Early infrastructure of an Internet of Things in Spaces for Learning

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Abstract

The deployment of mobile and ubiquitous computing in smart objects introduces the concept of an Internet of Things which will offer new scenarios for learning processes. This paper presents this concept in relation with some other new alternatives of spaces for learning. A basic architecture for interaction is proposed and a set of prototypes that we have developed are also explained as part of an early infrastructure.

1. Introduction

The new concept of an Internet of Things (IOT) brings a new opportunity for the creation of innovative options for learning; this concept is possible due to the evolution of concepts from ubiquitous computing and technologies as mobile, RFID and others. This paper focuses on a specific technology for the deployment of an IOT known as Near Field Communication NFC and explores some early scenarios and implementations to be applied in spaces for learning. The structure of the paper is as follows. First a background on IOT related concepts and technologies will be exposed. In section 3 we capture our proposal for the infrastructure and prototypes of an IOT in spaces for learning. Finally some relevant conclusions and future considerations are captured at the end of the paper.

2. Internet of Things Technologies

The new field of “ubiquitous computing” [1] or “ambient intelligence” [2] has brought computing capabilities to the physical context and has expanded the intelligence of objects surrounding us. Actually we have gone from smart place to smart objects in which objects can interact with each other and with people. In 2005 The International Telecommunication Union UIT published a report named “ITU Internet Reports 2005: The Internet of Things” [3]. This publication is part of the series of “ITU Internet Reports”. It looks at the next step in which new ubiquitous technologies (such as Radio frequency Identification and sensors) promise a world of networked and interconnected devices that provide relevant content to users. This publication covered a review of enabling technologies, business opportunities, public policy challenges, and implications for the developing world.

2.1 Near Field Communications

Near Field Communication (NFC) is one of the latest wireless networking technologies based on RFID. As a short-range wireless connectivity technology, NFC provides intuitive, simple, and safe communication between electronic devices. NFC [4] is distinguished by its intuitive interface. An ABI Research forecasts that by 2012, some 292 million handsets (over 20 percent of the global mobile handset market) will ship with built in NFC capabilities [5]. In this paper we will describe a proposal using NFC mobile phones from Nokia as a personal device in spaces for learning.

3. Infrastructure

3.1 General Architecture

A previous version of the general architecture can be found in [6]. As an evolution, part of architecture interacts directly with tags and other interacts with other devices. In this version, the communication is implemented only for Bluetooth. It helps to interacts with NFC interactive panel server described later.
3.2 Prototypes

The following prototypes have been developed in the context of the MOSAIC Project [7], using a NOKIA 6131 NFC mobile phone and some RFID tags. More information about the touching note, touching cabinet and touching campus can be found in previous works as [8]. As part of most recent effort about these prototypes, the NFC Interactive Panel will be explained in detail.

**Touching Note**

The “Touching Note” makes use of an NFC tag with the information of a text note; this is placed in the door of the teacher’s office to give relevant information while a person is not present. In figure 2, there is an office door with a tag.

**Touching Cabinet**

A place or object in a space can be tagged to give some basic information to the student only by touching. In this prototype, the object will have a tag with textual information. In figure 3, there is a tagged cabinet.

**Touching Campus**

The application proposed for this prototype is a campus recommender, which basically gives indications to new students and other people who don’t know much about the campus and need to know more about the places of interest to be found or found their actual location.

**NFC Interactive Panel**

In this prototype, mobile phone is used to touch a surface and interact with information only by touching with phone. On figure 5 could see the front and back of panel, and some pictures of its function. To enable this, the NFC Interactive Panel uses a phone with Bluetooth and NFC. NFC provides the touch and Bluetooth the communication. NFC tags are set in the surface and via j2me it connects to a server that displays the action. At difference with other technologies for display is the cost of implementation. The cost is reduced to tags and a pc with Bluetooth. Another important difference is the possibility to be resized. Some videos of NFC Interactive Panel are available in [9].
4. Conclusions

This paper proposes an early infrastructure of an Internet of Things to be introduced in spaces for learning. This infrastructure makes use of NFC as the technology to enable mobility and interaction with physical spaces.

It also proposes four prototypes. The “Touching Note” captures the basic need of communication between students and teachers and the space to cover is a teacher’s office. The “Touching Cabinet” represents the need for searching physical objects in the real world and the space to cover is the laboratory. The "Touching campus" is an early approximation of the interaction between campus buildings with students; this represents a large scale of space interaction. The NFC Interactive Panel represents a basic interaction of students with the most representative icon of a classroom.

Mobile phones are a probable tool which in the near future will be able to support the different types of processes needed in learning scenarios. Every new technological featured embedded in mobile phones facilitates their successful use for learning experiences. Many of these technological features will be part of the next generation in educational environments. This implies different analysis and future research about student behaviour in relation with mobile phones.

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5. References

[7] Mosaic Project http://mosaic.gast.it.uc3m.es/