Spectrum Management in the Health Care Environment

SMART-HC: A Virginia Based Industry-University Collaborative Research Program to Lower Health Costs and Improve Patient Outcomes

Wireless Technologies are Becoming Increasingly Prevalent in Health Care Environments

In the modern health care environment, there are an exponentially increasing number of heterogeneous wireless networks being used for such diverse tasks as patient diagnostics and monitoring, personnel and equipment tracking, and data analysis, among others. One reason for this recent proliferation of wireless technologies is that they offer new opportunities for improving patient quality of care, hospital operating efficiency, and operating costs.   With respect to patient quality of care, wireless technologies are making real-time diagnostics more affordable, new therapies possible and making customized treatment regimens more affordable. From an administration standpoint, wireless technologies allow for more efficient personnel management and decreased equipment costs through better inventory tracking, as well as reduced liabilities through safer drug control. Another advantageous byproduct of the rise in computing power in the modern day health care environment is the ability to infer, or extract, additional knowledge from the increased access to, and storage of, relevant data. This process is known by many terms such as machine learning, data mining, and knowledge discovery. The increased ability to wirelessly deliver secure data about patient, personnel, and assets is expected to drastically reduce the cost of data acquisition, and therefore make knowledge discovery more common.

Spectrum Management Solutions Will Be Required to Support Wireless Growth in Health Care

With this increase in the number of wireless networks in health care and the corresponding increase in the number of wireless medical devices hitting the marketplace, the health care spectrum environment is becoming increasingly cluttered. Each of these networks has its own data rates, transmit powers, transmit ranges, and spectrum needs. There could be many dozens of wireless devices in a given hospital room, and a myriad of wireless standards (different frequency bands and protocols). There are numerous RF bands used for medical systems around the world and this further motivates the need for an agile RF infrastructure to support medical devices. For example, there are more than 41 LTE bands designated around the world. A simple illustration of the potential wireless capabilities of just one hospital room is shown in Figure 1, showing use of Wi-Fi for hospital network access, Bluetooth for device interfacing, Zigbee for sensor pickup, and WiMedia for high data rate transfer off equipment. With the potential for so many wireless devices in just one hospital room, not to mention in adjacent rooms, the likelihood of detrimental interference is high. Therefore, understanding the RF limitations for these environments will be incredibly important in planning and deploying future wireless systems. Given these facts, it is anticipated that proper spectrum management in these environments will hasten the deployment of future wireless medical devices and reduce the operating costs of managing a large number of these devices.

Figure 1: A Hospital Room is a Dense Wireless Environment

Understanding how many devices at present can be deployed in a given area and the effectiveness of current approaches to spectrum management in avoiding interference is a critical first step to managing the health care wireless environment of the future. Pursuing these activities now will help guide efforts to ensure patient quality of care when using wireless medical

devices. Likewise, understanding how to exploit increased bandwidth and new models for patient care and knowledge discovery will hasten improvements to patient care.

SMART-HC Provides a Collaborative Solution

The Center for Advanced Engineering and Research (CAER), Wireless@VT within Virginia Tech, and the Mid-Atlantic Broadband Cooperative (MBC) recently formed a collaborative partnership called the SMART-HC Group (**S**pectrum **Ma**nagement **R**esearch **T**estbed for **H**ealth **C**are) to find solutions to these pressing needs. The SMART-HC Group plans to leverage their extensive knowledge and experience in the areas of wireless networking, spectrum management, data mining, and cyber security with key strategic industry partners in order to investigate, implement, and test novel spectrum management solutions for health care environments. The primary goal of this work is to demonstrate the practical need for, and feasibility of, spectrum management solutions in this unique and increasingly cluttered spectrum environment. Secondly, this work intends to demonstrate that ***improved spectrum management can lead to improvements in patient quality of care, hospital operating efficiency, and reduced operating costs***.   The vision is to develop and grow a collaborative initiative that offers partners the opportunity to participate in the creation of valuable intellectual property and shared infrastructure.   This partnership arrangement allows for solutions to cross-disciplinary problems that are not possible with a single organization. The strength of SMART-HC will be its collaborative research environment that combines the expertise of health care providers, medical equipment vendors, insurance companies, technical associations and university/research organizations.

SMART-HC is Looking for Partners

SMART-HC is currently looking for collaborative partners in the following areas to participate in this initiative:
- Medical Schools
- Medical Equipment Manufacturers
- RFID Tag Manufacturers / Inventory Control Service Providers
- Secure Cloud Computing Service Providers
- Data Mining Companies
- Research organizations

SMART-HC Industry Partners will benefit from having:
1) An active voice in a collaborative research community that sets the direction of future technology developments for advanced hospital rooms and related medical care
2) The rights to a non-exclusive, royalty-free license to all intellectual property developed through the membership supported generic research program.
3) The ability to direct the work of SMART-HC research staff in sponsored research projects, and jointly own the intellectual property that results from sponsored research.
4) Access to academic faculty and their students who will be future employees in this technology field.
5) Access to state-of-the-art research facilities for the development of next generation health care technologies
6) A superior position in the industry through both participation in the SMART-HC membership network and the competitive position provided through SMART-HC's technology developments.
7) The ability to leverage new technologies to actively drive the transition of the focus of health care from quality of patient care to quality of patient health
8) The ability to form collaborative interdisciplinary research teams to pursue large research funding opportunities

For more information on SMART-HC, contact:
- Bob Bailey, Executive Director – CAER: (434)477-5060, bbailey@caer.us
- Dr. Jeff Reed, Director – Wireless@VT: (540)231-2972, reedjh@vt.edu