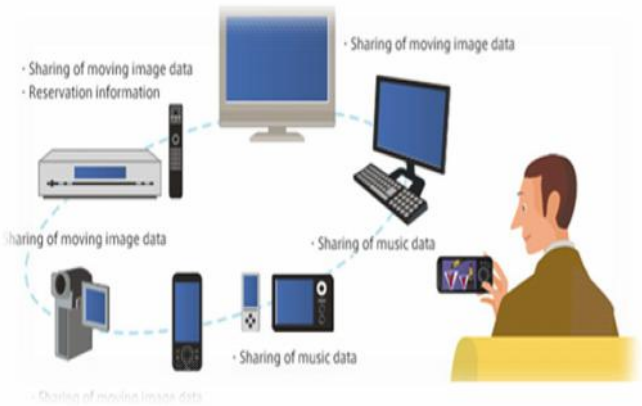

Fig.6. Easy usage over many devices

Touch To Pair/Share

A further application for NFC takes advantage of the data sharing capability to enable the simple and seamless transfer of data from one device to another, simply by touching the devices together. A number of activities associated with the transfer of

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data between devices require some degree of user interaction to set up. For example, many Bluetooth devices require a "pairing" process to take place before the devices can be used together. Whilst this is relatively straight forward, the functionality may not be immediately accessible within the menu system and the pairing process can be an inhibitor to using the technology (NFC world, 2010).The most up to date core specification for the Bluetooth standard includes the capability to pair devices via NFC. Simply put, the whole process of activating Bluetooth on both sides, searching, waiting, pairing and authorisation on both sides can be replaced by touching the two devices together. This provides the user with a simple and engaging way to link Bluetooth enabled devices. In a similar manner, users of NFC could "touch to access" a wireless LAN hotspot. Instead of the lengthy process of searching for a hotspot, accessing it and paying for use, a user could simply touch an NFC compatible wireless LAN point and the whole process could be automated, including the payment of any cost from the "virtual wallet" on the device.NFC can enable an environment where people can touch devices to share business cards, touch to download their photographs to a printer, or touch to share their music with a friend.

Furthermore, the NFC enabled mobile device could be used to receive information or a promotion from an advertisement. By embedding an NFC chip within a billboard advertisement or beside a product on the shelf of a retail store, users could touch to receive additional information. For example, an advertisement for a new record could allow users to touch to receive the track listings, download a free ringtone, or access the artist's mobile internet site. The NFC technology has the potential to significantly impact the marketing and promotions industry, since by touching to receive information the user is proactively taking an interest in a product or service. By sharing information both ways, the marketer can offer users an incentive in exchange for information or interest in a product or service.

Identity Management / Business Processes

Almost every office or factory based worker is required to carry an identity tag to access working premises. As businesses become more complex and global in nature, many workers require access to multiple premises. Managing this process can be complicated, even more so in environments where there are different levels of security for different workers. NFC can allow identity management to be added to a mobile device, providing one single integrated solution for identity management. The mobile device can be used to provide access to certain premises and, of course, deny access to others. Importantly, access can be upgraded over the mobile or wireless network, meaning workers are not required to physically visit a site to change their user profile. A further related application would be relevant anywhere that people are required to perform multiple tasks within a busy organization. For example, a care worker that makes a number of home visits during a working day may "touch to inform" (NFC world, 2010) that a particular visit has been completed. The worker can then be assigned a new task based on what is most urgent or where the professional is located at that time. A security guard could touch on entering and exiting a room, providing a digital footpath of his movements during a patrol. A courier could touch on delivery of a parcel to receive local traffic information and directions to the next collection point.

Key factors for the success of NFC

The success of NFC depends upon the creation of a complex yet interoperable environment, supported by a number of different parties (Fig.7). First, there needs to be mobile devices that support the system. This relies on mobile handset manufacturers producing NFC-compatible devices. These will also need to come from different vendors, offering the market choice and differentiation. The first NFC compatible mobile devices are now available on the market. Mobile network operators will also need to support NFC. Access to additional data services, and the potential revenues that these could bring through the mobile network, is a critical value add of NFC and the

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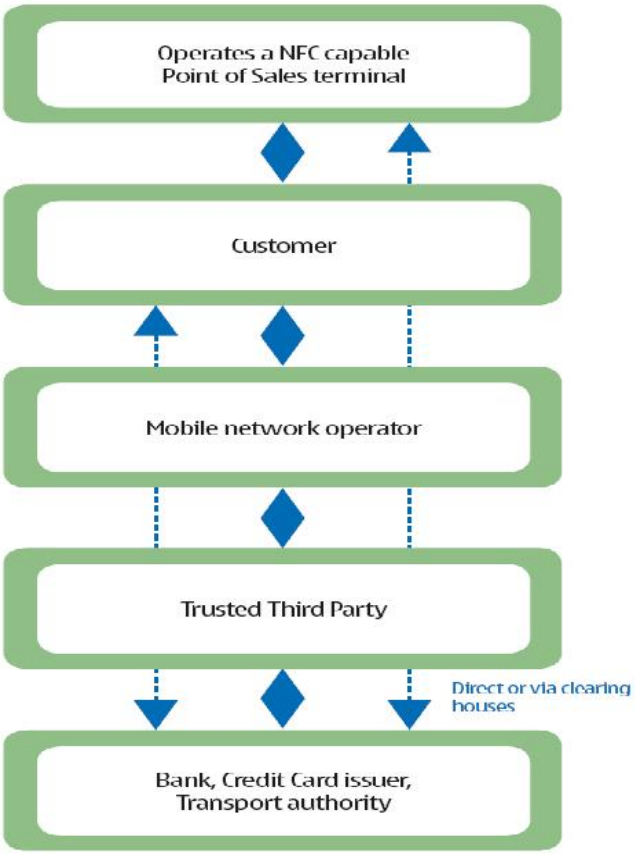

Fig. 7. Work flow of NFC device

support of the mobile operator community is required to facilitate this. Banks and credit card companies, along with transport operators will also need to engage with NFC. Delivering a required high level of perceived and real security will be essential to the success of NFC and the banks and credit companies have a critical role to play, ensuring the roll out of payment services to NFC devices. Retailers, from shops to restaurants, and from newsagents to coffee shops will need to support and enhance their current offerings with an NFC element.

In much the same way as the development of chip and PIN solutions led to the roll out of new hardware in retail, so the development of NFC will facilitate new retail hardware. Retailers will require "touch pads" to facilitate "wave to pay/touch to pay" solutions. Whilst this may seem like a significant investment for retailers, many are already rolling out NFC compatible technology to support payment through transportation cards or the new generation of "wave to pay" credit and debit cards. NFC is an extension of this technology, compatible with the current standards and offering customers further choices as to how to pay. Of course, the roll out of NFC technology within retail is likely to take place over time. Retailers near public transport stations may be early adopters of the technology to provide a service to their customers that are already using contactless solutions for transport. As mass adoption takes place, with increasing numbers of devices commercially available, the roll out of NFC to retail outlets will become ubiquitous. Finally, the developer community is also critically important to the development of NFC. An active developer community with the right tools in place to quickly and effectively bring new solutions to market can add impetus to the technology and offer easily accessible NFC applications to end users.

Security

Security is a critical requirement for NFC payment and ticketing and as such, it is important to understand the security within an NFC enabled environment. Mobile phones tend to come equipped with pass code that can be activated by the user. Whilst many users activate these to secure their phone, an NFC enabled mobile device, especially one that could incorporate a number of credit and debit cards, needs to have a higher level of security to reassure the user against misuse.

Inherently, NFC technology is built with a high level of security. Users can activate several options in order to store their data in a secure environment. A user can set a financial limit beyond which a pass code is required to authorise payment, or a user can also arrange for the mobile wallet element of the phone to be switched on for only, say two minutes at a time. This allows the user to make a purchase and then be sure the device is deactivated shortly afterwards. By transferring cash from one element of the device to another (ie from a credit card application to a "cash in wallet" type application), a user would also be able to limit the amount of risk associated with losing a phone to a

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relatively small amount. Further credit card and/or debit card applications could be activated only with a user pass code. Beyond user created and user defined security measures, there is an extremely high level of security built into an NFC wallet or payment application. An NFC enabled credit/debit card or ticketing application is held within a secure element of the mobile device. Using the same technology as chip and PIN cards, this secure element is certified and supported by the payment industry, providing as high a level of assurance to the end user as a traditional credit card. The secure element can either be held on a chip within the mobile phone, or on the SIM card or a memory card device. Potentially, there could even be a secure element on both the SIM card and the phone. This would ensure that the right phone and SIM card were used for any transaction, adding a further level of security. Finally, unlike a lost wallet, a mobile phone regularly communicates with the mobile network to enable it to function. At any given point, the mobile network will know where a phone is with a degree of accuracy. What is more, a phone can be disabled over the air within moments, moving the whole credit card to a new device (Ernst Haselstiner, 2011). Added together, these measures provide a far more comprehensive level of security than is available with most credit or debit cards (including the current generation of contactless payment and transport cards) that might sit in a wallet or home. The measure of confidence provided by these security elements is evident by the interest and involvement of industry standards like VISA and master card**.**

Conclusion

Thus the paper presented a new and improved increasing wireless communication technology NFC. The key features provides unique advantages over other available wireless technologies and the integration part provides how it adds advantage to the current technologies.NFC makes the life easier in day to day activities and plays a vital role in Medical field, economically as well. The enhanced security will make NFC enabled device to utilize all over the world.

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