Smart Environments for Decision Support in Health Care

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ABSTRACT

Decision support systems (DSS) in the health care community are not new. Information driven DSS systems were initially introduced in the early 1970ś and have been adapted to clinical, managerial, administrative, and cost control systems. Clinical DSSs are typically designed to integrate a medical knowledge base, patient data and an inference engine to generate case specific advice.

Recognizing the complexity of decisions made during patient care is a well known problem. This issue becomes even more difficult when addressing patient care outside of the clinic, when care providers have significantly less information about their wards. Historically, the clinician could only rely on brief face to face sessions and self report to make short and long term care decisions. As health care costs mount and clinicians have even less time to spend on individual cases, the industry continues to seek new ways to bring high quality information about their patients to decision makers.

The field of "smart" technologies has continually shown promise for many applications. A significant target for the smart environments community is in ambient assisted living (AAL), notably with the new Internet of Things (IoT) concepts [1]. The ability to monitor a person throughout their daily routine to build a much more complete profile of their life and well being is growing to be an invaluable tool to the users of these systems. Bringing this level of informational detail into the clinical community will revolutionize how health care decisions are made.

The process of building an AAL infrastructure has numerous engineering, user experience, social, political, and cost considerations. This talk will focus on the combination of engineering and user experience issues that are faced when trying to place sensors throughout a person's life, then use the high volume of data they generate as a means to help clinicans make decisions about the person being monitored. Supporting this work has been 8 years of effort at Washington State University directly in the Center for Advanced Studies in Adaptive Systems (CASAS) [2]. Similar notable projects have been undertaken worldwide such as ORCATECH [3], TigerPlace [4], the European Union's AALiance [5], and many more.

The CASAS project has worked to develop technologies for assisting and monitoring daily living with comprehensive, ambient sensing technologies [6]. These sensors placed around a home provide information about the residents as they go about their daily lives with as little intervention as necessary. Out of the data derived, several kinds of information have been derived, all seeking to better model the residents to help support decision making by other people or systems [7], [8], [9].

Until a strong understanding of the kinds of decisions being made by clinicians and patients is available, there will always be a disjoint between the technologies delivered and their users. To target the future use of technologies, the CASAS team has undergone a series of studies to determine what needs the health care community has during caring for patients. This work has sought out potential users of AAL technology in the eldercare and gerontech fields, notably older adults themselves [10], family members [11], and nurses [12]. Other research groups have undergone similar assessments [13] [14], but the work is still in its infancy when it comes to large scale understanding of how to deploy this kind of technology and who will benefit most.

The results of this work has shown that clinicians, family members, and patients are in situations with continual decision making pressures. Building tools that are capable of deriving context (patient behavior, clinical status, social issues, medicine effects, etc), and noting moments of change will be invaluable. Based on that change, the appropriate decision makers may be informed of the situation, information about the possible choices, probably outcomes, and costs. At every stage of the decison making process there are opportunities to improve overall outcomes with key pieces of information derived from the AAL environment.

SUMMARY

Smart Environments and Ambient Assisted Living technologies are rapidly gaining ground as health technologies. The sensors and models built from these systems are maturing, but rigorous evaluation of the user experience and technology acceptance still needs significant effort before it reaches the marketplace. Many companies are forming to fill the market need for our communities, but the concept of building well defined and well refined decision support tools still needs to be made more of the culture as technologists develop the latests tools to help us monitor our lives and provide that information to clinical decision makers.

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