Tourist Applications Made Easier Using Near Field Communication

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INTRODUCTION

Near field communication (NFC) is a new wireless connectivity technology that enables short-range communication between electronic devices. The operation of NFC is intuitive, making it easy for consumers to use. With built-in security, it has great potential for payment and financial applications. However, NFC is a relatively new technology and the related industries are still brainstorming for extensive applications to make it more marketable. Hence, the aim of our research is to design and build a working prototype for tourists using NFC and smart card.

Undoubtedly, photo-taking is an integral part of every tourist's holiday. However, it is noticed that pictures alone are often incomplete. People hardly remember the details of the places they have visited and find it a hassle to keep records of the attractions. Hence, it is more meaningful if digital photos have short descriptions attached with little effort. Another observation is that although it is often cheaper for tourists to purchase tour packages, it is a hassle to keep track of several tickets. Such inconvenience can be reduced with a single device that is able to store tickets electronically.

With the above observation in mind, we propose an NFC system (*HolidayPaL*) that would benefit tourists so that they have more memorable holidays. Firstly, NFC tags will be placed at each attraction, storing relevant snippets of site descriptions. The tourists can then use their NFC-enabled cameras to input the descriptions, which will then be attached to relevant photos. Personal comments can be added later as well. Tourists can subsequently view the photos and captions using some photo-album software. These captions give tourists better understanding and more vivid memory of the heritage and culture of the places visited. Another feature of the proposed application is to use NFC devices to store electronic tickets. Tourists can purchase a package over the counter and transfer it to their handheld devices via NFC. Subsequently, they can just tap their NFC devices at the entrance of each attraction to gain admission.

The proposed NFC application will benefit three groups of people: individual tourists, the tourism industry, and digital camera manufacturers.

BACKGROUND

Radio Frequency Identification

Radio frequency identification (RFID) is useful in storing and retrieving data through Electromagnetic (EM) transmission to a RF compatible integrated circuit. A RFID tag is a device that can be attached to or embedded inside a product for the purpose of identification using radio waves.

The RFID technology can be subdivided into two categories, namely the Near Field Communication (NFC) (Ortiz, 2006) and Far Field Communication (Capps, 2001). Near Field Communication Technology was jointly developed by Philips and Sony and was approved as an ECMA standard (ECMA-340) and an ISO/IEC standard (ISO/IEC 18092). The near field systems use magnetic coupling. In contrast, the far field system requires EM waves to be sent into free space and then captured by the tag's antenna.

Near Field Communication

NFC devices can function as an initiator or a target. The initiator sends out a communication request, while the target receives that request and starts the communication. NFC has two modes of transmission, namely the active mode and the passive mode. In the active mode, both the initiator and target generate a RF signal to transmit data. In the passive mode, only the initiator generates the RF field. The target uses power from the RF generated by the initiator's coil to transmit back the answer. Hence, passive communication consumes less power and is more suitable for this research work.

Mifare® Card

Mifare® is the industry standard for contactless and dual interface smart card schemes. It operates passively at 13.56MHz with a range of 0.1m and has a data transfer rate of 160kbps. The Mifare® 1K card used in this work has 1024 x 8 bits of EEPROM memory, organized into 16 sectors with 4 blocks of 16 bytes each. Each sector consists of 3 data blocks and 1 sector trailer. Each sector trailer consists of 2 secret keys and access bits, which are used to specify access rights to each block in that sector. Secure communication is also ensured with a three-pass authentication protocol.

RELATED WORK

- **Information reader:** NFC devices can be used to access information on products, services, and events from smart posters containing virtual bookmarks (Philips Semiconductors, 2005). This allows effective advertising. The proposed application in this work taps on this convenient feature of NFC to read information from smart posters effortlessly. Short descriptions can be stored in such smart posters at a tourist attraction and subsequently read by the tourists' NFC devices. In comparison, instead of simply reading information, our proposed application also takes the extra step of attaching these captions to related photos, adding meaning to the photos taken.
- **End-to-end transactions:** Philips, one of the codevelopers of NFC, envisions the use of NFC in mobile payment schemes (Harold, 2005) and end-to-end transactions. In Germany, the Association

of German Transport Undertaking implemented an Electronic Fare Management system (VDV), which provides for an interoperable electronic multiple journey ticket. However, such interoperability across different transport operators calls for an individual application, to which more than one operator has access and coordination of data. Hence, the encoding process used for secure access must be standardized (Ackermann, 2005). VDV can be used as a reference for the proposed tourism-oriented e-Ticketing application. Issues such as interoperability and security are also relevant in this work. Different companies across the world need to follow the same protocol for e-ticket detection. As compared to the VDV application which stores a single ticket, our proposed application allows the storage of multiple tickets which will not interfere with one another. This gives the flexibility of storing different types of ticket, ranging from vouchers to lucky draw coupons, and even to electronic keys, in the same memory device.

- **Wireless connection enabler:** Although wireless communications such as Bluetooth and Wi-Fi are becoming popular, the network setup procedures are complex. Philips suggested using NFC to exchange setup information (Philips Semiconductors, 2005). Subsequent data transfer takes place over the Bluetooth or Wi-Fi connection established by NFC, allowing users to separate the two devices in communication and roam with them within a 30m range. Hence, although NFC is not suitable for large amounts of data transfer, it can complement Bluetooth or Wi-Fi for greater convenience. Indeed, such an application would be in line with our proposed system. Tourists can view their photos from their hotel-room large-screen televisions wirelessly.

HolidayPaL:
DESIGN AND IMPLEMENTATION

Hardware Requirements

Applications for the user/tourist reside on the tourist's handheld device. Such a handheld device must have camera and NFC capabilities, and memory space to store electronic tickets. For implementation purpose, an

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