MEDINFO 2007
HISA Ltd Australia
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Delivering Structured, Multi-modal Clinical Guidelines via Cell Phones

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Abstract

The widespread penetration of cellular (mobile) telephones worldwide, along with their increasing power and sophistication as computing devices, makes them an attractive telehealth platform. Cellphone-GuideView is a technology designed to deliver multi-modal clinical guidelines on cell phones. The system is intended to assist non-physician healthcare providers by presenting diagnosis and treatment advice in a simple discourse structure. The advice is augmented simultaneously by images, animations/video, text, and voice instructions. The contents of the guideline are stored primarily on the cell phone. If the guideline determines that a medical situation requires expert advice, the system automatically calls a remote physician or treatment facility. Cellphone-GuideView represents a model of telehealth in which synchronous assistance of experts is requested only when needed, thus decreasing costs and enhancing productivity.

Keywords:

practice guidelines, cellular phone, multimedia, telemedicine

Introduction

Low physician density is endemic in developing countries, as well as in rural/remote areas of developed nations[1]. In these situations, non-physician care providers (NPCPs) are often the primary providers of medical care to a large segment of the population. Such individuals typically have uneven levels of clinical training and thus the care they provide often falls short of medical standards. While strict adherence to clinical guidelines can help alleviate the problem, clinical guidelines are typically designed for physicians and presented in text form (see www.guidelines.gov, and are often beyond the understanding of NPCPs..

GuideView was designed to overcome these issues and enforce standardization of care. It has two main components: GuideView Author and GuideView Viewer. GuideView Viewer delivers the guidelines in a rich and easy-to-use multi-modal format that includes voiced instructions, text, images, video and animations simultaneously. Each mode compliments the other, resulting in a rich content delivery environment.

GuideView Author enables development of GuideView-compatible guidelines (referred to as *GuideViews*) using a GUI-based authoring environment.. Typically, a team consisting of clinicians and subject-matter experts develops GuideViews. The architecture of the GuideView system enforces clear separation between presentation and content. A benefit of this approach is that content can be integrated in multiple languages. The GuideView Viewer is agnostic to such content variations.

Further details of GuideView can be found in [2],[3]. In the remainder of this paper, we describe the implementation of GuideView on mobile phones.

Mobile phones and healthcare

Currently, worldwide adoption of cellular phones is without precedent in the history of technology. While the number of cellular phone users in developed countries in Western Europe is estimated to be close to 380 million, it is the growth in cell phone usage in developing countries in Latin America, Asia, and Africa that is the most stunning [4]. Growth in the cellular phone market in this regions is around 17%. In India, it is estimated that there are currently (October 2006) 100 million to 125 million cellular phone users and new subscribers sign up at the rate of 3 to 5 million every month [5]. Media reports have documented the innovative ways in which rural and economically disadvantaged populations utilize cellular phones to improve their daily lives [6]. Previous research have noted that digital media tends to benefit already privileged users, but that cell phones can help to close the gap[7]. In Colombia people with income levels below the country's mean represent 72% of those with cellular phones [8]. The number of cellular phone subscribers worldwide is estimated at 2 Billion (32.2% of world population). These subscribers give access to mobile telephony to more than 5 billion people (80.6% of world population) [4].

Competition among cell phone manufacturers and service providers results in constant introduction of new cell phone models with increasingly powerful processors, higher data storage capacities, and higher display resolutions. Cell phones have gone from being purely a communications device, to becoming a sophisticated, powerful, mobile communications-computing device.

A strong motivation for exploring the use of cell phones in health care is that in developing countries care providers are mobile, traveling from village to village. This is due to limited resources in the general population and poor transportation infrastructure. Thus, portability and availability of medical information at the point of care is highly desirable. These are some reasons why cellular phones can potentially contribute to telehealth and health care delivery in general.[9]

Cellular phones have been used to monitor cardiac function for occurrences of arrhythmias that are then transmitted to medical experts[10]; short messages services for data exchange between nurses and patients [11]; traditional on-demand direct voice connection between caregivers and patients [9].

While there is worldwide interest in exploring the use of mobile phones in health care, it appears that delivery of multi-modal clinical guidelines on cell phones, as in C-GuideView, is novel.

Methods

In this paper we present a technology called *C-GuideView* (CGV) that enables delivery of clinical guidelines using cellular phones. While the use of cell phones for data gathering and communications with specialists has been investigated [9-11], to the best of our knowledge, delivering clinical guidelines via cell phones is novel.

Our interest, based on previous work with the GuideView system [2], is to support decision-making and treatment by non-physician care providers (NPCPs) using clinical guidelines presented in an effective, easy-to-use format.

We evaluate different cellular phones platforms and selected one based on price and back compatibility with standard versions of GuideView.

Results

Recently (4th quarter of 2006), several cellular phones based on Windows Mobile, such as the Cingular 3125 and T-Mobile SDA have appeared. These models have the same form-factor as conventional phones and are also significantly cheaper.

CGV targets such cell phones and has been tested on the Cingular 3125. Challenges that had to be overcome were related to the small (albeit high resolution) screen size and the necessity to develop a new navigation paradigm using the cell-phone keypad and soft-keys. Quality of voice, image display, and video playback were found to be comparable from that on PDAs or lap/desktop machines.

As in the case of GuideView, target users of CGV are NPCPs. A notable feature of CGV is that these guidelines are kept locally on the cell phone itself. However, when the guideline determines that the NPCP needs expert help, it automatically dials the pre-stored phone number of a physician, a specialist, or to other expert facility. In contrast to other forms of telehealth that typically require the physician to participate in a voice or video-conferencing session, CGV initiates such synchronous communication only when needed. This feature enables better utilization of all care providers, ensuring that routine care is handled in an appropriate and standardized form locally by the NPCP. Expert assistance from physicians and specialists is called upon only if and when necessary.

Conclusions and future work

Due to their ubiquity and increasing sophistication, even in less developed areas of the world, cell phones have great potential as a powerful medium for Telehealth. The goal of Cell-GuideView is to help realize this potential. The technology is being improved in several directions such as improving screen formatting, voice commands, data compression, documentation of care in a simple EMR, porting to Symbian OS, and others. Usability and field testing studies are also being planned currently.

Acknowledgements

We thank the following for their support and encouragement. Kathy A. Johnson, PhD, Director, Medical Informatics, NASA Johnson Space Center; John R Svirbely, MD, TriHealth, Cincinnati, OH; Kevin Montgomery, PhD. Tommy Morris, Telemedicine & Advanced Technology Research Center (TATRC). This research was supported in part by Grant number # W81XWH-04-00035, administered by the U.S. Army Medical Research & Materiel Command's (USAMRMC) Telemedicine & Advanced Technology Research Center (TATRC), (MSI, JF-A); and NCRR Grant No. 1UL1RR024148 (MSI).

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