

# Supporting Clinical Information Management by NFC Technology

J. Bravo, G. Casero, M. Vergara, C. Fuentes, R. Peña, R. Hervás & V. Villarreal

MAMi Research Lab, Castilla-La Mancha University, C. Real, Spain

**Abstract** — Tele-monitorization is a problem with aging people living alone since the vital signs control is complicated for them. In this sense, some initiatives by adapting technologies make easy these controls. In this work we present a solution consist of the Near Field Communications technology adaptability. Mobile phones NFC enabled serving as a middleware between measure devices and people. In addition, a proposal for managing clinical information and medicine prescription are presented.

**Keywords** — Ambient Intelligence, NFC, Natural Interaction

## I. INTRODUCTION

Ambient Intelligence vision proposes a shift in computing. In front of the traditional desktop computer emerge the idea of many devices placed around us [1]. This fact encourage researches look for contexts in order to model them according with this vision. Under that, greater expectations about technological adaptability in health care scenarios are arising. In addition, applications such as mobile telemedicine, patient monitoring, location-based medical services, emergency response and management, pervasive access to medical data, personalized monitoring and lifestyle incentive management can support physicians and nurses, improving the quality of service. [2]. However, many older staff members complain of using computers in their daily activities [3]. This author argues that despite the fact that computers have clear advantages, they are not well integrated into hospitals and Weiser's vision is not being played out successfully in these scenarios [4]. In addition, tele-monitoring at home is very difficult, especially for elderly people.

For all afore mentioned, we focus our researches on the Radiofrequency Identification technology achieving a natural interaction. In this case, we have changed the natural interaction that supposes that, only wearing tags, the user can obtain services from the environment. However it is necessary to mention that the hardness of the RFID kits in fixed places, the cost of infrastructures and finally, the responsibility of the environment of the "when" aspect, have guided us to adapt the Near Field Communication technology (NFC). It consists in a radiofrequency identification reader combined with cell phones. With it, the interaction is not implicit but, a simple touch is only needed.

In this work we present an approach for managing clinical information by patients. For that we have implemented three cell phone proposals. The first one is to acquire medicines' prescriptions without going to visit the general practitioner. This process can be solved by only touch the tag of the previously prescribed medicament. Doctor receives by GPRS the patient petition and, in the case of accepts the prescription, sends it by the same way. When the patient receives it, is able to obtain the medicine by only touch a NFC reader installed into the pharmacy. The second one is about carrying out clinical document by patients. For example X-ray or clinical tests can be stored into the cell phone. At the same way that pharmacies, doctor can be download from cell phone this documentation by the reader connected to the computer. Finally, house monitoring is the third application. In it and, supported by devices measuring blood pressure, glucose level, urine test, etc. and Bluetooth enabled, it is possible to store the correspondent measure into the cell phone. This application, according with captured measures, can offer advices to the patient and/or, at the same time, be able communicate automatically with the doctor.

## II. NFC A TECHNOLOGY FOR INTERACTION BY CONTACT

First of all, a mention about simple interaction, a key concept of our system, should be made. Old people are not familiarized with new technology, so it would be desirable an interaction as simple as possible [5]. This is also applicable to physicians, whose hard work helping lots of patients doesn't allow them to waste their time with the annoying common interaction. Stopping their work in order to be sat in front of a computer to type some records is not an option. They (both, patient and physician) must interact with the system in a transparent way, with the simplest possible actions. Technology should be at the service of the users and not the other way around.

In other words, to create applications for supporting daily activities in an assisted environment, it is necessary to adapt sensorial capabilities. From our experience, which bears mind Weiser's vision, we have applied identification technologies, concluding that we can achieve this objective using a Bluetooth enabled NFC cell phone. The interaction is as simple as bring the cell phone close to the device or

person that they want to make any action with: vital signs monitoring devices, displays, computers to store data or, even, the patients. Examples will be detailed in next sections.

NFC is a short range technology using a frequency of 13.56 Mhz. The system consists of two elements: the Initiator, which controls the information exchange (called reader in RFID); and the Target, which responds to the promptings of the initiator (called tag in RFID). In addition, two operation modes are available: Active and Passive. In the Active one, both devices generate their own field of radio frequency to transmit data (peer to peer). In the Passive one, only one of these devices generates the radiofrequency field, while the other is used to load modulation for data transfers. Fig. 1 shows the three types of NFC devices: cell phone, tag and reader. As well as that, the four modes of operation are presented.



Fig. 1 NFC devices and operation modes

So, using a device or get a patient’s information implies that the interested has to touch the corresponding NFC tag with the phone in order to launch the needed application. This application runs automatically thanks to the PushRegistry technology and JSR 257 API: the user doesn’t need to open the application manually.

This specification improves usability of the RF applications, providing means for starting applications based on events on RFID hardware. This means that when a target of requested type or target containing the requested NDEF record appears in the proximity of the device, applications registered for this event are started. At the same

time, starting applications based on events minimizes memory consumption in the device.

Registration for startup is based on the record type name and format of the NFC Data Exchange Format (NDEF) record. There can be one application for each record type name and format pair registered for startup at a time. If data on the target contains more than one NDEF record, the startup is based on the record type name and format of the first matching record in the data.

When a target is discovered, the application management software checks the PushRegistry entries. If there is an entry for the NDEF record type name and format in the target, the application having that entry is started. If there is no PushRegistry entry, notification about discovered NDEF record is sent to the registered application that has set the NDEFRecordListener for that NDEF records type. NDEF records should have the next syntax:

Table 1 NDEF record push URL in BNF format.

<ndef url>	::= “ndef:”<record_type_format> ?name=<record_type_string>
<record_type_format >	::= “rtd”   “external_rtd”   “mime”   “uri”
<record_type_string>	::= String of US_ASCII characters, the fully qualified name of the record type

When we want to automatically run our own midlet, <record\_type\_string> should contain its name. As an example, to run our monitoring application, the string should be: MIDlet-Push-1: ndef:mime?name=App/Monitor,MIDlet\_MONITORING,\*

The string before the midlet name (App/Monitor), helps the application to know which kind of tag has started the mechanism.

### III. OUR NFC PROPOSAL

#### A. NFC house monitoring

In order to keep under control the old people’s health when they are at home, it’s necessary to monitor their vital signs. Vital signs are measurements of the basic functions of the body.

##### *Device Monitoring Bluetooth enabled*

There are a lot of Bluetooth enabled devices that support monitoring of these vital signs.

The electrical activity of the heart can be controlled with a **Bluetooth ECG device**. For monitoring the Peak Expiratory Flow Rate (PEFR) and diagnosing lung conditions like asthma, a **Bluetooth Spirometer** can be used. The oxygen saturation in the blood (SpO2) can be