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Near field communication technology in tourism

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ABSTRACT

Technological progress and tourism have been gone hand in hand for years. The use of mobile devices such as smart phones and tablet computers has increased at a phenomenal rate in recent years. With the increase in the number of mobile devices more and more devices will be supporting Near-Field Communication (NFC), which is a short range and wireless technology for data transfer without physical touch. NFC technology will open up new opportunities for various stakeholders in tourism from destination level to tourism researchers. In this article earlier research on NFC technology is reviewed and categorized into four different topics: business models and ecosystems, software and applications, security and hardware, and threats and issues. Current and potential applications of NFC in tourism are also reviewed using existing case studies. Also managerial contributions of the study are presented.

1. Introduction

In a technical sense Near-Field Communication (NFC) is a short range and wireless technology for data transfer without physical touch. The technology enables two-way interaction such as data exchange in electronic devices. Mobile devices can for example exchange pictures just by enabling NFC transfer and bringing two NFC capable devices close to each other. NFC devices can also read NFC tags, which are unpowered NFC chips that contain data. By reading a NFC tag a device can for example launch a pre-installed program or access a website link.

NFC was developed by Sony and Philips. Their joint venture aimed to standardize their Smart Cards Mifare (Philips) and FliCa (Sony). Smart Cards are used for electronic authentication and authorization. NFC is an open standard so it can be integrated into many electronic devices (Sony, 2002). On the consumer side the primary NFC device is a mobile phone or a tablet computer. In combination with NFC, the device will act as a smart-key to gain access to services from any other NFC device or tag.

According to Ricci (2011), mobile phones are becoming a primary platform for information access and a primary application area for mobile applications is tourism. Understanding the capabilities of mobile channel is of great importance (Ricci, 2011). Also Wang, Park, and Fesenmaier (2011, p. 1) state that "smartphones have the potential to significantly influence the touristic experience."

Buhalis and Law (2008) refer to Poon (1993) and Sheldon (1997) when saying that technological progress and tourism have gone hand in hand for years. Buhalis and Law (2008) also mention mobile and wireless technologies as one of the most interesting areas in technological innovation and tourism. NFC has been predicted to be one of the next big things in technological progress and it can potentially have a huge effect on both the tourism business and tourism research. Thus understanding the current state and future possibilities of NFC technology in tourism is important. NFC offers tourism many useful applications, deserving greater attention from tourism researchers and professionals.

According to Guttenber (2010), many relevant ICT developments are not made directly for the sake of tourism. However, these developments can have a great impact on tourism. Number of mobile devices such as smart phones and tablet computers is increasing and travelers are using these devices before the trip, during the trip and after the trip. More and more ways to use mobile devices in travel and tourism are developed continuously making the topic very important from tourism management perspective.

NFC technology can be regarded as one of the recent ICT developments that has huge potential for travel and tourism. In this study earlier research in NFC technology is reviewed to examine the potential of NFC technology from tourism management perspective. The current state of NFC technology usage in tourism companies is also investigated by studying examples from several tourism companies and organizations. This study provides researchers a review of earlier literature clarifying what has been researched regarded NFC technology and tourism managers ways to implement NFC technology in their tourism business.

This paper is structured into four parts after the introduction. First, NFC technology is defined and its advantages compared to other

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Table 1
Comparison of different wireless technologies (Dubey et al., 2011).

	NFC	RFID	IrDa	Bluetooth
Set-up time	<0.1 ms	<0.1 ms	0.5 sec	6 sec
Range	Up to 10 cm	Up to 3 m	Up to 5 m	Up to 30 m
Usability	Human centric	Item centric	Data centric	Data centric
	Easy, intuitive, fast	Easy	Easy	Medium
Selectivity	High, given, security	Partly given	Line of sight	Who are you?
Use cases	Pay, get access, share, initiate service, easy set up	Item tracking	Control and exchange data	Network for data exchange, headset
Consumer experience	Touch, wave, simply connect	Get information	Easy	Configuration needed

forms of data transfer discussed. Then, earlier research on NFC technology is examined through literature review. Third, potential of NFC technology for tourism industry is studied by examining some of the applications of NFC technology in tourism. Research paper are presented in chapter 3 whereas case studies are presented in chapter 4. Finally the results of this study are discussed in the last part of the study.

2. Definition and advantages of NFC technology

According to Ok, Coskun, Aydin, and Ozdenizci (2010), NFC is a short range wireless communication technology, which is evolved from Radio Frequency Identification (RFID). NFC enables convenient short-range communication between electronic devices. Dubey, Giri, and Sahere (2011) present a comparison table of different wireless technologies (Table 1). Compared to other technologies NFC has very fast set-up time and better usability, more use cases and better consumer experience. Madlmayr and Scharinger (2010) also compare NFC with Bluetooth, WiFi and RFID. According to them the advantage of NFC compared to Bluetooth and WiFi is the fast and automated connection. However, NFC could be used to set up a Bluetooth or WiFi connection automatically. In this sense NFC would serve as an enabler for Bluetooth or WiFi. The idea of NFC originates in Radio Frequency Identification (RFID) Technology. In contrast to RFID, where the focus is on identification, NFC is based on interaction.

According to Ok et al. (2010), there are three NFC Forum defined operating modes for NFC: Peer-to-Peer, Reader/Writer and Card emulation. They state that (p. 335): "In card-emulation mode the data is transferred from mobile-device to NFC-Reader; in reader/writer mode data is transferred is from NFC tag to mobile device or mobile device to NFC tag; and in peer-to-peer mode data is transferred between two NFC compatible devices." These three operating modes are also included in the study by Siira and Törmänen (2010) and can be found in the NFC-Forum website (http://www.nfc-forum.org/resources/faqs/, accessed 8.11.2011).

Csapodi and Nagy (2007) list some of the user benefits of NFC technology. They state that the current state of mobile communication and consumer electronics is characterized by the convergence of devices and the growing need to connect these devices in a simple and secure way. NFC enables communication between two devices by just bringing them together or making them touch, while taking the devices away from each other stops the communication without any other user knowledge on networks or technology. This also increases security as if there are no other NFC-devices within a 20-cm radius, there is no communication. NFC also supports a passive mode of communication, meaning that devices will not generate any RF fields and the complete communication can be powered from one side only, saving device energy consumption (Csapodi & Nagy, 2007).

Ok et al. (2010) also list several advantages of NFC technology. First, mobile devices can be used both for information storage and as an NFC reader. Second, the technology is compatible with existing RFID structures, tags and contactless smart cards. Third, it is easy to use as users do not need to know anything about technology. Fourth, the short transmission range provides inherent security. According to Ondrus and Pigneur (2007) the performance of NFC technology is better than traditional payment cards and mobile methods.

Ok et al. (2010) presented the results of their study in a table, which included benefits and future scenarios for all the different NFC operating modes. As can be seen from Table 2, there are many potential applications of NFC technology from access control to gossiping. However, focusing on just these three operating modes might neglect some of the crucial aspects of the technology. In order to examine the whole NFC phenomenon an extensive review of the literature is needed, likewise of how NFC technology is currently used by tourism businesses.

3. Research on NFC

A literature reviews was conducted using Google Scholar search engine to search for NFC related articles and studies. Search words used were "NFC," "NFC technology" and "Near field communication." The first 20 pages of each search were examined to choose articles related to the topic, and the chosen articles were examined more closely.

According to the literature review conducted for this study most of the earlier research on NFC is published in conference proceedings, typically in the area of information technology. Only three studies directly applicable to tourism were found and are presented later in this chapter. Lack of research on NFC technology, especially in the context of mobile ticketing, is also mentioned by Juntunen, Luukkainen, and Tuunainen (2010).

Ok et al. (2010) argue that most research efforts regarding NFC focus on the development of NFC enabled services and applications. Ok et al. (2010) reviewed NFC studies on the basis of the operation

Table 2
Benefits and future scenarios for different NFC operating modes (Ok et al., 2010).

	Card emulation mode	Reader/writer mode	Peer-to-peer mode
Benefits	1. Physical Object Elimination 2. Access Control	1. Increases mobility 2. Decreases physical effort 3. Ability to be adapted by many scenarios 4. Easy to implement	1. Easy data exchange between devices 2. Device pairing
Future scenarios	1. Integration of id-cards, passports, finger-prints, driver-license 2. Storage area for critical information to provide user's privacy and authorizing people to access those information	Many real-life scenarios can be adapted to NFC in this mode. In all of the scenarios, some data need to be read from an NFC tag, and additional jobs need to be done by NFC-enabled mobile phone.	1. Secure exchange of critical data 2. Gossiping