Health 4.0 in the i2i Era

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ABSTRACT

The acceptance of iPhones, iPads, and iPods in medical environments, as well as the FDA approval of several diagnostic-prognostic-distant care-management applications, demonstrates the modern medicine trend to introduce mobile applications initiating the i2i era. Furthermore, Cloud and Internet applications ranging from non-quality control up to intelligent-quality-control data base management anytime, anywhere, are the basis of what is called Health 4.0. The present editorial listed approved FDA applications and future deployments, including three personal projects in iHealth: blood-pressure monitoring, iAnapath and the i-EEG control in child Attention Deficit Disorder.

Keywords: Health 4.0, i2i, i-EEG, Image Diagnosis, iPad, iPhone, iPod, Telemedicine, Vital Signs

INTRODUCTION

This century MD (medical devices) will be hand-held devices working in a pervasive environment of wireless communications and Cloud-computing. Hardware miniaturization will involve nanotechnology and alternative mechanism to provide power and/or reduce consume. For that reason, the paper brings awareness of what is already in the market and towards where we are moving.

Not only doctor initiatives (iDoctor) to assist patients (iPatients) will provide i2i medical applications, but solid quality care initiatives approved by the FDA will integrate i-devices in a renew Health IT services facing prevention and quality of live.

The paper will consider several subheadings to separate quality control (QC) versus the non-quality control (nQC) applications.

In the QC group we included those healthcare applications that in a short or long run will be integrated in what we called HEALTH 4.0, integrated by four main innovations:

- Applications that fulfill 3 criteria of availability:
  a) Anytime connections: On the move, indoors and outdoors, day & night.
  b) Anyplace connection: On the move, outdoors, indoors, at any PC.
  c) Anything connection: At any PC, H2H (human to human), H2T (human to thing), T2T (thing to thing).

- Applications that include image enhancement & RFID readings to be use for:
  a) People→by faces recognition and access to relevant information (home, work, medical, HER, PHR, medical schedule…).
  b) Object→by use and by owner recognition.

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c) Food—by principle content & by diet requirements.
d) Medication—by principle & by indication-contraindication.

- Application that includes quality controlled Web 3.0 items such as:
  a) HCQ Health Care Quality: ISO 13485-ISO 2700 or security.
  b) 3S: Social-Semantic-Services
  c) Cloud accessing (SAAS, pCloud or personal cloud were the iPhone can be included).

- Applications taking Web 4.0 items such as:
  a) KBL o Knowledge base learning, including literature base learning (LBL), Evidence Based learning (EBL), trial base learning (TBL), Image based learning (IBL) etc…
  b) QBE o Query by example, including query by image (QBI) etc…
  c) CoLD or Cloud of link data with Artificial intelligence.

Examples of the IV.a and IV.b, are our group developments on optical biopsy data base content retrieval from smartphones published elsewhere.

In the group of nQC applications we include mainly the Web 2.0 applications without control o regulation, and particularly iDoctors and iPatients.

Extending the definition of iMedicine, we should include as stated in the definition of the WHO any medical environment at distance with iPhones or any other pervasive and personalized hand held device that provide tele-control, tele-prevention, tele-management, tele-learning etc… in Medicine. In the latter the iLearing application developed inside of the medical students training of pathology, will be the developing show case of our group in the iAnaPat application.

Interesting enough is that since the OS-3, Apple has a specific class of services directly linked to MD that allow to developed applications and synchronize them with the MD through Bluetooth or USB.

Right now there are nearly 1,500 smart phone applications for health care professionals are already available for downloading and the Plug & Play busses the iBUS are arriving to the market (http://catai.net/blog/2011/03/md-bus-vs-ibus/) approved by the FDA transforming the hospital into smart rooms that integrate mobile phones, and not requiring any more connectivity specifications telemetric devices.

**IPHONE HEALTH CARE QUALITY APPLICATIONS**

The FDA has recently approved several applications controlled with iPhones listed here. Nevertheless it is important to consider that the Verizon version of the iPhone is different from the AT&T version of the iPhones. They are separate devices. Therefore, it will be necessary to test those separately for iPhone FDA applications.

1. **iPhone Ultrasound**

The first smartphone capable of record and send ultrasound medical images is the MobiUS from Mobisante®, approved in USA by the FDA (Food and Drugs Administration). The price is at the moment 10,000 $, much less than the regular US station (from 20.000 $ – 100.000 $) (Figure 1).

To our understanding too much, considering that the hand-held version of an US, the so-called VSCAN from General Electric cost 6000 Euros (Tous et al., 2011).

There are novel applications of a hand-held ultrasound device in Obstetrics and Gynecology (Troyano Luque et al., in press).

2. **iPhone Radiology**

A number of companies have DICOM compliant applications that can be installed on the iPhone. As OsiriX (http://www.osirix-viewer.com/MobileOsiriXWorkflow.pdf)

The DICOM visor of OsiriX had two versions.
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