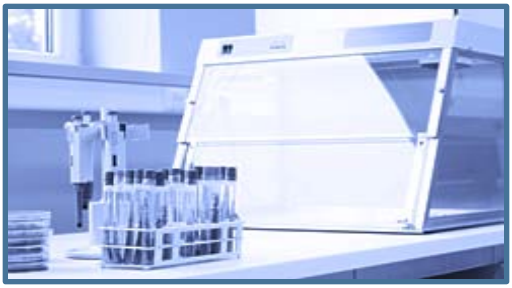
Body Area Networks & Pervasive Health Monitoring

Recent advances in microelectronics and wireless networking are moving closer to turning devices once thought of as science fiction into clinical reality.



Overview

Body Area Network (BAN) is a technology that allows communication between ultra-small and ultra low-power intelligent sensors/devices that are located on the body surface or implanted inside the body. In addition, the wearable/implantable nodes can communicate to a controller device that is located in the vicinity of the body. These radio-enabled sensors can be used to continuously gather a variety of important health and/or physiological data (i.e. information critical to providing care) wirelessly. The networking ability between these body devices and possible integration with existing IT infrastructure could result in a pervasive environment that can convey health-related information between the user's location and the healthcare service provider. Radio-enabled implantable medical devices offer a revolutionary set of applications among which we can point to smart pills for precision drug delivery, intelligent endoscope capsules, glucose monitors and eye pressure sensing systems. Similarly, wearable sensors allow for various medical/physiological monitoring (e.g. electrocardiogram, temperature, respiration, heart rate, and blood pressure), disability assistance, human performance management, etc. A simple example of BAN application would be a device equipped with a built in reservoir and pump. This device could administer just the right amount of insulin to a diabetic person based on wirelessly received glucose level measurements from another body sensor.

Industry Need Addressed

Although, the technology to create miniature-size devices for these novel applications is within reach, there are still several technical challenges, including interference issues, reliability, energy efficiency, and security issues, that need to be addressed.

NIST Approach

The Pervasive IT program at NIST's Information Technology Laboratory is conducting several research projects related to these challenges. These include:

- **Radio Frequency (RF) Propagation from Wearable and Implantable Medical Sensors –** NIST is working to better understand RF propagation within and on the human body surface.
- **Modeling and Characterization of Harvestable Kinetic Energy for Wearable Medical Sensors –** NIST is studying the statistical characteristics of harvestable kinetic energy generated from human motion. The result of this study can facilitate the development of efficient energy-management protocols for low-power wearable medical sensors.
- **Interference Analysis and Mitigation for Body Area Networks –** NIST researchers are developing software tools that can help to study the interference on wearable and implantable wireless medical devices.
- **Smart Autonomous Sensors and Environments –** NIST is conducting research to examine the optimal deployment of sensor devices (with controlled mobility) and the relevant possible trade-offs between coverage (i.e. connectivity) and information sensing.

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Impact

BAN is regarded as a promising interdisciplinary technology that could have a great impact on advancing health IT and telemedicine with its widespread commercialization. The research projects will facilitate the development of this technology along with its novel applications. This in turn will enhance the patient healthcare experience, resulting in a higher quality of life.

For additional information, please visit http://www.nist.gov/healthcare/emerging/ban.cfm

Key Contact

Kamran Sayrafian
Program Manager
Information Technology Laboratory
ksayrafian@nist.gov
(301) 975-5479