UNIVERSIDAD TECNOLÓGICA DE PANAMÁ
INFORME DE VIAJE

El presente formato tiene el objetivo de consolidar toda la información obtenida por los colaboradores, que de una u otra forma se hayan beneficiado para realizar viaje al exterior, el cual, a la vez será reportado al Ministerio de la Presidencia para justificar la gestión realizada, en correlación con el presupuesto ejecutado.

TIPO Y NOMBRE DE LA ACTIVIDAD	8vo International Conference on Ubiquitous Computing and Ambient Intelligence y 6to International Work-Conference on Ambient Assisted Living
LUGAR Y FECHA (DURACIÓN)	Belfast, Irlanda del Norte, del 1 al 5 de diciembre de 2014.
OBJETIVOS	• Presentar los artículos titulados: 1) Mobile physical rehabilitation of patients through intelligence devices 2) A framework to design parameterized and personalized m-health applications according to the patient's diseases • Reunión como co-investigador de proyecto aprobado FRASE. • Colaboración como Publicity Chair, Organizador y Comité evaluador de los artículos presentados. • Reunión para la nueva edición de UCAmI 2015 en Chile. • Reunión como miembro de la Asociación para la Inteligencia Ambiental AImA
PARTICIPANTES	Dr. Vladimir Villarreal Contreras
ASPECTOS RELEVANTES EN EL DESARROLLO DE LA ACTIVIDAD	Este evento permitió estrechar los lazos de cooperación internacional con países que desarrollan las mismas áreas que nuestro grupo GITCE. En las presentaciones de los artículos la comunidad científica internacional conoció que se hace como país en temas afines al congreso.
RESULTADOS OBTENIDOS (Contacto con futuros expositores, becas, firmas de convenios, etc.)	• Publicación del artículo en actas Springer: 1. A Framework to Design Parameterized and Personalized m-health Applications according to the Patient's Diseases . Ambient Assisted Living and Daily Activities Lecture Notes in Computer Science.Volume 8868, 2014, pp 417-420

	2. Mobile Physical Rehabilitation of Patients through Intelligence Devices. Ubiquitous Computing and Ambient Intelligence. Personalisation and User Adapted Services 3. Lecture Notes in Computer Science. Volume 8867, 2014, pp 13-16 • Invitación a seguir como miembro organizador e investigador de la UTP.
CONCLUSIONES	Este evento me ha permitido expander mi horizontee de nuevos temas de investigación, así como establecer nuevos intercambios de conocimientos entre otros investigadores y grupos de investigación. He sido invitado por un año más a formar parte del grupo organizaros y comités de la próxima versión en Chile.
RECOMENDACIONES	Se debe promover la participación de nuestros investigadores en actividades y eventos de este tipo, ya que nos permite intercambiar las experiencias adquiridas en el área de investigación. Además podremos dar a conocer los proyectos sobre los cuales estamos trabajando en nuestra universidad.
ANEXOS	• Fotos del evento • Copia del Certificado de participación • Copia certificado de Publicity Chair del evento • Copia certificado de participación • Dos certificados de presentación de dos artículos • Artículos presentados.

Presentación de artículo titulado: Mobile Physical Rehabilitation of Patients Through Intelligence Devices

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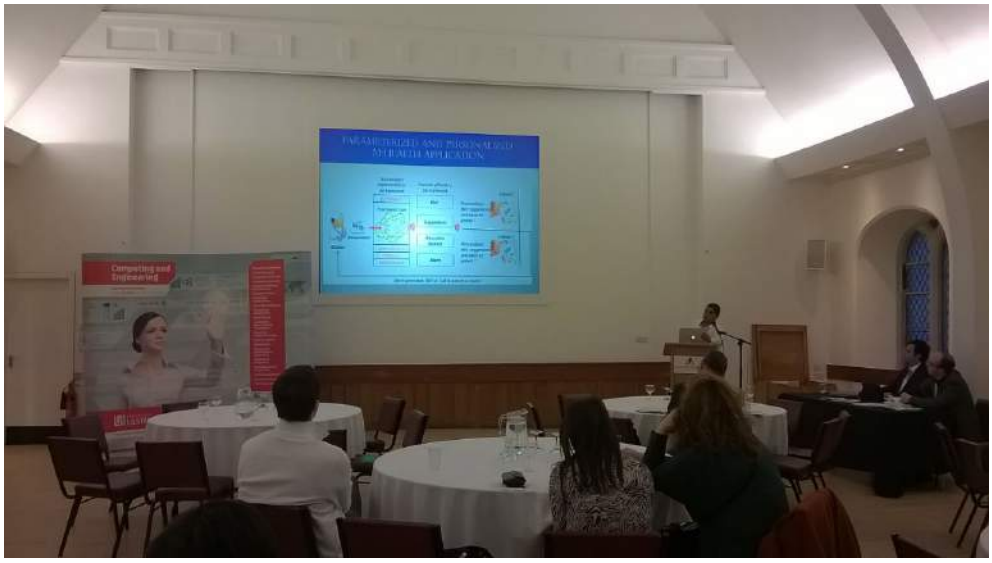

Presentación de artículo titulado: A Framework to Design Parameterized and Personalized m-health Applications according to the Patient's Diseases

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2014 TWENTY FOURTEEN

UCAmI 8th International Conference on Ubiquitous Computing & Ambient Intelligence

IWAAL 6th International Workconference on Ambient Assisted Living

The General Chair of UCAmI & IWAAL 2014 certifies

Vladimir Villarreal

*Has presented the paper entitled "**A framework to design parameterized and personalized m-health applications according to the patient's diseases**" in the*

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Mobile Physical Rehabilitation of Patients through Intelligence Devices

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Abstract. That develop solutions that facilitate the development of therapy from home are a compelling factor in our social environment. In our country mobile technology is important as a support tool in the rehabilitation of people. This paper presents a proposal that allows the development of an application that helps develop a patient physiotherapy activities, from your home, offering analysis and recommendation of your doctor. The application generates reports of the results of these physical activities both for the patient and the doctor. We integrate an ontological classification of mobile devices and a previous study of the impact of the development of this technology in our country.

Keywords: web services, software development, human computer interaction, mobile users interfaces design.

1 Introduction

Mobile devices evolve and are capable of running more demanding processes, what has unleashed an endless applications for different presentations of such devices, jumping to solve problems in different fields, such as academic, business and even staff. Given this, questions arise such as: Which advantages bring all this type of technological progress in Panama and the growing availability of Internet connection? and Are exploited in the sector health in Panama?

It is possible that the almost exponential advance mobile technology, do not allow to easily see the advantages of this mobile technology can provide at any given time. That is why that is necessary to determine the mobile technological advance in Panama, and thus have an idea clearer on how to get the most out of all these technologies, the improvement of mobile components, which help in coverage or supported medical assistance in an area not very common as it is physical therapy. Given this, we will notice the quantification of the Panamanian population who own a mobile phone, or otherwise has a smart device, which will facilitate your life, according to your need [1].

We can notice, that the realization of a mobile app of this type relating to health, could be a good way of responses from people, who need or require attention medical, since is observed at the national level there is a good percentage of people who have cell phones. remarkable that a smart device will not replace the functions that a specialist doctor, but our main goal is not to replace it, but that the device will help the patient or user, which can do exercises in the right way, and that such exercises be registered so that the patient can keep the results, in order to then have a record of the repetitions performed and which exercises. All this will happen, as assistance to the patient, given

R. Hervás et al. (Eds.): UCAmI 2014, LNCS 8867, pp. 13–16, 2014.

that the service of physiotherapy in Panama is composed of a gym that allows the patient to the development of treatment techniques for stimulating the movement of ambulation. A detail of the technical services held in 2012, in order to be able to determine how much population is the beneficiary of these medical processes, and many professionals are of domestic origin, who is trained to do this is shown below.

2 Development of the Application Following MoMo Framework

This application will be developed following the framework for the development of mobile applications MoMo [2][3]. The proposed development cycle allows us to obtain different functional prototypes that define each element or module that make up the final application (Figure 1). The steps of the development framework are following: Selection of the module to be applied, Definition of design patterns, Definition of functional patterns, Ontological relationship of each module, The layers relate to their respective modules, Determination of the relation between layers, Integration of all the elements, Evaluation of the prototype and Redesign of the elements for the generation of a new prototype.

To facilitate the development of the proposed application, we rely on the ontological model MoMOntology [4] [5] presenting a classification of all possible elements to be taken into account when developing mobile solutions can be adapted to any mobile device. To model the different services and elements that make up the framework, we will define each of the elements involved in the development of languages of the semantic web (OWL)-based software architecture.

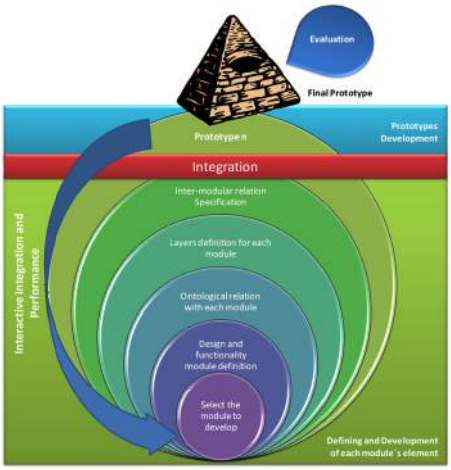

Fig. 1. Development of the application based into MOMO framework structure

Based on the steps that make up the development of the ontologies defined by METHONTOLOGY [6] [7] and for a better understanding of each of the elements of the application, we have based the development on the classification of mobile devices featuring MoMOntology. This ontology classified the devices according to your hardware, software, communication or network capabilities. These three elements are the aspects that define the functionality of the application.

3 Proposal for Mobile Rehabilitation of Patients

After evaluated all the technical and social aspects, is proposed to develop a mobile application based on the Android platform, so it works on devices with version 4.1 of Android "Jelly Bean", that has an interface that allows to know the General patient information, such as name, cedula, among others as shown in Figure 2 (a).

Given these facts, the patient will be another interface, which will ask the patient, to determine what type of need of rehabilitation is having, so the application applicable to show the patient how the exercises I should do (Figure 2 (b)). At the time that the patient knows the exercise which should make the application will define what magnitude or degree of exercise, for which applicable to indicate how many series have to do (Figure 2 (c)).

Given this device shall be in a data collection interface, counted repetitions of the exercise, since thus will tell the patient if he has managed to make the number of repetitions needed. When the patient finishes make the series or exercise routine (Figure 2 (d)), the application will show you a new interface in its results, and will be stored in real time, from the time that started the session until the moment that ended. Previously the patient should indicate at the time of filling their data, how much was the period that the specialist recommended him to do therapy. This will be done, because the application will also serve as an Assistant and remind the patient, periodically, the moment that should begin to make the session.

This application will be recommended to the patient by the professional physical therapist, who treats you at its first meeting, since depending on the degree of rehabilitation, can the professional indicate the frequency with which must attend the Centre to see the progress of the person, through outcomes remove device.

This will serve as a tool to professional, and at the same time as Assistant to the patient, since sessions have considerable economic value, and if at a certain moment it would require 20 sessions, ideally, with this application you can reduce the number of sessions, halved, and so be able to generate savings to the patient, which could be used in other treatments.

(a) (b) (c) (d)

Fig. 2. a. Capture of patient data, b. capture the type of exercise, c. selection of grade or difficulty of therapy, d. capture of data resulting from the exercise: series and routine

4 Conclusions

The development of the proposed application is based on the framework for the development of applications mobile MoMo, which defines as graphical interfaces are implemented to develop applications for monitoring of patients, an ontological classification of the possible elements used and distribution in all the programmable elements in an application layer. Are confident that once implemented, our application will benefit a large number of people who often cannot attend a rehabilitation session, offering an alternate tool to this problem. There are technical, communication capabilities and operations; we have to integrate them into a single functional application and which will grow with time.

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A Framework to Design Parameterized and Personalized m-health Applications According to the Patient's Diseases

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Abstract. The development of personalized mobile applications is a complex work. Currently, the most of applications for patients monitoring through mobile devices, is not developed considering the particular characteristics of each patient, but these applications have been developed taking into account a general behavior depending on the diseases instead of the own patients. The diseases manifest different symptoms depending on the patient situation. Mary and John (hypothetic patients) have diabetes, but the same measurement of glucose for each one affects their health in a different way. This paper describes a framework that allows the development of mobile applications, personalized for each patient, in such a way that even if they have the same disease, the application will respond to the individual needs of each patient.

Keywords: mobile monitoring, m-health, chronic diseases, adaptive framework.

1 Introduction

Evolution of technological devices has allowed the integration of new technologies for the treatment and follow-up of diseases in which patients find support through the device use. The increasing integration of new technical features in mobile devices, and the communication capabilities allows the deployment of multiple services.

The solutions developed provide a "specific" solution to health care issues. Health Buddy System [1] is a system that provides health monitoring of patients by reducing the possibilities of hospitalization. Everyday, patients respond to a set of questions about their health and well being using the simple Health Buddy appliance. AirStrip Patient Monitoring [2] is a software platform for providing monitoring information about critical patient aspects and ensuring the transmission of date between hospital devices and clinical records. WellDoc [3] is an application designed to be a service of monitoring for diabetics that allows monitoring the current condition of a patient through the manual introduction of food and glucose parameters. METABO [4] is a system for monitoring and handling of diabetes that aims the recording and interpretation of the context of the patient, as well as the decision support for the patient and the physician. However these applications have been developed for monitoring of patients regardless of their individual peculiarities, which are not configurable or customizable

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to each patient. This paper presents a solution to these problems, developing a customizable application which can be adapted to each patient according to the particular disease. We present a framework that allows the development of parameterized and personalized mobile applications and medical monitoring through mobile devices. This leads to a medical follow up through mobile devices, which are used day to day by the patient, and biometric devices that currently provide high technological capabilities.

2 Parameterized and Personalized m-health Application

2.1 The Design Goals of the Architecture

The vital signal is sent via wireless communication from the biometric device, suitable for each case (glucometer, blood pressure monitor, ECG, etc.), to the mobile device without any intervention by the patient. This signal will be analyzed taking into account some important aspects such as the requirements of the physician about situations of risk and maintenance, considering the clinical record and the profile of the patient, etc. Once the analysis is complete, the mobile device will warn with an alarm or reminder according to the situation. Thus, the mobile device can warn of an injection of insulin or a notification to relatives or medical staff, in case of a possible fall or a rise sudden blood sugar, in the case of diabetes.

The framework enables meta-definitions according to a set of clinical areas previously determined, subsequently, the physician, complete the profile of each patient and can provide a suitable group of recommendations to facilitate the self-control. This architecture must allow a correspondence between physician definitions and mobile software services for self-control according to each patient profile and disease to be monitored.

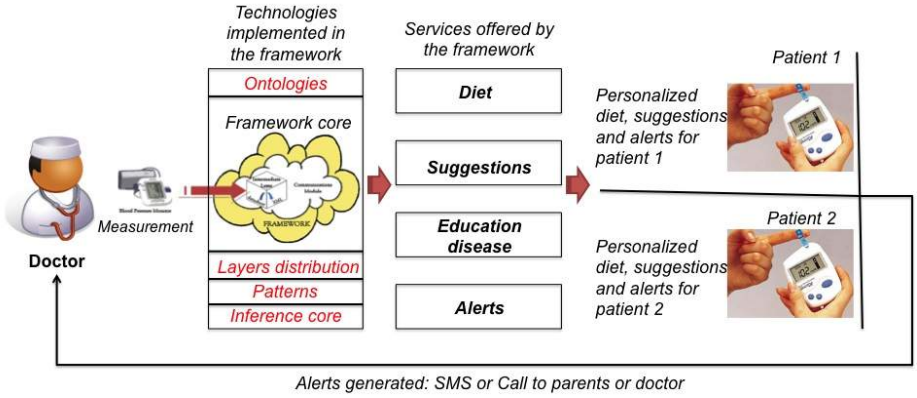


Fig. 1. Parameterized and adaptive functionality of the m-health application

In Figure 1, a doctor can have more than one patient with the same disease. The doctor recommends to each patient the use of the application for monitoring of glucose in blood, with a set of parameters and ranges initially defined. The doctor can adapt the new settings depending on each patient. Otherwise, the application, according the use

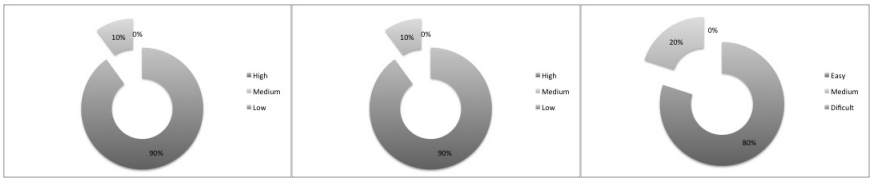
and the glucose new values, adapts every range taking into account the last measures obtained from the patient. The framework provides services such as diet, suggestions, basic information about the disease and alerts according to the last five ranges obtained from the patient. Predictive inference engine, adapted to these values of the patient can be proposed, providing new suggestions, diets and alerts for each patient.

2.2 Technological Elements Defined in the Framework

The final application generated by the framework consists of different elements related to the following: communication platform, interfaces design, data processing and human interaction. The elements defined in the development of the framework, and which establish the functionalities of the mobile applications are: definition of an ontological model [5], oriented to the definition of the domain in the study and description of each of its elements; development of a reference architecture for the development of modules that allows mobile monitoring of patients, independently of the technology, as well as the dynamic integration of new elements in the environment; patterns for the definition and creation of modules associated with each disease and the patient's individual profile [6]; the structure of the relationship between each of the modules generated by the architecture, defining the architecture of communication between mobile and biometric devices and the predictive inference engine that facilitates the deployment of self-control, assessing past situations that may arise in the future associated with the user [7]. This is the point of the framework, since it is that allows each user the adaptation and customization of the final application.

3 Results: Some Patients Experiences

It is very important to assess the impact the system has on patients using a mobile application that allows them to store, manage, handle information and also provides appropriate suggestions to the patient.



(a) (b) (c)

Fig. 2. User evaluation of the application generated by the framework: a. response time, b. efficiency of generated suggestions and c. applications interaction

The application was evaluated in ten patients with diabetes, considering aspects such as the application response time, accuracy of the generated recommendation, assessment of the patient record stored in mobile device, and ease of interaction with the mobile device. The results are shown in Figure 2, where we can see that the response time of

the application to the patient is high (90% of answers present a high score and 10% medium score). In the accuracy of the generated recommendation 90% of patients responded with high score and 10% medium, which show that the application responds according to the patient needs. Other aspect evaluated was the interaction of the patient with the mobile application obtaining high score in 80% of cases.

4 Conclusions

This paper presents a framework that allows the generation of mobile applications for the monitoring of patient diseases. The difference between our architecture and other systems is based on the development of a personalized and parameterized application for each patient. Our application is able to be adapted to patient requirements providing different modules for diet, suggestions, education and alerts depending on the last measures obtained through the communication between biometric devices and mobiles devices. This module sends the measurement to predictive inference engine for the interpretation and adaptation of the new modules. The evaluation related to the time of response, suggestions generated and the application interaction presented a high score for the evaluated patients.

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