

A new WBAN approach in ECG monitoring for Healthcare

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Abstract

The ability to augment medical telemetry with tiny, wearable, wireless sensors would have a profound impact on many aspects of clinical practice. Emergency medical care, triage and intensive care can all benefit from continuous vital sign monitoring, especially immediate notification of patient deterioration. The development of technology has greatly increased the public expectations for high, fast and unrestricted healthcare services quality. Wireless Body Area Networks (WBANs) are expected to reduce the mortality rate caused by chronic diseases. One of the major challenges of the world for the last decades has been the continuous elderly population increase in the developed countries. In-home pervasive networks may assist residents and their caregivers by providing continuous medical monitoring, memory enhancement, control of home appliances, medical data access, and emergency communication. Researchers in computer, networking, and medical fields are working together in order to make the broad vision of smart healthcare possible. The importance of integrating large-scale wireless telecommunication technologies such as 3G, Wi-Fi Mesh, and WiMAX, with telemedicine has already been addressed by some researchers. Further improvements will be achieved by the coexistence of small-scale personal area technologies like radio frequency identification (RFID), Bluetooth, ZigBee, and Wireless Sensor Networks (WSN), together with large-scale wireless networks to provide context-aware applications. One of the main issues about the Wireless Body Area Network (WBAN) is the power consumption, since changing the batteries is a burdensome task. Because of this, development of energy efficient Medium Access Control (MAC) protocols and energy efficient sensor devices are critical. The technologies like Bluetooth and Wi-Fi fail to provide support for energy efficient systems since they can only offer one or two weeks runtime on a small energy source like a coin battery. Another important issue is the output transmission power of the sensor nodes. The output power must be kept minimal for health issues which may lead to coverage and communication problems. Mobility and portability are other considerations for the physical design of such sensors, since the patients have to wear the WBAN devices all the time and mobility reduction is not acceptable. The real-time availability and reliable communications of the system is a further major issue since the data gathered by this system may be critical. Additionally, designing multi-hop systems have much importance. Finally, security issues also need to be considered since the physiological data of the individuals is highly confidential; a secure key establishment and authentication algorithm is used for transmitting medical data from body sensors like ECG, to a hand-held device of the mobile patient.

There is a significant research effort on cardiac monitoring: Especially the mobile ECG measurement systems are gaining importance since their extended usability. Given the importance of addressing ways to provide smart healthcare for the elderly, chronically and children, researchers have to explore the technological solutions to enhance health and social care provision in a way which complements existing services.