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Demonstration of GuideView, a Multi-platform System for Interactive, Multimodal Presentation of Clinical Advice

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Abstract

There is an increasing need for technologies that can assist in providing medical guidance in situations where physician availability is low. Such situations include the growing number of aging individuals living independently, rural areas in developed countries, and substantial populations in less developed countries. We demonstrate GuideView, a system that enables interactive, structured, multi-modal delivery of clinical advice. It provides clinical guidelines simultaneously using voice, pictures, video, and animation. GuideView is multi-platform, executing on desktops, over the web, on Pocket PCs, and on Windows Mobile cell-phones. GuideView interfaces to medical instruments such as Pulse-Oximeters and can automatically follow treatment or diagnostic pathways depending on the input received. GuideView Author, is a simple GUI-based environment for developing GuideView compatible protocols (GuideViews).

Keywords:

practice guidelines, cellular phone, multimedia, telemedicine, software design, user-computer interface

Introduction

The need for medical and skilled nursing care continues to increase worldwide. In advanced countries aging populations place increasing demands on healthcare systems and in developing countries medical facilities are likely to be poorly staffed and equipped. In these countries, while the availability of medical supplies and drugs is a pressing issue, another problem is the lack of high-quality, standardized medical training.

We demonstrate *GuideView*, a system designed to assist non-physician care providers (NPCPs) such as community health practitioners, nurse assistants, and similar personnel in providing medical care. In addition, GuideView can potentially assist the elderly. The GuideView system enables delivery of structured, multi-modal delivery of clinical protocols on multiple platforms, presenting a very similar look-and-feel on desktops, laptops, Personal Digital Assistants, and cell-phones.

GuideView

GuideView technology was originally developed at NASA Johnson Space Center as an advanced research project exploring technologies for providing medical support to astronauts during deep space exploration missions.

GuideView consist of two components, a) *GuideView Author,* for developing guidelines in the GuideView format, and b) *GuideView Viewer,* used to execute and display these guidelines. For brevity, any guideline that has been developed and saved in the GuideView format, is called a *GuideView.*

Design considerations

The design of GuideView was informed by the following basic objectives.

- The system should be portable and support ubiquity
- It should be highly interactive
- Medical guidance should be provided in a structured manner, as a sequence of *steps*
- Cognitive load should be reduced:
  - At any step in the procedure there should be only a few choices leading to the next step.
  - The task to be performed at any step should be simple
  - Sufficient information, but not an overwhelming amount, should be provided at every step
- Information should be given in multiple, redundant modes
- Presentation and content should be strictly separated. One important benefit is that GuideView protocols can be developed in multiple languages; the GuideView Viewer and Author are agnostic to such content variations.
- The system should be able to acquire medical data from sensors and branch through the guideline accordingly

To achieve the objectives of portability and ubiquity, the Viewer has been designed to be multi-platform, and can execute over the web, stand-alone on Windows desktops and laptops, Personal Digital Assistants (PDAs), and on cellular phones running the Windows Mobile Operating

System. PDAs and cell-phones are an attractive platform due to their portability. Web-based GuideViews can be executed on recent versions of most web browsers running on most client operating systems (Windows, Linux, MacOS), although it has been tested most extensively on Internet Explorer 6.0.

User interaction

User interaction with the system depends on the platform. On desktops and laptops, the mouse is the primary medium of navigation. In addition, GuideView accepts voice commands from a limited vocabulary (currently only on Windows Clients). including 'Affirmative', 'Advance', 'Play Video' etc.. Voice input mode enables hands-free operation, a desirable feature enabling the caregiver to use both hands to assist a patient while receiving guideline instructions.

On Pocket PCs (PDAs), screen tapping using a stylus is used for navigation. On the mobile phone, directional and selection buttons on the phone's numeric pad are used.

GuideViews are highly structured and appear to the user as a sequence of simple steps capable of being accomplished by those without specialized training. Information on how to accomplish each step in a GuideView is presented simultaneously as text, voice, and still pictures or annotated full-motion video. The video can consist of live motion or animation or a combination of both. Presenting information in multiple modes simultaneously enables a rich instruction and guidance environment. The multiple modes enhance understanding by reinforcing and supplementing each other.

Within each step in GuideView the user is given only a limited number of choices for the next step. Thus a GuideView can be thought of as pathway consisting of nodes from each of which multiple branches emerge, leading to other nodes.

The system is able to directly take input from medical sensors when available, and branch the execution accordingly. The input can occur from wired serial devices or wirelessly by BlueTooth. The current implementation accepts input from a serial-port Pulse-Oximeter (Avant ®4000, Nonin Medical Inc, Plymouth, MN, USA) and branches automatically depending on the pulse rate sensed.

The authoring environment

GuideView format guidelines (i.e., GuideViews) are created, typically by teams of physicians and nurses, using GuideView Author, a GUI authoring tool that enables development, editing, and update. Text input for each step is entered directly into GuideView Author. Multi-modal content such as voice and video files are produced separately and merged into the protocol using the Author. Modularity and re-use is supported in the sense that an existing GuideView protocol can be incorporated into another easily using the Author.

The design of GuideView Author supports strict separation of presentation and content, in the sense that the GuideView Viewer software is agnostic to the specific multimodal content presented in a GuideView. Such content can be developed in any desired language, integrated into GuideView format by the Author and saved for later viewing by the Viewer.

Integration with an Electronic Medical Record System

GuideView has been integrated with BMIST-J (Battlefield Medical Information System Tactical, http://www.tatrc.org), an electronic medical record system operating on PocketPCs developed by the US Army Telemedicine advanced Technology Research Center. From BMIST-J GuideView can be accessed in a context-sensitive way. For example, if the chief complaint in a patient encounter is eye pain, foreign object, or redness, tapping on the GuideView button within BMIST presents a GuideView protocol addressing diagnosis and treatment of such problems. Integration of GuideView with BMIST enables delivery of clinical advice as well as automated documentation of differential diagnoses, treatment and related care.

User acceptance

A preliminary study of GuideView in a Human patient simulator environment using 10 subjects revealed positive acceptance of the GuideView system [1]. None of the subjects were trained physicians; all had received some amount of training in CPR or similar first-aid procedures. Voice output received the greatest acceptance and was rated indispensable by 60% of the subjects and useful or very useful by the remaining 40%. Video assistance was rated in the useful to indispensable range by 80%. This has interesting implications for the design of future GuideViews.

GuideViews

So far, a variety of GuideViews have been developed, between them we have airway triage, basic CPR, red-eye, saliva sample collections and decompression sickness. The Red-eye Guideview has been developed in both Spanish and English. A GuideView in a non-medical area has been developed to support maintenance of underwater photographic equipment during NEEMO 12, an extended stay mission at the US National Underwater Research Center, Key Largo, Florida.

Conclusion and Future Work

The demonstration will include all the features described above on multiple platforms including web, stand alone

desk/laptop, Pocket PC (Windows Mobile) and cell phone. Voice navigation will be demonstrated on the laptop implementation.

In general, GuideView may be thought of as a procedure assistant enabling 'virtual experts' to offer guidance in performing tasks (not necessarily from the medical domain) where and when needed.

Future work includes improving the user interface, interfacing to a variety of medical sensors, and improving voice navigation. More extensive usability studies and field testing are in planning stage.

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References

[1] Iyengar, MS, Sarkar, S, Bacal K, Defouw, G, McCulley, P, Hurst, V, (2005) GuideView: Structured Multimodal Delivery of Clinical Guidlines. Proceedings of AMIA2005, Washington DC

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